

**A Thesis Submitted for the Degree of PhD at the University of Warwick**

**Permanent WRAP URL:**

<http://wrap.warwick.ac.uk/160214>

**Copyright and reuse:**

This thesis is made available online and is protected by original copyright.

Please scroll down to view the document itself.

Please refer to the repository record for this item for information to help you to cite it.

Our policy information is available from the repository home page.

For more information, please contact the WRAP Team at: [wrap@warwick.ac.uk](mailto:wrap@warwick.ac.uk)

**University of Warwick**  
Department of Economics

**Essays on Banking, Securitisation,  
Financial Regulation and Stability**

by

**Alessandro Diego Scopelliti**

A thesis submitted in fulfilment of the requirements for  
the degree of

Doctor of Philosophy in Economics

University of Warwick, Department of Economics

February 2020

# Table of Contents

|  |           |
|--|-----------|
| <b>List of Figures</b> .....   | <b>6</b>  |
| <b>List of Tables</b> .....  | <b>7</b>  |
| <b>Acknowledgements</b> .....  | <b>10</b> |
| <b>Declaration</b> .....   | <b>11</b> |
| <b>Abstract</b> .....  | <b>12</b> |
| <b>1 Securitisation, Bank Capital and Financial Regulation: Evidence from European Banks</b> ..... | <b>13</b> |
| 1.1 Introduction.....  | 14        |
| 1.2 Literature Review: Bank Capital and Securitisation .....                                       | 18        |
| 1.2.1 The Amount of Bank Capital: Incentives and Regulation .....                                  | 18        |
| 1.2.2 Bank Capital Determinants and Adjustments .....  | 24        |
| 1.2.3 Securitisation and Bank Capital .....  | 31        |
| 1.3 Institutional Background on Securitisation.....  | 38        |
| 1.3.1 The Developments of the Securitisation Market in Europe .....                                | 40        |
| 1.3.2 The Collateral Framework for Monetary Policy .....   | 51        |
| 1.3.3 The Prudential Requirements for Securitisation .....   | 53        |
| 1.4 Conceptual Framework.....  | 55        |
| 1.4.1 Securitisation Distribution and Retention .....  | 55        |
| 1.4.2 The Measures of Capital Ratios .....   | 57        |
| 1.4.3 Securitisation Distribution and Retention: Expected Changes in Capital Ratios .....          | 58        |
| 1.4.4 Further Possible Effects due to Changes in Balance Sheet Composition .....                   | 63        |
| 1.5 Data.....  | 66        |
| 1.6 Securitisation Issuances and Bank Capital Position.....  | 68        |
| 1.6.1 The Empirical Specification.....   | 68        |
| 1.6.2 Empirical Results .....  | 70        |
| 1.6.2.1 The Variations in Risk-Based Capital and Leverage Ratios .....                             | 71        |
| 1.6.2.2 Bank-level Heterogeneity in Funding Liquidity .....  | 74        |
| 1.6.2.3 Funding Liquidity, Securitisation and Regulatory Arbitrage.....                            | 78        |
| 1.7 Heterogeneity across Different Classes of Securitisation .....                                 | 79        |
| 1.7.1 Empirical Results: Securitisation Classified by Asset Types.....                             | 80        |
| 1.7.1.1 Securitisation Issuances Backed by Different Asset Types .....                             | 81        |
| 1.7.1.2 Securitisation Classified by Asset Types: Interaction with Funding Liquidity.....          | 83        |
| 1.7.2 Empirical Results: Securitisation Classified by Credit Ratings .....                         | 88        |
| 1.7.2.1 Securitisation Issuances with Different Credit Ratings.....                                | 89        |

|           |  |            |
|-----------|--|------------|
| 1.7.2.2   | Securitisation Classified by Credit Ratings: Interaction with Funding Liquidity                              | 92         |
| 1.8       | Robustness Analysis .....  | 95         |
| 1.8.1     | Country Heterogeneity: Robustness to Sample Composition .....  | 95         |
| 1.8.2     | Robustness Check: Alternative Measures of Funding Liquidity .....  | 98         |
| 1.9       | Future Extensions of the Empirical Analysis.....   | 101        |
| 1.9.1     | Time Dependency in Bank Capital Dynamics .....   | 101        |
| 1.9.2     | Adjustments in Bank Capital Dynamics .....   | 102        |
| 1.9.3     | Feedback from Capital Structure to Securitisation .....  | 104        |
| 1.10      | Conclusions.....   | 107        |
| 1.11      | ANNEXES .....  | 109        |
| Annex 1.A | The Retention of Different Types of Securitisation Products .....  | 109        |
| Annex 1.B | The Accounting Regime for Securitisation .....   | 111        |
| Annex 1.C | The Regulatory Treatment of Securitisation Positions in Basel II .....                                       | 113        |
| Annex 1.D | Dataset Construction and Summary Statistics.....   | 114        |
| Annex 1.E | Securitisation Classified by Asset Types: Interaction with the Liquid Assets Ratio .....                     | 118        |
| Annex 1.F | Securitisation Classified by Credit Ratings: Interaction with the Liquid Assets Ratio.....                   | 121        |
| <b>2</b>  | <b>Securitisation and Funding Decisions of Euro Area Banks: Evidence on ABS Issuance and Retention .....</b> | <b>123</b> |
| 2.1       | Introduction.....  | 124        |
| 2.2       | Related Literature: Securitisation and Bank Funding Liquidity .....  | 126        |
| 2.2.1     | The Determinants for the Issuance of Securitisation .....  | 127        |
| 2.2.2     | The Rationale for Risk Retention in Securitisation.....  | 128        |
| 2.2.3     | Bank Liquidity Crises .....  | 130        |
| 2.2.4     | The Transmission of Unconventional Monetary Policy Measures .....  | 131        |
| 2.3       | Securitisation in the Euro Area and Bank Liquidity during the Crisis.....                                    | 133        |
| 2.3.1     | Developments in the Euro Area ABS Market.....  | 133        |
| 2.3.2     | The Funding Liquidity Issues and the Securitize-to-Repo Incentives.....                                      | 134        |
| 2.3.3     | Monetary Policy Measures to Ensure Access to Central Bank Liquidity .....                                    | 135        |
| 2.4       | Data.....  | 137        |
| 2.5       | Empirical Analysis: Mortgage-Backed Securities versus Covered Bonds .....                                    | 140        |
| 2.5.1     | The Determinants for the Issuance of MBSs vs. Covered Bonds .....  | 140        |
| 2.5.1.1   | Empirical Strategy and Specification.....  | 140        |
| 2.5.1.2   | Empirical Results .....  | 142        |
| 2.5.2     | The Retention of MBSs and Covered Bonds by Eligibility Status .....  | 147        |
| 2.5.2.1   | Empirical Strategy and Specification.....  | 147        |

|          |   |            |
|----------|---|------------|
| 2.5.2.2  | Empirical Results .....   | 148        |
| 2.6      | Empirical Analysis: the Retention of Asset-Backed Securities by Originator Banks  | 153        |
| 2.6.1    | Baseline Probit Estimation.....   | 153        |
| 2.6.1.1  | Empirical Specification.....  | 153        |
| 2.6.1.2  | Empirical Results .....   | 155        |
| 2.6.2    | Country Drivers in Bank Funding and Asset Quality Patterns .....  | 157        |
| 2.6.2.1  | Probit Estimation with Country and Year Fixed Effects.....  | 157        |
| 2.6.2.2  | Country Drivers for Balance Sheet Conditions and MLE IV Probit Estimation<br>160  |            |
| 2.6.3    | Heterogeneity across Banks under the Full Allotment Policy .....  | 163        |
| 2.6.3.1  | Full Allotment Policy and the Retention of Originator Banks.....  | 163        |
| 2.6.3.2  | Empirical Results and Interaction Plots for the Full Allotment Policy.....  | 164        |
| 2.6.3.3  | The Role of Short-Term Interbank Market Distress .....  | 169        |
| 2.6.3.4  | Empirical Results and Interaction Plots for the Interbank Market Spread....   | 170        |
| 2.6.3.5  | Full Allotment and Interbank Market Developments for Eligible and Non-<br>Eligible ABSs.....  | 173        |
| 2.6.4    | The Introduction of the Additional Credit Claims Framework.....   | 175        |
| 2.6.4.1  | Empirical Strategy.....   | 175        |
| 2.6.4.2  | Empirical Specification and Results .....   | 177        |
| 2.7      | The Credit Easing Package and Avenues for Further Research.....   | 180        |
| 2.8      | Conclusions.....  | 184        |
| 2.9      | ANNEX.....  | 185        |
|          | Annex 2.A Dataset Construction and Security Issuances .....   | 185        |
|          | Annex 2.B ABS Retention. The Introduction of the ABSPP.....   | 187        |
| <b>3</b> | <b>Rules and Discretion(s) in Prudential Regulation and Supervision: Evidence<br/>from EU Banks in the Run-Up to the Crisis .....</b> | <b>188</b> |
| 3.1      | Introduction.....   | 189        |
| 3.2      | Related Literature.....   | 192        |
| 3.3      | Bank Regulation in the EU .....   | 198        |
| 3.4      | A Novel Indicator for Prudential Regulation in the EU.....  | 200        |
| 3.5      | Empirical Specification.....  | 204        |
| 3.5.1    | Rules versus Discretion in Prudential Regulation.....   | 205        |
| 3.5.2    | Bank Size: Large versus Small Banks .....   | 206        |
| 3.5.3    | Prudential Regulation and Banks' Balance Sheet Management .....   | 208        |
| 3.5.4    | Prudential Regulation, Bank Balance Sheets and Realised Risks.....  | 210        |
| 3.6      | Data.....   | 211        |
| 3.6.1    | Public Support to Banks.....  | 211        |

|          |   |            |
|----------|---|------------|
| 3.6.2    | Bank Characteristics .....  | 214        |
| 3.7      | Results.....  | 219        |
| 3.7.1    | Empirical Results: Baseline Specification .....   | 219        |
| 3.7.2    | Empirical Results: Large versus Medium-Small Banks .....  | 222        |
| 3.7.2.1  | Estimation for Different Subsamples .....   | 223        |
| 3.7.2.2  | Interaction with Bank Size .....  | 226        |
| 3.7.3    | Empirical Results: Prudential Regulation and Banks' Balance Sheet Management<br>229                   |            |
| 3.7.3.1  | Country-level Analysis: Changes in Balance Sheets after the CRD Adoption<br>229                       |            |
| 3.7.3.2  | Bank-level Regressions: Prudential Regulation and Balance Sheet Incentives<br>234                     |            |
| 3.7.4    | Empirical Results: Prudential Regulation, Banks' Balance Sheets and Realised<br>Risks 237             |            |
| 3.7.4.1  | Bank Lending.....   | 237        |
| 3.7.4.2  | Bank Non-Interest Income .....  | 240        |
| 3.7.4.3  | Bank Liquidity .....  | 241        |
| 3.7.4.4  | Bank Holdings of Sovereign Bonds.....   | 242        |
| 3.7.5    | Robustness Analysis .....   | 243        |
| 3.7.5.1  | Euro Area: Country Heterogeneity and Timing of Public Support.....                                    | 243        |
| 3.7.5.2  | Country Heterogeneity: Robustness to Sample Composition .....   | 248        |
| 3.7.5.3  | Bank Lending: Loan Type and Credit Quality.....   | 250        |
| 3.8      | Conclusions.....  | 253        |
| 3.9      | ANNEXES .....   | 255        |
|          | Annex 3.A: The Indicators of Prudential Regulation.....   | 255        |
| 3.A.1    | The Construction of the Indicators.....   | 255        |
| 3.A.2    | Main Examples of National Options and Discretions .....   | 257        |
|          | Annex 3.B: Cross-Section Baseline Probit Regressions (2005-2007) .....                                | 276        |
|          | Annex 3.C: MLE IV Cross-Section Probit Regressions (2005-2007) .....                                  | 285        |
| <b>4</b> | <b>Conclusions and Implications for Research and Policy .....</b>                                     | <b>300</b> |
| 4.1      | Securitisation, Bank Funding and Central Bank Liquidity Measures .....                                | 300        |
| 4.2      | Securitisation, Bank Capital and Prudential Regulation .....  | 304        |
| 4.3      | National Differences in Banking Regulation and the Prudential Framework in the<br>Banking Union ..... | 306        |
|          | <b>BIBLIOGRAPHY .....</b>   | <b>310</b> |

## List of Figures

|   |     |
|---|-----|
| Figure 1.1 A Stylised Representation of the Securitisation Process .....  | 39  |
| Figure 1.2 Use of Monetary Policy Collateral with the Eurosystem by Asset Type .....  | 52  |
| Figure 1.3 Bank Heterogeneity in Funding Liquidity: Pre-Crisis & Crisis Issuances .....   | 77  |
| Figure 1.4 Bank Heterogeneity: Eligible & Non-Eligible Securitisation by Asset.....   | 88  |
| Figure 1.5 Bank Heterogeneity: Eligible & Non-Eligible Securitisation by Rating.....  | 95  |
| Figure 2.1 Volumes of Euro Area ABS Issuances by Country Groups (annual, 2005-2017, EUR<br>bn) .....                            | 133 |
| Figure 2.2 Euro Area Placed and Retained ABS Issuances. Focus: 2007-2010 (monthly, EUR<br>bn) .....                             | 134 |
| Figure 2.3 Spread of the 3m Euribor Rate to the 3m Overnight Index Swap Rate.....   | 135 |
| Figure 2.4 Retention of MBSs and Covered Bonds. Interaction of Full Allotment Policy with<br>Liquid Assets Ratio.....           | 152 |
| Figure 2.5 ABS Retention. The Interaction of the Full Allotment Policy with the Existing Bank<br>Balance Sheet Conditions ..... | 168 |
| Figure 2.6 ABS Retention. The Interaction of the 3-month Euribor Spread with the Existing<br>Bank Balance Sheet Conditions..... | 172 |
| Figure 2.7 ABS Retention. Interaction of Full Allotment and Interbank Market Spread with<br>Liquid Assets Ratio.....            | 174 |
| Figure 3.1 The Indicator of Prudential Regulation across EU Countries.....  | 203 |
| Figure 3.2 Interaction with Size (All Banks) .....  | 227 |
| Figure 3.3 Prudential Regulation and Balance Sheet Changes (2005-2007, vs. 2000-2004) ...                                       | 231 |
| Figure 3.4 Prudential Regulation and Balance Sheet Composition (2005-2007) .....  | 233 |

## List of Tables

|  |     |
|--|-----|
| Table 1.1 Total Issuance of Securitisation Products by Country (in EUR millions) .....   | 46  |
| Table 1.2 Retention Rate of Securitisation Products by Country (in percentage) .....   | 48  |
| Table 1.3 Total Issuance of RMBSs by Country (in EUR millions).....  | 49  |
| Table 1.4 Total Issuance of CDOs by Country (in EUR millions) .....  | 50  |
| Table 1.5 Securitisation Issuances and Capital Ratios. Expected Effects.....   | 64  |
| Table 1.6 Securitisation Issuances and Capital Ratios: Baseline Specification.....   | 72  |
| Table 1.7 Securitisation and Capital Ratios: Interaction with the Liquid Assets Ratio .....  | 75  |
| Table 1.8 Securitisation Issuances Classified by Asset Type .....  | 82  |
| Table 1.9 Securitisation Classified by AssetTypes: Interaction with the Liquid Assets Ratio ...                                    | 85  |
| Table 1.10 Securitisation Issuances Classified by Credit Ratings .....   | 90  |
| Table 1.11 Securitisation Classified by Credit Ratings: Interaction with the Liquid Assets Ratio .....                             | 93  |
| Table 1.12 Robustness to Sample Composition: Baseline Specification with and without Liquidity Interaction .....                   | 97  |
| Table 1.13 Securitisation and Capital Ratios: Interaction with the Loans to Deposits Ratio .....                                   | 99  |
| Table 1.14 Securitisation and Capital Ratios: Interaction with the Short-Term Borrowing Ratio .....                                | 100 |
| Appendix Table 1.1 Retention Rate of RMBSs by Country (in percentage).....   | 109 |
| Appendix Table 1.2 Retention Rate of CDOs by Country (in percentage).....  | 110 |
| Appendix Table 1.3 The Risk Weights for Securitisation in the Ratings-Based Approach .....   | 113 |
| Appendix Table 1.4 Summary Statistics.....   | 116 |
| Appendix Table 1.5 Securitisation by Asset Types: Interaction with the Liquid Assets Ratio. Regression Estimates .....             | 118 |
| Appendix Table 1.6 Securitisation by Credit Ratings: Interaction with the Liquid Assets Ratio. Regression Estimates .....          | 121 |
| <br>   |     |
| Table 2.1 The Issuance of MBSs vs. Covered Bonds.....  | 143 |
| Table 2.2 The Determinants of the Retention of MBSs and Covered Bonds .....  | 149 |
| Table 2.3 ABS Retention. Probit Baseline Specification.....  | 154 |
| Table 2.4 ABS Retention. Probit Model with Originator and Risk Country FEs and Linear Probability Model with Country-Year FEs..... | 159 |
| Table 2.5 ABS Retention. MLE IV Probit Estimation for Bank Balance Sheet Variables Explained by Country-Level Factors .....        | 162 |
| Table 2.6 ABS Retention. The Interaction between the Full Allotment Policy and Originator Bank Balance Sheet Conditions.....       | 167 |



|  |     |
|--|-----|
| Table 2.7 ABS Retention. The Interaction between Interbank Market Spread and Originator Bank Balance Sheet Conditions..... | 171 |
| Table 2.8 ABS Retention. The Introduction of the Additional Credit Claims (ACC) Framework .....                            | 179 |
| Appendix Table 2.1 ABS Retention. The Introduction of the ABS Purchase Programme.....                                      | 187 |
|  |     |
| Table 3.1 Measures of Public Support to Banks by Country and Type.....   | 213 |
| Table 3.2 Country-level Characteristics of EU Banking Sector .....   | 215 |
| Table 3.3 Probit Baseline Specification: Average Marginal Effects .....  | 220 |
| Table 3.4 Baseline Probit Specification: Average Marginal Effects (by Bank Size) .....                                     | 224 |
| Table 3.5 Prudential Framework and Banks' Balance Sheet Management .....   | 236 |
| Table 3.6 MLE IV Probit Specification: Average Marginal Effects.....   | 238 |
| Table 3.7 Euro Area and Timing of Support: Baseline Probit - Average Marginal Effects .....                                | 245 |
| Table 3.8 Robustness to Sample Composition: Baseline Probit - Average Marginal Effects ..                                  | 249 |
| Table 3.9 Bank Lending: MLE IV Probit – Average Marginal Effects.....  | 252 |
| Appendix Table 3.1 OWN FUNDS – PILLAR 1 .....  | 262 |
| Appendix Table 3.2 SCOPE OF APPLICATION .....  | 263 |
| Appendix Table 3.3 COUNTERPARTY RISK IN DERIVATIVES AND OTHER EXPOSURES – PILLAR 1.....                                    | 264 |
| Appendix Table 3.4 STANDARDISED APPROACH – PILLAR 1 .....  | 265 |
| Appendix Table 3.5 IRB APPROACH - PILLAR 1 .....   | 267 |
| Appendix Table 3.6 CREDIT RISK MITIGATION - PILLAR 1 .....   | 269 |
| Appendix Table 3.7 OPERATIONAL RISK.....   | 270 |
| Appendix Table 3.8 QUALIFYING HOLDINGS OUTSIDE THE FINANCIAL SECTOR ..   | 271 |
| Appendix Table 3.9 TRADING BOOK .....  | 272 |
| Appendix Table 3.10 AGGREGATE (WEIGHTED) INDICATORS .....  | 275 |
| Appendix Table 3.11 Probit Baseline Specification with Overall Indicator (Overall Sample)                                  | 276 |
| Appendix Table 3.12 Probit Baseline Specification with Supervisory Discretion (Overall Sample) .....                       | 277 |
| Appendix Table 3.13 Probit Baseline Specification with Regulatory Flexibility (Overall Sample) .....                       | 278 |
| Appendix Table 3.14 Probit Baseline Specification with Overall Indicator (Large Banks).....                                | 279 |
| Appendix Table 3.15 Probit Baseline Specification with Supervisory Discretion (Large Banks) .....                          | 280 |
| Appendix Table 3.16 Probit Baseline Specification with Regulatory Flexibility (Large Banks) .....                          | 281 |
| Appendix Table 3.17 Probit Baseline Specification with Overall Indicator (Medium and Small Banks) .....                    | 282 |

|   |     |
|---|-----|
| Appendix Table 3.18 Probit Baseline Specification with Supervisory Discretion (Medium and Small Banks)..... | 283 |
| Appendix Table 3.19 Probit Baseline Specification with Regulatory Flexibility (Medium and Small Banks)..... | 284 |
| Appendix Table 3.20 MLE IV Probit for Loans Assets Ratio (Overall Sample) .....                             | 285 |
| Appendix Table 3.21 MLE IV Probit for Net Loans/Total Assets Ratio (Large Banks).....                       | 286 |
| Appendix Table 3.22 MLE IV Probit for Loans Assets Ratio (Medium and Small Banks).....                      | 287 |
| Appendix Table 3.23 MLE IV Probit for Non-Interest Income Ratio (Overall Sample) .....                      | 288 |
| Appendix Table 3.24 MLE IV Probit for Non-Interest Income Ratio (Large Banks) .....                         | 289 |
| Appendix Table 3.25 MLE IV Probit for Non-Interest Income Ratio (Medium and Small Banks) .....              | 290 |
| Appendix Table 3.26 MLE IV Probit for Liquid Assets Ratio (Overall Sample) .....                            | 291 |
| Appendix Table 3.27 MLE IV Probit for Liquid Assets Ratio (Large Banks) .....                               | 292 |
| Appendix Table 3.28 MLE IV Probit for Liquid Assets Ratio (Medium and Small Banks)....                      | 293 |
| Appendix Table 3.29 MLE IV Probit for Government Securities Ratio (Overall Sample).....                     | 294 |
| Appendix Table 3.30 MLE IV Probit for Government Securities Ratio (Large Banks) .....                       | 295 |
| Appendix Table 3.31 MLE IV Probit for Government Securities Ratio (Medium and Small Banks) .....            | 296 |
| Appendix Table 3.32 MLE IV Probit for NPL Ratio (Overall Sample).....                                       | 297 |
| Appendix Table 3.33 MLE IV Probit for Residential Mortgages/Total Assets Ratio (Overall Sample) .....       | 298 |
| Appendix Table 3.34 MLE IV Probit for Corporate Loans/Total Assets Ratio (Overall Sample) .....             | 299 |

## Acknowledgements

I would like to express my deepest gratitude to my Supervisors Mark P. Taylor, Michael McMahon and Juan Carlos Gozzi-Valdez for their invaluable and continuous help, support and encouragement during this enthusiastic and challenging journey of the doctoral thesis.

I am very grateful to my Examiners, Prof. Alistair Milne and Prof. Marcus Miller, for the inspiring and productive conversation in the viva and the very useful suggestions for the revision of the thesis.

I am very indebted to Steven Ongena, first for his invitation to visit the Department of Banking and Finance at the University of Zurich during the PhD, and more recently for the great opportunity to join the University of Zurich for the ERC Advanced Grant on Bank Lending.

I am very grateful to my co-author Angela Maddaloni. It has been a great pleasure to work with her and to learn from her experience.

I would like to express my gratitude to the Warwick Economics community, which provided me with an excellent academic environment. I benefited a lot from conversations with and advice from Faculty members, like Manuel Bagues, Kris Mitchener, Jeremy Smith, Thijs Van Rens, Michael Waterson, and from the participants of the Macro Group.

I take this opportunity also to thank the managers and the staff of the Financial Regulation Division at the European Central Bank, of the Banking System Division at the Bank of England and of the Regional Studies Division at the IMF for their kind hospitality and support in occasion of the PhD internships.

I am very grateful to my colleagues at the European Central Bank for their crucial experience in monetary policy, financial stability and market operations. I have benefited a lot from their experience on these issues in the preparation of this thesis.

I am very indebted to my parents for their continuous support and encouragement over all these years.

I gratefully acknowledge the financial support from ERC ADG 2016 - GA 740272 “lending” (University of Zurich).

As a note of disclaimer, I want to highlight that the views expressed in this thesis and in each of the chapters are exclusively my own and do not necessarily reflect those of the European Central Bank or the Eurosystem.

## **Declaration**

I declare that the thesis has not been submitted for a degree at any other university.

One chapter contains work based on collaborative research:

Chapter 2 “Rules and Discretion(s) in Prudential Regulation and Supervision: Evidence from EU Banks in the Run-Up to the Crisis” was written with Angela Maddaloni (European Central Bank). A former version of this paper has been published in the ECB Working Paper Series, No. 2284, in May 2019. Also, some results have been summarised in the ECB Research Bulletin Article No. 58 on “Prudential regulation, national differences and banking stability”, also published in May 2019.

## Abstract

The thesis consists of three essays on empirical banking, with a particular focus on Europe in the aftermath of the global financial crisis. The essays analyse some current issues for the policy debate on securitisation, bank capital and funding liquidity, also by exploring the role of monetary policy and prudential regulation in shaping the incentives for banks' behaviour.

The first chapter studies the capital management of originator banks, both when they distribute and when they retain the securitisation tranches. The analysis focuses on European banks sponsoring securitisation before and after the crisis and investigates the role of prudential regulation and of the collateral framework. In the pre-crisis period, originator banks observed an increase in their risk-based capital ratios particularly from the transfer of risky assets. In crisis time, securitising banks subject to tighter liquidity constraints obtained larger improvements in their risk-based capital ratios, especially after the issuance of securitisation products eligible as central bank collateral. Originator banks could exploit the regulatory arbitrage opportunities of the prudential framework, allowing for lower risk weights on retained securitisation positions than on the underlying securitised assets.

The second chapter studies the determinants for the issuance and the retention of asset-backed securities (ABSs) by Euro Area banks. I first study the relative incentives for the issuance of ABSs versus covered bonds. Then I analyse the potential drivers of the retention of ABSs by originator banks, with regard to monetary policy measures and financial markets developments. Non-standard measures expanding the amount of central bank liquidity increased the incentive to retain eligible ABSs particularly for banks in weaker liquidity conditions, as they were more interested in a securitise-to-repo strategy to increase the availability of collateral. In addition to this quantity effect, also the price effect of an increase in the interbank market spread – by reducing the relative funding cost of central bank liquidity - contributed to an increase in ABS retention for banks subject to stronger liquidity constraints.

The third chapter investigates the role of prudential regulation and supervision in the prevention of banking crises. We exploit the national differences in the capital regulation of EU countries thanks to the exercise of national options allowing for regulatory flexibility and supervisory discretion. We show that banks subject to a more lenient prudential framework displayed higher probability of requiring public support during the crisis. This reflected the transmission of the regulatory incentives via the risk-taking undertaken by banks in the management of their balance sheets.

# 1 Securitisation, Bank Capital and Financial Regulation: Evidence from European Banks <sup>1</sup>

*Alessandro D. Scopelliti*

## Abstract

This chapter analyses how banks manage their capital position when they securitise, by focusing on the issuances sponsored by European banks before and after the financial crisis. Stylised facts suggest that, at the time of the crisis, European banks continued to issue securitisation, but by retaining them on balance sheet for collateral purposes. Based on a new dataset combining tranche-level information for securitisation with bank balance sheet data for the corresponding originators, I investigate the changes in the risk-based capital ratios and in the leverage ratios of securitising banks, for different classes of products. In the pre-crisis period, originator banks observed an increase in their risk-based capital ratios particularly from the transfer of risky assets. In the crisis time, originator banks improved their risk-weighted solvency ratios but without reducing their actual leverage: across products, this increase in the risk-based prudential ratios was larger for the issuances of asset-backed securities eligible as collateral for monetary policy, which banks could retain and pledge in central bank liquidity operations. Also, across banks, institutions in weaker liquidity conditions exploited the regulatory arbitrage opportunities of the securitisation framework to obtain larger increases in their prudential solvency ratios.

JEL Classifications: G21, G23, G28, E58

Key-words: Securitisation, Risk-weighted Capital Ratio, Leverage Ratio, Bank Liquidity, Collateral Eligibility, Prudential Requirements

---

<sup>1</sup> I thank Mark P. Taylor, Michael McMahon, Juan Carlos Gozzi and Steven Ongena for their precious guidance and support. I am grateful to Urs Birchler, Robert DeYoung, Jordi Gual, Andreas Jobst, John Kiff, Nataliya Klimenko, Jan Pieter Krahnert, David Llewellyn, André Lucas, Angela Maddaloni, David Marques, Jean-Stéphane Mésonnier, George Pennacchi, José-Luis Peydró, Fatima Pires, Alberto Pozzolo, Marco Prototapa, Marc Quintyn, Massimiliano Rimarchi, Jean-Charles Rochet and Carmelo Salleo, for insightful discussions and helpful suggestions at various stages of this work. I gratefully acknowledge the support of the managers and of the staff of the Financial Regulation Division at the ECB, and the kind hospitality of the Department of Banking and Finance at the University of Zurich. This paper benefited also from useful comments and feedback from the participants of the 3<sup>rd</sup> ECB Forum on Central Banking (Sintra), the 4<sup>th</sup> EBA Research Workshop (London), the 14<sup>th</sup> CREDIT Conference (Venice), the SUERF-FinLawMetrics Conference (Milan), the 29<sup>th</sup> EEA Conference (Toulouse), the 6<sup>th</sup> IFABS Conference (Lisbon), the 4<sup>th</sup> FEBS Conference (Surrey), the MFS Symposium (Cyprus), the European Department Seminar (IMF), the Research Seminar on Banking (Zurich), the Barcelona GSE Banking Summer School (UPF), the Macro Workshop (Warwick). Some results have been mentioned in a non-technical policy study on “Securitisation and Risk Retention in European Banking: The Impact of Collateral and Prudential Rules”, published as a chapter in the SUERF Study 2014/4 on “Money, Regulation and Growth: Financing New Growth in Europe”. I am deeply indebted to the ESRB for shortlisting this paper for the Ieke van den Burg Prize and to SUERF for being awarded the 2014 SUERF Marjolin Prize. All the errors are mine.

## 1.1 Introduction

In the traditional view of securitisation, originator banks transfer a pool of underlying assets to a special purpose vehicle for the issuance of securitisation products to be placed among market investors. This operation may bring some benefits to the originator banks from a regulatory capital point of view: indeed, banks can obtain some capital relief from the transaction as the asset sale reduces the amount of risk-weighted assets and then implies lower capital requirements for the originator institutions.

In fact, the risk transfer motive captures only partially the economic rationale of securitisation, as originator banks pursue mainly other purposes, in particular obtaining funding to finance their loan provision. Also, securitising banks can retain a significant part of the credit risk on the underlying assets for various reasons. Indeed, they can provide explicit support to special purpose vehicles via credit enhancement (Acharya, Schnabl and Suarez, 2013; Sarkisyan and Casu, 2013) or via the retention of the equity tranche, which in fact may concentrate a significant part of the credit risk due to the seniority structure of the waterfall (Milne, 2009). Also, originator banks subject to funding liquidity constraints may decide to retain on balance sheet all the issued tranches of securitisation, if they are eligible as collateral for central bank liquidity operations, in order to increase the availability of eligible collateral (see Chapter 2).

The scope of this study is to investigate how banks conducting securitisation manage their capital position, both when they distribute and when they retain these tranches. Indeed, the decision to distribute or to retain securitisation may have relevant implications for the capital position of originator banks. The empirical study analyses the securitisation issuances of European banks in the period between 1999 and 2010, before the introduction of the retention requirements in 2011.

In that period, banks were not required by prudential rules to retain risk in securitisation either in the EU or in the US. However, empirical evidence suggests that, at the time of the global financial crisis, European banks changed significantly their securitisation strategy. Until mid-2007, European banks used to distribute all the issuances of securitisation among investors, with the exception of the equity tranche usually retained by the originator banks. Then, from the second half of 2007 and until mid-2010, European banks retained almost all the issuances of asset-backed securities (ABSs) on balance sheet. The share of retained tranches over total issuances could be different across months, but in 2008 and 2009 it was always included in a range between 75% and 100%, while before August 2007 the retention rate was close to 0%.

Such retention behaviour of European banks during the considered period can be explained only to some extent by the difficulties in placing securitisation with market investors. Indeed, it is true that some concerns for the creditworthiness of securitisation could have induced some reduction in the market demand for these products in several jurisdictions.

However, while in the US such confidence crisis determined a substantial decline in the issuance volumes of securitisation, in Europe banks continued to issue securitisation products but by retaining them on balance sheet.

In fact, a key motivation for this retention behaviour could be related to the possibility to use securitisation products as collateral in the liquidity operations with central banks. In particular, the monetary policy collateral framework of the Eurosystem allowed for a broad set of eligible instruments, including asset-backed securities. At the same time, also the liquidity measures implemented during the crisis by other central banks, like the Bank of England, allowed for the pledge of asset-backed securities. This was important for banks interested in obtaining central bank liquidity. Indeed, banks could not directly pledge loans as collateral, but they could collect various loans in a pool of assets to set up a securitisation operation and then retain the tranches on balance sheet. These products could then be posted as collateral in central bank refinancing operations. Therefore, banks potentially interested in obtaining central bank liquidity had the incentive to increase the amount of eligible collateral assets on balance sheet, also via securitisation retention, since the availability of adequate collateral was a pre-requisite for banks to participate in liquidity operations.

These facts offer the empirical motivation for the study. Indeed, the change in the securitisation strategy of European banks provides the opportunity to analyse the management of capital position by originator banks under securitisation distribution and retention. In order to develop the empirical analysis, I have constructed a new dataset of more than 17,000 securitisation tranches sponsored by European banks between 1999 and 2010 and I have combined the tranche-level information on securitisation with the bank balance sheet data for the corresponding originator banks, on a quarterly basis.

First, I explore the variations in the capital position of originator banks, by considering the changes in the risk-weighted capital ratios and in the leverage ratios following the issuances. I compare the variations in the two capital ratios to investigate whether and how banks exploited potential regulatory arbitrage opportunities of the prudential framework, due to the system of risk weights or to the definition of capital instruments. I find that, on average, securitising banks registered some significant increases in their risk-weighted capital ratios, so they obtained some improvements in their prudential solvency from the regulatory point of view; while in fact they were not changing or were even worsening their actual capital position (i.e. leverage ratios remained unchanged or even decreased).

Second, I analyse the differences in the capital management of securitising banks before and during the crisis. In general, we would suppose that banks distributing securitisation among investors should obtain an improvement in their risk-based capital ratios (because they have decreased their risk-weighted assets), while banks retaining the issued tranches should not significantly change their prudential solvency (as they have kept the exposures on their balance



sheet). In practice this may hold, in a capital framework based on risk-weighted solvency ratios, only if the risk weights on the retained securitisation positions are equal to the risk weights on the underlying securitised assets. In fact, the prudential regulation in place during the crisis period - based on the Basel II agreement - disciplined the securitisation framework such that, in several cases, the risk weights for high-rating securitisation positions could be lower than the risk weights on the underlying assets. This implied that banks could securitise their assets, retain the issued products on balance sheet and still decrease their risk-weighted assets. The empirical analysis shows that securitising banks obtained larger increases in their risk-weighted capital ratios particularly during the crisis period, at the time when they were actually retaining the vast majority of the issued asset-backed securities.

Third, I explore bank heterogeneity and in particular I investigate whether different ex-ante balance sheet conditions of originator institutions could explain differences in their capital management of securitisation operations. In particular, I focus on the role of bank funding liquidity position, which may be an important factor in banks' securitisation operations (Milne, 2009; Loutskina, 2011; Almazan, Martin Oliver and Saurina, 2015)<sup>2</sup>. For this purpose, I study the interaction between the share of securitised assets and a measure of bank funding liquidity. The empirical results show that, particularly during the crisis, the ex-post variation in the capital position of securitising banks was indeed different across institutions, depending on their ex-ante funding liquidity conditions. For a given increase in the securitisation activity, less-liquid banks observed larger increases in their risk-weighted capital ratios, compared with more-liquid banks. This suggests that – during the crisis period - banks in weaker funding liquidity conditions exploited the regulatory arbitrage opportunities offered by prudential regulation more than banks in stronger liquidity conditions.

Based on these results, liquidity constraints seem to be relevant for the capital management of securitising banks and then for the potential regulatory arbitrage incentives only for the crisis period, when credit institutions were retaining most of their issuances of asset-backed securities. Given this observation, I propose and explore a potential explanation for the link between liquidity shortage and regulatory arbitrage: banks subject to stronger liquidity pressures, and then potentially more interested in retaining asset-backed securities as eligible collateral for central bank liquidity operations, could have been also more interested in minimising the impact of this securitisation retention on bank capital requirements.

To investigate this hypothesis in more detail, I conduct the following part of the analysis on a more granular basis, by classifying the outstanding amounts of securitisation products either by asset type or by credit rating. In this way, I can distinguish – both for asset types and

---

<sup>2</sup> Banks subject to funding constraints may be interested in undertaking securitisation operations, either to obtain directly liquidity from external investors (who purchase the structured securitisation products placed on the market), or to increase the availability of liquid assets pledgeable as collateral in repo operations (if the issued products are eligible for this purpose).

for credit ratings – whether a given class of products was eligible as collateral for central bank liquidity operations. Then I study whether the issuances of different classes of securitisation implied different variations in the bank capital position, before and during the crisis. The results reveal significant differences across different types of products in the pre-crisis and in the crisis period.

In the pre-crisis period, the improvements in prudential solvency ratios were mainly due to the issuances of complex and risky products, not eligible as collateral, such as CBOs (Collateralised Bond Obligations) and CDOs (Collateralised Debt Obligations). This is consistent with the fact that banks were using securitisation to transfer the underlying pool of assets, and indeed the increase in the prudential solvency ratios was proportional to the regulatory risk weight of the transferred assets. Also, when considering the specific classes of products, the variation in the capital position of securitising banks – in the pre-crisis period - was not dependent on the existing funding liquidity position of the originator banks.

On the contrary, during the crisis, the largest increases in risk-based capital ratios for securitising banks were observed following the issuances of less-risky products, eligible as collateral and subject to low risk weights: in particular, regarding asset types, for the issuances of ABSs (Asset-Backed Securities) backed by residential mortgages and by home equity loans; concerning credit ratings, for the issuances rated as AA or A. In particular, for a given increase in the securitisation issuance of these specific classes, the improvement in prudential solvency ratios was actually larger for banks in an ex-ante weaker liquidity position.

This wider increase in prudential solvency ratios, registered for products eligible as collateral, means that banks interested in retaining ABSs for collateral purposes were also – at the margin – more active in exploiting the regulatory arbitrage opportunities of the prudential framework; indeed, they wanted to minimise the implications of securitisation retention on their capital requirements. Also, the fact that this effect was actually larger for less-liquid banks confirms that this conduct was aimed to improve the access to central bank operations for credit institutions in weaker funding liquidity conditions, through the increase of eligible collateral.

This chapter contributes to the literature on various aspects. First, it analyses the variations in the capital position of securitising banks, both when they distribute the tranches among investors, and when they retain them on balance sheet. The study shows that securitisation retention may provide larger scope for regulatory arbitrage by originator banks, if the prudential treatment for securitisation allows for lower risk weights on securitisation positions than on the underlying assets.

Second, the chapter studies the interaction between funding liquidity and capital position, in the context of securitisation operations. Banks more interested in improving their

funding liquidity positions showed to have stronger incentives to engage in capital regulatory arbitrage, while retaining the issued securitisation tranches.

Third, the study investigates the interaction between the collateral eligibility criteria for monetary policy and the prudential requirements for securitisation. The analysis shows that the eligibility of ABSs as collateral for monetary policy operations may have some relevant implications for the incentives of banks in conducting securitisation deals and in managing their balance sheets. This highlights the relevance of the collateral framework as a key policy tool to affect the behaviour of the credit institutions acting as central bank counterparties<sup>3</sup>.

## **1.2 Literature Review: Bank Capital and Securitisation**

This chapter relates to various strands of the theoretical and empirical literature on banking. Three main research areas can be identified at this regard: the amount of capital held by banks in relation to economic incentives and prudential requirements; the adjustments of banks' capital position in response to cyclical fluctuations and changes in bank risk-taking; the incentives of banks in the securitization process and the management of balance sheets and capital position by originator and investor banks.

### **1.2.1 The Amount of Bank Capital: Incentives and Regulation**

The question about how much capital banks hold for their activities is a fundamental issue in banking, which has been deeply analysed since the late 1970s in connection with the regulatory debate<sup>4</sup> and has found further recent developments after the global financial crisis<sup>5</sup>. I first discuss the incentives driving the financing choice of a bank between capital and debt, i.e. whether the Modigliani-Miller propositions hold for banks or whether capital can be more costly than debt. Then, I examine the rationale for capital regulation as presented in the theoretical literature and illustrate the issue whether capital requirements are binding or whether banks may have a preference for holding more capital than the minimum regulatory capital (and therefore for keeping a capital buffer above the minimum requirements). The amount of capital held by banks depends on the cost of capital relative to other funding sources, namely debt. The Modigliani-Miller theorem (Modigliani and Miller, 1958) states the irrelevance of the capital

---

<sup>3</sup> See for example Nyborg (2015); Fecht, Nyborg, Rocholl and Woschitz (2016)

<sup>4</sup>From 1979, US credit institutions have been subject to the Uniform Financial Institutions Rating System (UFIRS), also known with the abbreviation CAMEL(S), reflecting the following areas of assessment: Capital, Asset quality, Management, Earnings and Liquidity, and Sensitivity to market risk. After this US initiative, the first international agreement on bank capital– the Basel I accord– was finalised in 1988 and enforced in 1992 in G-10 member states, with the amendment for market risk in 1996. The Basel II accord was published in 2004 and implemented in the following years.

<sup>5</sup>Following the experience of the global financial crisis, the Basel III accord was first published in June 2011 and after some subsequent consultations it was finalised in December 2017.

structure for the value of a firm, under certain restrictive assumptions: complete and frictionless markets, symmetric information, lack of agency problems and no taxes. However, several deviations from these assumptions can be observed in the case of banks (Berger, Herring and Szego, 1995): first, they operate with high leverage, therefore the deductibility of interest expenses can imply an even larger tax shield of debt than for non-financial corporations; second, banks benefit from explicit deposit insurance and – depending on their size – also from a potential implicit government guarantee, all implying a reduction in the risk premium required by investors; third, banks are able to issue money-like liabilities, particularly deposits, and this liquidity feature implies lower interest rates. Given these significant deviations, it is unlikely that the irrelevance proposition of the capital structure will hold for banks, with the implication that raising new capital can be indeed more costly than issuing new debt for banks<sup>6</sup>.

However, it is to be determined to what extent new equity would be more costly than new debt, as the cost of equity is not fixed, but it is a function of the risk of the firm's earning assets and of the leverage in the firm's capital structure (Miller, 1995). In fact, a decrease in bank leverage reduces the volatility of equity returns, such that the shareholders of a better capitalized bank could expect a lower required return on equity. This argument has been tested in some recent empirical studies aimed at estimating the costs and the benefits<sup>7</sup> of the post-crisis increase in bank capital ratios, as required by the Basel III agreement for all banks or by the additional loss absorbency requirements for global systemically important banks (for the US: Kashyap, Stein and Hanson, 2010; for the UK: Miles, Yang and Marcheggiano, 2012; at the global level, ECB, 2011). These studies find that higher common equity ratios are associated with lower risk premia and with a decline in banks' required return on equity: therefore, the benefits from lower leverage can partially offset the costs from raising new equity. At the same time, these papers suggest that the short-run costs from raising new equity could be higher than the long-run costs of having more equity, recommending a gradual implementation of the capital regulation reforms.

Provided that for banks raising new capital can be more costly than issuing new debt, banks determine their amount of capital with respect to two components: the minimum required capital as set by prudential regulation; and the economic incentives for banks to hold more capital than the regulatory minimum. So I first discuss the rationale for the capital requirements,

---

<sup>6</sup>Miller (1995) clarifies that the Modigliani-Miller propositions are ex-ante propositions, as they are “concerned with *having* equity, not with *raising* equity”.

<sup>7</sup>The analysis of the costs and benefits of an increase in bank capital ratios can be conducted both at the bank-level, by considering the private costs and benefits for individual institutions, and at the economy-level, by focusing on the social welfare dimension. According to Admati, DeMarzo, Hellwig and Pfleiderer (2013), the fact that banks choose high leverage doesn't mean that it is socially optimal. They advocate for setting capital requirements significantly higher than the ones defined in the Basel III framework, explaining that this would entail large social benefits and minimal social costs: higher bank capitalisation is useful to prevent disruptive financial crises and to ensure the stable provision of bank credit to the real economy.

based on the theoretical studies on the portfolio approach and on the incentive-based view of solvency regulation; in this context, I present the theoretical arguments on bank capital buffers, to explain why banks may be interested in having an additional amount of capital above the minimum requirements.

The rationale for bank capital requirements has been discussed in the academic and policy debate in relation to the moral hazard incentives coming from the provision of the explicit deposit insurance or other types of implicit guarantees to banks (Keeley, 1990; Rochet, 1992). This is a key departure from the general assumptions of the Modigliani-Miller propositions. Under deposit insurance or implicit guarantees, depositors or other bank creditors may have less incentive to monitor bank behaviour - to ensure that the bank undertakes a prudentially sound conduct - as they expect to be covered by the deposit insurance or by a potential public bail-out in case of default. Then the risk taken by the bank may not be fully priced in the risk premium required by creditors and investors. Also, banks may not fully internalize the consequences of their risk-taking behavior and then may be interested in gambling to increase their profits.

The moral hazard related to deposit insurance may in fact depend on the pricing criteria used to compute the insurance premium, whether a flat rate is charged to the volumes of deposits independently from bank risk or whether an actuarially fair insurance premium is determined based on the composition and the risk of bank assets. Merton (1977, 1978) proposes using the contingent claims analysis to the pricing policy of deposit insurance, based on the idea that under deposit insurance bank equity can be considered as a call option of bondholders on the portfolio of assets held by the bank. This arbitrage pricing model requires the existence of complete financial markets and yields the result that the value of the call option is an increasing function of the volatility of bank assets. This implies, if the insurance rate is flat, that banks may have incentive to increase their risk-taking to exploit the safety net. Then, in order to limit this moral hazard, the deposit insurance should be based on an actuarially fair insurance premium set as a function of the volatility of bank assets.

Also, in their risk-taking decisions, banks may have to consider the role of potential bankruptcy costs, related to the loss of their franchise values (Kareken and Wallace, 1978). This is another important deviation from the assumptions of the Modigliani-Miller propositions. Without this cost, the debt-equity ratio would be indeterminate, as the proposition of the capital structure irrelevance would hold. But when a bankruptcy cost is introduced, and in absence of deposit insurance, banks would spontaneously choose their portfolio and hold a capital amount in a way to avoid their failure. Then it would not be necessary to introduce minimum capital requirements, as market discipline would create the appropriate incentives. If bank creditors are informed, any increase in bank risk would be reflected in a rise of the risk premia required by depositors and investors. On the other hand, if bank liabilities are insured at a premium

independent of portfolio risk, unregulated banks would hold risky portfolios and could be subject to bankruptcy. Under bankruptcy costs, regulation could usefully complement deposit insurance in reducing potential misallocation of resource, but a capital requirement might not be sufficient to prevent bankruptcy.

The design of capital requirements has benefited from the application of the theory of portfolio management to banks, along the paradigm proposed by Pyle (1971) and Hart and Jaffee (1974). Provided that all assets and liabilities of a bank can be assimilated as different types of securities, the bank can be considered as a portfolio manager, with the only peculiarity that bank liabilities would correspond to short positions in the bank's portfolio. In this framework banks would operate as mean-variance maximisers, trading off expected returns against the variance of returns.

Koehn and Santomero (1980) use the portfolio model to investigate the consequences of capital regulation on the behavior of banks. They focus on the issue of portfolio reaction to capital requirements, i.e. they explore the endogeneity of portfolio composition to a regulatory increase in the minimum capital asset ratio, to study the effects on bank portfolio risk. They find that, in absence of solvency regulation, the probability of banks' failure is a decreasing function of their capital ratio; however, the introduction of a solvency regulation imposing a minimum requirement may alter the asset allocation of banks. If the solvency constraint is based on simple capital ratios and is binding, the bank may choose an inefficient portfolio, where the composition would be distorted towards more risky assets: even if the total volume of risky assets decreases, because of this asset recomposition the failure probability of some banks may even increase. On the other hand, if the weights used in the capital ratio are proportional to the systematic risks of bank assets, the solvency regulation may induce banks to choose efficient portfolios and to reduce their probability of failure<sup>8</sup>. Kim and Santomero (1988) further develop the portfolio approach to provide a solution for the design of bank capital regulation, by deriving the "theoretically correct" risk weights, which consist of restrictions on asset composition, to alter the optimal portfolio choice of banks.

Following on this portfolio approach, Rochet (1992) analyses the role of capital regulation for the portfolio decisions of commercial banks, by introducing a distinction based on the objective function of banks. He finds that, if banks maximize an objective function based on the market value of their future profits, capital regulation is not adequate to prevent banks from selecting very specialized and risky portfolios: indeed, risk-based insurance premia would be the relevant instruments for this purpose. If, on the other hand, banks behave as portfolio managers maximizing a utility function, capital regulation can be effective, but only if the risk weights for the ratio computation are proportional to the systematic risks of the assets.

---

<sup>8</sup>These considerations based on the theoretical findings have played an important role in shaping the policy debate for the introduction of risk-based capital requirements.

Moreover, following on a point raised also by Keeley and Furlong (1990), Rochet takes into accounts the limited liability in the objective function of banks and shows that this further modifies banks' behavior towards risk, as they may become risk-lovers: in this case it may be necessary to impose in addition a minimum capital level to prevent them from choosing highly inefficient portfolios.

The papers discussed above are based on the assumption that capital requirements are binding, i.e. that banks hold exactly the amount of capital required by solvency regulation. However, this approach does not capture one possible dynamic dimension of bank capital management: Milne and Whalley (1999, 2001) and Milne (2002) argue that banks may have a forward looking perspective, taking initiatives as necessary to raise bank capital or to adjust asset portfolios to avoid potential future breaches of capital requirements. Indeed, if banks keep an amount of bank capital only corresponding to the minimum requirements, unexpected shocks may actually reduce their capital ratios below this threshold and this can imply potential enforcement actions by the supervisory authority or market reactions by investors. In this respect, capital requirements may play an incentive role for banks by inducing banks to hold some capital buffers<sup>9</sup>.

Milne and Whalley (1999, 2001) propose a dynamic model with endogenous capital to explain the choice of the desired level of bank capital as a result of a trade-off between two factors: on one hand, bank deposits or debt issuances are less expensive than bank equity, therefore bank debt would be preferable to equity; on the other hand, lower bank capital may increase the deadweight costs of liquidation<sup>10</sup>. Once a bank sets this optimal capital level, it adjusts its dividend decisions in order to reach this target: if the net worth is larger than the desired target, it distributes dividends among shareholders; if bank capital is below the target, it retains earnings. This approach yields significant implications for the relation between bank capital and risk-taking: the choice of risk in bank portfolio does not depend anymore on the overall bank capital position, but on the level of capital buffers above the minimum requirements.

Milne (2002) extends the incentive-based approach to capital requirements to analyse the implications on portfolio choice, finding different conclusions than under the standard portfolio approach to capital regulation. In this new framework, the effects of risk weights on bank portfolios may vary across time horizon: in the medium run, banks with high expected profits tend to increase their capital to avoid regulatory infringements, and then risk weights will have only a minor impact on bank portfolios; while, in the short-run, the concerns for potential

---

<sup>9</sup> The capital buffer theory has been developed also by Peura and Keppo (2006).

<sup>10</sup> The value of the expected bankruptcy costs rises with the probability of bank failure, which is indeed an inverse function of the amount of capital held by banks (Orgler and Taggart, 1983)

breaches may still imply some role of capital requirements in bank portfolio decisions<sup>11</sup>. Also, the liquidity of bank assets may be relevant for the effects of capital requirements on portfolio allocation: if the assets are liquid enough to be traded, then capital regulation does not affect portfolio choice, as in the case of a net worth decline the bank can always sell these assets.

Other dynamic models explore the relation between capital regulation and bank risk-taking by exploring other possible dimensions of bank capital management. Blum (1999) studies the effects of capital adequacy rules on bank risk-taking in a two-period setting, where capital requirements are binding in at least one period. If the bank faces a binding capital rule already in the first period, tightening the requirement decreases bank risk-taking. But if capital requirements are implemented in the second period, banks may increase asset risk in the first period for two reasons: first, a tighter regulation lowers the expected profits and then the charter value of the bank which could be lost in a bankruptcy; second, since additional capital allows the bank to increase the investment in risky assets for a leverage effect, increasing risk ex-ante may incentivize the bank to raise costly capital ex-post.

Hellmann, Murdock and Stiglitz (2000) show that the incentive to gamble under moral hazard can be stronger under financial markets liberalization, increasing the degree of competition among banks: this can reduce their profitability and therefore their franchise value<sup>12</sup>, as the cost of an eventual default could be lower than the gain from the potential success of the gambling strategy<sup>13</sup>. In this case, capital requirements may be useful to reduce the incentive to gamble, as banks with sufficient capital would internalize the consequences of their risk-taking behavior. However, Hellmann, Murdock and Stiglitz (2000) argue that capital requirements may need to be combined with other forms of regulation. Unless charged with inefficiently high minimum capital requirements, banks would still have incentive to compete for deposits by offering high rates and this would further reduce their profits. Therefore, deposit-rate regulation - setting a maximum ceiling for the rates to depositors – should be introduced to integrate capital regulation.

Finally, another relevant strand of theoretical literature on bank capital regards the potential agency issues in the contract between bank managers and shareholders. In fact, the assumption that banks are owned and managed by the same agent is not supported by the evidence, particularly for large banks. If the contract between stockholders and managers were

---

<sup>11</sup> For weak banks close to insolvency, capital requirements would not provide an effective restraint in any case.

<sup>12</sup> See also Marcus (1984) for a similar argument on the risk-taking consequences of deregulation on bank financial policies under bankruptcy costs for the loss of the franchise value.

<sup>13</sup> On the other hand, Allen, Carletti and Marques (2011) - analysing the relation between credit market competition and bank capital - find that competition provides an incentive for banks to use capital as a way to commit to greater monitoring. This theoretical result is consistent with the empirical evidence that banks hold capital in excess of the regulatory minima. Also, it is supported by the findings in Schaeck and Cihak (2012) that European banks hold higher capital ratios when operating in a more competitive environment.



to be complete, the actions of the managers would replicate the indications of the stockholders. However, as highlighted by Dewatripont and Tirole (1994, 1993), some decisions cannot pre-determined in the contract and this may lead to potential governance issues in all firms and particularly in banks, given also the potentially different objective function of shareholders and managers<sup>14</sup>. In addition, also depositors would not have the incentive and/or the capacity to monitor bank managers. This governance failure in the financial structure of firms is a further important departure from the set of assumptions in the Modigliani-Miller framework and it may significant implications for capital regulation.

As the payoff of equity is a convex function of bank profits, equity holders may be generally in favour of risky decisions; while, as the payoff of deposits is a concave function of bank profits, depositors may support less risky decisions. Therefore, stockholders should be given the control rights of the bank if the first-period performance is good, while depositors should have them if the same performance is negative. In this case, the regulator is in charge of representing the interests of the depositors: bank capital regulation defines the rules under which the stockholders remain in control of the bank or the regulator steps in by taking intervention.

### **1.2.2 Bank Capital Determinants and Adjustments**

Provided that banks determine their optimal amount of capital according to various determinants, I now discuss some of the main empirical studies analysing how banks set and adjust their capital position over time, also in response to cyclical fluctuations and possible changes in their risk profile.

A first important empirical question relates to the determinants of bank capital structure, also with regard to the role of capital regulation, i.e. whether banks hold an amount of capital just corresponding to the minimum requirements or whether they keep some capital buffers in excess also for other factors. A traditional view considers that, since the deposit insurance and the bank safety net may incentivise excessive risk-taking by banks, capital regulation is necessary to reduce this moral hazard: following this argument, the capital decisions of banks would be mainly driven by binding capital requirements<sup>15</sup>. However, some other studies suggest that capital requirements may indeed provide an incentive mechanism to keep capital buffers above the regulatory minima (Milne, 2002), and also argue that banks set their capital amounts according to various other factors, like the costs of bank distress, the liquidity creation, and the ability to force borrower repayment (Diamond and Rajan, 2000).

---

<sup>14</sup> Saunders, Strock and Travlos (1990) find that the managers may have the incentive to decrease the risk of bank insolvency below the level which would be optimal for the stockholders, as managers may have more to lose in the event of bank insolvency.

<sup>15</sup> See Berger, Herring and Szego (1995) for a review of the traditional arguments about the role of bank capital in financial institutions.

The empirical studies on the determinants of bank capital structure have recently explored some factors traditionally considered in corporate finance literature but relevant also for banks. On one hand, the trade-off theory (Kraus and Litzenberger, 1973) points that firms set their capital amount on the basis of a trade-off between the benefits and the costs of debt financing: the benefits generally refer to the tax advantage of debt over equity, but in the case of banks they are reinforced by the provision of the bank safety net and the deposit insurance; while the costs of debt finance come from the higher probability of distress due to inadequate solvency, which could lead – in the case of bank failure – to the loss of the franchise value for shareholders. On the other hand, the pecking order theory (Myers and Majluff, 1984) notes that under asymmetric information the short-run costs from the capital structure adjustment may exceed the benefits, and then predicts that firms modify their capital structure according to a pre-defined pecking order: first, they retain earnings; then, if they need external funds, firms prefer to issue debt rather than equity. An application of the pecking order theory to banks would imply that, given the short-run adjustment costs, banks would tend to follow a relatively passive approach in the management of bank capital, relying mainly on retained earnings and less on new issuances of shares.

On one hand, empirical evidence provides some support to the moral hazard argument that the provision of public guarantees on bank liabilities may raise risk-taking incentives for banks. However, also the empirical studies analysing these incentives from deposit insurance and other public guarantees suggest that capital regulation might have only a limited role in explaining bank capital structure and in controlling bank risk-taking.

Hovakimian and Kane (2000) analyse the incentives for US banks from 1985 to 1994 to shift risks towards the governmental safety net and investigate the effectiveness of the regulatory efforts via capital requirements, partly before the global adoption of the first Basel agreement. They find that capital discipline did not prevent banks from controlling this risk-shifting; while the reform of the Federal Deposit Insurance Corporation in 1991, requiring the assessment of insurance premiums according to risk, contributed to improve also the discipline role of capital requirements. Gropp, Gruendl and Guettler (2014) investigate the effects of government guarantees on bank risk-taking, by exploiting the removal of public guarantees for savings banks in Germany in 2001. Using a diff-in-diff approach, they explore the effects of this removal on the assets and the liabilities of savings banks and find that these banks reduced ex-post credit risk by cutting off the riskiest borrowers and adjusted their liabilities away from risk-sensitive debt instruments. Similar results are obtained also for the studies on the implicit guarantees, which could be related to the too-big-to-fail status of certain banks: Boyd and Runkle (1993), Boyd and Gertler (1994), Gropp, Hakenes and Schnabel (2011) confirm that large banks have been shown to follow riskier strategies than smaller banks.

As for the determination of bank capital amounts, empirical evidence shows that banks are generally interested in keeping capital buffers above the minimum requirements. This finding is obtained in some studies analyzing bank capital developments in various countries already before the crisis: for the US, Berger, DeYoung, Flannery, Lee and Oztekin (2008); for North America and Europe, Brewer III, Kaufman and Wall (2008), as well as Gropp and Heider (2010); at the global level, Barth, Caprio and Levine (2006).

This tendency to keep bank capital buffers above the regulatory minima could be related also to potential differences between the capital ratios required by prudential regulation and by market expectations<sup>16</sup>. Wall and Peterson (1995) and Barrios and Blanco (2003) explore these differences by developing two models for the determination of bank capital ratios: the market model describes the behavior of those banks not affected by regulation as their optimal capital ratios are already higher than the regulatory minima; the regulatory model explains the behavior of those banks which would have optimal capital ratios lower than the regulatory minima, but which decide for precautionary reasons to keep a capital cushion above the requirements<sup>17</sup>. The empirical evidence confirms that banks used to have - under both models - capital ratios above the requirements, either because they had higher optimal market ratios, or because they set a capital cushion above the regulatory minima.

Provided that banks display higher capital ratios than the regulatory minima, some empirical banking studies investigate the determinants of bank capital structure exploiting some approaches from empirical corporate finance<sup>18</sup>. As for the empirical strategy, most of these studies are developed from the estimation of partial adjustment models to capture the variations of bank capital buffers over time. For instance, Flannery and Rangan (2006) analyse the capital adjustments of non-financial firms, while Flannery and Rangan (2008) apply this methodology to the study of the capital build-up of US banks in the 1990s.

The partial adjustment models are based on the argument that each bank has its own capital target, determined in relation to bank-specific characteristics and preferences. Therefore, each bank adjusts gradually its capital buffer over time in order to pursue the target in the medium-term. The variation of the capital buffer in a given period is therefore a function of the gap between the target capital buffer and the actual capital buffer in the previous period, as well as of the speed of adjustment. In particular, this adjustment speed may depend on the costs of adjusting bank capital: in fact, an active management of the capital buffer may require a change

---

<sup>16</sup> This question was explored for the first time in relation to the adoption of the Basel I agreement, particularly to understand whether the introduction of the Basel capital requirements could have contributed to some tightening of credit supply, but it is still relevant now.

<sup>17</sup> In this particular case, Barrios and Blanco show that banks would set this capital buffer whenever the capital ratio is stochastic and when important enforcement sanctions are available to the supervisors (consistently with the argument proposed in Milne, 2002)

<sup>18</sup> See Fama and French (2002) and Frank and Goyal (2008) for a discussion on the empirical tests for the different theoretical arguments on corporate capital structure.

in the bank dividend policy, or the issuance of new bank shares, or a change in the composition of bank assets. Also, the adjustment speed may be asymmetric depending on the direction of adjustment, i.e. an increase or a decrease in the capital buffer, and may be also heterogeneous across banks depending on their ex-ante conditions.

A general issue of the partial adjustment models is that the desired capital buffer is not observable: therefore, the empirical analysis – instead of using the target capital – has to consider in the estimation some balance sheet characteristics relevant for the individual capital decisions, like the expected remuneration for equity funding, the risk of bank assets, the size and the business model of the bank. Another potential econometric issue is related to the inclusion of the lagged dependent variable in the regression specification: this may affect the consistency of the panel estimator, due to the autoregressive process in bank capital management as captured in the error terms. To deal with this issue, most studies use the two-step generalized method of moments (GMM) estimator proposed by Arellano and Bond (1991).

Berger, DeYoung, Flannery, Lee and Oztekin (2008) analyse a sample of US bank holding companies from 1992 to 2006 and develop a three-step partial adjustment model where not only the target capital levels, but also the adjustment speeds are determined by time-varying bank-specific characteristics<sup>19</sup>. They test for different hypotheses explaining the holding of excess capital: banks could build excess capital through a passive retention of earnings in line with a pecking order theory, or they could set their target levels based on an optimal assessment of the economic capital based on the trade-off theory and pursue them through the issuance or the repurchase of shares. The analysis shows that banks actively managed their capital ratios by setting target capital levels significantly above regulatory minima and that especially poorly capitalised institutions made rapid adjustments toward their targets. Brewer III, Kaufman and Wall (2008) extend this literature by modeling bank capital structure as a function of not only bank-specific characteristics, but also of country-level prudential regulation and supervision features (including capital regulation stringency, effective supervisory enforcement, corporate governance effectiveness)<sup>20</sup>.

Gropp and Heider (2010) find that standard cross-sectional determinants of leverage for non-financial firms apply also to banks, unless for those ones with a capital ratio close to the regulatory minimum. Also, they show that unobserved time-invariant bank fixed effects are the most important determinants of bank capital structure, as the leverage of banks converges to bank-specific time-invariant targets. When decomposing the leverage with respect to different

---

<sup>19</sup> Memmel and Raupach (2010) exploit the richness of monthly supervisory data for German banks to estimate not only the target level, but also the adjustment speed of capital ratios for each bank separately.

<sup>20</sup> See the literature review in Chapter 3, namely Section 3.2, for a more detailed discussion on the role of national prudential framework in explaining the capital position of banks and the related implications on bank resilience

funding sources, and for a period between 1991 and 2004, they document a shift over time in the liabilities structure from deposits towards other liabilities.

A second relevant question concerns the relationship between capital buffers and business cycle fluctuations. The introduction of the Basel II accord – aimed at increasing the risk sensitiveness of bank capital requirements – triggered a large academic and policy debate on the potential pro-cyclicality of solvency regulation. The link between credit risk measures and regulatory risk weights under cyclical fluctuations<sup>21</sup> implies that capital requirements may increase in downturns, when banks are facing a reduction in profits due to the lower economic activity and to the losses on non-performing exposures; if risk-based solvency requirements are binding, this tightening could also have potential negative implications on bank credit supply. On the other hand, capital requirements tend to decrease in economic booms both for the improvement in economic conditions and for the effects of potential credit rating upgrades on risk weights: this may incentivise an increase in bank risk-taking, which may be acceptable under certain conditions and for healthy banks, but may raise concerns for potential boom and bust cycles and particularly for weak banks.

More recently, in the context of the Basel III agreement, a renewed focus on this topic has been motivated by the introduction of the countercyclical capital buffer<sup>22</sup>, to strengthen the capital position of banks thanks to the earnings accrued in expansionary times and to allow banks to improve their resilience also in recession times. In this perspective, the countercyclical capital buffer may be useful to prevent a bank lending contraction in recession times, by counterbalancing the potential pro-cyclical effects of capital regulation.

The policy discussions explain the attention on the relation between cyclical fluctuations and bank capital. Various studies have been conducted both at the country-level (for Spain: Ayuso, Perez and Saurina, 2004; for Germany: Stolz and Wedow, 2011; for the US: Shim, 2013) and in a cross-country perspective (for the EU: Jopikii and Milne, 2008; at the global level: Carvallo Valencia and Ortiz Bolaños, 2018; Fonseca and Gonzalez, 2010; Bikker and Metzmakers, 2007). Most of these studies focus on bank capital buffers<sup>23</sup> to study their changes over the cycle: provided that banks have to fulfill the minimum capital requirements in any case, the capital buffers above these regulatory minima can be subject to some variations over the cycle. Moreover, if banks generally hold capital buffers, the potential pro-cyclical

---

<sup>21</sup>In Basel II, capital requirements are linked to the risk of bank assets – either through the credit ratings in the standardised approach or through the model-based probability of default in the internal ratings based approach

<sup>22</sup> In this regulatory context, the word “buffer” is used in a slightly different meaning than the above discussion on bank capital buffers. The countercyclical capital buffer is an additional amount of capital that banks have to hold in boom periods, when it is activated by macroprudential policy authorities. In this respect, it is part of the Pillar 1 mandatory capital requirements.

<sup>23</sup> Only Bikker and Metzmakers (2007) refer to the overall capital amount of banks.

effects of capital regulation can be less relevant as banks would in any case have this additional capital and then it may be indeed more useful to investigate the cyclicity of capital buffers.

The analysis of the co-movement between capital buffers and business cycle can lead to two different conclusions for the pro-cyclicality debate. An increase in bank capital buffers during upturns might suggest either that banks internalize the negative externalities of pro-cyclical capital requirements, or that they consider the possibility of a risk increase during booms. On the contrary, a negative relation between capital buffers and the cycle would advise that some institutions may underestimate the actual development of risks which could materialize after the economic upswing.

Ayuso, Perez and Saurina (2004) use Spanish supervisory data for the period 1986-2000 to study the variation of bank capital buffers over the cycle. They find evidence of a negative relation between the size of capital buffer and the GDP growth rate, i.e. banks tend to have smaller capital buffers under economic booms and larger capital buffers in recessions.

Jopikii and Milne (2008) conduct their analysis on a panel of European banks from 1997 to 2004, also by classifying countries in distinct groups to account for the differences in their banking systems. For the 15 EU member states pre-existing to the 2004 enlargement, bank capital buffers showed a negative co-movement with the cycle; while, for the 10 enlargement countries, they displayed a positive co-movement with the cycle. Also, the study introduces a further classification of banks in relation to their business models and their size: the authors find a negative relation between capital buffers and GDP growth rate for commercial and savings banks, as well as for large banks; while they observe a positive relation for cooperative and for small banks. While the differences between the two sets of countries could be related to the ongoing structural changes in the accession countries<sup>24</sup>, the heterogeneity across bank types could be explained by potential capital market frictions in raising new capital. In fact, cooperative and small banks may then rely more on retained earnings for capital adjustments and this could explain the build-up of capital during booms.

A third important empirical question on bank capital management regards the relationship between bank capital and risk-taking. This question raised particular attention at the time of the introduction of the Basel I framework and then renewed focus in connection with the debate for the Basel II accord, also in consideration of the stronger emphasis on the risk sensitiveness of capital requirements.

The literature discussion on capital regulation highlights that the capital position of a bank may be relevant for its risk-taking behavior, particularly for the composition of bank assets and the management of bank liabilities. At the same time, the illustration on the determinants of

---

<sup>24</sup> In the context of cross-country studies, some cases of negative correlation between capital buffers and the business cycle are found also in Fonseca and Gonzalez (2010)

bank capital structure suggests that the risk characteristics of individual banks may be important for the desired capital target for a bank and though this – based on a partial adjustment process – for the actual bank capital position. Therefore, we observe a potential two-way relationship between capital and risk. The empirical literature has dealt with this potential reverse causality by estimating a system of simultaneous equations for the two variables, allowing for this two-way feedback.

The theoretical literature reaches different conclusions on the relation between bank capital and risk-taking, as summarized in Shrieves and Dahl (1992). On one hand, the traditional argument on the moral hazard incentives due to the deposit insurance suggests the potential existence of a negative relation, which could raise several concerns in a financial stability perspective. Banks with a weaker capital position may have stronger incentives to exploit the bank safety net by increasing their risk-taking, as they could increase the potential gains from gambling, without bearing negative consequences on their financing costs thanks to the safety net. Also, banks more involved in riskier activities may have less incentive to increase their capital, given that lower bank capital implies also lower franchise value to be lost in case of a potential bank default and then less bankruptcy costs.

On the other hand, a positive relation between bank capital and risk may be explained by various possible arguments, where one does not exclude the others. First, the portfolio approach to banks as mean-variance optimisers finds that, as an unintended consequence of capital regulation, and for banks at or close to the regulatory minima, an increase in bank capital may result also in an increase in bank risk due to changes in portfolio composition. Second, the incentive-based view of capital regulation – exploring the trade-off between the funding advantage of debt and the bankruptcy costs in capital determination – suggests that banks may increase capital if they increase their asset portfolio risk. Third, the incomplete contract approach to the financial structure of banks suggests that managers of banks with high risk portfolios may be interested in setting higher capital.

Shrieves and Dahl (1992) test the above hypotheses about the capital-risk relation on a sample of US banks from 1984 to 1986 by estimating a system of partial adjustment equations for three key variables: one measure of capital (the equity to total assets ratio) and two measures of risk (a composite index of risk and the ratio of non-performing loans)<sup>25</sup>. The observed change in each of these variables is the result of two components: one discretionary related to bank decisions, one exogenous due to a random shock. The discretionary component of the change depends on the difference between the target value of the variable and the value in the previous period. Since the changes in bank capital and risk are driven by the bank targets, the results of the analysis may be interpreted as whether target capital levels are affected by risk

---

<sup>25</sup> Given the endogeneity of some explanatory variables, the simultaneous equations are estimated by two-stage least squares

changes and/or target risk levels are influenced by capital changes. The results show a positive relation between capital and risk, which holds for banks with different levels of capitalisation. For banks with capital ratios above the regulatory minima, the private incentives due to bankruptcy cost avoidance or to managerial risk aversion may induce banks to mitigate an increase in risk with a corresponding increase in capital and vice versa. For undercapitalized banks, regulation could explain the higher target capital levels and capital adjustment rates for banks under regulatory pressure.

A similar approach is used in other papers: Jacques and Nigro (1997) examine the behavior of US banks in the first year (i.e. 1991) of the introduction of the risk-weighted capital requirements set by Basel I; Aggarwal and Jacques (2001) investigate the measures of regulatory intervention applied to US banks from 1992 onwards under the regime of prompt corrective action; Rime (2001) explores these questions for Swiss banks for the period 1989-1995.

More recently, Jopikii and Milne (2011) analyse the relation between the short-term capital buffer and portfolio risk adjustments for a sample of US bank holding companies and commercial banks from 1986 to 2008. They estimate first the partial adjustment equations separately by GMM and then the system of simultaneous equations for capital and risk. In the latter specification, they also interact the key explanatory variables with dummies for low or high capital banks: they find a positive and significant relation between capital buffer and risk adjustments for well capitalized banks, in line with the predictions of the capital buffer theory, while they document a negative relation for banks with low capital buffers. Also, they show that banks with smaller capital buffers adjust to their capital target faster than well capitalised banks. Moreover, they investigate the potential changes in the relationship over time: shocks to capital buffers positively affect risk adjustments constantly over time, while shocks to risk are relevant for capital buffer adjustments only starting from 1999.

### **1.2.3 Securitisation and Bank Capital**

Securitisation is an important tool used by banks to manage the liquidity of their asset portfolio and to obtain funding from capital markets to finance their lending provision. The theoretical studies have investigated the incentives of originator banks to sell loans and the potential solutions to deal with the asymmetric information issues in the securitization context; while the empirical literature has explored the implications of asset securitization on the management of bank assets and liabilities, as well as on the quality and the quantity of bank credit provision.

First, the theoretical analysis has explored how securitization may reduce the liquidity mismatch in bank balance sheets by allowing for the transformation of illiquid loans in liquid



securities. In general, bank loans used to be considered as non-marketable assets because of the asymmetric information between sellers and buyers: on one hand, originator banks would not have the incentive to monitor the credit risk of the borrowers if they are not exposed to the loans or if they expect not to be exposed in the near future, increasing moral hazard; on the other hand, financial intermediaries different from the originator bank would not dispose of the soft information gained by the lender, so as in an adverse selection context they would not be able to properly price these assets and may be willing to pay only a price below their actual value (Gorton and Pennacchi, 1995). This asymmetric information issue may be tackled in an incentive-compatible way if originator banks retain some “skin in the game”, either by keeping some part of the credit risk in the loan portfolio, or by providing some explicit or implicit guarantees to loan buyers against the potential default of borrowers<sup>26</sup>. DeMarzo (2005) investigates how an originator bank can better sell the assets, depending on the information available to the seller and on its ability to design a structured product. If the originator has superior information about the value of the assets, it may prefer to sell them separately than as a pool for the information destruction effect of pooling. At the same time, if the originator is able to structure a product collateralized by the assets, pooling and tranching may be optimal: indeed, if the risks of individual assets are not highly correlated, tranching allows to exploit the risk diversification effect of pooling and to create a low-risk and highly liquid asset.

Second the theoretical literature analyses how banks may use securitization to get funding and how they can structure an optimal security design for this purpose. Greenbaum and Thakor (1987) explore the funding choice between securitization and deposits to finance bank loans. They find that, under common knowledge of loan quality and in an unregulated banking market, the choice would be irrelevant. However, when introducing asymmetric information, they show that better quality assets will be securitized, while poorer quality assets will be funded with deposits. In addition, public regulation can further influence the bank's choice; governmental subsidies may induce a bank to favour deposit funding (as protected by deposit insurance and then implying lower financing costs); at the same time, mutual funds and third-party insurers (e.g. investment banks) may encourage the issuance of securitization respectively by offering diversification opportunities and by providing additional enhancement to investors. Pennacchi (1988) further explores the funding cost incentive for the issuance of securitization and shows that loan sales allow banks to finance loans less expensively than by customer deposits or equity issuance, given that the funds received via loan sales can avoid the costs related to respectively central bank reserves or minimum required capital: however, the extent of the loan sales may be limited by the above issues of moral hazard due to lack of monitoring.

---

<sup>26</sup> Küncl (2018) analyses the efficiency of the signaling provided via the recourse by the originator bank and shows that this recourse reduces information asymmetry differently over the business cycle.

DeMarzo and Duffie (1999) investigate the security design of a securitization deal as to improve the market liquidity of the instrument. In particular, they explore the potential trade-offs that an originator bank faces when setting the value of the deal for a given amount of underlying assets, i.e. the degree of credit enhancement provided through the deal overcollateralization. When the originator bank places the deal among market investors, it has some private information on the distribution of the cash flows from the underlying assets, otherwise not available to investors. As in standard “lemons” problem, investors may offer a lower price if the originator intends to place a larger amount: then, the information asymmetry between originators and investors may lead to some market illiquidity in the pricing. On the other hand, if the asset cash flows largely exceed the value of the deal, the originator can offer a relatively riskless security; however, this comes with the cost of retaining a larger portion of the asset cash flows, with a consequent reduction in the amount of funding raised via the issuance. Given this trade-off between the obtainable amount of funding and the market liquidity of the security, the authors characterize the optimal security design, based on a seniority structure, whereby the originator retains the residual portion plus any unsold fraction of the senior tranche.

The empirical literature has widely investigated the effects of securitization on the role of credit intermediaries in the economy and on the provision of credit in the originate-to-distribute model. Several papers have explored the impact of securitization on loan origination decisions, particularly in the US, to explain whether and to what extent it may have contributed to a loosening in lending standards and/or to excessive credit supply: see Loutskina and Strahan (2009); Mian and Sufi (2009); Keys, Mukherjee, Seru and Vig (2010); Demyanik and Van Hemert (2011); Dell’Ariccia, Igan and Laeven (2012); Kara, Marques-Ibanez and Ongena (2016).

Some attention, but comparatively less, has been paid to the effects of securitization on bank balance sheet management, particularly on the funding conditions and on the liquidity position of banks. Loutskina (2011) shows that securitization provides a new source of liquidity, by allowing banks to convert illiquid assets into marketable securities. Also, by providing a new source of funding - based on the pooling and tranching of existing loan portfolios - securitization also reduces the sensitivity of bank lending to the availability of external funding sources. As discussed also in Altunbas, Gambacorta and Marques-Ibanez (2009), securitisation activity may also affect the effectiveness of the bank lending channel: by strengthening banks' capacity to supply new loans, it shelters their loan supply from the effects of monetary policy.

For the purpose of this chapter, I focus the literature discussion on the relation between securitization and bank capital. The analysis on this aspect – particularly after the subprime crisis - was motivated by the significant losses borne by banks during the crisis for their involvement in securitization in different roles, both as originators and as investors.

I discuss first the role of originator banks: a relevant challenge for an empirical study on securitization and bank capital could be related to potential issues of reverse causality, as a two-way relationship could be observed between two variables. On one hand, the ex-ante capital position can be relevant – with other factors - for the bank’s decision to securitise, in two possible directions: on the supply side, less capitalized banks may be more interested in securitizing to improve their prudential solvency ratios; on the demand side, weakly capitalized banks may be less able to place securitization if investors are concerned about the risk of their loan portfolios. On the other hand, securitization – as all the operations of balance sheet management potentially affecting the credit risk of bank activities - may imply some variation in the capital position of originator banks: a true-sale securitization may ex-post reduce the risk-weighted assets and then increase the risk-based capital ratios, while the retention of securitization may imply no significant changes on the exposures neither on the capital ratios.

Various papers at the country-level (for the US: Calomiris and Mason, 2004; Jangli and Pritsker, 2008; Casu, Clare, Sarkisyan and Thomas, 2013; Le, Narayanan and Van Vo, 2016; for Canada: Dionne and Harchaoui, 2008) or in a cross-country perspective (for Europe: Michalak and Uhde, 2012; at the global level: Panetta and Pozzolo, 2018) have analysed the effects of securitisation on bank capital, taking as a main source of variation the distinction between securitisers and non-securitisers (on the extensive margin). I discuss these papers also in relation to the identification strategies designed to tackle the potential self-selection concerns, as related to the endogeneity of the securitisation decision. In fact, securitizing banks may have ex-ante different characteristics than non-securitizing banks: therefore, the variation in some balance sheet characteristics we may observe after securitization may be related to the different pre-existing features of the two groups of banks. In this case, it may be difficult to disentangle the causal effect of securitization – if any – from the differences in bank characteristics between the two groups that we would have observed anyway independently from securitisation.

One possible solution to this issue would be based on an instrumental variables estimator, where the first-stage regression uses some instruments for the decision to securitise (via a probit) and/or for the issuance amount (via a tobit), while the second-stage regression analyses the changes in the bank capital ratios after securitisation. The IV method requires the existence of at least one instrumental variable that determines the treatment but is unrelated to the unobserved heterogeneity. Calomiris and Mason (2004) investigate the potential regulatory arbitrage issues in the securitization of credit card receivables for a cross-section of US banks in 1996, focusing on the off-balance sheet finance of these loans via securitization with recourse. They explore whether the avoidance of capital requirements via this off-balance sheet finance may be explained by the abuse of the safety net or by efficient contracting with market

investors<sup>27</sup>. In the first-stage regression, they use as instruments the total amount of credit card receivables, the growth rate of managed receivables, and the growth rate of capital. In the second-stage regression, they introduce as dependent variable the ratio of capital to total managed assets<sup>28</sup>: they find that this capital ratio is an increasing function of the risk of the receivables and of the bank's loan exposure, while it is lower for banks securitizing a larger fraction of their total managed assets. Since banks determine their capital position based on the risk of their portfolio, this evidence is presented as a support to the efficient contracting view of the securitization with recourse.

Also Jiangli and Pritsker (2008) follow an instrumental variable approach to study the effects of mortgage securitization for a sample of US bank holding companies from 2001 to 2007: they use bank size as an instrument to explain bank securitization decisions, as they observe that bank size has little or no effect on the analysed performance measures while it has significant effect on the probability that a bank securitises. Their results confirm that mortgage securitization increased bank leverage (defined as the ratio between liabilities and assets); nevertheless, this did not negatively affect bank performance, as securitisation reduced the insolvency risk and increased bank profitability<sup>29</sup>.

Given the potential issues in identifying valid and exogenous instruments, another potentially more robust estimation method would be based on a two-step Heckman selection model. Panetta and Pozzolo (2018) conduct a study for a large sample of banks from over 100 countries from 1991 to 2007 to examine the effects of the first securitization conducted by banks. The first step of the analysis involves a probit estimation of the probability that a bank is a first-time securitiser<sup>30</sup>. In the second step, the inverse Mill's ratio obtained from the probit estimation is included among the regressors to estimate the effects of the first securitization: a significant coefficient of this ratio in the second step implies that banks with higher likelihood to securitise would have an ex-post different level of the dependent variable, independently from the actual securitisation. The analysis shows that – after securitization – banks improved their risk-weighted capital ratios, both in the transition and in the completion periods, while increasing their leverage. At the same time, the results do not provide evidence of an ex-post increase in bank risk, looking at the Z-Score or at the charge-off ratio.

---

<sup>27</sup> According to the efficient contracting view, banks set their capital adequately to satisfy the market expectations. Therefore, if the minimum capital required by regulation for on-balance sheet exposures are deemed as excessively high for market expectations, it may be efficient for banks to use securitization with recourse as the best available means to finance credit card receivables.

<sup>28</sup> Total managed assets includes both on-balance sheet and off-balance sheet exposure.

<sup>29</sup> Jiangli and Pritsker (2008) measure the insolvency risk with the term deposit premium, i.e. the spread between the rate on uninsured and insured time deposits, and use the return on equity as a profitability measure

<sup>30</sup> They use as explanatory variables bank size, the number of securitizers in the same country, specialisation, country and time dummies

Finally, a third identification strategy to deal with the self-selection is to use a propensity score matching approach, to compare securitizing banks with ex-ante comparable non-securitizing banks. Casu, Clare, Sarkisyan and Thomas (2013) explore the effect of securitization on bank performance for a sample of US commercial banks from 2001 to 2008, by conducting a difference-in-difference estimation for some performance indicators before and after. To test the hypothesis that securitization allows banks to improve their performance, the analysis focuses on first-time securitisers, i.e. banks which had not securitised before but which conducted their first securitization transaction in the observation period: the first securitization is then defined as the treatment potentially leading to an improvement in bank performance. As usual in non-experimental settings, the performance of the first-time securitizing banks after the treatment can be observed, while it is not possible to observe the counterfactual, i.e. what would have been the performance of those banks had they not securitized. Then, to construct the counterfactual, the analysis has to consider non-securitising banks which would be ex-ante comparable, based on pre-existing balance sheet characteristics. The propensity score matching is conducted to identify, for each first-time securitiser, a set of non-securitisers to be used in the control sample for the diff-in-diff estimation<sup>31</sup>. The counterfactual analysis based on this matching does not find evidence of an effect of securitization on performance indicators including capital, profitability, credit risk. At the same time, the univariate analysis shows the existence of some ex-ante differences between the two groups: securitizing banks tend to hold less capital, to be more profitable and to have higher credit risk exposure.

The above papers analyse the securitization behaviour of originator banks and the related implications on bank balance sheet management and capital position. However, in many cases banks have also acted as investors in securitization products, either directly through their on-balance-sheet exposures, or indirectly through their off-balance sheet conduits. In both cases, recent papers in the literature document significant cases of regulatory arbitrage relevant for the discussion on securitization and bank capital.

I first consider the case of the asset-backed commercial paper (ABCP) conduits sponsored by several major banks before the crisis: the money market runs on the commercial paper issued by these conduits in 2007 had significant implications on the solvency and the liquidity of sponsor banks, highlighting the strong linkages between banks and shadow banking entities<sup>32</sup>. In fact, the sponsoring banks used to provide both explicit and implicit support to their conduits.

---

<sup>31</sup> While the exact matching has to be conducted on all the covariates, the propensity score matching overcomes this dimensionality issue by estimating the probability of the assignment to the treatment group based on a set of covariates. In both cases, after the matching, the conditional distribution of covariates in the treatment and control groups should be the same.

<sup>32</sup> ABCP conduits were special purpose vehicles set up by financial institutions with the sole purpose of purchasing high-yield medium- to long-term assets and holding them off-balance-sheet. Conduits used to finance these assets via the issuance of asset-backed commercial paper generally with a one-month

Acharya, Schnabl and Suarez (2013) study the incentives for setting ABCP conduits in the US and in Europe from 2000 to 2006 and the design of explicit support by the sponsor banks<sup>33</sup>. They show that sponsor banks with low economic capital preferred to arrange liquidity guarantees - instead of credit guarantees - for regulatory arbitrage, in order to obtain some relief in terms of regulatory capital but without transferring the risk of the exposures. Therefore more capital-constrained banks were incentivized to use forms of explicit support subject to lower capital requirements. Moreover, these guarantees had relevant effects on the ability of conduits to roll over maturing ABCP during the shadow banking run: conduits with stronger guarantees faced a smaller decrease in issuances and a smaller rise in spreads than other conduits, consistently with the lack of risk transfer. But at the same time, banks suffered significant losses from conduits: as a consequence of that, banks with larger exposures to conduits had lower stock returns

Segura (2018) focuses on the implicit support provided by sponsor banks to conduits established as structured investment vehicles<sup>34</sup> (SIVs). He develops a signaling model to explain why, in response to the money market runs, sponsor banks decided to rescue their SIVs even without any contractual obligation, in order to preserve their reputation on the markets for funding cost purposes. He shows that in equilibrium all good banks rescue their vehicles, both because they have fundamental reasons for doing so, and because this is a good signal for investors; while bad banks trade off the costs of rescuing their vehicles with the debt pricing benefits for keeping their own type unrevealed.

Finally, I consider the case of banks purchasing and holding securitization products on their balance sheets. Empirical studies have investigated the role of the ongoing securitization activity and of potential regulatory arbitrage incentives in explaining the decisions of banks to invest in securitization tranches on the extensive or on the intensive margin.

Erel, Nadauld and Stulz (2014) analyse the determinants for the cross-bank variation in the holdings of highly rated securitization tranches by US bank holding companies from 2002 to 2008. They first explore whether ex-ante differences in bank risk, as denoted by leverage or distance-to-default measures, may explain this cross-sectional variation of the holdings but they don't find evidence of that. However, banks with pre-crisis larger holdings of highly rated tranches showed worse performance during the crisis in terms of excess stock returns. The analysis supports a securitization by-product explanation of these bank holdings: banks already

---

maturity, mostly purchased by money market funds. Notwithstanding this significant maturity mismatch between assets and liabilities, in normal times ABCP conduits could regularly roll-over their liabilities using the proceeds from new issuances to repay the maturing ones.

<sup>33</sup> The liquidity guarantees required the sponsor bank to pay off maturing ABCP if the conduit assets were not in default. However, the definition of default was set such that ABCP almost always matured before the assets were declared in default. Therefore, in practice, liquidity guarantees provided to investors a protection similar to the one offered by credit guarantees, but being subject to a considerably lower conversion factor for off-balance sheet items and so implying lower capital requirements for banks.

<sup>34</sup> SIVs issue not only ABCP, but also longer-maturity uninsured debt like medium-term notes.

active in the securitization market tend to have larger investments in these products, either because they may be able to price them, or because originator banks may have some interest in retaining also some senior tranches of their securitization.

Efing (2016) investigates the risk weight arbitrage hypothesis for the investments of German banks in asset-backed securities, both at the extensive margin and at the intensive margin, using security-level data on bank holdings from 2007 to 2012. He first explores whether the low risk-sensitivity of rating-based capital requirements for ABS exposures was exploited by banks to conduct a reach-for-yield strategy: he finds that, for the securities included in the same risk weight cluster, banks were more inclined to purchase – and in larger amounts - those tranches with higher yields, in order to maximise their returns for a given regulatory capital burden. Then he studies the interaction between the reach-for-yield incentive and the capital constraints of banks: he shows that banks with lower risk-weighted capital ratios picked the securities with the higher yields (and the lower collateral performance) among ABS with the same regulatory risk weight. This reaching for yield allowed constrained banks to increase significantly the return on the capital required for an ABS investment.

### **1.3 Institutional Background on Securitisation**

In a securitisation operation, an originator bank transfers a given pool of assets to a bankruptcy-remote special purpose vehicle (SPV), which is created in order to issue securitisation products structured in tranches with different seniority. The assets transferred by the originator banks may be of different types: mainly loans, like residential or commercial mortgages, corporate loans, auto loans, leasing or credit card receivables; but also debt securities, like corporate bonds or other securitisation products<sup>35</sup>. The securitisation products backed by these assets are legally treated as liabilities of the special purpose vehicle: therefore, the investors are entitled to receive the principal and coupon payments based on the cash flows from the assets and generally cannot exert any recourse to the originator bank.

Figure 1.1 provides a simplified illustration of a securitisation operation, which involves an originator bank and a special purpose vehicle, as well as the borrowers in the loan contracts and the investors in the securitisation products. The figure presents the balance sheet of a hypothetical originator bank<sup>36</sup>: to simplify, this bank has cash, loans and securities on the assets side, while it has deposits, debt and capital on the liabilities side, for a total amount equal to 100. Let us suppose that this bank creates and sponsors a special purpose vehicle, to which it

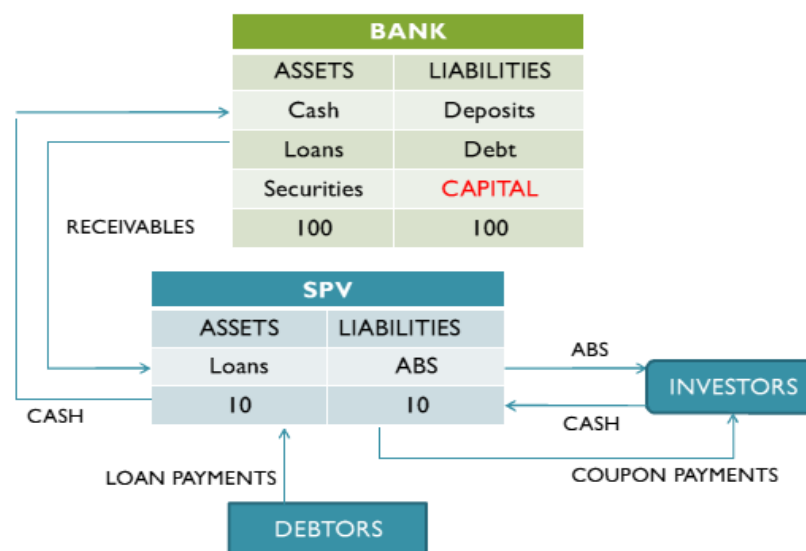
---

<sup>35</sup> The type of underlying assets in the pool explain the different names used for the securitisation products: mortgage backed securities (MBSs) are backed by mortgages; asset-backed securities (ABSs) are based on other types of loans; collateralised debt obligations (CDOs) are backed by debt securities.

<sup>36</sup> The above example assumes many simplifications from the accounting point of view. The key purpose of the example is to identify the main economic transactions occurring among the involved agents.

transfers a given amount of loans, for example 10. The SPV finances the purchase of the asset pool through the issuance of asset-backed securities: indeed, the revenues collected from the investors in structured products are passed on to the bank in order to pay for the sale of receivables. Also, the SPV uses the loan payments from the borrowers in order to pay the investors in securitisation products.

**Figure 1.1 A Stylised Representation of the Securitisation Process**



Source: Author's elaboration

The above example illustrates the pooling and the transfer of the securitised tranches. But another key feature of securitisation is tranching, i.e. the structuring of deals in tranches according to a waterfall structure. Securitisation deals are composed of many tranches, which differ primarily in their seniority structure, but also in other characteristics of fixed-income securities.

In the most basic structure, a securitisation deal includes senior, mezzanine and junior tranches: the holders of senior tranches are the first ones to receive the payments; afterwards, the waterfall structure of a deal foresees the payments to the mezzanine tranches and finally to the junior tranches, if there are sufficient cash flows. In fact, several tranches can be issued for each of these categories, with a further segmentation of the waterfall structure. The position of each tranche in the seniority structure, by determining the priority of payments, explains the probability of default on each security and therefore drives the assignment of the credit rating by rating agencies.

This segmentation of the seniority structure is designed by issuers, often in the interaction with rating agencies, to pursue two main objectives: first, to obtain the highest



possible rating for the most senior tranche, ideally a triple-A rating; but also, to cater the other tranches for the risk appetite and the return expectations of various types of investors. In fact, the different risk characteristics of these tranches are reflected in different coupon rates<sup>37</sup>: for floating-rate coupons, higher spreads are paid - in addition to the benchmark rate - for tranches with lower seniority. Also, within a given seniority segment, SPVs can issue securities with different characteristics regarding the maturity date, the provision of call options or the coupon structure, always to fully satisfy the demand of a heterogeneous investor base.

### **1.3.1 The Developments of the Securitisation Market in Europe**

While in the US the securitisation market started to develop already in the 1970s thanks to the activity of government-sponsored agencies<sup>38</sup>, in Europe this market began its development only around the end of the 1990s, in connection with the creation of the Euro and after the adoption of some laws disciplining securitisation in the national legal systems. Also, while in the US mortgage-backed securities have generally benefited from a public guarantee provided by the government-sponsored agencies, in Europe the securitisation process has been mainly a private sector initiative, undertaken by credit institutions subject to the condition of having a sufficiently liquid market to attract the interest of investors.

As observed in Altunbas, Gambacorta and Marques-Ibanez (2009), the creation of the Euro - by increasing the financial integration across capital markets in the European Union and eliminating the exchange rate risk - has been instrumental in creating the conditions for the development of a large EU securitisation market. This holds for all the deals issued in the EU, independently from whether the underlying loans were originated in the Euro Area or in other EU countries, to the extent that the securities could be denominated in Euros.

Table 1.1 shows the trends in the total annual amounts of securitisation issuances for European countries (EU member states plus Switzerland<sup>39</sup>) from 1999 to 2018. The issuances are assigned to individual countries based on the origination country of the underlying loans. Table 1.2 presents, for the same countries, the developments in the retention rate. Moreover, I classify different types of securitisation, in relation to the type of underlying assets. Tables 1.3 and 1.4 display the total amounts of issuances for the residential mortgage-backed securities (RMBSs) and the collateralised debt obligations (CDOs).

---

<sup>37</sup> In principle, the coupon structure of securitisation may foresee either a floating rate or a fixed rate coupon: however, in practice, securitisation products are generally subject to floating rate coupons, i.e. a spread is added to a given benchmark, like the 3-month or 6-month Euribor rate.

<sup>38</sup> The two most important agencies are the Federal National Mortgage Association, known as Fannie Mae, and the Federal Home Loan Mortgage Corporation, or Freddie Mac.

<sup>39</sup> I include also the issuances originated by Swiss banks, as at the least the two most important ones operated important subsidiaries in the European Union, which could therefore securitise loans originated in the EU or sponsor securitisation issuances denominated in Euros.

Table 1.1 displays first a constantly increasing trend in securitisation issuances since the creation of the Euro in 1999 until the global financial crisis in 2007-2008, then a slowly decreasing trend in the years from 2008 to 2011 - still with very significant volumes – and finally a steeper decline from 2012 until nowadays. I analyse first the developments until the subprime crisis, then the trends during the global financial crisis and the sovereign debt crisis.

Starting from an issuance volume close to EUR 66 bn in 1999, the European securitisation market reached an issuance volume above EUR 300 bn in 2004 and then increased up to EUR 589 bn in 2007. However, this diffusion of securitisation was highly heterogeneous across countries, depending on the features of national capital markets and on the developments of credit markets across countries. In fact, the securitisation technique was used for different types of underlying assets in distinct countries, leading to a significant fragmentation of the securitisation markets across countries, although the investor base for institutional investors was in general internationally broad-based.

For instance, before the global financial crisis, in countries like Ireland, Netherlands, Spain or United Kingdom, securitisation was used by banks to finance the credit expansion for residential mortgages, as reflected also in the trends for housing prices. In other countries like Germany, traditionally characterised by the diffusion of covered bonds for residential mortgages and public sector loans, the securitisation technique was employed more for other asset classes, like auto loans. For instance, as observed in Table 1.3, the overall issuance of European RMBSs in 2007 was equal to EUR 362 bn: however, it was unevenly distributed across countries, with EUR 156 bn (43%) in the UK, EUR 86 bn (24%) in Netherlands, EUR 59 bn (16%) in Spain, EUR 22 bn (6%) in Italy and EUR 19 bn (4%) in Ireland.

Another important category of securitisation before the subprime crisis was based on the collateralised debt obligations (CDOs), which could be backed by a potentially large set of assets, including mortgage-backed securities or other asset-backed securities, as well as corporate bonds or leveraged loans. On one hand, the process of pooling and tranching portfolios of other securitisation products or corporate bonds could increase the opaqueness of the newly issued securities; on the other hand, they could attract the investors thanks to the higher yields paid to investors. As shown in Table 1.4, the overall issuances of European CDOs in 2007 amounted to EUR 120 bn: also these issuances showed some relevant heterogeneity across countries, as they were mostly backed by Pan-European<sup>40</sup> (EUR 58 bn), Spanish (EUR 30 bn), Dutch (EUR 12 bn) and UK assets (EUR 11 bn).

The global financial crisis trends show some interesting facts about the European securitisation market, especially if compared with the private-label US securitisation market. In

---

<sup>40</sup> Pan-European issuances were based on underlying assets from several countries. While RMBSs are generally based on residential mortgages originated in a single country, CDOs were often based on assets originated in different countries.

fact, the European market reached the highest peak in 2008, in the most acute phase of the Lehman crisis, with an issuance volume of EUR 806 bn. Then, although decreasing from this record level, it still kept significant volumes above the pre-crisis levels in 2005 for the following years: EUR 421 bn in 2009, EUR 374 bn in 2010 and EUR 345 bn in 2011 (Table 1.1). However, most of these issuances were retained by the originator banks, with a retention rate equal to 100% in 2008, 98% in 2009, 80% in 2010, 79% in 2011 (Table 1.2). The same holds for the Euro Area: the trends show that the Euro Area issuances increased from EUR 313 bn in 2007 to EUR 457 bn in 2008 and then remained at still substantial levels in the following years (EUR 315 bn in 2009, EUR 273 bn in 2010, EUR 250 bn in 2011), well above the pre-crisis levels observed in 2006 or 2005, while with retention rates equal to 100% in 2008, 99% in 2009, 87% in 2010 and 90% (respectively Tables 1.1 and 1.2).

Also, these market developments were accompanied by some changes in the composition of the underlying assets for the securitisation issuances, generally with an increase in the share of RMBSs, particularly during the global financial crisis, given that they were eligible as collateral for central bank refinancing operations. While in 2007 RMBS issuances amounted to 61% of all European securitisation issuances, this share increased to 76% in 2008, then it was still equal to 72% in 2010. Then it declined in the following years until 65% in 2017, also with the developments of other asset classes, like auto ABSs, consumer and credit card ABSs, lease ABS. At the same time, the share of CDOs showed some decline already during the global financial crisis but more markedly over the last few years, both because of the lower demand for opaque and complex structured products, and because they were not eligible as collateral for central bank liquidity operations. While in 2007 CDO issuances corresponded to 20% of the European securitisation market, this share decreased to 14% in 2008, then it was still equal to 18% in 2010. Afterwards, it progressively declined until just 7% in 2017.

The geographical distribution of securitisation issuances during the global financial crisis broadly reflects the differences already observed in the pre-crisis period, but with some changes. Looking at the issuance data for RMBSs in 2010, Netherlands acquired a dominant position with EUR 124 bn (46%), and UK still showed a relevant volume with EUR 86 bn (32%); while Spain, Italy and Ireland reduced significantly their issuances, respectively to EUR 18 bn (7%), EUR 10 bn (4%) and EUR 4 bn (2%). This explains, for instance, why Dutch RMBSs became a quite standardised product with large demand across investors.

The developments in the European securitisation market - in particular for RMBS - during the global financial crisis could be explained by various factors. To a partial extent, the retention of newly issued securitisation products could be related to the lack of investors on the demand side. For instance, such explanation could hold for the months straight after the subprime crisis in mid-2007, when investors started to have relevant concerns about the credit

risk of securitisation<sup>41</sup>. However, a demand-side argument would not be able to explain why originator banks - well aware of this investor stigma towards securitisation already in the second half of 2007 - would have continued to issue and retain significant volumes of these products for several years afterwards: as they had other available funding sources or could issue other debt instruments, they could have simply switched to other financing strategies.

This raises the question whether these developments in the securitisation market could be related also to supply factors, like the existence of cheaper funding sources for banks, namely central bank liquidity operations or issuances of other debt securities like covered bonds<sup>42</sup>. To introduce the analysis of this chapter, it may be useful to present some descriptive evidence on the developments of the RMBS market in distinct monetary policy jurisdictions. In the Euro Area, the RMBS issuances increased from EUR 199 bn in 2007 (60% retained) to EUR 341 bn in 2008 (100% retained), to decline to EUR 178 bn in 2009 (100% retained) and then to rise to EUR 183 bn in 2010 (85% retained). In the UK, the RMBS issuances rose from EUR 156 bn in 2007 (47% retained) to EUR 260 bn in 2008 (100% retained), to decline to EUR 61 bn in 2009 (93% retained) and then to increase to EUR 86 bn in 2010 (62% retained).

This spike in the new issuances in 2008 and the full retention of the new issuances in 2008 and 2009 took place in a market context where originator banks used extensively RMBSs as collateral for central bank liquidity operations, both in the Euro Area, and in the UK. In the Euro Area, the ECB introduced the fixed-rate full allotment policy in October 2008, to remove the pre-existing limits to the quantity of available central bank liquidity in refinancing operations. In the UK, the Bank of England introduced the Special Liquidity Scheme (SLS) in April 2008, a collateral swap allowing banks to borrow treasury bills in exchange of less liquid assets like mortgage-backed securities or covered bonds. The fixed-rate full allotment policy of the Eurosystem is still in place for refinancing operations, while the SLS provided a drawdown period until January 2009 and expired in January 2012 with the last transaction. Although with different modalities, the two policy measures raised similar types of incentives, as banks interested in obtaining central bank liquidity could then sponsor the issuance of RMBS to be retained and then pledged as collateral in central bank liquidity measures.

In the most recent years, from 2012 onwards, the decline in securitisation issuances has been more marked than during the global financial crisis. In general, European issuances almost halved from EUR 345 bn in 2011 (retention rate at 79%) to EUR 179 in 2017 (retention rate at 63%). In particular, Euro Area issuances decreased from EUR 250 bn in 2011 (90% retained) to EUR 132 bn in 2017 (78% retained); while UK issuances diminished from EUR 94 bn (51%

---

<sup>41</sup> As the process for the structuring of a securitisation deal may take several months, it could be well the case that some deals designed few months before the start of the subprime crisis (August 2007) could not find investors in the immediate aftermath, like in the second half of 2007 or in the first half of 2008.

<sup>42</sup> The analysis presented in Chapter 2 investigates precisely these issuance determinants with a focus on the Euro Area, also for monetary policy reasons, using micro data at the security-bank level.

retained) to EUR 45 bn (22% retained). The issuance volume trends were relatively similar in their decline path in both monetary policy jurisdictions; however, these data suggest that the retention behaviour has continued to be a prominent feature of the Euro Area securitisation market, while it is now relatively low in the UK market.

Market participants have suggested possible explanations for these declining trends in distributed securitisation issuances: on the investors' side, the unfavourable regulatory treatment for securitisation vis-à-vis other (secured) debt instruments like covered bonds; on the issuers' side, cheaper funding sources in the more recent low interest rate environment, like central bank liquidity operations or issuances of covered bonds. Provided that the prudential regulation framework should be broadly homogeneous<sup>43</sup> across all EU countries, particularly after the adoption of the Single Rulebook<sup>44</sup> in force from 2014, some relevant differences could be related to central bank policy measures, given the different timing in the design and implementation of non-standard monetary policies in the UK and the Euro Area.

In the UK most unconventional monetary policy measures to tackle the consequences of the Great Recession were introduced by the Bank of England between 2009 and 2012<sup>45</sup>; in the Euro Area, while some non-standard measures were introduced by the ECB in late 2011 and early 2012<sup>46</sup> to deal with the liquidity issues of banks during the sovereign debt crisis, most of the unconventional policies were adopted by the ECB only from mid-2014 onwards<sup>47</sup>. Therefore, while UK banks may not have any more strong incentives to retain newly issued securitisation tranches for central bank collateral purposes, Euro Area originator banks seem to be still quite interested in retaining newly issued ABSs as the monetary policy incentives for retention are still in place in relation to central bank liquidity provision<sup>48</sup>.

This decline in distributed securitisation issuances over the last few years has raised significant attention by policy authorities. On one hand, it is understandable that - in the immediate aftermath of the global financial crisis - securitisation could have been subject to substantive concerns due to the disruptions in the financial system, due to an inappropriate use of the originate-to-distribute model in the pre-crisis period and mainly in the US. At the same

---

<sup>43</sup> Though with some national options and discretion, see the analysis of Chapter 3 on the topic.

<sup>44</sup> The Single Rulebook includes the Capital Requirements Regulation and the Capital Requirements Directive 4.

<sup>45</sup> The key measures adopted by the Bank of England during this period were: the Quantitative Easing (in various steps: March 2009, October 2011, February 2012 and July 2012); the Funding for Lending Scheme (starting from July 2012)

<sup>46</sup> I refer mainly to the 3-year Long-Term Refinancing Operations implemented in December 2011 and February 2012, also with the consequent introduction of the Additional Credit Claims Framework.

<sup>47</sup> I refer firstly to the Credit Easing Package announced in June 2014 (negative deposit facility rate, Targeted Long-Term Refinancing Operations, the ABS Purchase Programme and the Covered Bond Purchase Programme 3) and secondly to the Asset Purchase Programme (including the Public Sector Purchase Programme, the Corporate Sector Purchase Programme in addition to the two above purchase programmes).

<sup>48</sup> For more details on the monetary policy measures implemented by the Eurosystem with the Credit Easing Package and with the Asset Purchase Programme and on related implications on the securitisation market, see Section 2.7.

time, academic and policy studies have supported the argument that simple and transparent securitisation can be helpful for the economy, especially in bank-based systems, to redistribute the credit risk borne by banks for their lending across market investors, and to alleviate potential supply-induced constraints for credit provision (Bank of England and ECB, 2014). Consistent with this approach, central banks and policy institutions across the world have launched policy initiatives to promote the development of securitisation markets, in particular for high-quality asset-backed securities (ABSs), by proposing the application of less stringent prudential rules for the products fulfilling the criteria for simple, transparent and standardised (STS) securitisation.

**Table 1.1 Total Issuance of Securitisation Products by Country (in EUR millions)**

**Panel A: Issuance Years from 1999 to 2007**

|                    | 1999   | 2000    | 2001    | 2002    | 2003    | 2004    | 2005    | 2006    | 2007    |
|--------------------|--------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>Austria</b>     |        |         | 4,336   | 162     | 609     | 500     | 674     | 600     | 143     |
| <b>Belgium</b>     | 774    | 568     | 392     | 336     | 2,720   | 1,628   | 536     | 2,331   | 4,668   |
| <b>Cyprus</b>      |        |         |         |         |         |         |         |         | 11      |
| <b>Denmark</b>     | 99     |         |         |         | 58      | 160     | 446     | 329     | 6,529   |
| <b>Pan-Europe</b>  |        |         |         |         |         |         | 27,707  | 77,296  | 69,419  |
| <b>Finland</b>     | 500    | 800     | 500     | 370     |         |         | 8       | 207     | 1,134   |
| <b>France</b>      | 6,545  | 4,215   | 6,144   | 9,253   | 16,107  | 8,569   | 8,724   | 10,868  | 7,574   |
| <b>Germany</b>     | 11,221 | 16,150  | 5,087   | 15,780  | 7,299   | 11,445  | 23,502  | 46,401  | 38,274  |
| <b>Greece</b>      |        | 1,390   | 2,365   |         | 250     | 750     | 2,250   | 5,800   | 5,310   |
| <b>Ireland</b>     | 1,150  | 4,386   | 1,943   | 516     | 2,791   | 332     | 1,794   | 10,594  | 15,393  |
| <b>Italy</b>       | 6,756  | 10,158  | 31,573  | 30,061  | 28,945  | 33,630  | 32,320  | 30,671  | 32,168  |
| <b>Luxembourg</b>  |        |         | 2,215   | 1,000   | 50      |         |         |         | 5       |
| <b>Netherlands</b> | 6,493  | 15,384  | 15,465  | 11,768  | 20,444  | 13,622  | 39,387  | 43,539  | 104,275 |
| <b>Poland</b>      |        |         |         |         | 74      |         |         |         | 46      |
| <b>Portugal</b>    | 1,404  | 737     | 4,122   | 3,310   | 9,769   | 7,315   | 7,260   | 6,227   | 8,330   |
| <b>Slovakia</b>    |        |         |         |         |         |         |         |         |         |
| <b>Spain</b>       | 5,406  | 6,728   | 4,189   | 13,392  | 22,869  | 28,708  | 42,341  | 63,310  | 95,802  |
| <b>Sweden</b>      |        | 2,302   | 1,464   | 384     | 1,016   | 1,530   | 293     | 178     | 84      |
| <b>Switzerland</b> |        |         |         |         |         |         | 12      | 116     | 670     |
| <b>UK</b>          | 25,484 | 44,389  | 57,568  | 49,272  | 78,666  | 195,721 | 126,891 | 187,278 | 199,490 |
| <b>Europe</b>      | 65,831 | 107,206 | 137,363 | 135,604 | 191,667 | 303,910 | 314,145 | 485,745 | 589,323 |
| <b>EU</b>          | 65,831 | 107,206 | 137,363 | 135,604 | 191,667 | 303,910 | 314,133 | 485,629 | 588,653 |
| <b>Euro Area</b>   | 40,249 | 60,516  | 78,331  | 85,948  | 111,853 | 106,499 | 158,796 | 220,548 | 313,085 |

**Panel B: Issuance Years from 2008 to 2018**

|                    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015    | 2016    | 2017    | 2018    |
|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>Austria</b>     |         |         |         |         |         | 267     |         | 325     | 438     |         |         |
| <b>Belgium</b>     | 34,986  | 27,434  | 17,861  | 18,948  | 15,411  | 2,018   |         | 1,030   | 3,636   | 12,331  | 218     |
| <b>Cyprus</b>      |         |         |         |         |         |         |         |         |         |         |         |
| <b>Denmark</b>     | 279     |         |         |         |         | 800     |         |         |         |         |         |
| <b>Pan-Europe</b>  | 70,706  | 18,187  | 5,006   | 1,153   | 163     |         | 127     | 146     |         |         |         |
| <b>Finland</b>     | 7,535   |         |         |         | 482     | 1,013   | 518     | 389     | 607     | 700     | 531     |
| <b>France</b>      | 29,792  | 27,540  | 6,841   | 11,559  | 15,984  | 9,876   | 49,948  | 16,478  | 20,396  | 32,531  | 17,745  |
| <b>Germany</b>     | 40,990  | 33,771  | 12,590  | 12,823  | 9,699   | 21,756  | 18,281  | 41,098  | 16,427  | 12,092  | 10,130  |
| <b>Greece</b>      | 13,472  | 22,481  | 956     | 3,729   |         |         | 238     |         | 648     |         | 101     |
| <b>Ireland</b>     | 40,120  | 13,757  | 6,737   | 284     | 890     | 1,020   | 2,072   | 652     | 4,377   | 2,618   | 7,628   |
| <b>Italy</b>       | 92,923  | 68,326  | 16,116  | 46,653  | 62,037  | 26,265  | 18,296  | 27,380  | 39,352  | 27,422  | 23,735  |
| <b>Luxembourg</b>  |         | 168     |         |         |         |         |         |         |         |         |         |
| <b>Netherlands</b> | 75,707  | 38,215  | 136,933 | 87,148  | 47,091  | 39,288  | 26,447  | 21,589  | 33,161  | 15,638  | 27,931  |
| <b>Poland</b>      |         |         |         |         | 267     |         | 419     |         |         | 310     |         |
| <b>Portugal</b>    | 15,202  | 13,570  | 14,949  | 9,501   | 1,293   | 2,898   | 2,917   | 4,877   | 1,325   | 1,123   | 2,918   |
| <b>Slovakia</b>    |         |         |         |         |         | 1,243   |         |         |         |         |         |
| <b>Spain</b>       | 106,154 | 69,968  | 60,395  | 59,378  | 17,850  | 20,151  | 27,169  | 26,962  | 33,146  | 27,849  | 9,146   |
| <b>Sweden</b>      |         |         | 97      | 514     | 527     | 182     |         | 553     |         | 313     |         |
| <b>Switzerland</b> | 83      |         |         |         | 563     | 627     |         | 882     | 1,043   | 898     | 460     |
| <b>UK</b>          | 278,018 | 87,799  | 95,533  | 93,802  | 60,049  | 28,796  | 42,709  | 46,466  | 51,228  | 45,192  | 35,985  |
| <b>Europe</b>      | 805,968 | 421,216 | 374,015 | 345,494 | 232,305 | 155,933 | 190,462 | 188,828 | 205,784 | 179,015 | 136,528 |
| <b>EU</b>          | 805,885 | 421,216 | 374,015 | 345,494 | 231,742 | 155,573 | 189,140 | 187,947 | 204,741 | 178,118 | 136,068 |
| <b>Euro Area</b>   | 456,881 | 315,230 | 273,379 | 250,024 | 170,737 | 125,795 | 145,885 | 140,782 | 153,513 | 132,303 | 100,083 |

Source: Dealogic and JP Morgan (2018); Author's elaboration. Note: the data for 2018 include the issuances until October



**Table 1.2 Retention Rate of Securitisation Products by Country (in percentage)**

|                    | 2005 | 2006 | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015  | 2016   | 2017   | 2018  |
|--------------------|------|------|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|-------|
| <b>Austria</b>     | 0    | 0    | 100.00 |        |        |        |        |        | 0.00   |        | 29.02 | 0.00   |        |       |
| <b>Belgium</b>     | 0    | 0    | 11.67  | 100.00 | 100.00 | 69.52  | 100.00 | 100.00 | 100.00 |        | 22.33 | 100.00 | 100.00 | 0.00  |
| <b>Cyprus</b>      |      |      | 0.00   |        |        |        |        |        |        |        |       |        |        |       |
| <b>Denmark</b>     | 0    | 0    | 2.73   | 100.00 |        |        |        |        | 100.00 |        |       |        |        |       |
| <b>Pan-Europe</b>  | 0    | 0    | 21.29  | 99.96  | 99.56  | 77.91  | 75.03  | 100.00 |        | 0.00   | 0.00  |        |        |       |
| <b>Finland</b>     | 0    | 0    | 100.00 | 100.00 |        |        |        | 16.50  | 7.33   | 6.07   | 13.02 | 10.51  | 9.26   | 0.00  |
| <b>France</b>      | 0    | 0    | 45.73  | 100.00 | 100.00 | 100.00 | 80.73  | 61.47  | 76.70  | 95.04  | 77.94 | 82.04  | 87.78  | 74.57 |
| <b>Germany</b>     | 0    | 0    | 44.60  | 100.00 | 96.41  | 56.76  | 50.60  | 41.23  | 28.41  | 48.42  | 66.02 | 37.41  | 45.57  | 4.12  |
| <b>Greece</b>      | 0    | 0    | 50.89  | 100.00 | 100.00 | 100.00 | 100.00 |        |        | 0.00   |       | 100.00 |        | 28.50 |
| <b>Ireland</b>     | 0    | 0    | 79.51  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 51.00  | 100.00 | 43.18 | 81.79  | 29.32  | 80.41 |
| <b>Italy</b>       | 0    | 0    | 31.22  | 100.00 | 99.52  | 83.48  | 93.12  | 96.33  | 91.39  | 65.38  | 83.32 | 88.80  | 83.53  | 76.09 |
| <b>Luxembourg</b>  |      |      | 0.00   |        | 100.00 |        |        |        |        |        |       |        |        |       |
| <b>Netherlands</b> | 0    | 0    | 78.72  | 100.00 | 97.82  | 83.87  | 86.02  | 72.34  | 61.20  | 58.45  | 68.94 | 73.01  | 50.04  | 74.70 |
| <b>Poland</b>      |      |      | 51.53  |        |        |        |        | 48.64  |        | 33.49  |       |        | 100.00 |       |
| <b>Portugal</b>    | 0    | 0    | 37.61  | 100.00 | 100.00 | 100.00 | 98.94  | 87.76  | 78.37  | 41.46  | 80.73 | 25.63  | 7.12   | 77.73 |
| <b>Slovakia</b>    |      |      |        |        |        |        |        |        | 0.00   |        |       |        |        |       |
| <b>Spain</b>       | 0    | 0    | 48.64  | 100.00 | 99.59  | 99.60  | 99.04  | 96.26  | 96.15  | 99.67  | 93.72 | 93.28  | 88.63  | 81.17 |
| <b>Sweden</b>      | 0    | 0    | 86.44  |        |        | 100.00 | 18.93  | 13.00  | 14.35  |        | 21.22 |        | 14.60  |       |
| <b>Switzerland</b> | 0    | 0    | 2.13   | 100.00 |        |        |        | 15.97  | 19.24  |        | 2.89  | 1.10   | 4.43   | 11.17 |
| <b>UK</b>          | 0    | 0    | 48.68  | 99.77  | 93.05  | 60.13  | 50.55  | 43.74  | 54.43  | 35.46  | 40.78 | 33.73  | 21.55  | 26.25 |
| <b>Europe</b>      | 0    | 0    | 49.43  | 99.92  | 97.90  | 79.93  | 79.24  | 72.78  | 65.74  | 68.42  | 67.06 | 67.31  | 63.04  | 57.08 |
| <b>EU</b>          | 0    | 0    | 49.49  | 99.92  | 97.90  | 79.93  | 79.24  | 72.92  | 65.93  | 68.42  | 67.36 | 67.64  | 63.34  | 57.23 |
| <b>Euro Area</b>   | 0    | 0    | 57.22  | 100.00 | 99.16  | 86.87  | 90.15  | 83.37  | 68.42  | 78.23  | 76.39 | 78.96  | 77.64  | 68.37 |

Source: JP Morgan (2018) and Author's elaboration

**Table 1.3 Total Issuance of RMBSs by Country (in EUR millions)**

|                    | 2005    | 2006    | 2007    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013   | 2014    | 2015    | 2016    | 2017    | 2018   |
|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|---------|--------|
| <b>Austria</b>     |         |         |         |         |         |         |         |         |        |         |         |         |         |        |
| <b>Belgium</b>     |         | 1,616   | 3,876   | 34,838  | 19,154  | 11,594  | 18,948  | 4,699   | 2,018  |         | 1,030   | 3,636   | 6,675   |        |
| <b>Cyprus</b>      |         |         |         |         |         |         |         |         |        |         |         |         |         |        |
| <b>Denmark</b>     | 412     |         | 6,521   |         |         |         |         |         |        |         |         |         |         |        |
| <b>Pan-Europe</b>  |         |         |         | 11,945  | 615     |         |         |         |        |         |         |         |         |        |
| <b>Finland</b>     |         |         |         | 7,535   |         |         |         |         |        |         |         |         |         |        |
| <b>France</b>      | 3,968   | 2,497   | 1,399   | 22,907  | 19,194  | 5,000   | 8,973   | 2,628   |        | 47,218  | 11,362  | 9,554   | 29,284  | 13,640 |
| <b>Germany</b>     | 1,598   | 4,117   | 1,965   | 19,372  | 134     | 363     |         |         |        |         | 20,487  |         | 2,500   |        |
| <b>Greece</b>      | 1,500   | 3,550   | 2,805   | 4,593   | 1,410   |         |         |         |        |         |         |         |         |        |
| <b>Ireland</b>     | 1,750   | 10,219  | 14,850  | 35,967  | 13,757  | 4,339   |         | 890     | 1,020  | 2,072   | 206     | 4,377   | 2,460   | 7,628  |
| <b>Italy</b>       | 9,808   | 15,449  | 22,445  | 66,949  | 52,032  | 9,967   | 8,476   | 33,533  | 4,638  | 4,739   | 6,182   | 5,626   | 12,505  | 9,293  |
| <b>Luxembourg</b>  |         |         |         |         |         |         |         |         |        |         |         |         |         |        |
| <b>Netherlands</b> | 28,580  | 41,096  | 85,516  | 71,917  | 37,105  | 124,045 | 82,945  | 45,773  | 39,288 | 15,533  | 19,475  | 32,360  | 14,608  | 27,696 |
| <b>Poland</b>      |         |         |         |         |         |         |         |         |        |         |         |         |         |        |
| <b>Portugal</b>    | 6,697   | 4,422   | 7,597   | 11,906  | 9,605   | 9,352   | 1,340   | 1,067   | 1,373  |         | 1,192   |         |         | 2,266  |
| <b>Slovakia</b>    |         |         |         |         |         |         |         |         |        |         |         |         |         |        |
| <b>Spain</b>       | 28,733  | 36,300  | 59,044  | 65,096  | 25,662  | 18,830  | 14,110  | 2,393   | 7,321  | 17,321  | 10,286  | 19,575  | 15,716  | 428    |
| <b>Sweden</b>      | 278     |         |         |         |         | 97      |         |         | 182    |         | 358     |         | 313     |        |
| <b>Switzerland</b> |         |         |         |         |         |         |         |         |        |         |         | 199     |         |        |
| <b>UK</b>          | 74,717  | 134,721 | 156,152 | 259,579 | 61,260  | 86,417  | 79,167  | 40,291  | 8,688  | 20,520  | 30,630  | 40,432  | 31,527  | 27,303 |
| <b>Europe</b>      | 158,040 | 253,986 | 362,170 | 612,603 | 239,926 | 270,003 | 213,959 | 131,275 | 64,529 | 107,402 | 101,208 | 115,758 | 115,589 | 88,254 |
| <b>EU</b>          | 158,040 | 253,986 | 362,170 | 612,603 | 239,926 | 270,003 | 213,959 | 131,275 | 64,529 | 107,402 | 101,208 | 115,559 | 115,589 | 88,254 |
| <b>Euro Area</b>   | 82,634  | 119,265 | 199,497 | 341,078 | 178,052 | 183,489 | 134,792 | 90,983  | 55,659 | 86,882  | 70,220  | 75,127  | 83,748  | 60,951 |

Source: JP Morgan (2018) and Author's elaboration

**Table 1.4 Total Issuance of CDOs by Country (in EUR millions)**

|                    | 2005   | 2006    | 2007    | 2008    | 2009    | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   | 2016   | 2017   | 2018  |
|--------------------|--------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| <b>Austria</b>     | 8      |         | 143     |         |         |        |        |        |        |        |        |        |        |       |
| <b>Belgium</b>     | 36     |         | 551     |         | 8,280   | 6,267  |        | 10,712 |        |        |        |        | 5,656  |       |
| <b>Cyprus</b>      |        |         | 11      |         |         |        |        |        |        |        |        |        |        |       |
| <b>Denmark</b>     | 34     | 329     | 8       | 279     |         |        |        |        |        |        |        |        |        |       |
| <b>Pan-Europe</b>  | 26,611 | 71,602  | 57,803  | 57,755  | 15,615  | 3,465  | 923    |        |        |        |        |        |        |       |
| <b>Finland</b>     | 8      | 145     | 750     |         |         |        |        |        |        |        |        |        |        |       |
| <b>France</b>      | 394    | 196     | 222     |         |         | 880    | 74     | 1,453  |        |        |        |        |        |       |
| <b>Germany</b>     | 6,915  | 5,820   | 5,987   | 7,448   | 14,147  |        | 492    |        | 852    |        | 2,022  |        | 415    |       |
| <b>Greece</b>      |        | 2,250   | 5       | 5,590   | 12,984  |        | 1,166  |        |        |        |        | 648    |        |       |
| <b>Ireland</b>     | 44     |         | 143     | 1,127   |         | 2,398  |        |        |        |        |        |        |        |       |
| <b>Italy</b>       | 63     |         | 277     | 5,253   | 4,114   |        | 17,488 | 18,086 | 10,397 | 5,321  | 6,113  | 7,492  | 2,726  | 3,145 |
| <b>Luxembourg</b>  |        |         | 5       |         | 168     |        |        |        |        |        |        |        |        |       |
| <b>Netherlands</b> | 7,494  | 595     | 12,441  | 3,001   | 306     | 10,059 | 2,746  |        |        | 9,260  |        |        |        |       |
| <b>Poland</b>      |        |         |         |         |         |        |        |        |        |        |        |        |        |       |
| <b>Portugal</b>    | 500    | 1,472   |         | 3,090   |         | 3,947  | 6,801  |        | 834    | 1,852  | 1,921  | 725    |        |       |
| <b>Slovakia</b>    |        |         |         |         |         |        |        |        |        |        |        |        |        |       |
| <b>Spain</b>       | 12,281 | 19,790  | 30,186  | 27,400  | 37,157  | 38,154 | 38,072 | 12,598 | 9,703  | 8,750  | 14,124 | 7,500  | 3,847  | 4,001 |
| <b>Sweden</b>      | 15     |         | 11      |         |         |        |        |        |        |        |        |        |        |       |
| <b>Switzerland</b> | 12     |         | 427     |         |         |        |        |        |        |        |        |        |        |       |
| <b>UK</b>          | 10,470 | 5,833   | 10,898  | 3,799   | 7,601   | 2,859  | 1,429  | 3,615  |        | 4,080  |        | 165    |        | 234   |
| <b>Europe</b>      | 64,886 | 108,033 | 119,869 | 114,743 | 100,374 | 68,029 | 69,192 | 46,464 | 21,786 | 29,263 | 24,180 | 16,530 | 12,644 | 7,380 |
| <b>EU</b>          | 64,874 | 108,033 | 119,442 | 114,743 | 100,374 | 68,029 | 69,192 | 46,464 | 21,786 | 29,263 | 24,180 | 16,530 | 12,644 | 7,380 |
| <b>Euro Area</b>   | 54,355 | 101,871 | 108,524 | 110,664 | 92,772  | 65,171 | 67,763 | 42,849 | 21,786 | 25,183 | 24,180 | 16,365 | 12,644 | 7,146 |

Source: JP Morgan (2018) and Author's elaboration

### 1.3.2 The Collateral Framework for Monetary Policy

In the crisis period, European banks largely retained securitisation products to increase the availability of eligible assets to be pledged as collateral in the liquidity operations with central banks. As described in the previous section, this concerned not only the European Central Bank, but also the Bank of England, though with different types of measures.

The ECB collateral framework used to recognise a broad range of assets as eligible collateral for all its liquidity operations also before the crisis. Such breadth was due also to the institutional and structural differences across the collateral frameworks previously adopted by the national central banks (ECB, 2013), and therefore to the need of ensuring adequate access to central bank liquidity to all monetary policy counterparties in the Euro area.

Already before the crisis, the ECB used to accept asset-backed securities, issued in the European Economic Area<sup>49</sup> and denominated in Euro, provided that they fulfilled the general credit quality threshold of a “single A” both at issuance and over the lifetime of the transaction. In this respect, the ECB kept unchanged the minimum credit quality threshold for asset-backed securities also at the beginning of the crisis. Indeed, in October 2008, the ECB amended its collateral eligibility requirements for marketable and non-marketable assets, by decreasing the minimum credit threshold from “A-” to “BBB-”, but with the exception of asset-backed securities, for which the minimum threshold of “A-” remained in force.

Then, in the following years, the above collateral requirements were subject to some technical refinements<sup>50</sup>, which however did not change the main credit rating threshold: i.e. the asset-backed security had to keep a single A rating over the lifetime of the transaction<sup>51</sup>. At the same time, the ECB adopted some measures to control for the risks of eligible ABSs, by requiring higher haircuts compared with other marketable assets and by applying graduated valuation haircuts for ABSs depending on their ratings. For this reason, even with a large set of eligible collaterals (in terms of credit ratings), banks still preferred securitisation products with the highest possible rating: pledging lower-rating collateral could imply higher haircuts on the repo and then higher cost of funding.

---

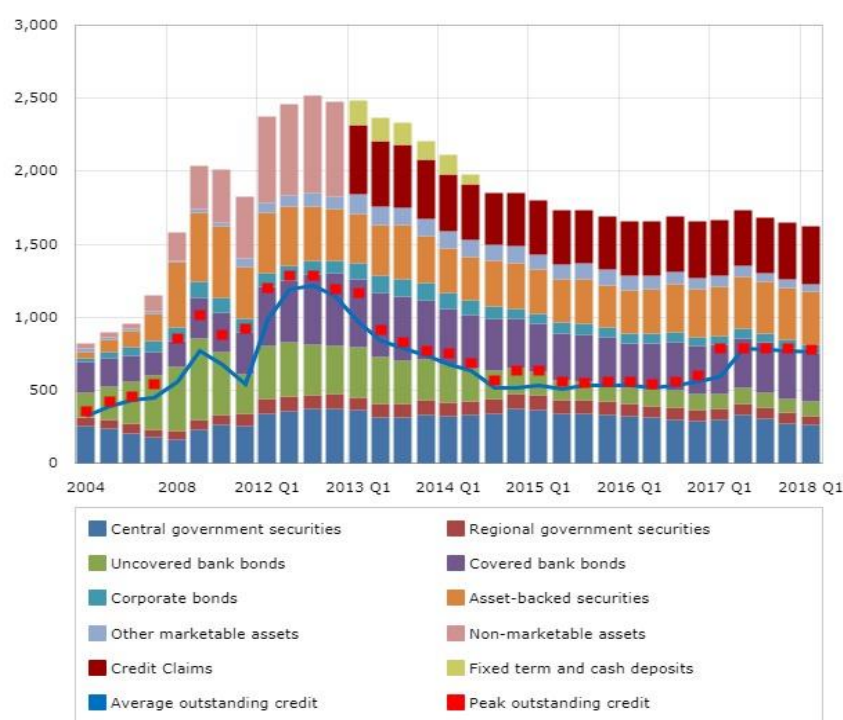
<sup>49</sup> The European Economic Area (EEA) includes the member states of the European Union, plus Iceland, Liechtenstein and Norway.

<sup>50</sup> Firstly, in January 2009 the Eurosystem decided to require a rating at the AAA level at issuance as an additional eligibility criterion for all ABSs issued as of 1 March 2009, while retaining the existing single A minimum threshold over the lifetime of the product; this requirement was then extended to the previously issued ABSs, starting from 1 March 2010. Secondly, in November 2009, the Eurosystem decided to require at least two ratings for all ABSs issued as of 1 March 2010, by introducing the “second-best” rule: not only the best, but also the second-best available credit rating must comply with the credit quality threshold for ABSs; this requirement was then applied to the previously issued ABSs, starting from 1 March 2011.

<sup>51</sup> This is relevant for the empirical analysis, given that the data show the evolution of the credit ratings for a given tranche over time.

The chart in Figure 1.2 displays the developments in the use of monetary policy collateral with the Eurosystem, in terms of volumes for different types of eligible assets. The volumes in the use of collateral follow the trends in the outstanding credit obtained by monetary policy counterparties. However, it is important also to highlight the changes in the composition of the pledged collateral over time, particularly with respect to asset-backed securities. Indeed, the amount of ABSs pledged as collateral with the Eurosystem increased from EUR 109.3 billions (12% of total collateral) in 2006 to EUR 443.6 billions (28% of total collateral) in 2008. Moreover, the share of ABSs out of total collateral has remained broadly stable around 25% since then, suggesting that this has continued also after the peak of the liquidity crisis.

**Figure 1.2 Use of Monetary Policy Collateral with the Eurosystem by Asset Type**



Source: ECB (2019)

Note: The above amounts are in Euro billions. The chart refers to the period from 2004 to 2019. Annual observations are available for the years from 2004 to 2011, while quarterly observations are available starting from 2012.

Moreover, during the entire period under consideration, banks could not pledge credit claims as collateral in the refinancing operations with the Eurosystem. This would explain the incentive that banks had to securitise the existing portfolio of loans on their balance sheets in order to issue and retain asset-backed securities to be pledged as collateral. This incentive was significantly reduced only in December 2011, when - in order to ensure the availability of sufficient collateral to counterparties at the peak of the sovereign debt crisis - the ECB Governing Council allowed national central banks, as a temporary solution, to accept as

collateral performing credit claims subject to specific eligibility criteria<sup>52</sup>. After that, the main rationale for the “securitise-to-repo” strategy was substantially removed.

### 1.3.3 The Prudential Requirements for Securitisation

The design of the prudential requirements for capital adequacy has always played an important role in shaping the incentives of banks in securitisation. The period considered in the analysis covers the implementation of two different prudential regimes, Basel I and Basel II.

*Basel I* provided strong incentives to use securitisation for regulatory arbitrage purposes. Indeed, for the determination of risk-based capital requirements, the risk weights required for consumer and corporate loans (100%) and for mortgages (50%) were higher than the risk weights for claims on OECD banks (20%), including also asset sales with recourse. Then, banks could securitise a package of loans and retain the related credit risk - through tranche retention or credit guarantees – with the advantage of reducing significantly the amount of capital required for such exposures. Banks could also securitise a pool of claims and provide liquidity facilities to the SPV, with the effect of being completely relieved from capital requirements for such positions, given that liquidity lines were considered to cover liquidity risk but not credit risk (Acharya, Schnabl and Suarez, 2013).

*Basel II*, as implemented in the European Union via the Capital Requirements Directive, has changed the incentives for regulatory arbitrage in various aspects: defining operational requirements for risk transfer in securitisation; regulating the treatment of off-balance sheet securitisation positions; introducing a more risk-sensitive approach for exposures.

First, according to the rule on “significant risk transfer”<sup>53</sup>, an originator can exclude securitised exposures from the calculation of risk-weighted assets only if significant credit risk has been transferred to third parties, if the transferor doesn’t maintain effective or indirect control over the transferred exposures and if the securities issued are not obligations of the transferor. If any of these conditions is not met, banks have to hold regulatory capital against securitisation exposures.

Second, risk weights are assigned to general exposures on the basis of their credit risk, as measured by credit ratings in the standardised approach and by internal models in the internal rating approach. In particular, in the securitisation framework, the rating-based approach is put

---

<sup>52</sup> Indeed the responsibility related to the acceptance of such loans has to be borne by the national central banks authorising their use. Also for this reason, only some national central banks have authorised the use of loans as collateral, given the issues related to the evaluation of the credit risk associated with these credit claims.

<sup>53</sup> The criteria for a significant risk transfer used to be regulated in the Annex IX, Part 2, of the Directive 48/2006, before it has been replaced by the Capital Requirements Regulation as of 2014. The implications of the significant risk transfer for the calculation of the risk-weighted assets of originator banks were disciplined by Art. 95 of the above directive.

at the top of the hierarchy also for banks using internal models, such that banks completely rely on credit ratings for the credit risk assessment of such positions. Under this approach, high-rating securities (such as AAA or AA) receive a very favourable treatment, still better than the one applicable to the underlying assets; medium-rating products (like BBB) are subject to risk weights which increase more than proportionally with respect to the credit risk; non-investment grade securities (with rating below BB-) require full deduction from capital, i.e. banks have to keep an amount of capital equal to the value of the exposure (see Appendix A).

Overall, Basel II has limited the incentives to use securitisation for regulatory arbitrage due to the requirements for effective risk transfer, but it has induced a mechanistic reliance on credit ratings for the determination of capital requirements on securitisation positions.

Following the subprime crisis, the academic and policy debate has considered the implications of the transfer or retention of credit risk in securitisation for financial stability. A complete transfer of credit risk in securitisation may imply some risks for financial stability, if – under asymmetric information - banks are induced to originate and distribute loans with high credit risk and special purpose vehicles issue securitisation products with high ratings but based on assets of poor quality. In such case, banks with significant securitisation positions might be exposed to high credit risk and then might not be able to use those products as collateral in repo transactions, or might employ them subject to very high haircuts<sup>54</sup>.

In this perspective, various policy initiatives were adopted at the regulatory level in order to repair the distortions in the system of incentives characterising the OTD model. With regard to the securitisation framework, I would specifically highlight two aspects. First, regulatory bodies intervened to mitigate the conflict of interests in the credit rating process and to limit the reliance on credit ratings in financial regulation<sup>55</sup>, which contributed to the flaws in the credit risk assessment of structured products. Second, in order to avoid the negative effects of a complete transfer of credit risk on the lender's incentives to screen and monitor, the amendments to the Basel securitisation framework introduced in the US with the Dodd-Frank Act and in the EU with the Capital Requirements Directive II required the originator or the sponsor to retain a material net economic interest of at least 5% in the securitised assets<sup>56</sup>.

---

<sup>54</sup> Indeed, during the crisis, some financial institutions with large securitisation positions lacked liquid assets to get funding in the repo market and so they were affected by a severe liquidity crisis.

<sup>55</sup> In particular, in the US the Dodd-Frank Act completely abolishes any reference to credit ratings for the evaluation of credit risk for structured finance products, while in the EU the new legislation on CRA (Reg. 462/2013 and Dir. 2013/14) introduces several measures to reduce a mechanistic reliance on credit ratings, by increasing the transparency and the accountability of the rating process and by inducing the development of internal risk assessment by financial institutions. Moreover, the Basel Committee has recently proposed a new hybrid approach for the treatment of securitisation positions.

<sup>56</sup> This principle has been applied differently in the US and in the EU. The Capital Requirements Directive II (Dir. 2009/111) defines a retention requirement for the investor banks, which are allowed to assume exposures to a securitisation only if the originator or the sponsor has explicitly disclosed the retention of a 5% net economic interest. On the contrary, the Dodd-Frank Act requires directly a securitiser to retain no less than 5 per cent of the credit risk in the securitised assets and prohibits a

The main rationale for the retention requirements is that they should help solving the problem of incentive misalignment between originator and investors: indeed the lender, by keeping an economic interest in the securitised assets, would be induced to choose better borrowers at the time of loan applications and to monitor them more closely during the duration of the loan. In this sense, a better quality of the underlying assets in the securitisation process would contribute to reduce the credit risk of structured products and then to decrease risks for financial stability.

## **1.4 Conceptual Framework**

The aim of this chapter is to investigate how banks manage their capital position after securitisation, both when they distribute (most of) the issued tranches with market investors and when they retain them on balance sheet<sup>57</sup>. In this section, I introduce some hypotheses about the possible changes in bank capital position which may follow a securitisation operation - in case of tranche distribution or retention - and I consider in particular the variations in bank solvency, as measured by different capital ratios, the risk-weighted capital ratio and the leverage ratio.

### **1.4.1 Securitisation Distribution and Retention**

In the traditional model of securitisation taking place in the pre-crisis period, the tranches of securitisation issued by special purpose vehicles and sponsored by originator banks were distributed among market investors, which could be other banks, investment funds, insurance companies or pension funds. In some cases, other banks could invest in securitisation products also by sponsoring ABCP conduits to which they had provided credit or liquidity guarantees; this practice was undertaken also by major European banks, but mostly for securitisation products originated in the US.<sup>58</sup>

In the traditional originate-to-distribute model, originator banks used to transfer the entire pool of underlying assets to the issuer special purpose vehicle but could still keep the equity tranche for skin-in-the-game purposes. Even when the senior tranches were distributed among market investors, the seniority structure of the deal implied that significant risk from the

---

securitiser from directly or indirectly hedging or otherwise transferring the credit risk that it would be required to retain.

<sup>57</sup> Chapter 2 analyses the determinants for the decision of originator banks to distribute or to retain the issued securitisation tranches, also in relation to their funding liquidity position. In this chapter, I focus on the implications that the distribution or the retention may have on the capital position of banks.

<sup>58</sup> As described in Acharya, Schnabl and Suarez (2011), the ABCP conduits sponsored by European banks used to hold securitisation products originated mainly in the US and only to a minor extent in the UK, also for accounting reasons due to the consolidation of conduits at the group-level. The IFRS principles implemented both in the European Union and in Switzerland since 2003 required the full consolidation of conduits in the balance sheets of banks. This could decrease the incentives for using ABCP conduits established in Europe. Therefore, after the IFRS introduction, European banks continued to sponsor ABCP conduits but mostly in the US and using assets originated in the US.



borrowers' repayments could be concentrated in the equity tranche<sup>59</sup>, or at most in the mezzanine tranche. Therefore, from an economic point of view, an originator bank retaining the equity tranche would still bear a relevant part of the credit risk from the underlying assets. However, from a regulatory point of view, under the Basel I framework in place during the pre-crisis period, this exposure to the equity tranche implied only a modest regulatory capital burden for two reasons: first, in a securitisation deal the amount of the equity tranche is considerably small when compared with the other tranches of the deal; second, even if the equity tranche is generally subject to low ratings, the Basel I framework used to set the risk weights on the basis of the asset classes and so was not risk sensitive to credit ratings.

Therefore, under this system in place before the crisis, originator banks could largely benefit from asset securitisation for capital relief purposes, given that the capital requirements related to the retention of the equity tranche or to the provision of liquidity guarantees to special purpose vehicles were in any case quite modest. Some empirical studies developed mostly for the US (Calomiris and Mason, 2004; Acharya and Richardson, 2009) show the regulatory arbitrage incentives at play: banks could still retain significant credit risk without being subject to correspondingly appropriate capital requirements.

Starting from the subprime crisis, and particularly after the introduction of the fixed-rate full allotment policy by the ECB and of the Special Liquidity Scheme by the Bank of England, European banks retained almost all the tranches of securitisation, i.e. the senior and the mezzanine tranches, in addition to the equity tranche usually retained also before (see the discussion in Section 1.3.1). This retention was mainly focused on the asset-backed securities eligible as collateral for central bank liquidity operations (see the analysis in Chapter 2). In fact, this could have significant implications for banks' capital position, not only for the economic capital (the capital needed by the bank to protect against the actual risk of exposures), but also for the regulatory capital (the minimum capital required by prudential regulation): indeed, any exposure to credit risk requires banks to hold minimum required capital and in particular the Basel II framework determines the risk weights on securitisation positions by using a ratings-based approach<sup>60</sup>.

Conditional on this retention behaviour, and particularly in a period of financial distress, banks may have developed some interest in minimising the regulatory capital implications of this retention, also by exploiting the potential regulatory arbitrage opportunities of the prudential framework. In fact, this arbitrage could take place to the extent that the regulatory treatment of securitisation in Basel II was not based on a neutrality principle, which would have

---

<sup>59</sup> See Milne (2009). In particular, Chapter 4 discusses how the securitisation was initially used by commercial banks to finance their lending and how the tranching – by concentrating the risk in the equity tranche – allowed banks to create a large amount of default-risk-free securities.

<sup>60</sup> See the discussed in Section 1.3.3 for more details on Basel II. The application of a ratings-based approach implies also that equity tranches with a rating below BB- should be deducted from regulatory capital, therefore requiring a significant capital burden for banks.

required the same capital amount for a given exposure independently from whether this is securitised (see Section 1.4.3).

## 1.4.2 The Measures of Capital Ratios

I investigate the variations in bank solvency after securitisation, by using different measures of capital ratios, both risk-weighted and leverage-based, to have a more complete view of the developments in banks' capital position.

The risk-weighted capital ratio is computed as the ratio of regulatory capital to risk-weighted assets, as defined in the traditional Basel framework.

$$(1) \text{ CapRatio}_{it} = \frac{\text{Regulatory Capital}_{it}}{\text{Risk - Weighted Assets}_{it}} \\ = \frac{\text{Common Equity}_{it} + \text{Additional Tier 1}_{it} + \text{Tier 2}_{it}}{\sum_{j=1}^n \text{Risk Weight}_{ijt} * \text{Exposure}_{ijt}}$$

where *i* indicates the bank, *j* refers to the types of exposure and *t* indicates the time period. The regulatory capital includes the Common Equity<sup>61</sup>, the additional Tier 1<sup>62</sup> and the Tier 2<sup>63</sup> items. The amount of risk-weighted assets is computed as the sum of the risk-weighted exposures for different asset classes: for each class, the risk-weighted exposure is the product of the exposure amount by the risk weight assigned to that based on the standardised approach (applicable to all banks) or on the internal rating-based approach (as estimated by the specific bank based on the supervisory approval of the internal models).

In order to allow for comparability both on the numerator and on the denominator of capital ratios, I use two distinct definitions of the leverage ratio.

First, I define the regulatory capital leverage ratio, as the ratio of regulatory capital to total assets. This ratio uses the same numerator as the risk-weighted capital ratio, but different denominator. In this way, I can compare the two capital ratios and attribute their differences to the system of risk weights, as set in the Basel prudential framework.

$$(2) \text{ LevRatioCap}_{it} = \frac{\text{Regulatory Capital}_{it}}{\text{Total Assets}_{it}} \\ = \frac{\text{Common Equity}_{it} + \text{Additional Tier 1}_{it} + \text{Tier 2}_{it}}{\text{Total Assets}_{it}}$$

---

<sup>61</sup> Common Equity includes only the Tier 1 items with the fullest absorption capacity: common shares, retained earnings and additional paid-in capital.

<sup>62</sup> Additional Tier 1 refers to other Tier 1 instruments different than common equity: preferred shares, contingent convertibles and non-controlling interests

<sup>63</sup> Tier 2 capital indicates other components of capital with lower loss absorption capacity, as undisclosed reserves, revaluation reserves, subordinated debt and hybrid instruments.

The amount of total assets is computed on a consolidated basis, by including all the assets of the banking group. Due to the accounting framework based on the IFRS principles<sup>64</sup>, the creation of a SPV sponsored by a banking group and the transfer of some assets from the bank to the SPV are regulated by the principles for the consolidation of bank holdings. Then, if the SPV is controlled by the parent bank, it has to be consolidated at the group level, so the assets transferred to the SPV need to be included in the group consolidated balance sheet<sup>65</sup>.

Second, I introduce the common equity leverage ratio, calculated as the ratio of common equity to total assets. The two measures of leverage ratio have the same denominator, but different numerator (regulatory capital or common equity). In this way, I can compare the two ratios and highlight the differences related to the composition of the capital base.

$$(3) LevRatioCE_{it} = \frac{Common\ Equity_{it}}{Total\ Assets_{it}}$$

The structure of the capital base is important to explain the loss-absorbency capacity of bank capital. Despite the limits set by the Basel framework both for the minimum amount of Tier 1 and for the maximum amount of Tier 2, the use of capital instruments with lower loss-absorbency capacity represented – in the period considered for the analysis - a potential source of regulatory arbitrage, in addition to the more discussed manipulation of the risk weights. The use of the above three measures of capital ratios allows me to explore regulatory arbitrage incentives not only via risk weights, but also via capital composition.

### **1.4.3 Securitisation Distribution and Retention: Expected Changes in Capital Ratios**

In the design of a securitisation operation, the originator bank has to take at least two important decisions: 1) whether to distribute or to retain the tranches of securitisation and eventually which part of them (direct effect of securitisation); 2) how to use the revenues coming from the asset sale, and so eventually how to change the composition of assets and liabilities in the bank balance sheet (indirect effect of securitisation).

In this section I focus on the direct effects of securitisation: therefore, I consider the changes in the capital ratios which are determined by the distribution or the retention of securitisation tranches by the originator banks, while assuming that the capital base would remain constant straight after the issuance<sup>66</sup> and without considering other changes in the

---

<sup>64</sup> See the Annex 1.B for a discussion on the accounting regime for securitisation operations, with particular focus on the consolidation of special purpose vehicles.

<sup>65</sup> This general principle of accounting consolidation may admit some exemptions due to specific legal structures in individual countries.

<sup>66</sup> This assumption is plausible under some positive adjustment costs for bank capital. Indeed, a change in the capital base would require either the issuance of new capital instruments or the retention of earnings

balance sheet composition. Then, in the following section, I extend the discussion to the indirect effects of securitisation and I explore the possible variations in the balance sheet composition.

The distribution or the retention of securitisation has implications for banks' capital position. I discuss below the expected changes in the capital ratios, using some accounting identities to illustrate the dynamics in their components. Following the illustration in Figure 1.1, I consider the example of a bank which has cash, loans and bonds in its asset composition. For simplicity, I assume that the bank has two loans, A and B, and securitises only loan B.

While cash has in any case zero risk weights, loans and bonds<sup>67</sup> are generally subject to positive risk weights. In time t, before the securitisation, the risk-weighted capital ratio can be characterised as follows:

$$(4) \text{CapRatio}_{it} = \frac{\text{Regulatory Capital}_{it}}{rw_{LOAN\_A} * \text{Loan\_A}_{it} + rw_{LOAN\_B} * \text{Loan\_B}_{it} + rw_{BONDS} * \text{Bonds}_{it}}$$

At the same time, for the purpose of the leverage ratio, all bank assets shall be included in the denominator. The common equity leverage ratio in the time t can be written as follows:

$$(5) \text{LevRatioCE}_{it} = \frac{\text{Common Equity}_{it}}{\text{Cash}_{it} + \text{Loan\_A}_{it} + \text{Loan\_B}_{it} + \text{Bonds}_{it}}$$

#### *Securitisation Distribution*

First, I analyse the case of securitisation distribution<sup>68</sup>. If the transaction fulfils the criteria for a significant risk transfer<sup>69</sup>, the bank can exclude the exposures it has securitised from its calculation of risk-weighted assets. Then, the risk-weighted capital ratio of the bank in time t is:

$$(6) \text{CapRatio}_{it+1} = \frac{\text{Regulatory Capital}_{it+1}}{rw_{LOAN\_A} * \text{Loan\_A}_{it+1} + rw_{BONDS} * \text{Bonds}_{it+1}}$$

where we assume that the stock variables for the other balance sheet components, namely  $\text{Loan\_A}_{it}$ ,  $\text{Bonds}_{it}$  and  $\text{Regulatory Capital}_{it}$  remain constant from t to t+1. For the sale of  $\text{Loan\_B}_{it}$ , the bank receives some cash payment which would not be subject to risk weight. Therefore, the denominator of the ratio, i.e. the amount of risk-weighted assets, decreases by an amount corresponding to the risk-weighted value of the securitised exposure.

<sup>67</sup> While sovereign bonds are subject to zero risk weights in the standardised approach for credit risk, other types bonds are subject to positive risk weights.

<sup>68</sup> For this illustration, I discuss the cases of securitisation distribution and retention by focusing on senior and mezzanine tranches, whose face value represents almost the entirety of the deal value. The below discussion does not model explicitly the retention of equity tranche; in fact, this would likely take place in both the cases, therefore it would not make a distinction among the two cases.

<sup>69</sup> See the discussion in Section 1.3.3

This implies that, under the distribution case, for a given value of regulatory capital, the securitisation transaction has the mechanical effect of increasing the risk-weighted capital ratio:

$$\text{Distribution: } \Delta CapRatio_{it+1} > 0, \text{ as } RWA_{it+1} < RWA_{it}$$

where  $RWA_{it}$  and  $RWA_{it-1}$  refer to risk-weighted assets after and before the securitisation.

Therefore, when originator banks opt for distributed securitisation, the risk-based capital ratio is a positive function of the value of securitised exposures: for a given amount of total assets, the larger is the value of securitised exposures, the lower is the amount of risk-weighted assets and then the higher is the risk-based capital ratio after the securitisation. I investigate this hypothesis in particular for the period before the subprime crisis.

The issuance of a distributed securitisation deal may have implications also on the leverage ratio. For this purpose, I have to distinguish whether the transferred assets are included in the consolidated balance sheet for accounting purposes.

Indeed, if the bank doesn't consolidate the SPV or derecognises the transferred assets, the leverage ratio in time t+1 is:

$$(7) LevRatioCE_{it+1} = \frac{Common\ Equity_{it+1}}{Cash_{it+1} + Loan\_A_{it+1} + Bonds_{it+1}}$$

where the amount of total assets does not include anymore  $Loan\_B_{it+1}$ , since the amount of securitised loan has been derecognised so it is not consolidated on balance sheet. Therefore, assuming no other change in the stock variables:

$$\text{No Consolidation: } \Delta LevRatioCE_{it+1} > 0, \text{ as } Total\ Assets_{it+1} < Total\ Assets_{it}$$

If the SPV is not consolidated at the group level, the amount of bank total assets decreases, so the leverage ratio increases as a result of the securitisation operation.

On the contrary, if the SPV is consolidated on balance sheet, the leverage ratio in time t+1 is the same as in time t:

$$(8) LevRatioCE_{it+1} = \frac{Common\ Equity_{it+1}}{Cash_{it+1} + Loan\_A_{it+1} + Loan\_B_{it+1} + Bonds_{it+1}}$$

Assuming no other change in the stock variables, the leverage ratio remains unchanged after the securitisation operation as the amount of consolidated assets is not affected.

$$\text{Consolidation: } \Delta LevRatioCE_{it+1} = 0, \text{ as } Total\ Assets_{it+1} = Total\ Assets_{it}$$

To sum up, if the principle of consolidation is implemented, the issuance of distributed securitisation can lead to an increase in the risk-weighted capital ratio, while leaving the leverage ratio unchanged. I explore this hypothesis particularly for the period before the crisis.

### *Securitisation Retention*

Second, I discuss the case where the originator bank retains the securitisation issuance on its balance sheet. The retention of some tranches implies a securitisation position for prudential purposes. Therefore, the bank has to calculate the risk-weighted amount for the retained securitisation tranches, while not including anymore the underlying exposures in the risk-weighted assets. In line with the facts observed during the crisis, we suppose that the originator bank retains all the tranches in a new deal. After the securitisation, the risk-weighted capital ratio of the bank can be written as follows:

$$(9) \text{CapRatio}_{it+1} = \frac{\text{Regulatory Capital}_{it+1}}{rw_{LOAN\_A} * \text{Loan\_A}_{it+1} + rw_{SECUR} * \text{Ret\_Secur}_{it+1} + rw_{BONDS} * \text{Bonds}_{it+1}}$$

where  $rw_{SECUR}$  indicates the risk weight for the securitisation position and  $\text{Ret\_Secur}_{it-1}$  refers to the value of the retained securitisation position.

Provided that the other stock variables for the balance sheet components remain constant from  $t$  to  $t+1$ , we have to compare the risk-weighted value of the securitisation position and the risk-weighted amount of the underlying assets. Assuming no over-collateralisation in the deal, the amount of the deal corresponds to the book value of the securitised exposures. Therefore, the only change may concern the risk weight on securitisation. For this purpose, we have to compare the risk weights for the securitisation position and the underlying assets.

If the risk weight of the securitisation position is equal to the risk weight of the underlying assets, the capital ratio should remain unchanged after securitisation. Instead, if the risk weight of the securitisation position is lower (or higher) than the risk weight of the securitised assets<sup>70</sup>, the capital ratio is expected to increase (or to decrease).

- Retention:
- (i)  $\Delta \text{CapRatio}_{it+1} = 0$  if  $rw_{SECUR} = rw_{LOAN\_B}$
  - (ii)  $\Delta \text{CapRatio}_{it+1} > 0$  if  $rw_{SECUR} < rw_{LOAN\_B}$
  - (iii)  $\Delta \text{CapRatio}_{it+1} < 0$  if  $rw_{SECUR} > rw_{LOAN\_B}$

For this purpose, we have to refer to the prudential framework in place during the period of securitisation retention, i.e. from the 3<sup>rd</sup> quarter of 2007, as set in the Basel II framework implemented in the EU via the Capital Requirements Directive<sup>71</sup>. We can generally exclude the hypothesis (iii), i.e. a decrease in the risk-based capital ratio, as the directive sets an

---

<sup>70</sup> This is a quite relevant case in the empirical analysis, also for the implications of securitisation in terms of regulatory arbitrage. Indeed, if a bank – by securitising a given amount of assets and retaining the structured tranches on balance sheet – can obtain an improvement in terms of risk-based capital ratios, this may induce substantial incentives to securitise for regulatory capital reasons. A similar argument is developed, with regard to the liquidity enhancement provided to ABCP conduits by US banks, in the paper by Acharya, Schnabl and Suarez (2013).

<sup>71</sup> Please note that the Basel II framework was implemented also in Switzerland with similar modalities for the securitisation framework.

upper bound for the risk weight of securitisation positions held by originator banks<sup>72</sup>. Apart from that, the tranches retained by originator banks should be subject to the general securitisation framework, which puts the ratings based method at the top of the hierarchy (see Section 1.3.3, as well as Annex 1.C).

Under this approach, the base risk weight for a securitisation position rated AAA was 12%, and it could be reduced to 7% for the most senior tranches in a securitisation. As shown in Appendix Table 1.3, higher credit ratings are associated with increasing risk weights, though still very favourable. For instance, securitisation tranches rated AA and A were subject to base risk weights of 15% and 20%, which could be decreased to respectively 8% and 12% for the most senior tranches.

Just to have a comparison, in the CRD framework, residential and commercial mortgages were subject to risk weights of respectively 35% and 50%; corporate loans were subject to a risk weight of 20% only for firms rated AAA or AA, of 50% for firms rated A and of 100% for unrated firms (the vast majority); while retail exposures (to individuals or to small or medium size entities) benefited from a risk weight of 75%.

The comparison between the risk weights for securitisation positions and for the underlying exposures suggests that banks securitising their exposures and retaining all the tranches may have largely benefited from the application of lower risk weights via a reduction in their amount of risk-weighted assets. This could have then increased the risk-weighted capital ratios of the originator banks conducting securitisation transactions.

As for the leverage ratio, the retention of the securitisation position on balance sheet – for the same amount of the underlying assets – should imply that the amount of total assets does not change. The leverage ratio should then remain unchanged:

$$\text{Retention: } \Delta LevRatioCE_{it+1} = 0, \text{ as } Total\ Assets_{it+1} = Total\ Assets_{it}$$

To sum up, when banks securitise and retain the tranches on balance sheet, the securitisation issuance may lead to an increase in the risk-weighted capital ratio (subject to a more favourable risk weight for the retained securitisation) with no change in the leverage ratio. I investigate this hypothesis for the period of the global financial crisis, when banks used securitisation to retain tranches on balance sheet.

For completeness, a third possibility - concerning some types of securitisation (e.g. for credit card receivables) and however not considered in this empirical analysis - is that banks

---

<sup>72</sup> Art. 8 and Art.45 of the Annex IX Part 4 in the Directive 48/2006 provide that, for an originator bank, the risk-weighted exposure amounts for its positions in a securitisation may be limited to the risk-weighted exposure amounts which would be calculated for the securitised exposures had they not been securitised.

transfer the asset pool at the time of the transaction but then provide ex-post some implicit support to a SPV without a previous contractual arrangement. In that case, the bank is not expected to hold ex ante any additional capital for this; therefore, the implicit recourse implies an ex post increase in the amount of risk-weighted assets and then an ex-post decrease in the risk-weighted capital ratio. The negative impact of the implicit recourse on capital ratios may be even larger if the bank has to stand some losses from securitisation.

However, the event triggering the implicit support by the originator bank may happen only sometime after the securitisation issuance, during the maturity period of the product. This raises significant difficulties in measuring the implicit support based on the available information for the securitisation deals and the banks' balance sheets. Therefore, I don't consider this hypothesis in the development of the empirical analysis. To properly investigate this, I would need granular information about the implicit recourse provided by banks for individual tranches of securitisation<sup>73</sup>.

The empirical setting developed in this chapter analyses the developments in the capital position of originator banks from one quarter to another one. Therefore, it can be used to estimate the changes in the capital position at the time of securitisation issuance – by distinguishing the cases of distribution or retention at that time - but it may not properly capture the event of implicit support.

#### **1.4.4 Further Possible Effects due to Changes in Balance Sheet Composition**

The previous section has described the changes in the risk-weighted capital ratio in the two cases of securitisation distribution and retention, assuming no other changes in the capital base or in the balance sheet composition straight after the issuance. After the distribution or the retention of securitisation, the expected variations in the risk-weighted solvency position follow as a consequence either of the transfer of the assets, or of the difference in the risk weights between the underlying assets and the securitisation position; while the expected changes in the leverage ratio depend on whether the originator bank fulfils the consolidation criteria for SPVs.

In fact, a securitisation operation may be followed by other actions that originator banks can take on their balance sheet composition. The indirect impact of securitisation depends on the way the bank uses the revenues collected from the asset sale and it changes the composition of its assets and liabilities after the securitisation operation<sup>74</sup> (Uhde and Michalak, 2010;

---

<sup>73</sup> In fact, while indications about explicit support may be extracted from the deals, it is quite difficult to find such detailed information about implicit recourse, because it occurs only ex-post and banks may be interested in avoiding disclosure to the public and to supervisors, to avoid the regulatory implications for capital requirements. For a discussion on the provision of implicit support and the issues for testing it empirically, see also Kuncl (2015).

<sup>74</sup> Also in this discussion, I still keep the assumption of constant capital base, which seems to be plausible in the context of a one-quarter change, under some positive adjustment costs for bank capital. Indeed, a



Michalak and Uhde, 2012). This is because banks may adopt securitisation for multiple purposes: as a funding scheme, in order to get some funding liquidity from the issuance of securitisation products to finance their asset portfolio; as a credit risk transfer technique, in order to reduce the risk-weighted assets on their balance sheet and to free up regulatory capital; as a way to create further collateral, by issuing securitisation products and retaining them on balance sheet. Given the various possible purposes of the operation, banks can adopt multiple strategies. This significantly expands the range of effects we can observe in the relationship between securitisation issuances and bank capital.

In order to analyse the possible signs of this relationship, I examine the main strategies that a bank can adopt and the related consequences in terms of risk-weighted capital and leverage ratios, in case of securitisation distribution and retention. Table 1.5 displays the possible changes in the risk-weighted capital ratio and in the leverage ratio, depending on the bank's decisions for securitisation retention and for assets and liabilities management. I also develop some of the accounting identities in the previous sections to highlight the changes in the considered capital ratios.

**Table 1.5 Securitisation Issuances and Capital Ratios. Expected Effects**

| SECURITISATION DISTRIBUTION     |  | SECURITISATION RETENTION        |   |
|---------------------------------|--|---------------------------------|---|
| <i>Risk-based capital ratio</i> |  | <i>Risk-based capital ratio</i> |   |
| ↑                               | If the bank keeps cash, invests in less risky assets or repays debt            | ↑                               | If $RWA_{SECURITISATION} < RWA_{ASSETS}$        |
| ≡                               | If the bank invests in equally risky assets                                    | ≡                               | If $RWA_{SECURITISATION} = RWA_{ASSETS}$        |
| ↓                               | If the bank invests in riskier assets  | ↓                               | If $RWA_{SECURITISATION} > RWA_{ASSETS}$        |
| <i>Leverage ratio</i>           |  | <i>Leverage ratio</i>           |   |
| ↑                               | If the bank doesn't consolidate the SPV or derecognises the transferred assets | ≡                               | If the bank retains the securitisation exposure |
| ≡                               | If the bank uses cash to repay debt  |                                 |   |
| ↓                               | If the bank invests in new assets  |                                 |   |

change in the capital base would require either the issuance of new capital instruments or the retention of earnings. The future extension discussed in Section 1.9.2 addresses the possibility of adjustments in bank capital dynamics, also as a result of changes in the capital base.

*Securitisation Distribution: Risk-Weighted Capital Ratio*

When the bank transfers the asset pool to the SPV, then it has to decide how to use the amount of liquidity from the asset sale. It can keep cash on balance sheet, it can use liquidity to repay debt, or it can invest in other assets. These cases can be developed as extensions of Equation (6), where I include in the denominator the new asset items.

First, I consider the case where the originator bank keeps this liquidity in the form of cash or other assets with a zero risk weight:

$$(10) \text{ Keep Cash: } CapRatio_{it+1} = \frac{Regulatory\ Capital_{it}}{rw_{LOAN\_A} * Loan_{A_{it+1}} + rw_{CASH} * Cash_{it+1} + rw_{BONDS} * Bonds_{it+1}}$$

Since  $rw_{CASH} = 0$ ,  $\Delta CapRatio_{it+1} > 0$ , as  $RWA_{it+1} < RWA_{it}$

Second, I explore the case where the originator repays debt<sup>75</sup> using the revenues from the loan sale. Both assets and liabilities are reduced by this amount. Therefore:

$$(11) \text{ Repay Debt: } CapRatio_{it+1} = \frac{Regulatory\ Capital_{it}}{rw_{LOAN\_A} * Loan_{A_{it+1}} + rw_{BONDS} * Bonds_{it+1}}$$

Also in this case,  $\Delta CapRatio_{it+1} > 0$ , as  $RWA_{it+1} < RWA_{it}$

Third, I analyse the case where the originator uses the additional liquidity to invest in new assets with a positive risk weight:

$$(12) \text{ New Asset: } CapRatio_{it+1} = \frac{Regulatory\ Capital_{it}}{rw_{LOAN\_A} * Loan_{A_{it+1}} + rw_{ASSET\_X} * Asset_{X_{it+1}} + rw_{BONDS} * Bonds_{it+1}}$$

If the risk weight of new asset is lower than the risk weight of the securitised assets, the capital ratio is expected to increase.

If  $rw_{ASSET\_X} < rw_{LOAN\_B}$ ,  $\Delta CapRatio_{it+1} > 0$ , as  $RWA_{it+1} < RWA_{it}$

If the bank invests in equally risky assets (for instance it securitises residential mortgages to provide new residential mortgages), the amount of risk-weighted assets remains unchanged and the capital ratio doesn't change<sup>76</sup>.

If  $rw_{ASSET\_X} = rw_{LOAN\_B}$ ,  $\Delta CapRatio_{it+1} = 0$ , as  $RWA_{it+1} = RWA_{it}$

If the bank invests in riskier assets (e.g. use the proceeds from residential mortgages to provide corporate loans), the risk-weighted assets increase and the capital ratio decreases.

If  $rw_{ASSET\_X} > rw_{LOAN\_B}$ ,  $\Delta CapRatio_{it+1} < 0$ , as  $RWA_{it+1} > RWA_{it}$

<sup>75</sup> In such case, if we consider the securitisation operation in a funding perspective, the bank is just changing the composition of its liabilities: instead of rolling over the existing debt, it repays the maturing obligations while it gets funding through the issuance of structured products.

<sup>76</sup> In principle, this process of lending and securitising, by transferring the underlying pool of assets every time, could be repeated an infinite amount of times. The bank can expand credit by keeping the same risk-based capital ratios, so without apparently raising any concern from the micro-prudential point of view. However, such praxis can generate very significant risks in a macro-prudential perspective, because of the uncontrolled credit expansion.

### *Securitisation Distribution: Leverage Ratio*

The above strategies for assets and liabilities management would also have an impact on leverage ratios. Provided that the SPV is consolidated on balance sheet, we can have different effects depending on the way the bank uses the revenues from the asset sale.

If the bank uses cash to repay debt, i.e. the holding simply changes the composition of its liabilities while keeping the same amount of total assets.

$$(13) \text{ Repay Debt: } LevRatioCE_{it+1} = \frac{Common\ Equity_{it+1}}{Cash_{it+1} + Loan\_A_{it+1} + Loan\_B_{it+1} + Bonds_{it+1}}$$

This implies that the leverage ratio remains unchanged after the securitisation operation:

$$\Delta LevRatioCE_{it+1} = 0, \text{ as } Total\ Assets_{it+1} = Total\ Assets_{it}$$

Instead, if the banking group invests in new assets (independently from the risk of the asset), this will increase the amount of consolidated total assets:

$$(14) \text{ New Asset: } LevRatioCE_{it+1} = \frac{Common\ Equity_{it+1}}{Cash_{it+1} + Loan\_A_{it+1} + Loan\_B_{it+1} + Bonds_{it+1} + Asset_{x,it+1}}$$

This implies an increase in the leverage ratio of the bank:

$$\Delta LevRatioCE_{it+1} > 0, \text{ as } Total\ Assets_{it+1} > Total\ Assets_{it}$$

### *Securitisation Retention: Risk-Weighted Capital Ratio and leverage Ratio*

When the originator bank retains securitisation tranches, the revenues from the asset sale are used to purchase the issued securitisation tranches. Therefore, the expected effects are the ones already described in Section 1.4.3

## **1.5 Data**

In order to address the empirical question, I construct a new dataset which combines the tranche-level data on securitisation issuances with the institution-level data on the balance sheets of the corresponding originator banks, based on the information provided by Capital IQ for European banks.

The empirical analysis focuses on the issuances of securitisation products by European banks in the period between 1999 and 2010 and it is organised on a quarterly basis. To identify the issuances, I consider all the tranches of securitisation issued by special purpose entities whose ultimate parent is a bank with the main geographical location in Europe. This screening criterion is aimed at including all the subsidiary vehicles, independently from their country of

establishment, provided that the bank holding is headquartered in Europe<sup>77</sup>. This is because several European banks issued securitisation products through vehicles established in non-European countries, like the United States (in most cases) or the Cayman Islands (in few cases), in order to exploit better conditions offered by other legal systems for corporate or taxation law. On the other hand, the dataset doesn't include the securitisation issuances by SPVs controlled by US banks, which may have subsidiaries or branches in Europe or securitise assets originated in Europe. This is to ensure consistency with the objective of the work, focused on the capital strategy of European banks after securitisation: indeed, even when the European subsidiaries of US banks are subject – for specific supervisory purposes - to the regulatory framework of the country of establishment, the main strategic decisions in terms of capital and liquidity management are taken at the holding level.

The availability of granular data at the tranche-level allows studying the effects of securitisation, by considering the specific features of the securitisation deals. For this purpose, I classify the tranches by asset type and credit rating. Capital IQ provides indications on the type of underlying assets: mortgage backed securities are based on residential and commercial mortgages; asset-backed securities are based on credit card receivables, auto leases, home equity loans; collateralised loan obligations (CLOs) are backed by large corporate loans, mostly provided by loan syndicates for leveraged buy-outs; collateralised debt obligations (CDOs) are backed by a pool of other fixed income instruments, such as asset-backed securities; collateralised bond obligations (CBOs) are backed by high-yield corporate bonds.

The products are classified on the basis of their long-term issue rating, assigned by Standard and Poor's to each tranche. Different tranches (senior, mezzanine, equity) of the same securitisation deal can have different ratings, depending on their order of priority with respect to the payment rights on the asset cash-flows. In particular, I observe the evolution of the credit risk assessment by rating agencies, given that it can affect the amount of the risk-weighted assets for banks: for this reason, I use data on the time series of credit ratings for each securitisation tranche and I consider the latest rating for each quarter.

Given the offering date and the maturity date of the deal, the data indicate the outstanding amounts of the tranche, i.e. the total amounts of securities outstanding in the market (net of possible early amortisation). The outstanding amounts, classified by product, asset type and rating, are collected on a quarterly basis, in order to match the data on securitisation issuances with the data on bank balance sheets (which are provided on a quarterly basis).

The Appendix 1.D provides a more detailed description of the steps followed in the construction of the dataset, as well as a discussion of the choices of the data sources. It also

---

<sup>77</sup> In my definition, Europe refers to the geographical continent. Then I include not only the member states of the European Union, but also Switzerland.

presents some summary statistics, at the bank level, for the variables used in the analysis, both for the bank balance sheet variables and for the securitisation data.

## 1.6 Securitisation Issuances and Bank Capital Position

The first part of the empirical analysis examines the changes in the capital position of originator banks after securitisation, by considering the overall amount of issuances, without distinction across types of product. In particular, I investigate the variations in the risk-weighted capital ratios and in the leverage ratios of the corresponding originator banks after the issuances.

### 1.6.1 The Empirical Specification

In the baseline empirical specification, I estimate the following panel regression by using bank and time fixed effects:

$$(15) y_{it} = \alpha_i + \delta_t + \beta SECUR_{it-1} + \gamma BANKCONTROLS_{it-1} + u_{it}$$

The dependent variable can be, depending on the specifications, either the risk-weighted capital ratio or the leverage ratio. I define the risk-weighted capital ratio ( $CapRatio_{it}$ ) as the ratio of regulatory capital to risk-weighted assets. To exclude the effects of risk weights, I conduct the analysis also on the leverage ratio. As discussed in Section 1.4.2, I use two distinct definitions of the leverage ratio. The regulatory capital leverage ratio ( $LevRatioCap_{it}$ ) is computed as the ratio of regulatory capital to total assets. The common equity leverage ratio ( $LevRatCE_{it}$ ) is calculated as the ratio of common equity to total assets.

The leverage ratio was not yet implemented in the European prudential framework during the period under consideration<sup>78</sup>. This has two implications. On one side, I can compare the developments in different solvency ratios, both risk-based and leverage-based, following the same securitisation operation<sup>79</sup>. This may be relevant to understand whether, in some cases, a leverage ratio could have worked better than a risk-based capital ratio to warn against the build-up of excessive risks in the banking sector. On the other side, given that I don't have a prudential measure of total assets for that period, in order to run this exercise I need to assume

---

<sup>78</sup> Actually, a similar leverage ratio was provided in the US prudential regulation. However, the US prudential framework required the application of capital and leverage requirements only for securitisation positions which were consolidated on balance sheet for accounting purposes. So, if the transfer was considered as a true sale for accounting purposes, the transferred assets could not be included anymore in bank total assets. As discussed in the Annex on the accounting framework, the GAAP principles were quite flexible in allowing for an off-balance sheet treatment of securitised assets. Then, in such case, the leverage ratio could not work effectively as a credible backstop against the build-up of excessive leverage through securitisation.

<sup>79</sup> An interpretation of these results in a potential counterfactual perspective may be subject to a key caveat: the provision of a compulsory leverage ratio could have affected bank incentives in a different way with regard to their securitisation behaviour

that that the amount of total assets reported for accounting purposes corresponds also to the amount of total assets for prudential regulation<sup>80</sup>.

The main explanatory variable is defined as the ratio of the outstanding amounts of securitisation sponsored by a bank  $i$  in quarter  $t$ , over the amount of bank total assets. I divide the amount of outstanding issuances by bank total assets to avoid that the values of the coefficients may be driven by size effects. At this stage of the analysis, I consider the overall amount of outstanding securitisation, without distinction across asset types and credit ratings.

$BANKCONTROLS_{it}$  is a vector of bank balance sheet variables and ratios, used to control for other factors able to affect capital ratios. Indeed, the capital position may evolve over time due to a broad set of balance sheet factors, related to the composition and the quality of bank assets, to the bank business model, to the profitability and to the funding strategies of the bank. To control for asset quality, I consider the ratio of nonperforming loans to total loans: it provides a measure of the riskiness of bank assets, as a higher ratio implies a higher probability of standing losses which can affect bank capital. To take into account the role of bank business model, I use the ratio of trading assets to investment securities: it provides a balance sheet measure of the bank's involvement in trading activities and it can be correlated with bank capital in a potentially different way, depending on the considered period and on the degree of market distress<sup>81</sup>. Also, to consider the diversification in terms of income sources, I introduce the ratio of non-interest income to total revenues: it defines the fraction of bank revenues coming from fee-based activities rather than from lending activities and it may be associated with higher or lower capital, depending on the analysed period and on the individual bank's assessment. To control for bank profitability, I employ the return on assets (RoA), computed as the ratio of net income to total assets: a higher ratio implies higher profitability and is generally associated with higher capital ratios, as banks making more profits can use them to increase the capital base.

In fact, bank balance sheet controls may not completely account for all the unobserved fixed characteristics, regarding the management of banks' balance sheets and capital position. This explains the rationale for a panel estimation with bank fixed effects, provided that the behaviour of different institutions may be driven by various bank-specific factors captured by the individual fixed components.

As discussed earlier, bank liquidity position may affect the incentives of banks for securitisation in various ways: by inducing banks to securitise in order to get funding from

---

<sup>80</sup> This assumption can be considered as feasible with respect to the accounting framework of European banks, provided that under the IFRS principles the amount of total assets should reflect the full consolidation of all sponsored entities.

<sup>81</sup> In general we observe that, before the crisis, banks more involved in trading activities were also better capitalised (at least in terms of risk-based capital ratios), while in the crisis period a larger trading activity was associated with lower capital ratios.

investors, when the issuances are placed on the market; or by incentivising banks to issue asset-backed securities to be pledged as collateral with central banks, when the issuances are retained on bank balance sheets. Banks may display substantial heterogeneity in terms of liquidity position. The empirical analysis captures such differences across banks by introducing an interaction term of the securitisation ratio with a measure of bank funding liquidity. Such interaction is useful to explain the role of funding liquidity in the change of the banks' capital position after securitisation. Then I run the following panel regression by using bank and time fixed effects:

$$(16) \ y_{it} = \alpha_i + \delta_t + \beta_1 SECUR_{it-1} + \beta_2 SECUR_{it-1} * FUNDING_{it-1} + \gamma BANKCONTROLS_{it-1} + u_{it}$$

I employ different measures of bank funding liquidity. The liquid assets ratio is defined as the ratio of liquid assets to total deposits and short-term borrowing: it indicates the buffer of liquid assets a bank can dispose of with respect to its short-term liabilities; a lower liquid assets ratio means either that a bank has a limited amount of liquid assets or that it has a relatively large amount of short-term liabilities. This is the preferred measure for the empirical analysis, as it captures well the incentives of banks with regard to the availability of liquid assets for collateral purposes.

I use also two other measures, for which I report the results in the annex. The second one is the ratio of total loans to total deposits: a higher ratio means that a larger quantity of loans is financed by a smaller amount of deposits, so it implies a higher reliance on wholesale funding and short-term borrowings; such banks can be more easily affected by liquidity problems. Then, a third indicator is the ratio of short-term borrowing to total liabilities, which can be informative about the composition of bank liabilities: a higher ratio means that the bank funding position depends more on short-term sources, which can be easily available and also relatively cheap in good times but subject to market disruptions in distressed times.

In general, we can argue that banks with lower liquid assets ratio, higher loans to deposits ratio and higher short-term borrowing ratio are weaker in terms of funding liquidity. For this reason, they may be eventually also more incentivised to use retained securitisation as collateral to deal with these funding liquidity issues.

## 1.6.2 Empirical Results

I conduct the analysis for the entire sample period (1999Q1-2010Q4), but I focus the attention mainly on two sub-sample periods: 2003Q1-2007Q2 (the pre-crisis period) and 2007Q3-2010Q4 (the crisis period). The distinction between these two sub-sample periods is important to understand the developments in the securitisation market. Indeed, the 3rd quarter of 2007 sets the beginning of the subprime crisis, with the consequent shut-down of the

securitisation market. Also, these two periods are defined in such a way to ensure the homogeneity of the regulatory framework for their entire duration<sup>82</sup>.

Given these facts, the two sub-periods were characterised by very different conditions: in the first sub-period, European banks were induced both by lax prudential requirements and by favourable market conditions to use securitisation to receive funding from market investors, also by distributing most of the issued securitisation tranches; in the second sub-period, European banks were highly discouraged by market conditions to place securitisation among market investors, due to the lack in demand for such securities, but they were incentivised by the monetary policy collateral framework to issue mainly asset-backed securities, in order to retain and to pledge them as collateral in the liquidity operations with central banks<sup>83</sup>.

### **1.6.2.1 The Variations in Risk-Based Capital and Leverage Ratios**

First, following the specification in equation (15), I estimate the changes in bank capital ratios after securitisation, for the overall amount of securitisation sponsored by each institution. Table 1.6 presents the results of this baseline specification. In particular, I consider the variations in the risk-weighted capital ratio, in the (regulatory capital) leverage ratio and in the (common equity) leverage ratio. Moreover, to gauge the economic size of these results, I compute the marginal effect of a one-standard-deviation increase in the (one-quarter lagged) securitisation ratio on the above capital ratios.

This preliminary regression is focused on the overall amount of securitisation at the bank-quarter level, but without distinction across product types. So the results of this regression are meant to provide some general indications about the developments in banks' capital position after securitisation. At the same time, when classifying different types of securitisation, we may observe different variations in the capital ratios of originator banks for the issuances of different classes of securitisation products<sup>84</sup>, given the heterogeneous characteristics of the products, and the distinct treatments of the collateral framework and prudential regulation.

---

<sup>82</sup> In 2003, the IFRS principles were adopted in the EU accounting framework. This is the main reason why I don't include the period between 1999 and 2002 in the first sub-period: at that time, the accounting framework enforced in the EU did not require yet the full consolidation of securitisation vehicles by sponsoring banks. In any case, by excluding that period, I don't lose many observations, given that the issuance of securitisation products in Europe was quite limited at that time.

<sup>83</sup> See the analysis of Chapter 2 for a more accurate study of this shift in the use of securitisation, with focus on Euro Area banks.

<sup>84</sup> The results obtained in this regression reflect some compositional issues, as they are determined as an average of the marginal effects observed for different types of products, whereas the sign may be positive for some and negative for others.



**Table 1.6 Securitisation Issuances and Capital Ratios: Baseline Specification**

| VARIABLES                               | 1999Q1-2010Q4           |                        |                        | 2003Q1-2007Q2         |                       |                         | 2007Q3-2010Q4            |                          |                         |
|---|-------------------------|------------------------|------------------------|-----------------------|-----------------------|-------------------------|--------------------------|--------------------------|-------------------------|
|   | (1)<br>CapRatio         | (2)<br>LevRatioCap     | (3)<br>LevRatCE        | (4)<br>CapRatio       | (5)<br>LevRatioCap    | (6)<br>LevRatCE         | (7)<br>CapRatio          | (8)<br>LevRatioCap       | (9)<br>LevRatCE         |
| <i>MAIN EXPLANATORY</i>                 |                         |                        |                        |                       |                       |                         |                          |                          |                         |
| Total Securitisation_1                  | 0.271***<br>(0.0882)    | 0.153***<br>(0.0425)   | -0.0935**<br>(0.0469)  | 0.119<br>(0.209)      | 0.0981<br>(0.0917)    | 0.0208<br>(0.0849)      | 0.482**<br>(0.217)       | 0.0668<br>(0.0667)       | -0.0288<br>(0.0719)     |
| <i>ECONOMIC EFFECT</i>                  |                         |                        |                        |                       |                       |                         |                          |                          |                         |
| 1 St. Dev. Increase<br>in Total Secur_1 | <b>+0.439***</b>        | <b>+0.248***</b>       | <b>-0.151**</b>        | +0.116                | +0.096                | +0.02                   | <b>+1.204**</b>          | +0.167                   | -0.072                  |
| <i>BANK CONTROLS</i>                    |                         |                        |                        |                       |                       |                         |                          |                          |                         |
| RoA_1                                   | 1.696**<br>(0.730)      | 0.933***<br>(0.352)    | 1.706***<br>(0.385)    | -0.0546<br>(1.516)    | 1.477**<br>(0.664)    | 1.274**<br>(0.618)      | 3.488***<br>(1.153)      | 0.365<br>(0.354)         | 1.286***<br>(0.368)     |
| NPL Ratio_1                             | 0.00246<br>(0.0970)     | 0.0522<br>(0.0463)     | 0.0524<br>(0.0472)     | 0.283<br>(0.254)      | 0.283<br>(0.254)      | -0.0213<br>(0.0958)     | -0.168<br>(0.148)        | 0.0738<br>(0.0455)       | 0.167***<br>(0.0481)    |
| Trad Invest Ratio_1                     | -0.000140<br>(0.000666) | 0.000222<br>(0.000322) | 0.000520<br>(0.000362) | 0.00103<br>(0.000912) | 0.00103<br>(0.000912) | 0.000151<br>(0.000384)  | -0.00417***<br>(0.00142) | -0.000748*<br>(0.000434) | -0.000732<br>(0.000461) |
| Non Inter Income Ratio_1                | 0.00675<br>(0.00492)    | 0.00105<br>(0.00237)   | -0.000197<br>(0.00128) | 0.0145<br>(0.0116)    | -0.00446<br>(0.00510) | -0.0106***<br>(0.00398) | 0.00762<br>(0.00747)     | -0.00214<br>(0.00229)    | -0.000871<br>(0.000934) |
| Constant                                | 0.105***<br>(0.0123)    | 0.0536***<br>(0.00594) | 0.0417***<br>(0.00483) | 0.110***<br>(0.00872) | -0.00446<br>(0.00510) | 0.0489***<br>(0.00308)  | 0.118***<br>(0.00985)    | -0.00214<br>(0.00229)    | 0.0417***<br>(0.00343)  |
| Bank Fixed Effects                      | YES                     | YES                    | YES                    | YES                   | YES                   | YES                     | YES                      | YES                      | YES                     |
| Quarter Fixed Effects                   | YES                     | YES                    | YES                    | YES                   | YES                   | YES                     | YES                      | YES                      | YES                     |
| R-squared                               | 0.651                   | 0.517                  | 0.464                  | 0.326                 | 0.631                 | 0.575                   | 0.729                    | 0.651                    | 0.714                   |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The evidence suggests that the use of one or another definition of bank capital ratios is particularly relevant to explain the changes in the bank capital position after securitisation: the conclusions which can be inferred from the observation of a given ratio may be significantly different from the ones obtained on the basis of another ratio. This may have also relevant policy implications for the definition of solvency requirements in prudential regulation.

Firstly, let us consider the results for the whole sample period. The coefficients for the risk-weighted capital ratio and for the (regulatory capital) leverage ratio are both positive, although with different magnitudes, while the coefficient for the (common equity) leverage ratio is negative. In particular, for a one-standard-deviation increase in the securitisation ratio, we observe: an increase in the risk-weighted capital ratio by 0.44 percentage points (+3.5% with respect to the mean ratio); an increase in the (regulatory capital) leverage ratio by 0.25 percentage points (+5.2% with respect to the mean ratio); a decrease in the (common equity) leverage ratio by 0.15 percentage points (-3.6% with respect to the mean ratio)<sup>85</sup>.

In particular, the evidence reveals that an increase in the securitisation activity is associated with an increase in the risk-weighted capital ratio but with a decrease in the common equity leverage ratio. This means that on average, for the entire sample period, banks expanding their securitisation issuances were improving their prudential solvency from the viewpoint of Basel regulations, while they were in fact increasing their leverage. So they were exploiting the regulatory arbitrage opportunities offered by the risk-weighted system and by the broad definition of capital in the Basel framework, in order to raise their prudential capital ratios through securitisation.

During the overall sample period, some regulatory changes had modified the existing prudential framework. In particular, the computation of the risk weighted assets was relevantly revised by Basel II, while the definition of regulatory capital remained broadly unchanged. To account for the differences in the regulatory regime, I examine separately the effects of securitisation on capital ratios in the two sub-sample periods, 2003Q1-2007Q2 (pre-crisis) and 2007Q3-2010Q4 (crisis).

In the pre-crisis time, the coefficients for the securitisation ratio are positive for all the three capital ratios, but they are not significant and in general are of small magnitude. This may reflect the coexistence of marginal effects of opposite sign for distinct classes of products, as explored in the following sections.

In the crisis time, banks expanding their securitisation activity registered a substantial increase in their risk-weighted capital ratios, but no significant change in their leverage ratios. In particular, a one-standard-deviation increase in the securitisation ratio was associated with an

---

<sup>85</sup> It may be useful to recall that the first and the second ratio share the same numerator, while the second and the third one present the same denominator. Then the first and the third ratio have different numerators and denominators.

increase in the risk-weighted capital ratio by 1.2 p.p. (+8.9% with respect to the mean ratio). Instead, the coefficients for the leverage ratio are non-significant: they display a positive sign for the regulatory capital leverage ratio and a negative sign for the common equity leverage ratio. Then, on average, banks issuing securitisation during the crisis registered a quite substantial improvement in their prudential risk-based ratios, while they were not in fact changing their leverage. Also, the greater discrepancy in the effects - between the risk-weighted capital ratio and the leverage ratio - as observed in the crisis period versus the pre-crisis time, may suggest possibly an even larger scope for regulatory arbitrage after mid-2007, when the new Basel II regime was in place.

### **1.6.2.2 Bank-level Heterogeneity in Funding Liquidity**

In the period prior to the crisis, securitisation was largely used by banks to expand their funding sources and high-rating asset-backed securities were used as collateral in the repo transactions among financial institutions. Then the subprime crisis induced a severe liquidity shock in the interbank market and relevant disruptions in the private repo market, by inducing credit institutions to increase their recourse to central bank refinancing operations. So, for various reasons before and after the crisis, bank funding liquidity may have played a key role in the securitisation decisions of credit institutions (Loutskina, 2011), especially of the large ones, which are also the main sponsors and originators of securitisation.

For this reason, I exploit the heterogeneity across banks in their funding liquidity, in order to explore whether differences in bank liquidity position can explain potential differences in the management of securitisation operations across banks. In particular, I extend the analysis of the previous section by introducing an interaction term between the securitisation ratio and the funding liquidity indicator. I use three indicators of funding liquidity position: the liquid assets ratio, the loans to deposits ratio and the short-term borrowing ratio. I estimate the regression in equation (16), by employing as dependent variables the three measures of capital ratios: the risk-weighted capital ratio, the (regulatory capital) leverage ratio and the (common equity) leverage ratio.

Table 1.7 presents the results of this specification, where the interacted indicator of funding liquidity is the liquid assets ratio.

For the entire sample period, I observe that banks increasing their issuances of securitisation registered an increase in their risk-based capital ratios, but that this effect was larger for banks with weaker liquidity position (i.e. with lower liquid assets ratio). I compute the marginal effect of a one-standard-deviation increase in the securitisation ratio for different values of the liquid assets ratio. Considering both the coefficients of the main explanatory and

**Table 1.7 Securitisation and Capital Ratios: Interaction with the Liquid Assets Ratio**

**Panel 1. Regression Results**

| VARIABLES               | 1999Q1-2010Q4        |                    |                      | 2003Q1-2007Q2     |                    |                    | 2007Q3-2010Q4        |                      |                     |
|-------------------------|----------------------|--------------------|----------------------|-------------------|--------------------|--------------------|----------------------|----------------------|---------------------|
|                         | (1)<br>CapRatio      | (2)<br>LevRatioCap | (3)<br>LevRatCE      | (4)<br>CapRatio   | (5)<br>LevRatioCap | (6)<br>LevRatCE    | (7)<br>CapRatio      | (8)<br>LevRatioCap   | (9)<br>LevRatCE     |
| <i>MAIN EXPLANATORY</i> |                      |                    |                      |                   |                    |                    |                      |                      |                     |
| Total Securitisation_1  | 0.833***<br>(0.199)  | 0.0167<br>(0.0982) | -0.373***<br>(0.108) | 0.277<br>(0.358)  | -0.0264<br>(0.156) | -0.0591<br>(0.152) | 1.563***<br>(0.332)  | 0.250**<br>(0.108)   | 0.0562<br>(0.122)   |
| <i>INTERACTION</i>      |                      |                    |                      |                   |                    |                    |                      |                      |                     |
| Tot Secur_1*LiqAssets_1 | -0.557***<br>(0.174) | 0.127<br>(0.0859)  | 0.271***<br>(0.0952) | -0.142<br>(0.259) | 0.112<br>(0.113)   | 0.0713<br>(0.113)  | -0.964***<br>(0.235) | -0.170**<br>(0.0769) | -0.0828<br>(0.0861) |
| Bank Controls           | YES                  | YES                | YES                  | YES               | YES                | YES                | YES                  | YES                  | YES                 |
| Bank Fixed Effects      | YES                  | YES                | YES                  | YES               | YES                | YES                | YES                  | YES                  | YES                 |
| Quarter Fixed Effects   | YES                  | YES                | YES                  | YES               | YES                | YES                | YES                  | YES                  | YES                 |
| R-squared               | 0.675                | 0.525              | 0.487                | 0.329             | 0.637              | 0.578              | 0.790                | 0.691                | 0.725               |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Panel 2. The Economic Effect of 1-Standard-Deviation Increase in the Securitisation Ratio**

| Dependent Variables                 | 1999Q1-2010Q4           |                        |                        | 2003Q1-2007Q2           |                        |                        | 2007Q3-2010Q4           |                        |                        |
|-------------------------------------|-------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|
|                                     | Values of the LiqAssets |                        |                        | Values of the LiqAssets |                        |                        | Values of the LiqAssets |                        |                        |
|                                     | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. |
| Risk Weighted Capital Ratio         | <b>0.861***</b>         | <b>1.209***</b>        | <b>0.676***</b>        | 0.194                   | 0.246                  | 0.15                   | <b>1.983***</b>         | <b>3.175***</b>        | <b>1.705***</b>        |
| (Regulatory Capital) Leverage Ratio | 0.138                   | 0.059                  | 0.180                  | 0.034                   | -0.007                 | 0.069                  | <b>0.286**</b>          | <b>0.496**</b>         | <b>0.237**</b>         |
| (Common Equity) Leverage Ratio      | <b>-0.367***</b>        | <b>-0.536***</b>       | <b>-0.276***</b>       | -0.020                  | -0.046                 | 0.003                  | -0.025                  | 0.078                  | -0.048                 |

Note: The results in bold characters denote the effects which correspond to statistically significant coefficients in the regression analysis: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

of the interaction term, I find that an increase in the securitisation ratio is associated with an increase in the risk-weighted capital ratios, for almost the entire distribution of the liquid assets ratio<sup>86</sup>.

Also, within the distribution of this variable, a decrease in the liquid assets ratio (a weakening in the bank's funding liquidity) from the 75<sup>th</sup> percentile to the 25<sup>th</sup> percentile would increase the positive change in the risk-based capital ratio from 0.676 p.p. to 1.209 p.p.. This means that banks with weaker funding liquidity, when implementing a securitisation operation, obtained larger improvements in their risk-based capital ratios than other banks. A possible explanation could be that less-liquid banks may have stronger interest than more-liquid banks in signalling – to market participants or supervisory authorities – to have a sound capital position: then the structuring of the securitisation deal could be functional to such purpose.

At the same time, the evidence shows that banks increasing their securitisation issuances observed a reduction in their (common equity) leverage ratio. For banks with an average liquid assets ratio, a one-standard deviation increase in the securitisation ratio was associated with a decrease in the (common equity) leverage ratio by 0.367 p.p. (-9.3% with respect to the mean ratio). The funding liquidity position of a bank has a substantial role in explaining this effect: a decrease in the liquid assets ratio from the 75<sup>th</sup> percentile to the 25<sup>th</sup> percentile increased the magnitude of the negative effect from -0.276 p.p. to -0.536 p.p.. This means that, during the entire sample period, when structuring a securitisation operation, less-liquid banks increased their leverage to a larger extent than more-liquid banks.

This liquidity-induced source of regulatory arbitrage may be captured from comparing the marginal effects on the risk-weighted capital ratio and on the (common equity) leverage ratio, for banks with low (25<sup>th</sup> percentile) and high (75<sup>th</sup> percentile) liquidity. Both the increase in the risk-based capital ratio and the decrease in the (common equity) leverage ratio almost double - in terms of magnitude - when banks move from the 75<sup>th</sup> percentile to the 25<sup>th</sup> percentile of the liquid assets ratio. This fact is observed for the whole sample period. Then I explore whether this effect may work differently, in distinct sub-periods.

In the pre-crisis period, when banks could easily get funding from the interbank market or from the private repo market, the funding liquidity position of banks didn't seem to have a relevant role in explaining the variation in the capital ratios of securitiser banks. I observe only some minor and non-significant coefficients for the main explanatory and for the interaction term: this is consistent with the non-significant effects for the pre-crisis time in Table 1.6.

For the crisis time, the evidence reveals a substantial role of liquidity in explaining the differences – across banks - in the capital management of securitisation operations. For a bank

---

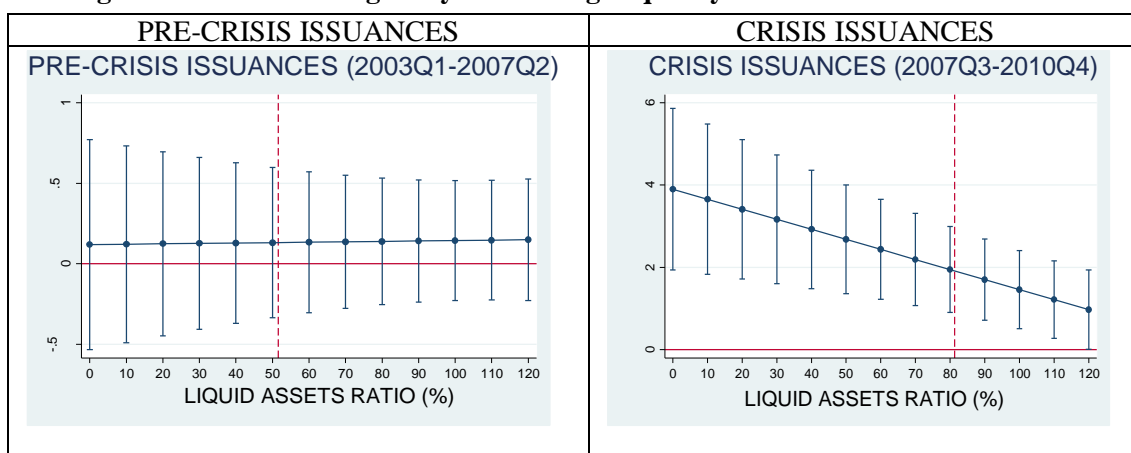
<sup>86</sup> This is the case for all values of the liquid assets ratio below 150% (corresponding to the 94<sup>th</sup> percentile). For the entire sample period, the mean value of the liquid assets ratio is equal to 54%, while the 25<sup>th</sup> percentile value is equal to 16% and the 75<sup>th</sup> percentile value is equal to 75%.

with an average liquid assets ratio<sup>87</sup>, a one-standard-deviation increase in the securitisation ratio increased the risk-based capital ratios by 1.98 p.p. (+14.6% with respect to the mean ratio), the (regulatory capital) leverage ratios by 0.29 p.p. (+6.4% with respect to the mean ratio) while it did not imply significant changes in the (common equity) leverage ratios. However, less-liquid banks obtained from securitisation larger gains in terms of prudential solvency ratios than more-liquid banks. Indeed, the marginal increase in the risk-based capital ratios becomes larger for banks in a weaker liquidity position: a decrease in the liquid assets ratio from the 75<sup>th</sup> percentile to the 25<sup>th</sup> percentile enlarges the marginal effect from +1.70 to +3.17.

In this period, I don't observe statistically significant decreases in the (common equity) leverage ratio. But the gap between the increase in the risk-based capital ratio and the null effect on the (common equity) leverage ratio becomes much larger during the crisis than in previous periods. Also, this difference is even more pronounced for banks displaying lower buffers of liquidity. This means that, during the crisis, banks subject to liquidity pressures exploited the regulatory arbitrage opportunities offered by the prudential framework even more than in the past, and that the driver for this behaviour was actually the funding shortage of banks.

To summarise this empirical evidence, the plots in Figure 1.3 represent the average marginal effect of a one-standard-deviation increase in the securitisation ratio on the risk-weighted capital ratio, for different values of the liquid assets ratio. The average marginal effects are computed – for the pre-crisis period and for the crisis period - on the basis of the estimates in Table 1.7 for the coefficients of the securitisation ratio and of the interaction term with the liquid assets ratio. The plots show that, while in the pre-crisis period the variation in the risk-based capital ratio was not significant and in any case not depending on the liquidity position of the bank, in the crisis time the positive and significant change in the risk-weighted capital ratio was sizeable and a decreasing function of the liquid assets ratio: banks with tighter

**Figure 1.3 Bank Heterogeneity in Funding Liquidity: Pre-Crisis & Crisis Issuances**



<sup>87</sup> For the crisis period, the mean value of the liquid assets ratio is equal to 0.80, while the 25<sup>th</sup> percentile value is equal to 0.30 and the 75<sup>th</sup> percentile value is equal to 0.91.

liquidity constraints obtained from securitisation larger increases in the prudential ratios than banks with a stronger liquidity position.

I obtain equivalent results also when I use different indicators of funding liquidity, namely the loans to deposits ratio and the short-term borrowing ratio (see the robustness analysis in Section 1.8.2).

### **1.6.2.3 Funding Liquidity, Securitisation and Regulatory Arbitrage**

The evidence observed from the interaction of the securitisation ratio with the various measures of funding liquidity suggests that banks with lower liquid assets ratio, higher loans to deposits ratio and higher short-term borrowing ratio, had stronger incentives to increase their risk-based capital ratios while keeping or even decreasing their leverage ratios.

In particular, this effect of liquidity was sensibly stronger during the crisis time, that is when banks were retaining on balance sheet most tranches of the issued asset-backed securities. As studied more formally in the following chapter, the key rationale for banks to retain ABSs during that period was to enlarge the availability of eligible collateral, in order to be able to participate in the liquidity operations of central banks. Indeed, credit institutions in a weaker liquidity position, being more involved in central bank liquidity operations, were also potentially more interested in increasing - through ABS retention - the amount of eligible collateral for central bank repos<sup>88</sup>.

Then the key question is through which channel this eventual need for liquidity could affect the design of structured deals and so the capital management of originator banks. For this purpose, we need to consider that the retention of asset-backed securities on balance sheet implies – for originator banks – the need to hold an appropriate amount of capital for the credit risk of these exposures. Given the cost of capital, banks planning to retain asset-backed securities for collateral purposes might be interested in avoiding that this risk retention may excessively increase their capital requirements. In particular, originator institutions would be induced to design the securitisation deal in such a way to minimise the impact of risk retention on prudential solvency, and possibly to improve their regulatory ratios. To achieve this aim, banks could retain those asset-backed securities which were subject to lower risk weights or, more precisely, which presented a larger gap between the risk weight of the securitised asset and the risk weight of the (retained) securitisation exposure, as discussed in Section 1.4.3.

---

<sup>88</sup> The available bank balance sheet data do not report the actual amounts of liquidity withdrawn from the Eurosystem and of the collateral pledged for central bank operations. However, from the viewpoint of banks, the availability of large amount of eligible assets was even more important than the actual use of the instruments as collateral. Indeed, a bank could retain some asset-backed securities to have more eligible assets but without using them in actual repo operations. In this perspective, the liquid assets ratio may be considered as a good indicator of funding liquidity also with respect to the availability of eligible assets, given that most eligible assets are actually marketable instruments. For this reason, banks with a lower liquid assets ratio would have stronger need to expand the set of eligible assets

The analysis presented in the following chapter shows that banks under stronger pressures for liquidity reasons had higher probability to retain asset-backed securities for collateral purposes. In this chapter, we aim to explore whether these banks more subject to liquidity constraints might have had also stronger incentives to exploit the regulatory arbitrage opportunities from the prudential framework, in order to minimise the effects of risk retention on capital requirements. This might possibly explain why, when securitising, and in particular during the crisis, less-liquid banks registered a larger improvement in their prudential solvency ratios than more-liquid banks.

In order to investigate this hypothesis more in depth, we need to distinguish the various categories of structured products, since they are subject to different regulatory regimes, both for collateral criteria, and for prudential requirements. Indeed, only some products are eligible as collateral for central bank liquidity operations and also different securitisation exposures get assigned different risk weights for prudential regulation. This opens the scope for a more granular analysis, focused on distinct categories of structured products, as presented in the following section.

## **1.7 Heterogeneity across Different Classes of Securitisation**

In the second part of the analysis, I classify the outstanding issuances of securitisation in various classes – either by asset type or by credit rating - and I analyse the changes in the capital position of originator banks after the issuance of different types of products.

In this way, I can account also for the potential differences in the regulatory treatment across distinct classes of securitisation. Indeed, different products may be subject to different regimes both for the monetary policy collateral framework and for prudential regulation. This could raise relevant incentives, by increasing or reducing the advantages that banks may obtain from issuing or holding a securitisation product. In fact, collateral and prudential rules may determine – for specific products – a more (less) beneficial treatment, by favouring (limiting) the access to central bank liquidity or by reducing (increasing) the burden for regulatory capital.

First, the collateral eligibility of an instrument as collateral can increase the amount of liquidity that a credit institution may obtain from central banks. This may be relevant both for banks acting as investors, when securitisation products are placed on the market, and for originator banks, when they decide to retain the product on balance sheet.

Second, prudential regulation can affect securitisation incentives from two sides, through the risk weights for the underlying assets or the risk weights for the securitisation products. In the case of market placement, the risk weight on the underlying exposures determines - with the exposure amount - the potential reduction in risk-weighted assets that an



originator bank can achieve via securitisation. While, in the case of risk retention, the incentive for a bank to securitise and retain the issued tranches depends on the regulatory arbitrage between the risk weight for the underlying assets and the risk weight for securitisation positions: the assignment of a lower risk weight to the securitisation exposure reduces the amount of capital that a bank has to hold, when it retains some tranches on balance sheet.

These regulatory incentives concerning different classes of securitisation may be more or less effective for banks also in relation to their balance sheet conditions. For this reason, I conduct the following analysis in two steps: 1) first, I investigate – without distinction across banks - the changes in the capital ratios following the issuance of different classes of securitisation; 2) then, I explore whether this post-securitisation variation in bank capital position may be different across banks with heterogeneous characteristics (mainly for funding liquidity). I use two different specifications.

In the first specification, reported as equation (17), I classify different categories of securitisation and in each regression I focus on a specific class to estimate the marginal variations in capital ratios for the issuances of that type by a bank.

$$(17) \ y_{it} = \alpha_i + \delta_t + \beta \text{SECUR\_}X_{it-1} + \gamma \text{CONTROLS}_{it-n} + u_{it}$$

In this way, I investigate whether the issuances of distinct categories of products are associated with different variations in bank capital ratios, in terms of sign and magnitude.

In a second specification, reported as equation (18), I account for bank heterogeneity in the ex-ante funding liquidity profile. So I expand the above specification by introducing an interaction term between the securitisation ratio (for a given category of product) and an indicator of funding liquidity position, namely the liquid assets ratio.

$$(18) \ y_{it} = \alpha_i + \delta_t + \beta_1 \text{SECUR\_}X_{it-1} + \beta_2 \text{SECUR\_}X_{it-1} * \text{FUNDING}_{it-1} + \gamma \text{BANKCONTROLS}_{it-1} + u_{it}$$

Based on this specification, I explore whether and how the funding liquidity position of a bank may have some role in affecting the capital management of banks, for the issuance of specific classes of securitisation.

### 1.7.1 Empirical Results: Securitisation Classified by Asset Types

First, I consider the issuances of securitisation classified by asset type. Securitisation may be backed by different types of assets, such as residential mortgages, home equity loans, commercial loans, syndicated loans, corporate bonds or other structured products. The type of underlying asset is relevant to determine the regulatory treatment, both for the collateral standards and for the prudential requirements.

As for the collateral framework, only securitisation products backed by relatively transparent assets, such as asset-backed securities based on residential mortgages, can be accepted as eligible collateral, while other more complex structured instruments backed by riskier assets, like collateralised debt obligations (CDOs) backed by corporate bonds or other structured products, cannot be pledged as collateral for monetary policy operations.

In a capital regulation perspective, the incentives may work differently depending on whether securitisation products are placed among market investors or retained by the originator. In case of market placement, banks obtain a larger decrease in their risk-weighted assets from the securitisation of exposures subject to higher risk weights. In case of tranche retention, banks can benefit from a reduction in the risk-weighted assets if the securitisation position is subject to lower risk weights than the underlying assets.

### 1.7.1.1 Securitisation Issuances Backed by Different Asset Types

In equation (19), I classify the outstanding amounts of securitisation by asset type, in order to analyse and compare the variations in the capital ratios following securitisation issuances backed by different assets. I estimate the following equation:

$$(19) y_{it} = \alpha_i + \delta_t + \beta SECUR\_ASSET\_TYPE_{it-1} + \gamma CONTROLS_{it-1} + u_{it}$$

The dependent variable  $y_{it}$  can be, depending on the specifications, the risk-weighted capital ratio (CapRatio) or the (common equity) leverage ratio (LevRatCE). The main explanatory variable is the ratio of the outstanding amounts of securitisation, for a given asset class<sup>89</sup>, to bank total assets.

Table 1.8 presents the results for securitisation issuances backed by different asset types. For an easier economic interpretation of the results, I report the estimates of the marginal changes in the risk-based capital ratios and in the leverage ratios, as resulting from a 1-standard-deviation increase in the securitisation ratio for distinct asset classes. This empirical exercise also provides a quantitative idea of the capital regulation incentives driving the securitisation process: the different sizes of the changes in the risk-weighted capital ratios, for distinct categories of products, suggest how large improvements in the prudential solvency ratios banks could obtain from the securitisation of certain types of assets versus others.

---

<sup>89</sup> For the purpose of this analysis, we focus on some of the most relevant asset classes: residential mortgages (ResidMort), home equity loans (HomeEquity), commercial loans (CommLoans), collateralised bond obligations (CBOs), collateralised debt obligations (CDOs).

**Table 1.8 Securitisation Issuances Classified by Asset Type**

| VARIABLES                     | (1)<br>CapRatio     | (2)<br>LevRatCE      | (3)<br>CapRatio     | (4)<br>LevRatCE     | (5)<br>CapRatio     | (6)<br>LevRatCE      | (7)<br>CapRatio   | (8)<br>LevRatCE     | (9)<br>CapRatio     | (10)<br>LevRatCE    |
|-------------------------------|---------------------|----------------------|---------------------|---------------------|---------------------|----------------------|-------------------|---------------------|---------------------|---------------------|
| <b>Panel A. 1999Q1-2010Q4</b> |                     |                      |                     |                     |                     |                      |                   |                     |                     |                     |
| CBO_1                         | 0.703***<br>(0.156) | -0.00929<br>(0.0839) |                     |                     |                     |                      |                   |                     |                     |                     |
| CDO_1                         |                     |                      | 0.875***<br>(0.279) | 0.469***<br>(0.140) |                     |                      |                   |                     |                     |                     |
| CommLoans_1                   |                     |                      |                     |                     | 0.119<br>(0.109)    | -0.115**<br>(0.0541) |                   |                     |                     |                     |
| HomeEquity_1                  |                     |                      |                     |                     |                     |                      | 0.169<br>(0.135)  | -0.110*<br>(0.0666) |                     |                     |
| ResidMort_1                   |                     |                      |                     |                     |                     |                      |                   |                     | 0.381***<br>(0.112) | -0.108*<br>(0.0586) |
| <b>Panel B. 2003Q1-2007Q2</b> |                     |                      |                     |                     |                     |                      |                   |                     |                     |                     |
| CBO_1                         | 0.959***<br>(0.150) | 0.0592<br>(0.0815)   |                     |                     |                     |                      |                   |                     |                     |                     |
| CDO_1                         |                     |                      | 0.716*<br>(0.392)   | 0.0579<br>(0.161)   |                     |                      |                   |                     |                     |                     |
| CommLoans_1                   |                     |                      |                     |                     | 0.371***<br>(0.124) | 0.0190<br>(0.0549)   |                   |                     |                     |                     |
| HomeEquity_1                  |                     |                      |                     |                     |                     |                      | -0.182<br>(0.129) | 0.0423<br>(0.0529)  |                     |                     |
| ResidMort_1                   |                     |                      |                     |                     |                     |                      |                   |                     | 0.0290<br>(0.154)   | 0.0846<br>(0.0634)  |
| <b>Panel C. 2007Q3-2010Q4</b> |                     |                      |                     |                     |                     |                      |                   |                     |                     |                     |
| CBO_1                         | 0.277<br>(0.218)    | -0.0159<br>(0.0757)  |                     |                     |                     |                      |                   |                     |                     |                     |
| CDO_1                         |                     |                      | 1.293**<br>(0.592)  | 0.336<br>(0.205)    |                     |                      |                   |                     |                     |                     |
| CommLoans_1                   |                     |                      |                     |                     | -0.429<br>(0.292)   | -0.0408<br>(0.102)   |                   |                     |                     |                     |
| HomeEquity_1                  |                     |                      |                     |                     |                     |                      | 0.477<br>(0.350)  | -0.0231<br>(0.123)  |                     |                     |
| ResidMort_1                   |                     |                      |                     |                     |                     |                      |                   |                     | 0.603**<br>(0.267)  | -0.0899<br>(0.0947) |
| Bank Controls                 | YES                 | YES                  | YES                 | YES                 | YES                 | YES                  | YES               | YES                 | YES                 | YES                 |
| Bank Fixed Effects            | YES                 | YES                  | YES                 | YES                 | YES                 | YES                  | YES               | YES                 | YES                 | YES                 |
| Quarter Fixed Effects         | YES                 | YES                  | YES                 | YES                 | YES                 | YES                  | YES               | YES                 | YES                 | YES                 |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In the *pre-crisis period*, banks sponsoring securitisation showed in general an improvement in their risk-based capital ratios, mostly because these deals were designed for capital relief purposes, i.e. to transfer assets from their balance sheets. These results hold both for complex products not eligible as collateral, like CDOs or CBOs<sup>90</sup>, and for simpler eligible products, such as ABSs backed by commercial loans.

During this period, since banks were distributing the securitisation tranches among investors, the rise in the risk-weighted capital ratios was proportional to the risk of the securitised assets: the higher was the credit risk of the (transferred) assets, the larger was the improvement in the risk-adjusted solvency ratios. For instance, a 1-standard-deviation increase in the securitisation ratio for CBOs and CDOs (typically high-risk products) increased the risk-weighted capital ratio by 0.96 p.p. and 0.72 p.p., while a corresponding rise in the issuances of ABSs backed by commercial loans raised the risk-based capital ratio by 0.37 p.p. At the same time, I find a positive but not significant coefficient for residential mortgage-backed securities, which could however reflect different factors: on one hand, the lower risk weight for residential mortgages on banks' balance sheets, therefore implying smaller reduction in risk-weighted assets; on the other hand, the potential use of revenues from the issuance of RMBSs for the provision of new credit to residential real estate<sup>91</sup>.

During the *crisis period*, banks increasing their issuances of RMBSs registered significant improvements in their risk-weighted capital ratios, but no change or eventually an increase in bank leverage. In particular, a one-standard deviation increase in the securitisation ratio for residential mortgages was associated with a rise in the risk-weighted capital ratio by 0.60 p.p. and with no significant change in the (common equity) leverage ratio. We still observe a sizeable positive effect for the issuance of CDOs, around 1.2 p.p.. However, the drivers of capital management for the issuance of these two types of securitization could be quite different, as explained in the below analysis exploring banks' heterogeneity in their funding liquidity.

### 1.7.1.2 Securitisation Classified by Asset Types: Interaction with Funding Liquidity

In equation (20), I estimate the changes in the capital position for the securitisation issuances backed by specific types of assets and I investigate whether the funding liquidity position of banks may have some role in affecting the capital management of securitiser banks, effects - for the issuances backed by specific asset types.

$$(20) \ y_{it} = \alpha_i + \delta_t + \beta_1 SECUR\_ASSET\_TYPE_{it-1} + \beta_2 SECUR\_ASSET\_TYPE_{it-1} \\ * FUNDING_{it-1} + \gamma BANKCONTROLS_{it-1} + u_{it}$$

<sup>90</sup> CBOs stand for Collateralized Bond Obligations. They are structured products backed by high-risk and high-yield bonds.

<sup>91</sup> At the bank-level, we may not be able to fully explore the additional provision of credit based on the revenues from securitisation, as we may need to use loan-level data to better control for credit demand.

The dependent variable  $y_{it}$  can be, depending on the specifications, either the risk-weighted capital ratio (CapRatio) or the (common equity) leverage ratio<sup>92</sup> (LevRatCE).

The full set of regression coefficients is presented in the tables of Appendix 1.E. Table 1.9 reports, for each category of underlying asset, the economic effect of a 1-standard deviation increase in the securitisation ratio on the risk-weighted capital ratio and on the (common equity) leverage ratio, for different values of the liquid assets ratio (corresponding to the 25<sup>th</sup> percentile, to the mean and to the 75<sup>th</sup> percentile). This economic effect considers both the coefficient of the securitisation ratio and of the interaction between the securitisation ratio and the liquid assets ratio (to the extent they are statistically significant).

The results reported in Table 1.9 suggest that the funding liquidity position may have played a substantial role in affecting the capital management of securitiser banks, in particular for some particular categories of products (mostly eligible as collateral for monetary policy operations). This result may be different across distinct types of underlying assets as well as across different time periods.

For this reason, I distinguish two broad categories of products: the asset-backed securities (backed directly by various types of loans, like residential mortgages, home equity loans, commercial loans) and the collateralised debt obligations in a broad sense<sup>93</sup> (backed by other debt instruments). This distinction is important for the purpose of central bank collateral framework: indeed, ABSs can be eligible as collateral while CBOs and CDOs are not. The empirical analysis shows that bank liquidity may have a role particularly for the issuances of asset-backed securities (backed by credit claims) and only to a minor extent for the issuances of collateralised debt obligations (backed by other securities).

Let's focus first on the issuances of structured products (*CBOs and CDOs*) backed by other debt instruments. When considering the overall sample period, we observe that a one-standard-deviation increase in the securitisation ratio increases the risk-weighted capital ratios by 0.99 points for the issuances of CBOs and by 1.43 points for the issuances of other types of CDOs. However, since the interaction term displays a non-significant coefficient, this effect is homogeneous across banks, as it doesn't depend on the liquidity position of individual institutions. Then I compare the results for the two sub-sample periods.

---

<sup>92</sup> I estimate this regression also for the (regulatory capital) leverage ratio. For space reasons, to make tables more readable, I report the results for the two dependent variables which are actually more relevant from the regulatory point of view: the risk-based capital ratio, i.e. the traditional prudential solvency ratio in the Basel framework; the (common equity) leverage ratio, which is closer to the current definition of leverage ratio in the Basel III accord.

<sup>93</sup> In this category, I include both the products previously labeled as CBOs and as CDOs. The key feature of these structured products is that the underlying asset is not constituted by loans, but by other financial instruments (bonds, asset-backed securities, etc.)

**Table 1.9 Securitisation Classified by AssetTypes: Interaction with the Liquid Assets Ratio**  
The Economic Effect of 1-Standard-Deviation Increase in the Securitisation Ratio

| Asset Types                  |          | 1999Q1-2010Q4           |                        |                        | 2003Q1-2007Q2           |                        |                        | 2007Q3-2010Q4           |                        |                        |
|------------------------------|----------|-------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|
|                              |          | Values of the LiqAssets |                        |                        | Values of the LiqAssets |                        |                        | Values of the LiqAssets |                        |                        |
|                              |          | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. |
| <b>CBO</b>                   | CapRatio | <b>0.986***</b>         | <b>0.986***</b>        | <b>0.986***</b>        | <b>1.029***</b>         | <b>1.029***</b>        | <b>1.029***</b>        | <b>0.627**</b>          | <b>1.38**</b>          | <b>0.451**</b>         |
|                              | LevRatCE | 0.058                   | 0.052                  | 0.062                  | 0.069                   | 0.013                  | 0.117                  | 0.009                   | 0.070                  | -0.005                 |
| <b>CDO</b>                   | CapRatio | <b>1.427***</b>         | <b>1.427***</b>        | <b>1.427***</b>        | <b>0.939*</b>           | <b>0.939*</b>          | <b>0.939*</b>          | 1.447                   | 1.892                  | 1.343                  |
|                              | LevRatCE | <b>0.747***</b>         | <b>0.747***</b>        | <b>0.747***</b>        | 0.037                   | -0.033                 | 0.098                  | 0.317                   | 0.288                  | 0.323                  |
| <b>Commercial Loans</b>      | CapRatio | <b>0.505***</b>         | <b>0.783***</b>        | <b>0.357***</b>        | <b>0.658*</b>           | <b>0.658*</b>          | <b>0.658*</b>          | <b>0.094**</b>          | <b>0.804**</b>         | <b>-0.072**</b>        |
|                              | LevRatCE | <b>-0.303***</b>        | <b>-0.456***</b>       | <b>-0.221***</b>       | 0.121                   | 0.197                  | 0.056                  | -0.058                  | -0.079                 | -0.053                 |
| <b>Home Equity Loans</b>     | CapRatio | <b>0.566***</b>         | <b>0.856***</b>        | <b>0.411***</b>        | -0.140                  | -0.099                 | -0.175                 | <b>0.956***</b>         | <b>1.806***</b>        | <b>0.758***</b>        |
|                              | LevRatCE | <b>-0.366***</b>        | <b>-0.539***</b>       | <b>-0.274***</b>       | -0.042                  | -0.079                 | -0.009                 | -0.041                  | -0.072                 | -0.033                 |
| <b>Residential Mortgages</b> | CapRatio | <b>0.774***</b>         | <b>1.073***</b>        | <b>0.614***</b>        | -0.019                  | -0.051                 | 0.009                  | <b>1.187***</b>         | <b>2.296***</b>        | <b>0.928***</b>        |
|                              | LevRatCE | <b>-0.313***</b>        | <b>-0.465***</b>       | <b>-0.232***</b>       | 0.041                   | 0.021                  | 0.059                  | -0.022                  | 0.101                  | -0.051                 |

Note: The results in bold characters denote the effects which correspond to statistically significant coefficients in the regression analysis: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In the *pre-crisis period*, banks sponsoring the issuances of CBOs and CDOs obtained a considerable rise in the risk-weighted capital ratios, but no change in their (common equity) leverage ratios. Moreover, the increase in the risk-based capital ratios registered for such products was considerably larger than the variation observed for any other type of securitisation products in the pre-crisis period. In fact, at that time banks were using securitisation mostly for capital relief: so the increase in the risk-weighted capital ratios was proportional to the risk weights of the assets transferred through the deals and it was larger for the issuances backed by more risky assets.

On the other hand, in the *crisis time*, banks were less interested in issuing such types of structured products, since they could not use them as collateral in repos with central banks and it was difficult to find interested market investors. The issuance of – considerably fewer<sup>94</sup> - CBOs was associated with a still positive but smaller change in the risk-based capital ratios: the marginal effect decreased from +1.029 in the pre-crisis time to +0.627 (on average) during the crisis. Also, within the fewer issuances of CBOs at that time, banks with lower liquid assets ratios obtained larger improvements in their prudential solvency. However, since these products could not be pledged as collateral, there wouldn't have been any point in retaining them, unless in case of lack of demand from market investors. At the same time, no significant change in capital ratios is observed for the issuances of CDOs

Now I consider the issuances of asset-backed securities (*ABSs*), backed by residential mortgages, home equity loans and commercial loans. The results for the overall sample period reveal that the ex-ante funding liquidity position was relevant to explain the ex-post variation in the capital ratios for securitiser banks.

In general, banks increasing their issuances of asset-backed securities registered an increase in their risk-based capital ratios and a decrease in their (common equity) leverage ratio: then banks were improving their prudential solvency ratios but in fact they were raising their leverage. For a bank with an average liquid assets ratio, a one-standard-deviation increase in the securitisation of residential mortgages would have increased the risk-weighted capital ratio by +0.774 and decreased the (common equity) leverage ratio by -0.313. The same increase in the securitisation of home equity loans would have improved the risk-based capital ratio by +0.556 and reduced the (common equity) leverage ratio by -0.366.

Also, this divergence of sign in the marginal variations of the two capital ratios is even more pronounced – following the securitisation of these loans – for banks with a weaker liquidity position. For the issuances of *ABSs* backed by residential mortgages, a weakening in the funding liquidity position of banks (i.e. a decrease in the liquid assets ratio from the 75<sup>th</sup>

---

<sup>94</sup> The change in the issuance trends of different types of products may suggest, as an extension of this analysis, to model also the issuance decisions of banks, preliminarily to the post-issuance variations in bank capital.

percentile to the 25<sup>th</sup> percentile) would have increased both the size of the (positive) marginal effect in the risk-based capital ratio – from +0.614 to +1.073 – and the magnitude of the (negative) marginal effect in the (common equity) leverage ratio – from -0.232 to -0.465. Similar effects hold also for ABSs backed by home equity loans and commercial loans. As observed in Table 1.7 for the overall issuances of securitisation, banks which were more liquidity-constrained had stronger incentives to exploit the regulatory arbitrage opportunities offered by the prudential framework. Then I investigate whether these effects may hold differently depending on the periods.

In the *pre-crisis time*, the funding liquidity position of banks doesn't seem to be relevant for the variations in capital ratios. Also the coefficients for the securitisation ratios of ABSs are not significant, as noticed in the model without the interaction term. Only the issuances of ABSs backed by commercial loans were associated with an increase in the risk-based capital ratios. This variation was smaller – in magnitude - than the one observed for CDOs and CBOs but it was still significant (at the 10% level). This is also consistent with a risk transfer hypothesis: given that commercial loans were subject to higher risk weights than residential mortgages, the securitisation of commercial loans was accompanied by a larger decrease in the risk-weighted assets and a wider increase in the risk-based capital ratio.

During the *crisis period*, banks expanding their issuances backed by residential mortgages, home equity loans and commercial loans observed substantial improvements in their risk-based solvency ratios, but no change in their (common equity) leverage ratios. This was particularly relevant for banks with lower liquid assets ratios. Indeed, a decrease in the liquid assets ratio from the 75<sup>th</sup> to the 25<sup>th</sup> percentile would have increased the (positive) marginal effect on the risk-based capital ratios to a quite significant extent: from +0.93 to +2.30 for issuances backed by residential mortgages; from +0.76 to +1.81 for ABSs backed by home equity loans; from -0.07 to +0.8 for securitisation backed by commercial loans. The ABSs backed by the above types of loans were eligible as collateral for central bank operations and then banks had incentives in retaining them on balance sheet for liquidity reasons. Moreover, ABSs based on residential mortgages and home equity loans were subject to a favorable regulatory treatment, as they were charged with low risk weights. In particular, the risk weight for the (retained) securitisation products could be lower than the risk weight for the underlying (securitised) loans. For this reason, banks issuing ABSs backed by these underlying assets and retaining them on balance sheet could even get an increase in their risk-weighted capital ratios.

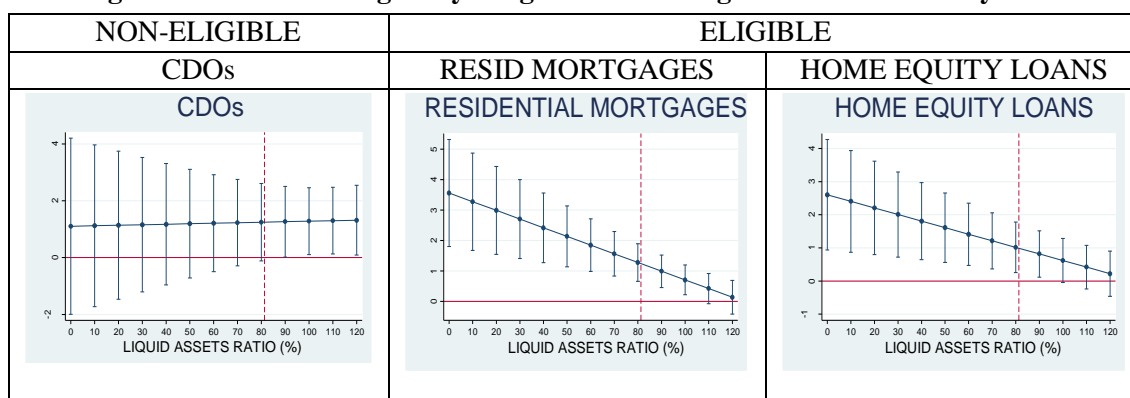
To summarise this empirical evidence, particularly for the crisis period, the plots in Figure 1.4 compare - for securitisation products backed by different asset types - the average marginal effect of a one-standard-deviation increase in the securitisation ratio on the risk-weighted capital ratios. The average marginal effects are computed – for different values of the



liquid assets ratio - on the basis of the estimates in Table 1.9 for the coefficients of the securitisation ratio and of the interaction term with the liquid assets ratio.

As mentioned earlier, I distinguish asset-backed securities eligible as collateral (backed by residential mortgages and home equity loans) and collateralised debt obligations (CDOs) non-eligible as collateral. The plots show that during the crisis period, while the issuance of non-eligible CDOs was associated with a risk-based capital variation mostly non-significant and also not depending on the liquidity position of the bank, the issuance of eligible ABSs was related to a positive and significant change in the risk-weighted capital ratio, which was indeed

**Figure 1.4 Bank Heterogeneity: Eligible & Non-Eligible Securitisation by Asset**



a decreasing function of the liquid assets ratio: banks with tighter liquidity constraints obtained from collateral-eligible securitisation larger increases in the prudential ratios than banks with a stronger liquidity position.

This result, obtained for securitiser banks under stronger liquidity constraints and for products eligible as collateral, would confirm the hypothesis about funding liquidity and regulatory arbitrage: during the crisis, less-liquid banks – and then more interested in increasing the availability of collateral through the retention of eligible ABSs– exploited the regulatory arbitrage opportunities of securitisation to obtain larger improvements in prudential solvency than more-liquid banks.

### 1.7.2 Empirical Results: Securitisation Classified by Credit Ratings

In this section, I consider the issuances of securitisation with different credit ratings. In particular, I classify the ratings provided by Standard and Poor’s in rating buckets, based on relatively homogeneous risk characteristics and I focus on four rating buckets: AAA, AA and A, BBB (all investment-grade), BB and B (non-investment grade). I investigate the variations in capital ratios for the issuances of securitisation products with different credit ratings.

Credit ratings are important to determine the regulatory treatment of securitisation products, both for collateral reasons and for prudential purposes. Indeed, in the Eurosystem

framework at the time of the analysis, only asset-backed securities with at least a single A rating could be pledged as collateral, while other instruments with lower rating could not be eligible in the refinancing operations. Also, in the Basel II securitisation framework, founded on the rating-based approach, credit ratings were relevant to determine the risk weights for securitisation positions: the higher was the credit rating of the product, the lower was the risk weight assigned to the securitisation tranche, and then the lower was the minimum required capital that the bank had to keep for that exposure<sup>95</sup>.

### 1.7.2.1 Securitisation Issuances with Different Credit Ratings

In equation (21), I focus – for each regression - on the securitisation products within a given rating bucket and I run the following regression:

$$(21) y_{it} = \alpha_i + \delta_t + \beta_1 SECUR\_CREDIT\_RATING_{it-1} + \gamma CONTROLS_{it-1} + u_{it}$$

The dependent variable  $y_{it}$  can be, depending on the specifications, the risk-weighted capital ratio (CapRatio) or the (common equity) leverage ratio (LevRatCE). The main explanatory variable is the (one-quarter lagged) ratio of the outstanding issuances of securitisation, belonging to a given rating bucket, to bank total assets. Then,  $AAA_{it-1}$  indicates the ratio for the outstanding amount of AAA products,  $AA\_A_{it-1}$  denotes the ratio for the outstanding amount of AA and A securities (including AA+, AA, AA-, A+, A, A-), etc.

The results presented in Table 1.10 illustrate and compare the variations in the capital position for the securitisation issuances of different rating buckets. For an easier economic interpretation of the results, I report the estimates of the marginal effects of a one-standard deviation increase in the securitisation ratio for various rating buckets.

In the *pre-crisis period*, banks issuing AAA products showed a relevant increase in their risk-weighted capital ratios, but no significant change in their (common equity) leverage ratios. Precisely, a one-standard deviation increase in the securitisation ratio for AAA products was associated with a rise in the risk-based capital ratio by 0.36 p.p.. This result is important to compare the adequacy of different measures of prudential solvency in reflecting the build-up of excessive leverage through securitisation. In that period, banks were used to place high-rating securitisation tranches among market investors; therefore, they could transfer the asset pool and exclude the securitised exposures from their risk-weighted assets<sup>96</sup> (even if the assets were still

---

<sup>95</sup> Prudential regulation applies positive risk weights for the securitisation positions with a rating in the range between AAA and BB-; while, for the rating buckets equal to and below B+, capital regulation requires the full deduction of the securitisation position from regulatory capital, meaning that the securitisation exposure has to be covered by a corresponding amount of regulatory capital.

<sup>96</sup> At that time, before the introduction of Basel II, there were not strict conditions requiring a significant and effective risk transfer to exclude securitisation exposures from the risk-weighted assets for prudential purposes.

**Table 1.10 Securitisation Issuances Classified by Credit Ratings**

| VARIABLES                     | (1)<br>CapRatio      | (2)<br>LevRatCE     | (3)<br>CapRatio     | (4)<br>LevRatCE      | (5)<br>CapRatio      | (6)<br>LevRatCE       | (7)<br>CapRatio      | (8)<br>LevRatCE       |
|-------------------------------|----------------------|---------------------|---------------------|----------------------|----------------------|-----------------------|----------------------|-----------------------|
| <b>Panel A. 1999Q1-2010Q4</b> |                      |                     |                     |                      |                      |                       |                      |                       |
| AAA_1                         | -0.126<br>(0.127)    | -0.0511<br>(0.0621) |                     |                      |                      |                       |                      |                       |
| AA_A_1                        |                      |                     | 0.431***<br>(0.135) | -0.148**<br>(0.0682) |                      |                       |                      |                       |
| BBB_1                         |                      |                     |                     |                      | 0.374***<br>(0.0926) | -0.187***<br>(0.0476) |                      |                       |
| BB_B_1                        |                      |                     |                     |                      |                      |                       | 0.430***<br>(0.0777) | -0.114***<br>(0.0420) |
| <b>Panel B. 2003Q1-2007Q2</b> |                      |                     |                     |                      |                      |                       |                      |                       |
| AAA_1                         | 0.362**<br>(0.168)   | 0.0441<br>(0.0712)  |                     |                      |                      |                       |                      |                       |
| AA_A_1                        |                      |                     | -0.409**<br>(0.175) | 0.108<br>(0.0730)    |                      |                       |                      |                       |
| BBB_1                         |                      |                     |                     |                      | -0.0499<br>(0.218)   | 0.161*<br>(0.0852)    |                      |                       |
| BB_B_1                        |                      |                     |                     |                      |                      |                       | 0.180<br>(0.197)     | 0.127<br>(0.0800)     |
| <b>Panel C. 2007Q3-2010Q4</b> |                      |                     |                     |                      |                      |                       |                      |                       |
| AAA_1                         | -1.202***<br>(0.272) | 0.0399<br>(0.106)   |                     |                      |                      |                       |                      |                       |
| AA_A_1                        |                      |                     | 1.143***<br>(0.345) | -0.244**<br>(0.122)  |                      |                       |                      |                       |
| BBB_1                         |                      |                     |                     |                      | 0.793***<br>(0.192)  | -0.0360<br>(0.0723)   |                      |                       |
| BB_B_1                        |                      |                     |                     |                      |                      |                       | 0.978***<br>(0.171)  | 0.0449<br>(0.0689)    |
| Bank Controls                 | YES                  | YES                 | YES                 | YES                  | YES                  | YES                   | YES                  | YES                   |
| Bank Fixed Effects            | YES                  | YES                 | YES                 | YES                  | YES                  | YES                   | YES                  | YES                   |
| Quarter Fixed Effects         | YES                  | YES                 | YES                 | YES                  | YES                  | YES                   | YES                  | YES                   |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

included in the balance sheets of some controlled special purpose vehicles and therefore relevant for the consolidated balance sheet of the group).

This effect is observed for AAA-rated tranches, but not for other tranches. Just to have an idea of the relative size of the market, considering all the securitisation issuances in the period from 2003 Q1 to 2007 Q2, AAA-rated tranches represented around 36% of all issued tranches and, most importantly, around 80% of the overall issuance volume. In the pre-crisis period, investors strongly relied on credit ratings and so exerted only limited due diligence for those tranches rated as AAA (Adelino, 2009). Therefore, during that period, issuers worked along with credit rating agencies to ensure that a triple A rating could be assigned to the issued securitisation tranches, as this was key to the successful market placement of these securities. This explains the process of credit rating inflation which was enhanced by the “issuer pays” model, as highlighted in the discussion by Akerlof and Shiller (2015) on the conflict of interest of rating agencies in their interaction with the issuers.

During the *crisis period*, securitisation products were heavily downgraded, because of the concerns related to the creditworthiness of the underlying assets. This process of downgrading affected in particular the products with the highest ratings, i.e. AAA tranches. Indeed, the results show that banks which had issued AAA securitisation observed a decline in their risk-based capital ratios, by around 1.2 p.p. This may reflect the downgrades of securitisation products having AAA rating at the time of their launch, particularly for banks retaining these tranches on balance sheet. Due to the ratings-based approach set in Basel II, the rating downgrade implies automatically an increase in the risk-weight of that securitisation position, and therefore a rise in the risk-weighted assets and a decrease in the risk-based capital ratio. This effect is consistent with the evidence observed during the global financial crisis and it seems to be concentrated on AAA securitisation products.

At the same time, the evidence suggests that banks issuing AA and A-rated securitisation products during the crisis registered some increase in their risk-weighted capital ratios and a relevant decrease in their (common equity) leverage ratio. In particular, a one-standard-deviation increase in the issuance of AA and A rated products was associated with an increase in the risk-weighted capital ratio by 1.14 p.p. and a decrease in the (common equity) leverage ratio by 0.24 p.p.. So banks were improving their prudential solvency ratios while in fact they were increasing their leverage. These products were eligible as collateral and banks had incentives to retain them on balance sheet during the crisis. In that case, the retention of these products could still lead to an increase in the risk-weighted capital ratios if the risk weight for the securitisation tranche was lower than the risk weight of the underlying assets. To shed light on these results particularly for the crisis period, in the below section I explore the heterogeneity across banks in funding liquidity.

### 1.7.2.2 Securitisation Classified by Credit Ratings: Interaction with Funding Liquidity

In equation (22), I investigate the variations in the capital position for the issuances of securitisation belonging to different rating buckets and I investigate whether the ex-ante funding liquidity position may have played some role in the capital management of securitiser banks. I estimate the following regression:

$$(22) y_{it} = \alpha_i + \delta_t + \beta_1 SECUR\_CREDIT\_RATING_{it-1} + \beta_1 SECUR\_CREDIT\_RATING_{it-1} * FUNDING_{it-1} + \gamma BANKCONTROLS_{it-1} + u_{it}$$

The dependent variable  $y_{it}$  can be, depending on the specifications, either the risk-weighted capital ratio (CapRatio) or the (common equity) leverage ratio (LevRatCE).

The full set of regression coefficients is presented in the tables of Appendix 1.F. Table 1.11 reports, for each rating bucket of securitisation, the economic effect of a 1-standard deviation increase in the securitisation ratio on the risk-weighted capital ratio and on the (common equity) leverage ratio, for different values of the liquid assets ratio (corresponding to the 25<sup>th</sup> percentile, to the mean and to the 75<sup>th</sup> percentile). This economic effect considers both the coefficient of the securitisation ratio and of the interaction between the securitisation ratio and the liquid assets ratio (to the extent they are statistically significant). The results reported in Table 1.11 focus on high-rating products, namely the tranches rated as AAA, AA or A.

The evidence shows that, during the *entire sample period*, banks issuing high-rating securitisation registered an increase in the risk-weighted capital ratios and a decrease in the (common equity) leverage ratios. Then, securitiser banks obtained substantial improvements in their prudential solvency ratios, while in fact they were significantly increasing their leverage. Moreover, the funding liquidity position of banks was relevant to explain the size of the variations in the banks' capital position for high-rating products. Less-liquid banks obtained larger increases in their risk-based capital ratios and wider decreases in their (common equity) leverage ratios, compared to more-liquid banks. This suggests that banks more subject to liquidity constraints exploited the regulatory arbitrage opportunities from the prudential framework to a larger extent than banks in a stronger funding position. I further investigate this for the two sub-sample periods.

In the *pre-crisis time*, the funding liquidity position doesn't appear to be relevant to explain the change in the banks' capital position, as the coefficients for the interaction term are not significant.

For the *crisis period*, the heterogeneity in the funding liquidity position is important to explain the potential differences in the capital management of securitiser banks. This focus on liquidity heterogeneity is useful to identify a common factor across different rating buckets, reconciling effects of opposite sign observed in the previous section: banks in a weaker liquidity

**Table 1.11 Securitisation Classified by Credit Ratings: Interaction with the Liquid Assets Ratio**  
The Economic Effect of 1-Stand-Dev Increase in the Securitisation Ratio

| Rating Groups |          | 1999Q1-2010Q4           |                        |                        | 2003Q1-2007Q2           |                        |                        | 2007Q3-2010Q4           |                        |                        |
|---------------|----------|-------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|
|               |          | Values of the LiqAssets |                        |                        | Values of the LiqAssets |                        |                        | Values of the LiqAssets |                        |                        |
|               |          | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. | Mean                    | 25 <sup>th</sup> Perc. | 75 <sup>th</sup> Perc. |
| AAA           | CapRatio | <b>0.2***</b>           | <b>0.461***</b>        | <b>0.061***</b>        | 0.373                   | 0.373                  | 0.371                  | <b>-0.854**</b>         | <b>-0.324**</b>        | <b>-0.978**</b>        |
|               | LevRatCE | <b>-0.196***</b>        | <b>-0.312***</b>       | <b>-0.135***</b>       | -0.005                  | -0.027                 | 0.015                  | -0.0007                 | -0.057                 | 0.014                  |
| AA            | CapRatio | <b>0.293**</b>          | <b>0.49**</b>          | <b>0.188**</b>         | -0.285                  | -0.202                 | -0.357                 | <b>0.347*</b>           | <b>0.827*</b>          | <b>0.235*</b>          |
|               | LevRatCE | <b>-0.198**</b>         | <b>-0.304**</b>        | <b>-0.142**</b>        | 0.010                   | -0.021                 | 0.037                  | -0.007                  | -0.080                 | 0.011                  |
| A             | CapRatio | <b>0.813**</b>          | <b>0.813**</b>         | <b>0.813**</b>         | <b>-0.487*</b>          | <b>-0.487*</b>         | <b>-0.487*</b>         | <b>1.746**</b>          | <b>1.746**</b>         | <b>1.746**</b>         |
|               | LevRatCE | <b>-0.385*</b>          | <b>-0.385*</b>         | <b>-0.385*</b>         | 0.013                   | -0.023                 | 0.043                  | -0.170                  | -0.085                 | -0.190                 |

Note: The results in bold characters denote the effects which correspond to statistically significant coefficients in the regression analysis: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

position tend to manage their securitisation operations in such a way either to improve their prudential solvency ratios, or to minimize their reduction.

Because of the downgrades in AAA tranches during the crisis, the issuance of AAA-rated securitisation was associated with a decrease in the risk-based capital ratios. However, this marginal effect was larger for more-liquid banks than for less-liquid banks<sup>97</sup>. However, these results may mask the combination of a stock and a flow effect: the stock effect related to the downgrade of existing AAA securitisation products and to the increase in risk weigh for these positions; the flow effect due to the retention of new securitisation products, still subject to lower risk weights than the underlying assets.

This flow effect related to the retention of new securitisation products can be observed for the issuances of AA and A products, which were less affected by rating downgrades. As noted in the previous section, the securitisation issuances in this rating bucket were associated with an increase in the risk-based capital ratio in the crisis period. Also in this case, the funding liquidity position of banks was relevant for the capital management of originator banks, as the increase in prudential solvency was larger for banks with lower liquidity buffers<sup>98</sup>. This is consistent with our hypothesis on funding liquidity and regulatory arbitrage: indeed, these products were both eligible as collateral and still subject to low risk-weights for prudential requirements. This confirms that, in the crisis time, banks subject to stronger liquidity pressures, and then potentially more interested in retaining securitisation as collateral, obtained larger improvements in their prudential solvency from high-rating securitisation issuances<sup>99</sup>.

To summarise this empirical evidence, particularly for the crisis period, the plots in Figure 1.5 compare - for securitisation products with different credit ratings - the average marginal effect of a one-standard-deviation increase in the securitisation ratio on the risk-weighted capital ratios. The average marginal effects are computed – for different values of the liquid assets ratio - on the basis of the estimates in Table 1.11 for the coefficients of the securitisation ratio and of the interaction term with the liquid assets ratio.

---

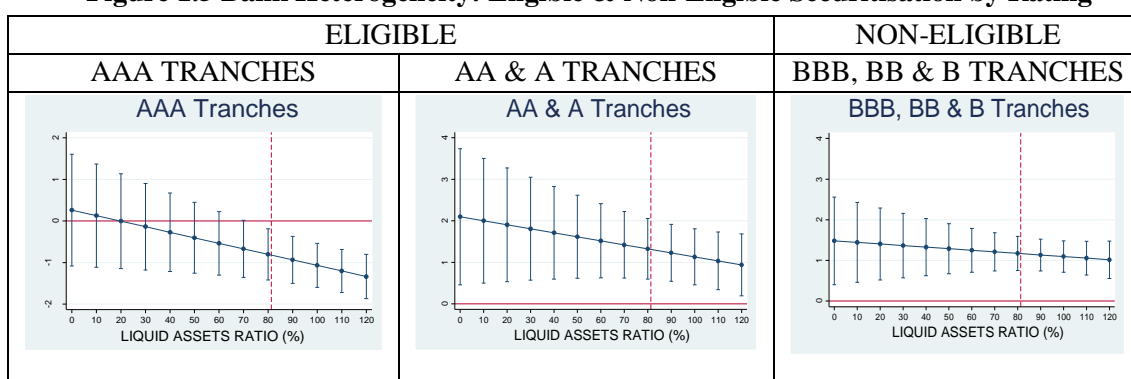
<sup>97</sup> Institutions with a liquid assets ratio at the 75<sup>th</sup> percentile (80%) reduced their risk-weighted capital ratios by 0.98 p.p., while banks with a liquidity ratio at the 25<sup>th</sup> percentile (30%) decreased their risk-based capital ratios by 0.32 p.p..

<sup>98</sup> For a bank with an average liquid assets ratio, a one-standard-deviation increase in the securitisation ratio increased the risk-weighted capital ratio by 0.347, while it did not imply significant change in the leverage ratio. Then, a decrease in the liquid assets ratio from the 75<sup>th</sup> percentile to the 25<sup>th</sup> percentile increased this positive marginal effect from +0.235 to +0.827.

<sup>99</sup> Also for the issuance of A-rated products, the evidence reveals a strong positive impact of securitisation on the risk-weighted capital ratios. The interaction term has the same economic effect but it is not statistically significant, so the effect seems to be more homogeneous across banks. In fact, it seems plausible that the discussed liquidity effect may be stronger for securitisation tranches with higher ratings (in this case AA-rated), provided that higher ratings should imply lower collateral haircuts (and then larger amount of liquidity obtainable against that collateral) and lower risk weights for the (retained) securitisation exposures.

For simplicity of comparison, I distinguish securities eligible as collateral [two rating buckets: a) AAA; b) AA & A] and non-eligible as collateral [c) all products with BBB, BB & B]. The plots show that: during the crisis period, the issuance of low-rating non-eligible products was associated with a risk-based capital variation relatively homogeneous across banks in different liquidity conditions; while, in the same period, the issuance of high-rating ABSs was related to a change in the risk-weighted capital ratio, which was indeed a decreasing function of the liquid assets ratio. Banks with tighter liquidity constraints obtained from high-rating eligible securitisation more positive variations<sup>100</sup> in the prudential ratios than banks with a stronger liquidity position. This supports the argument that the liquidity position during the crisis may have affected the incentives for capital arbitrage of originator banks interested in expanding their availability of eligible liquid assets.

**Figure 1.5 Bank Heterogeneity: Eligible & Non-Eligible Securitisation by Rating**



## 1.8 Robustness Analysis

I conduct some robustness analysis to check that the results obtained above are confirmed also when I consider smaller samples, by dropping individual countries, or when I use other measures of funding liquidity other than the liquid assets ratio.

### 1.8.1 Country Heterogeneity: Robustness to Sample Composition

The country heterogeneity in the developments of the securitisation market and in the balance sheet conditions of banking systems provides the rationale to analyse the robustness of the empirical results to the inclusion of individual countries in the sample composition.

I estimate the main specification without and with the interaction with funding liquidity as in equations (15) and (16), by excluding each time one country from the sample. Given that our sample for the empirical analysis includes banks from seven countries we drop once per

<sup>100</sup> Or less negative, as in the case of AAA products (see the above explanation for the effect of rating downgrades affecting in particular this rating bucket)



time: a) the main non-Euro Area country (UK); b) the two main Euro Area countries classified as vulnerable (ES, IT); c) the three main Euro Area countries classified as non-vulnerable (DE, FR, NL).

The results of this robustness analysis are presented in Table 1.12. For each subsample (after dropping one country per time), I estimate the fixed-effects regressions for the two main dependent variables – the risk-weighted capital ratio and the common equity leverage ratio – and for the two specifications without and with the interaction with funding liquidity. As in the previous analysis, I present the results first for the overall sample and then I focus on the two subsample periods, corresponding to the pre-crisis time (2005 Q1-2007 Q2) and the crisis time (2007Q3 – 2010 Q4).

I find that the results are confirmed also when I drop individual countries, with some minor differences only in the magnitude of the effects. In the overall sample period, larger securitisation activity is associated with higher risk-weighted capital ratios and lower leverage ratios: moreover, originator banks in weaker funding liquidity conditions display an even larger increase in the risk-weighted solvency ratio and a stronger decrease in the leverage ratio, i.e. they improve their prudential solvency while increasing their leverage. When looking at the two subsample periods, the overall securitisation activity is associated with no significant changes in the risk-weighted capital ratios in the pre-crisis period<sup>101</sup> and with a strong increase in the risk-weighted solvency ratios during the crisis. Also, this improvement in the prudential solvency ratios for originator banks in the crisis period is larger for banks in ex-ante weaker funding liquidity position.

---

<sup>101</sup> In fact, when classifying different categories of securitisation, a significant increase in the risk-based prudential solvency is still observed for securitisation products backed by assets with higher risk weights.

**Table 1.12 Robustness to Sample Composition: Baseline Specification with and without Liquidity Interaction**

| DROP | VARIABLE    | 1999Q1-2010Q4          |                          |                          |                          | 2003Q1-2007Q2         |                       |                          |                          | 2007Q3-2010Q4          |                         |                         |                        |
|------|-------------|------------------------|--------------------------|--------------------------|--------------------------|-----------------------|-----------------------|--------------------------|--------------------------|------------------------|-------------------------|-------------------------|------------------------|
|      |             | (1)                    | (2)                      | (3)                      | (4)                      | (5)                   | (6)                   | (7)                      | (8)                      | (9)                    | (10)                    | (11)                    | (12)                   |
|      |             | CapRatio               |                          | LevRatioCE               |                          | CapRatio              |                       | LevRatioCE               |                          | CapRatio               |                         | LevRatioCE              |                        |
| DE   | Secur_1     | 0.475***<br>(0.146)    | 1.321***<br>(0.330)      | -0.146**<br>(0.0729)     | -0.905***<br>(0.158)     | 0.148<br>(0.199)      | 0.0729<br>(0.342)     | 0.0795<br>(0.0763)       | -0.221*<br>(0.129)       | 1.281**<br>(0.510)     | 3.961***<br>(0.997)     | -0.0827<br>(0.178)      | 0.256<br>(0.368)       |
|      | LiqAssets_1 | -0.00325<br>(0.00559)  | -0.00165<br>(0.00550)    | -0.0144***<br>(0.00273)  | -0.0155***<br>(0.00256)  | -0.00745<br>(0.00637) | -0.00779<br>(0.00654) | -0.00579**<br>(0.00252)  | -0.00698***<br>(0.00243) | -0.0327**<br>(0.0124)  | -0.0113<br>(0.0135)     | -0.00128<br>(0.00426)   | 0.00143<br>(0.00497)   |
|      | Secur_1 *   |                        | -0.00835***<br>(0.00293) |                          | 0.00761***<br>(0.00143)  |                       | 0.000735<br>(0.00271) |                          | 0.00294***<br>(0.00105)  |                        | -0.0248***<br>(0.00810) |                         | -0.00314<br>(0.00299)  |
|      | LiqAssets_1 |                        |                          |                          |                          |                       |                       |                          |                          |                        |                         |                         |                        |
| FR   | Secur_1     | 0.364**<br>(0.140)     | 1.281***<br>(0.330)      | -0.160**<br>(0.0701)     | -0.938***<br>(0.158)     | 0.139<br>(0.190)      | 0.119<br>(0.339)      | 0.0605<br>(0.0728)       | -0.208<br>(0.129)        | 1.215**<br>(0.508)     | 3.455***<br>(1.064)     | -0.111<br>(0.178)       | 0.127<br>(0.385)       |
|      | LiqAssets_1 | -0.00451<br>(0.00574)  | -0.00167<br>(0.00568)    | -0.0147***<br>(0.00278)  | -0.0167***<br>(0.00262)  | -0.00882<br>(0.00657) | -0.00897<br>(0.00697) | -0.00845***<br>(0.00255) | -0.0102***<br>(0.00256)  | -0.0377***<br>(0.0126) | -0.0177<br>(0.0148)     | -0.00242<br>(0.00437)   | -0.000315<br>(0.00532) |
|      | Secur_1 *   |                        | -0.00890***<br>(0.00292) |                          | 0.00767***<br>(0.00141)  |                       | 0.000189<br>(0.00266) |                          | 0.00256**<br>(0.00103)   |                        | -0.0206**<br>(0.00867)  |                         | -0.00219<br>(0.00314)  |
|      | LiqAssets_1 |                        |                          |                          |                          |                       |                       |                          |                          |                        |                         |                         |                        |
| NL   | Secur_1     | 0.470***<br>(0.145)    | 1.646***<br>(0.339)      | -0.104<br>(0.0725)       | -0.815***<br>(0.167)     | 0.160<br>(0.187)      | 0.280<br>(0.337)      | 0.0547<br>(0.0714)       | -0.136<br>(0.132)        | 1.300**<br>(0.544)     | 4.132***<br>(1.082)     | -0.107<br>(0.187)       | 0.177<br>(0.395)       |
|      | LiqAssets_1 | 0.00137<br>(0.00590)   | 0.00593<br>(0.00579)     | -0.0102***<br>(0.00286)  | -0.0126***<br>(0.00276)  | -0.00276<br>(0.00649) | -0.00169<br>(0.00699) | -0.00428*<br>(0.00253)   | -0.00574**<br>(0.00263)  | -0.0327**<br>(0.0131)  | -0.0114<br>(0.0142)     | -0.000885<br>(0.00444)  | 0.00128<br>(0.00518)   |
|      | Secur_1 *   |                        | -0.0112***<br>(0.00295)  |                          | 0.00689***<br>(0.00147)  |                       | -0.00114<br>(0.00265) |                          | 0.00181*<br>(0.00105)    |                        | -0.0258***<br>(0.00868) |                         | -0.00259<br>(0.00317)  |
|      | LiqAssets_1 |                        |                          |                          |                          |                       |                       |                          |                          |                        |                         |                         |                        |
| ES   | Secur_1     | 0.265*<br>(0.140)      | 0.921***<br>(0.336)      | -0.141*<br>(0.0756)      | -0.897***<br>(0.168)     | 0.0687<br>(0.226)     | -0.0388<br>(0.378)    | 0.0738<br>(0.0754)       | -0.128<br>(0.123)        | 0.886*<br>(0.481)      | 2.764**<br>(1.063)      | -0.154<br>(0.196)       | 0.0812<br>(0.439)      |
|      | LiqAssets_1 | -0.00628<br>(0.00542)  | -0.00423<br>(0.00544)    | -0.0121***<br>(0.00281)  | -0.0139***<br>(0.00265)  | -0.0109*<br>(0.00649) | -0.0116*<br>(0.00684) | -0.00519**<br>(0.00215)  | -0.00648***<br>(0.00218) | -0.0319**<br>(0.0122)  | -0.0142<br>(0.0149)     | -0.00146<br>(0.00494)   | 0.000784<br>(0.00623)  |
|      | Secur_1 *   |                        | -0.00635**<br>(0.00296)  |                          | 0.00741***<br>(0.00150)  |                       | 0.00100<br>(0.00280)  |                          | 0.00187**<br>(0.000909)  |                        | -0.0174*<br>(0.00886)   |                         | -0.00220<br>(0.00367)  |
|      | LiqAssets_1 |                        |                          |                          |                          |                       |                       |                          |                          |                        |                         |                         |                        |
| IT   | Secur_1     | 0.403***<br>(0.145)    | 1.405***<br>(0.346)      | -0.110<br>(0.0665)       | -0.728***<br>(0.153)     | 0.143<br>(0.184)      | 0.0276<br>(0.330)     | 0.0526<br>(0.0796)       | -0.216<br>(0.141)        | 1.191**<br>(0.536)     | 3.768***<br>(1.052)     | -0.0488<br>(0.179)      | 0.447<br>(0.371)       |
|      | LiqAssets_1 | -0.00348<br>(0.00584)  | -0.000510<br>(0.00575)   | -0.00956***<br>(0.00268) | -0.0113***<br>(0.00257)  | -0.00502<br>(0.00598) | -0.00571<br>(0.00624) | -0.00756***<br>(0.00266) | -0.00908***<br>(0.00266) | -0.0327**<br>(0.0131)  | -0.0116<br>(0.0145)     | -0.000108<br>(0.00439)  | 0.00390<br>(0.00508)   |
|      | Secur_1 *   |                        | -0.00960***<br>(0.00303) |                          | 0.00606***<br>(0.00136)  |                       | 0.547*<br>(0.309)     | 0.00108<br>(0.00257)     | 0.00276<br>(0.139)       | 0.00254**<br>(0.00112) |                         | -0.0237***<br>(0.00849) | -0.00454<br>(0.00298)  |
|      | LiqAssets_1 |                        |                          |                          |                          |                       |                       |                          |                          |                        |                         |                         |                        |
| UK   | Secur_1     | 0.546***<br>(0.196)    | 1.668***<br>(0.514)      | 0.0166<br>(0.0697)       | -0.114<br>(0.193)        | 0.0841<br>(0.424)     | -1.637*<br>(0.943)    | -0.00867<br>(0.129)      | -0.0984<br>(0.300)       | 1.195***<br>(0.418)    | 3.082***<br>(0.829)     | -0.0337<br>(0.156)      | 0.00249<br>(0.337)     |
|      | LiqAssets_1 | -0.0162**<br>(0.00726) | -0.0108<br>(0.00743)     | -0.00797***<br>(0.00263) | -0.00860***<br>(0.00277) | -0.00929<br>(0.00927) | -0.0169*<br>(0.00948) | -0.00418<br>(0.00328)    | -0.00468<br>(0.00366)    | -0.0433***<br>(0.0122) | -0.0248*<br>(0.0133)    | -0.00882*<br>(0.00444)  | -0.00847<br>(0.00534)  |
|      | Secur_1 *   |                        | -0.0106**<br>(0.00449)   |                          | 0.00125<br>(0.00172)     |                       | 0.0138*<br>(0.00684)  |                          | 0.000753<br>(0.00227)    |                        | -0.0175**<br>(0.00680)  |                         | -0.000336<br>(0.00276) |
|      | LiqAssets_1 |                        |                          |                          |                          |                       |                       |                          |                          |                        |                         |                         |                        |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 1.8.2 Robustness Check: Alternative Measures of Funding Liquidity

In Table 1.7, I have analysed the role of funding liquidity in explaining the changes in bank capital position after securitisation, i.e. whether banks in different ex-ante liquidity conditions managed their capital differently when securitising. Then I have used the ratio of liquid assets to deposits and short-term borrowing as a measure of funding liquidity. As a robustness check, I consider some alternative measures of funding liquidity, namely the loans to deposits ratio and the short-term borrowing ratio.

I obtain equivalent results also when I use different indicators of funding liquidity. In particular, the loans to deposits ratio explains to what extent the lending activity of a bank is financed through retail funding sources (more stable) instead of wholesale funding (potentially more unstable). Then banks with higher loans to deposits ratio could be more subject to liquidity pressures. The results in Table 1.13 show that securitising banks with higher loans to deposits ratio obtained larger improvement in their risk-based ratios, although increasing their leverage to a wider extent<sup>102</sup>. This effect of funding liquidity is even more evident in the variations of the risk-weighted capital ratios during the crisis time.

The short-term borrowing ratio is another indicator of potential weakness in the funding position of credit institutions: banks more reliant on short-term funding sources may be more subject to a liquidity crisis. The results in Table 1.14 suggest that banks obtaining a larger fraction of their funding from short-term sources tend to increase their leverage to a larger extent when they securitise<sup>103</sup>. As for the other measures, the role of funding liquidity in the impact of securitisation is also more evident in the crisis time<sup>104</sup>. This means that, during the crisis, when structuring a securitisation operation, banks more reliant on short-term borrowing increased their risk-weighted capital ratios by a larger measure than banks less dependent on short-term funding, even by keeping the same leverage.

---

<sup>102</sup> For the entire sample period, an increase in the loans to deposits ratio from the 25th percentile to the 75th percentile (then a weakening in the funding liquidity position) raises the marginal (positive) effect of securitisation on the risk-weighted capital ratio from 0.75 to 1.08, but it also augments the marginal (negative) effect on the (common equity) leverage ratio from -0.24 to -0.70

<sup>103</sup> Indeed, for the entire sample period, a rise in the short-term borrowing ratio (then a weakening in the bank funding liquidity) from the 25th percentile to the 75th percentile increases the negative variation in the (common equity) leverage ratio from -0.05 to -0.27.

<sup>104</sup> The evidence for that period reveals that an increase in the loans to deposits ratio from the 25<sup>th</sup> percentile to the 75<sup>th</sup> percentile increases the positive variation in the risk-weighted capital ratio from +0.29 to +1.16, while it doesn't change the non-significant effect on the (common equity) leverage ratio.

**Table 1.13 Securitisation and Capital Ratios: Interaction with the Loans to Deposits Ratio**

**Panel 1. Regression Results**

| VARIABLES                     | 1999Q1-2010Q4     |                      |                      | 2003Q1-2007Q2     |                    |                   | 2007Q3-2010Q4      |                    |                    |
|-------------------------------|-------------------|----------------------|----------------------|-------------------|--------------------|-------------------|--------------------|--------------------|--------------------|
|                               | (1)<br>CapRatio   | (2)<br>LevRatioCap   | (3)<br>LevRatCE      | (4)<br>CapRatio   | (5)<br>LevRatioCap | (6)<br>LevRatCE   | (7)<br>CapRatio    | (8)<br>LevRatioCap | (9)<br>LevRatCE    |
| <i>MAIN EXPLANATORY</i>       |                   |                      |                      |                   |                    |                   |                    |                    |                    |
| Total Securitisation_1        | -0.169<br>(0.242) | 0.536***<br>(0.114)  | 0.485***<br>(0.122)  | -0.138<br>(0.354) | 0.264*<br>(0.154)  | 0.192<br>(0.143)  | -0.954<br>(0.683)  | -0.257<br>(0.209)  | -0.412*<br>(0.228) |
| <i>INTERACTION</i>            |                   |                      |                      |                   |                    |                   |                    |                    |                    |
| Tot Secur_1*LoansDeposRatio_1 | 0.549*<br>(0.290) | -0.499***<br>(0.137) | -0.750***<br>(0.146) | 0.347<br>(0.385)  | -0.224<br>(0.167)  | -0.240<br>(0.162) | 1.884**<br>(0.864) | 0.415<br>(0.265)   | 0.496*<br>(0.287)  |
| Bank Controls                 | YES               | YES                  | YES                  | YES               | YES                | YES               | YES                | YES                | YES                |
| Bank Fixed Effects            | YES               | YES                  | YES                  | YES               | YES                | YES               | YES                | YES                | YES                |
| Quarter Fixed Effects         | YES               | YES                  | YES                  | YES               | YES                | YES               | YES                | YES                | YES                |
| R-squared                     | 0.663             | 0.554                | 0.528                | 0.334             | 0.642              | 0.588             | 0.752              | 0.679              | 0.733              |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Panel 2. The Economic Effect of 1-Standard-Deviation Increase in the Securitisation Ratio**

| Dependent Variables                 | 1999Q1-2010Q4                 |                             |                             | 2003Q1-2007Q2                 |                             |                             | 2007Q3-2010Q4                 |                              |                              |
|-------------------------------------|-------------------------------|-----------------------------|-----------------------------|-------------------------------|-----------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|
|                                     | Values of the LoansDeposRatio |                             |                             | Values of the LoansDeposRatio |                             |                             | Values of the LoansDeposRatio |                              |                              |
|                                     | Mean                          | 25 <sup>th</sup> Perc.      | 75 <sup>th</sup> Perc.      | Mean                          | 25 <sup>th</sup> Perc.      | 75 <sup>th</sup> Perc.      | Mean                          | 25 <sup>th</sup> Perc.       | 75 <sup>th</sup> Perc.       |
| Risk Weighted Capital Ratio         | <b>1.035*</b> <sup>105</sup>  | <b>0.754*</b> <sup>64</sup> | <b>1.084*</b> <sup>64</sup> | 0.236                         | 0.147                       | 0.268                       | <b>6.426**</b> <sup>106</sup> | <b>4.367**</b> <sup>65</sup> | <b>6.464**</b> <sup>65</sup> |
| (Regulatory Capital) Leverage Ratio | <b>-0.073***</b>              | <b>0.183***</b>             | <b>-0.117***</b>            | <b>0.427*</b> <sup>107</sup>  | <b>0.427*</b> <sup>66</sup> | <b>0.427*</b> <sup>66</sup> | 0.774                         | 0.320                        | 0.782                        |
| (Common Equity) Leverage Ratio      | <b>-0.629***</b>              | <b>-0.244***</b>            | <b>-0.696***</b>            | -0.115                        | -0.013                      | -0.151                      | <b>0.663*</b>                 | <b>0.121*</b>                | <b>0.673*</b>                |

Note: The results in bold characters denote the effects which correspond to statistically significant coefficients in the regression analysis: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>105</sup> The effect considers only the coefficient of the interaction term, which is significant at the 10% level, while the one of the securitisation ratio is not significant.

<sup>106</sup> The effect considers only the coefficient of the interaction term, which is significant at the 5% level, while the one of the securitisation ratio is not significant.

<sup>107</sup> The effect considers only the coefficient of the securitisation ratio, which is significant at the 10% level, while the one of the interaction term is not significant.

**Table 1.14 Securitisation and Capital Ratios: Interaction with the Short-Term Borrowing Ratio**

**Panel 1. Regression Results**

| VARIABLES               | 1999Q1-2010Q4    |                      |                     | 2003Q1-2007Q2     |                    |                    | 2007Q3-2010Q4      |                     |                     |
|-------------------------|------------------|----------------------|---------------------|-------------------|--------------------|--------------------|--------------------|---------------------|---------------------|
|                         | (1)<br>CapRatio  | (2)<br>LevRatioCap   | (3)<br>LevRatCE     | (4)<br>CapRatio   | (5)<br>LevRatioCap | (6)<br>LevRatCE    | (7)<br>CapRatio    | (8)<br>LevRatioCap  | (9)<br>LevRatCE     |
| <i>MAIN EXPLANATORY</i> |                  |                      |                     |                   |                    |                    |                    |                     |                     |
| Total Securitisation_1  | 0.196<br>(0.186) | 0.365***<br>(0.0848) | 0.144<br>(0.0875)   | 0.354<br>(0.469)  | 0.354*<br>(0.190)  | 0.132<br>(0.192)   | -0.0188<br>(0.281) | -0.0824<br>(0.0777) | -0.0859<br>(0.0948) |
| <i>INTERACTION</i>      |                  |                      |                     |                   |                    |                    |                    |                     |                     |
| Tot Secur_1*ShortBorr_1 | 0.377<br>(0.648) | -0.805***<br>(0.295) | -0.730**<br>(0.296) | -0.935<br>(1.415) | -0.770<br>(0.575)  | -0.0846<br>(0.611) | 1.760**<br>(0.728) | 0.472**<br>(0.201)  | 0.177<br>(0.244)    |
| Bank Controls           | YES              | YES                  | YES                 | YES               | YES                | YES                | YES                | YES                 | YES                 |
| Bank Fixed Effects      | YES              | YES                  | YES                 | YES               | YES                | YES                | YES                | YES                 | YES                 |
| Quarter Fixed Effects   | YES              | YES                  | YES                 | YES               | YES                | YES                | YES                | YES                 | YES                 |
| R-squared               | 0.672            | 0.566                | 0.613               | 0.517             | 0.735              | 0.656              | 0.771              | 0.730               | 0.741               |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Panel 2. The Economic Effect of 1-Standard-Deviation Increase in the Securitisation Ratio**

| Dependent Variables                 | 1999Q1-2010Q4                 |                               |                               | 2003Q1-2007Q2                |                             |                             | 2007Q3-2010Q4                 |                              |                              |
|-------------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|-----------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|
|                                     | Values of the ShortBorrRatio  |                               |                               | Values of the ShortBorrRatio |                             |                             | Values of the ShortBorrRatio  |                              |                              |
|                                     | Mean                          | 25 <sup>th</sup> Perc.        | 75 <sup>th</sup> Perc.        | Mean                         | 25 <sup>th</sup> Perc.      | 75 <sup>th</sup> Perc.      | Mean                          | 25 <sup>th</sup> Perc.       | 75 <sup>th</sup> Perc.       |
| Risk Weighted Capital Ratio         | 0.406                         | 0.345                         | 0.456                         | 0.216                        | 0.304                       | 0.135                       | <b>0.774**</b> <sup>108</sup> | <b>0.291**</b> <sup>67</sup> | <b>1.163**</b> <sup>67</sup> |
| (Regulatory Capital) Leverage Ratio | <b>0.401***</b>               | <b>0.532***</b>               | <b>0.295**</b>                | <b>0.346*</b> <sup>109</sup> | <b>0.346*</b> <sup>68</sup> | <b>0.346*</b> <sup>68</sup> | <b>0.208**</b> <sup>67</sup>  | <b>0.078**</b> <sup>67</sup> | <b>0.312**</b> <sup>67</sup> |
| (Common Equity) Leverage Ratio      | <b>-0.172**</b> <sup>67</sup> | <b>-0.053**</b> <sup>67</sup> | <b>-0.268**</b> <sup>67</sup> | 0.117                        | 0.125                       | 0.110                       | -0.137                        | -0.185                       | -0.098                       |

Note: The results in bold characters denote the effects which correspond to statistically significant coefficients in the regression analysis: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

<sup>108</sup> The effect considers only the coefficient of the interaction term, which is significant at the 5% level, while the one of the securitisation ratio is not significant.

<sup>109</sup> The effect considers only the coefficient of the securitisation ratio, which is significant at the 10% level, while the one of the interaction term is not significant.

## 1.9 Future Extensions of the Empirical Analysis

In this section I discuss some future extensions of the empirical analysis which can be developed to address some aspects of the identification strategy. The first and the second point concern the analysis on bank capital dynamics, in particular the time dependency from previous capital levels and the potential adjustment towards bank capital targets. The third point discusses the feedback between capital structure and securitisation.

### 1.9.1 Time Dependency in Bank Capital Dynamics

The current capital position of a bank may be explained by various balance sheet factors, but it may depend to some extent also on its previous capital position: i.e., there can be some time dependency in the capital dynamics at the bank-level, particularly if individual institutions show low speed of capital adjustment over time<sup>110</sup>.

This may be relevant for the analysis presented in this chapter. The current study investigates the relationship between the ex-ante securitisation activity and the ex-post bank capital position: for this purpose, I use lagged (stock) measures of securitisation (in quarter t-1) and current measures of the capital position (in quarter t), while controlling for other ex-ante bank balance sheet characteristics potentially affecting bank capital.

In fact, the previous capital position may play some role in explaining the current capital position particularly when banks cannot take actions to change their capital base in the short-term: for instance, they cannot issue new equity or they can make limited use of retained earnings, due to dividend expectations of shareholders or to low profitability. At the same time, banks can change their capital position also by increasing or decreasing the amount of their exposures or shifting their asset composition towards more or less risky asset classes. However, also these changes on the asset side may require some time for their implementation.

Therefore, to the extent that the existing solvency position of a bank may be important also for the current and future capital developments, the omission of this component may lead to some bias in the estimation of the relationship between securitisation and bank capital.

In order to deal with this bias, two possible approaches can be pursued: one would be to estimate a first difference equation to analyse the relation between a change in the securitisation stock and a change in bank capital; the other one would be to estimate a regression with bank fixed effects, to control for the unobserved bank heterogeneity not explained by the bank balance sheet controls. In a two-period setting, fixed effects estimation and first-difference produce identical estimates and inference. When the sample includes more than two periods,

---

<sup>110</sup> See the literature discussed in Section 1.2 for bank capital adjustments over time with respect to the target ratios pursued by banks.

and provided that the strict exogeneity<sup>111</sup> assumption holds, the differences between the two approaches are mainly related to the assumptions for the idiosyncratic errors<sup>112</sup>, as that they may affect the efficiency of the estimators.

In the current empirical setting, I use bank fixed effects in all the specifications, to control for the unobserved bank heterogeneity. In this way, the bank fixed effect captures also the pre-existing solvency position of the originator bank; by considering the deviations from the means, the regression estimates – at the bank-level – the effects of the changes in the securitisation stock on the capital position. The use of bank fixed effects is preferred in this estimation also because, in certain quarters, mainly in the crisis period and for some banks, the changes in the main explanatory variable – i.e. the share of securitised assets – may display relatively small variations. Therefore, a regression in levels could better capture the relationship between the share of securitised assets and the capital ratios of banks.

Another possible solution to account explicitly for this capital dynamics in the regression specification would be to design a dynamic panel setting, where in the regression I would use lagged values of bank capital. However, the inclusion of a lagged dependent variable as a regressor would violate the strict exogeneity assumption, as this variable would be correlated with the error. To deal with the potential inconsistency of the estimator, I should then use the GMM estimator proposed by Arellano and Bond (1991). The time dimension of this panel dataset, particularly in the overall sample period, but also in the two subsample periods, would allow for a long enough time series; therefore, once the unobserved heterogeneity is taken out of the model via the first difference, deeper lagged levels of the dependent variable can be used as instruments for the lagged difference of the dependent variable (which would be endogenous).

## **1.9.2 Adjustments in Bank Capital Dynamics**

The dynamics in bank capital over time may also include a potential adjustment process towards some targets pursued by banks.

As observed in the theoretical and empirical literature<sup>113</sup>, banks tend to keep an amount of capital above the minimum required by prudential regulation, i.e. banks have some capital buffers. Various arguments have been proposed to explain this: in a dynamic perspective, banks may be incentivised by capital requirements to keep capital buffers in order to avoid the explicit

---

<sup>111</sup> Conditional on the unobserved heterogeneity, explanatory variables should be strictly exogenous to the error component.

<sup>112</sup> As discussed in Wooldridge (2010) and in Angrist and Pischke (2009), the fixed effects estimator is more efficient when the errors are serially uncorrelated, while the first-difference estimator is more efficient when the error follows a random walk.

<sup>113</sup> See Sections 1.2.1 and 1.2.2 for a discussion on the role of incentives and regulation in the determination of bank capital, as well as on the adjustments in bank capital position.

and implicit costs of breaching the regulatory minima (Milne and Whalley, 2001; Milne, 2002); banks may set their optimal capital amount based on a trade-off between benefits and costs of debt financing, accounting for the liquidity creation on one side, the costs of bank distress and the ability to force borrower repayment on the other side (Diamond and Rajan, 2000).

Once banks set some targets for their future capital position, they undertake some balance sheet adjustments to achieve those targets. Partial adjustment models are used to study this transition towards the targets. These models require first the estimation of a target capital ratio (as in Berger, DeYoung, Flannery, Lee and Oztekin, 2008) or of an optimal capital buffer (as in Jokipii and Milne, 2011), based on some bank balance sheet characteristics; and then they study the change in the bank capital position in a given period as a function of the gap between the target and the actual capital in the previous period, as well as of the speed of adjustment.

This adjustment in the capital position may somehow interfere with the securitisation operations conducted by banks in two possible ways: first, banks may set their optimal capital ratios (or buffers) by taking into account also their securitisation activity, to the extent that this may explain the risks undertaken by banks; second, in case the speed of adjustment is allowed to be heterogeneous across banks, securitisation transactions may affect the adjustment speed towards the target, via their effects on capital ratios.

The change in the capital position (from t-1 to t) can be estimated as a function of the gap between the target capital ratio for quarter t and the actual capital ratio for quarter t-1:

$$(23) \Delta \text{Capital Ratio}_{it} = \varphi_{it} [\text{Capital Ratio}_{it}^* - \text{Capital Ratio}_{it-1}] + \eta_{it}$$

where  $\text{Capital Ratio}_{it}^*$  denotes the target capital ratio for time t,  $\varphi_{it}$  indicates the speed of adjustment and  $\eta_{it}$  is a random error. The target capital ratio would be determined based on the securitisation stock and other bank balance sheet variables in t-1

$$(24) \text{Capital Ratio}_{it}^* = \vartheta \text{Securitisation}_{i,t-1} + \Lambda \text{BankBalanceSheet}_{j,t-1}$$

In case the adjustment speed could vary at the bank-level, it would be explained by the securitisation flow and other bank characteristics:

$$(25) \varphi_{it} = \mu \Delta \text{Securitisation}_{it} + \nu \Delta \text{Equity}_{it} + \xi \Delta \text{Retained Earnings}_{it}$$

This dynamic model for the adjustment in bank capital under securitisation could be estimated using the Blundell-Bond estimator.

The analysis presented in this chapter does not model explicitly this potential adjustment process; however, as for the lagged capital, also the target capital position would be a component of the bank-specific heterogeneity, which is accounted for in the bank fixed effects. Also, the capital target is set by banks for a medium-term horizon and individual institutions undertake these adjustments to achieve the target over this time period. Although it may be subject to minor changes, this target would not be revised from a quarter to another one,



so it may be considered as relatively invariant in a short-term horizon. Therefore, it can be captured by bank fixed effects, particularly for the shorter subsample periods of few years.

Also, thanks to the quarterly frequency of the dataset, the main specification is constructed in a way to link the securitisation activity in quarter  $t-1$  and the capital position in quarter  $t$ . It is unlikely that a significant transition to the capital target may be undertaken just in one quarter, as the bank would not have the time to implement any substantial change in asset composition or in the capital base. Moreover, as shown in Berger, DeYoung, Flannery, Lee and Oztekin (2008), the adjustment speed in bank capital may be heterogeneous across banks and then can be considered also as part of the bank-specific heterogeneity captured by fixed effects.

### **1.9.3 Feedback from Capital Structure to Securitisation**

Another point for the identification strategy of this study regards the potential two-way relationship between bank capital and securitisation: the securitisation activity can shape the ex-post capital position of originator banks; but, at the same time, the existing capital position may have affected ex-ante the securitisation decisions of banks.

This potential two-way relationship may raise some potential endogeneity bias in the estimation of the relationship between securitisation and bank capital, both when we consider the extensive margin of securitisation (the decision to issue or not to issue), and when we analyse the intensive margin (the volume of securitisation issuances).

On the extensive margin, the heterogeneity across banks in their existing capital position may indeed affect their probability to sponsor a securitisation issuance<sup>114</sup>. For this reason, empirical studies using as a source of variation the distinction between securitising and non-securitising banks may be subject to a potential self-selection issue. In fact, the balance sheet variations observed after the securitisation may reflect some pre-existing differences in balance sheet characteristics - across the two groups - which also explain the issuance decision.

Various empirical studies analyse the effects of securitisation on bank performance - including bank solvency and risk-taking - using the securitisation decision as a main explanatory variable, and therefore have to deal with this self-selection issue by designing appropriate identification strategies<sup>115</sup> (see for example: Jangli and Pritsker, 2008; Casu, Clare, Sarkisyan and Thomas et al., 2013; Michalak and Uhde, 2012; Panetta and Pozzolo, 2018).

---

<sup>114</sup> See also the analysis in Chapter 2 Section 2.5 on the determinants of securitisation issuance. I observe different relationships across the considered periods. I find that in the pre-crisis period less capitalised banks displayed higher relative probability to issue MBSs, as securitisation could be used to reduce bank assets; while in the crisis time weakly capitalised banks showed lower probability to use securitisation, as low capital could be perceived by market investors as a proxy for the risk of their asset portfolio.

<sup>115</sup> See the discussion on this issue in the literature review in Section 1.2.3. Some examples of these identification strategies are: the estimation of a Heckman selection model, with a probit regression in the

The analysis presented in this chapter focuses on securitising banks and then avoids the self-selection issues due to the potential differences with non-securitising banks. In this setting, I exploit two sources of variation across banks: first, the share of securitised assets, i.e. the amount of securitisation issuances divided by total assets; second, the ex-ante funding liquidity position of a bank, i.e. the ratio of liquid assets to deposits and short-term borrowing. I explore the interaction between these two variables, to study how securitising banks managed their capital position conditional on their existing liquidity constraints, given that the ex-ante liquidity position has been a key driver for the retention decisions of originator banks during the crisis<sup>116</sup>. Provided that originator banks subject to stronger liquidity constraints showed higher probability to retain newly issued eligible ABSs for collateral purposes, they could have been interested in minimising the regulatory capital implications of this retention. The analysis presented in this chapter explores this hypothesis particularly for the crisis period.

While the focus on securitising banks overcomes the concerns for the self-selection on the extensive margin, the use of the securitisation volume as an explanatory variable may raise the case for considering the ex-ante feedback from capital structure to securitisation on the intensive margin. In fact, the ex-ante capital position may be relevant not only for the issuance decision, but also for the volumes of securitisation. I discuss two possible approaches for dealing with this potential issue on the intensive margin.

One potential solution could be to use a two-stage estimation based on an instrumental variable approach: in the first-stage regression we would estimate the determinants of the securitisation volumes, using some instruments correlated with the securitisation issuances but not with bank capital; and then in the second-stage regression we would use the fitted values of securitisation volumes to estimate the relationship with bank capital. Given that securitisation volumes would be truncated at zero values for some observations, there may be some rationale for estimating the first-stage equation via a tobit regression<sup>117</sup>. A similar approach has been followed, for example, in Calomiris and Mason (2004): they estimate a first-stage equation using two alternative specifications, a probit model for the securitisation decision on the extensive margin, and a tobit model for the securitisation volume on the intensive margin.

However, the desirability of this approach is subject to the possibility to identify proper instruments at the bank-level which would explain securitisation issuances but not determine the

---

first stage to estimate the probability to securitise (Panetta and Pozzolo, 2018); the use of an instrumental variables estimator, with bank size commonly used as an instrument for the securitisation decision (Jangli and Pritsker, 2008; Michalak and Uhde, 2012); the matching on the propensity score, to compare securitiser banks with ex-ante comparable non-securitiser banks (Casu, Clare, Sarkisyan and Thomas, 2013).

<sup>116</sup> See the analysis in Chapter 2 Section 2.6 on the incentives for securitisation retention due to the existing funding liquidity position of securitising banks, particularly after the introduction of the fixed-rate full allotment policy.

<sup>117</sup> At the same time, the focus on securitising banks should limit the number of zero observations and therefore could make a case also for a linear estimation in the first stage.

capital position of originator banks: while country-level institutional factors could set some incentives for securitisation, bank-balance sheet variables could be correlated with the capital position. For instance, Calomiris and Mason use as instruments the total amount of loan receivables, the growth rate of managed receivables, and the growth rate of capital; while Jiangli and Pritsker (2008) employ lagged values of bank size to predict banks' securitisation activity.

Due to the potential correlation of bank variables with the capital position, and considering the potential simultaneity in bank decisions for capital and securitisation, an approach with simultaneous equations could have some advantages to deal with this potential two-way relationship. The system would include two equations: one to explain the determinants of the changes in securitisation (i.e. the new issuances); the other one to explore the drivers of the changes in the capital ratios. In a baseline specification with country-time fixed effects, the two equations could be written as:

$$(26) \Delta Capital Ratio_{it} = \alpha_1 + \varphi_{kt} + \beta_1 \Delta Securitisation_{it} + \Gamma_1 BankBalanceSheet_{i,t-1} + Z_1 CountryControls_{k,t-1} + u_{it}$$

$$(27) \Delta Securitisation_{it} = \alpha_2 + \varphi_{kt} + \beta_2 \Delta Capital Ratio_{it} + \Gamma_2 BankBalanceSheet_{i,t-1} + Z_2 CountryControls_{k,t-1} + \varepsilon_{ijt}$$

where  $i$  indicates the bank,  $k$  the country of the originator banks and  $t$  the quarter. The above specification is formulated as a dynamic model, where we can explore how the capital developments affect the securitisation activity and how the securitisation issuances explain the capital changes, while using bank balance sheet controls and country-level variables.

In case we are interested in explaining the transition dynamics in bank capital and securitisation, the two regressions could be designed also as partial adjustment equations. This approach would be similar to the one developed in some empirical studies on bank capital and risk (Jopikii and Milne, 2011; Shrieves and Dahl, 1990), which estimate simultaneous equations models to explore the adjustment in capital ratios (or buffers) and balance sheet risk-taking.

The change in the capital position (from  $t-1$  to  $t$ ) could be estimated using a simplified version of the capital adjustment model discussed in the previous section:

$$(28) \Delta Capital Ratio_{it} = \varphi [Capital Ratio_{it}^* - Capital Ratio_{it-1}] + \eta_{it}$$

where  $\varphi$  indicates the speed of adjustment (in this case constant across banks). The target capital ratio would be determined as follows:

$$(29) Capital Ratio_{it}^* = \vartheta \Delta Securitisation_{i,t} + \Lambda BankBalanceSheet_{j,t-1}$$

Also the change in the securitisation stock (from t-1 to t) could be derived as a function of the difference between the target securitisation for quarter t and the existing stock in quarter t-1: this would be particularly relevant for the crisis period, when banks faced a decline in market demand for securitisation and changed their use of securitisation for collateral purposes.

$$(30) \Delta Securitisation_{it} = \chi [Securitisation_{it}^* - Securitisation_{it-1}] + \omega_{it}$$

where  $Securitisation_{it}^*$  denotes the target securitisation for time t,  $\chi_{it}$  indicates the speed of adjustment and  $\eta_{it}$  is a random error. The target securitisation ratio would be determined based on the developments in the capital ratio and on other bank balance sheet variables in t-1

$$(31) Securitisation_{it}^* = \pi \Delta Capital Ratio_{i,t} + K BankBalanceSheet_{j,t-1}$$

Therefore, the system could be written as follows and could be estimated using the Blundell-Bond GMM estimator, as in the model developed by Jokipii and Milne (2011).

$$(32) \Delta Capital Ratio_{it}$$

$$= \varphi [(\theta \Delta Securitisation_{i,t} + \Lambda BankBalanceSheet_{j,t-1}) - Capital Ratio_{it-1}] + \eta_{it}$$

$$(33) \Delta Securitisation_{it}$$

$$= \chi [(\pi \Delta Capital Ratio_{i,t} + K BankBalanceSheet_{j,t-1}) - Securitisation_{it-1}] + \omega_{it}$$

This model would allow to estimate the feedback between capital and securitisation in the balance sheet management of originator banks. This analysis could be conducted also for different subsample periods, also to capture empirically the difference across periods with mostly distributed or retained securitisation.

## 1.10 Conclusions

This chapter analyses how credit institutions manage their capital position when they conduct securitisation operations. The analysis focuses on the issuances sponsored by European banks in the period between 1999 and 2010, before the introduction of the retention requirements in 2011. The study is developed on a new dataset, which combines tranche-level information for more than 17,000 securitisation products with bank-level balance sheet data for the corresponding originator institutions.

The empirical analysis is motivated by the change in the securitisation strategy of European banks at the time of the crisis, when credit institutions under financial pressure started to retain most of their issuances of asset-backed securities, especially to pledge them as collateral in central bank refinancing operations. I investigate the changes in the capital position of securitiser banks before and during the crisis and I explore whether this effect was different across banks, depending on their ex-ante balance sheet conditions, or across products, depending on their collateral eligibility status.

I find that, for the overall sample period, securitising banks observed in general an increase in their risk-based capital ratios, while in fact they did not change or even reduced their leverage ratios. This means that banks were improving their prudential solvency, from the regulatory point of view, while in practice they were possibly increasing their balance sheet leverage. This evidence suggests that the definition of capital ratios may change significantly the sign and the size of the observed variation in bank solvency.

This has also policy implications for prudential regulation, in particular for the discussion about the measures of capital adequacy: the analysis provides evidence in favour of the introduction of the new leverage ratio in Basel III as a backstop to identify the build-up of excessive leverage, in addition to the risk-based capital ratio. The leverage ratio is complementary to the risk-weighted capital ratio, as it reveals some additional information not observable from risk-adjusted ratios.

I present the results of the empirical analysis separately for the pre-crisis and the crisis periods and I observe some relevant differences across banks and across securitisation products. In the pre-crisis period, the increase in the risk-based capital ratios for securitiser banks was larger for the issuances of more complex products, like CBOs and CDOs, not eligible as collateral and backed by assets subject to higher risk weights. This is consistent with the objective to achieve some capital relief: indeed, the increase in prudential solvency was proportional to the regulatory risk weight of the transferred assets. Moreover, this variation was homogeneous across banks, so it was not dependent on the funding liquidity position of banks.

On the contrary, in the crisis period, the largest increases in the risk-based capital ratios - against no variation in the corresponding leverage ratios - were observed for the issuances of less-risky and collateral-eligible products: in particular, ABSs backed by residential mortgages and home equity loans. Moreover, such improvement in prudential solvency ratios was heterogeneous across banks, as a function of their funding liquidity position: institutions with ex-ante weaker liquidity conditions – when securitising – obtained larger increases in their risk-based capital ratios.

This evidence suggests that those banks subject to stronger liquidity constraints - and then possibly more interested in using retained asset-backed securities as eligible collateral - exploited relatively more, at the margin, the regulatory arbitrage opportunities offered by the prudential framework when conducting their securitisation operations. This is consistent with the explanation that banks retaining securitisation for collateral eligibility purposes had to fulfill some capital requirements on such exposures and then could be interested in minimising the additional capital burden coming from that.

## 1.11 ANNEXES

### Annex 1.A The Retention of Different Types of Securitisation Products

Appendix Table 1.1 Retention Rate of RMBSs by Country (in percentage)

|                    | 2005 | 2006 | 2007  | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   | 2016   | 2017   | 2018   |
|--------------------|------|------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>Austria</b>     |      |      |       |        |        |        |        |        |        |        |        |        |        |        |
| <b>Belgium</b>     |      | 0    | 0.00  | 100.00 | 100.00 | 53.04  | 100.00 | 100.00 | 100.00 |        | 22.33  | 100.00 | 100.00 |        |
| <b>Cyprus</b>      |      |      |       |        |        |        |        |        |        |        |        |        |        |        |
| <b>Denmark</b>     | 0    |      | 2.74  |        |        |        |        |        |        |        |        |        |        |        |
| <b>Europe</b>      |      |      |       | 100.00 | 100.00 |        |        |        |        |        |        |        |        |        |
| <b>Finland</b>     |      |      |       | 100.00 |        |        |        |        |        |        |        |        |        |        |
| <b>France</b>      | 0    | 0    | 0.00  | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |        | 98.04  | 88.01  | 84.14  | 94.29  | 85.34  |
| <b>Germany</b>     | 0    | 0    | 95.07 | 100.00 | 100.00 | 100.00 |        |        |        |        | 99.19  |        | 100.00 |        |
| <b>Greece</b>      | 0    | 0    | 7.20  | 100.00 | 100.00 |        |        |        |        |        |        |        |        |        |
| <b>Ireland</b>     | 0    | 0    | 78.76 | 100.00 | 100.00 | 100.00 |        | 100.00 | 51.00  | 100.00 | 5.00   | 81.79  | 30.88  | 80.41  |
| <b>Italy</b>       | 0    | 0    | 36.76 | 100.00 | 100.00 | 90.02  | 74.39  | 94.15  | 100.00 | 62.01  | 100.00 | 100.00 | 91.97  | 100.00 |
| <b>Luxembourg</b>  |      |      |       |        |        |        |        |        |        |        |        |        |        |        |
| <b>Netherlands</b> | 0    | 0    | 83.72 | 100.00 | 97.76  | 82.47  | 86.29  | 73.90  | 61.20  | 37.75  | 69.71  | 74.43  | 52.71  | 75.33  |
| <b>Poland</b>      |      |      |       |        |        |        |        |        |        |        |        |        |        |        |
| <b>Portugal</b>    | 0    | 0    | 31.60 | 100.00 | 100.00 | 100.00 | 100.00 | 0.00   | 100.00 |        | 100.00 |        |        | 100.00 |
| <b>Slovakia</b>    |      |      |       |        |        |        |        |        |        |        |        |        |        |        |
| <b>Spain</b>       | 0    | 0    | 41.44 | 100.00 | 100.00 | 100.00 | 100.00 | 44.58  | 100.00 | 99.48  | 90.36  | 95.42  | 90.35  | 17.99  |
| <b>Sweden</b>      | 0    |      |       |        |        | 100.00 |        |        | 14.35  |        | 11.00  |        | 14.60  |        |
| <b>Switzerland</b> |      |      |       |        |        |        |        |        |        |        |        | 0.00   |        |        |
| <b>UK</b>          | 0    | 0    | 47.22 | 99.76  | 92.58  | 61.64  | 53.63  | 43.21  | 38.77  | 29.48  | 41.93  | 38.68  | 23.09  | 26.91  |
| <b>Europe</b>      | 0    | 0    | 53.68 | 99.90  | 97.76  | 77.28  | 76.51  | 71.97  | 67.12  | 74.90  | 72.81  | 68.49  | 67.72  | 65.29  |
| <b>EU</b>          | 0    | 0    | 53.68 | 99.90  | 97.76  | 77.28  | 76.51  | 71.97  | 67.12  | 74.90  | 72.81  | 68.61  | 67.72  | 65.29  |
| <b>Euro Area</b>   | 0    | 0    | 60.39 | 100.00 | 99.53  | 84.64  | 89.95  | 82.08  | 71.71  | 85.63  | 86.59  | 84.71  | 84.71  | 82.48  |

**Appendix Table 1.2 Retention Rate of CDOs by Country (in percentage)**

|                    | 2005 | 2006 | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   | 2016   | 2017   | 2018  |
|--------------------|------|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| <b>Austria</b>     | 0    |      | 100.00 |        |        |        |        |        |        |        |        |        |        |       |
| <b>Belgium</b>     | 0    |      | 98.84  |        | 100.00 | 100.00 |        | 100.00 |        |        |        |        | 100.00 |       |
| <b>Cyprus</b>      |      |      | 0.00   |        |        |        |        |        |        |        |        |        |        |       |
| <b>Denmark</b>     | 0    | 0    | 0.00   | 100.00 |        |        |        |        |        |        |        |        |        |       |
| <b>Pan-Europe</b>  | 0    | 0    | 24.21  | 99.95  | 99.49  | 76.02  | 68.81  |        |        |        |        |        |        |       |
| <b>Finland</b>     | 0    | 0    | 100.00 |        |        |        |        |        |        |        |        |        |        |       |
| <b>France</b>      | 0    | 0    | 0.00   |        |        | 100.00 | 100.00 | 100.00 |        |        |        |        |        |       |
| <b>Germany</b>     | 0    | 0    | 2.47   | 100.00 | 100.00 |        | 69.53  |        | 12.01  |        | 100.00 |        | 100.00 |       |
| <b>Greece</b>      |      | 0    | 0.00   | 100.00 | 100.00 |        | 100.00 |        |        |        |        | 100.00 |        |       |
| <b>Ireland</b>     | 0    |      | 100.00 | 100.00 |        | 100.00 |        |        |        |        |        |        |        |       |
| <b>Italy</b>       | 0    |      | 69.75  | 100.00 | 100.00 |        | 100.00 | 100.00 | 90.57  | 87.33  | 78.11  | 96.56  | 81.36  | 88.87 |
| <b>Luxembourg</b>  |      |      | 0.00   |        | 100.00 |        |        |        |        |        |        |        |        |       |
| <b>Netherlands</b> | 0    | 0    | 60.28  | 100.00 | 100.00 | 100.00 | 100.00 |        |        | 100.00 |        |        |        |       |
| <b>Poland</b>      |      |      |        |        |        |        |        |        |        |        |        |        |        |       |
| <b>Portugal</b>    | 0    | 0    |        | 100.00 |        | 100.00 | 100.00 |        | 100.00 | 48.30  | 77.09  | 46.84  |        |       |
| <b>Slovakia</b>    |      |      |        |        |        |        |        |        |        |        |        |        |        |       |
| <b>Spain</b>       | 0    | 0    | 64.93  | 100.00 | 99.23  | 99.37  | 100.00 | 0.00   | 98.20  | 100.00 | 100.00 | 100.00 | 98.27  | 95.84 |
| <b>Sweden</b>      | 0    |      | 0.00   |        |        |        |        |        |        |        |        |        |        |       |
| <b>Switzerland</b> | 0    |      | 0.00   |        |        |        |        |        |        |        |        |        |        |       |
| <b>UK</b>          | 0    | 0    | 97.36  | 100.00 | 100.00 | 75.05  | 44.42  | 72.66  |        | 100.00 |        | 16.41  |        | 18.00 |
| <b>Europe</b>      | 0    | 0    | 44.74  | 99.97  | 99.64  | 97.38  | 98.22  | 97.87  | 91.26  | 94.43  | 92.65  | 95.28  | 95.45  | 90.40 |
| <b>EU</b>          | 0    | 0    | 44.90  | 99.97  | 99.64  | 97.38  | 98.22  | 97.87  | 91.26  | 94.43  | 92.65  | 95.28  | 95.45  | 90.40 |
| <b>Euro Area</b>   | 0    | 0    | 39.64  | 99.97  | 99.61  | 98.36  | 99.35  | 70.60  | 91.26  | 93.52  | 92.65  | 96.07  | 95.45  | 92.78 |

Source: JP Morgan (2018) and Author's elaboration

## **Annex 1.B The Accounting Regime for Securitisation**

As for the accounting regime, the European Union has endorsed since 2003 the IFRS (International Financial Reporting Standards), which are international accounting standards defined by the IASB (International Accounting Standards Board). This is particularly relevant for securitisation because, under the IFRS, it is more difficult to obtain an off-balance sheet treatment for securitisation vehicles rather than under the US GAAP, at least until the accounting reforms introduced in the US after the crisis. The accounting regime established by the IFRS implies a two-stage evaluation process.

First, the accounting principles require an assessment as to whether the sponsor or the originator consolidates the special purpose vehicle. The IAS 27 defines the consolidation principles for sponsored entities and specifically the SIC 12 provides some interpretation criteria regarding SPVs, such as: whether the sponsor obtains benefits from the SPV operations, whether it exerts or delegates the decision-making powers for SPV activities, whether it is exposed to the risks coming from SPV operations. If some of these requirements are fulfilled, that implies that the sponsor has some control on the SPV and then it needs to consolidate it.

Second, even if the SPV is not consolidated by the sponsor, an assessment is needed to determine whether the transferred asset has to be recognised by the sponsor institution. The IAS 39 establishes some conditions, such as: whether the sponsor has the rights to the cash flows from the assets; whether it has assumed after the transfer an obligation to pay the cash flows from the assets; whether it has retained risks and rewards related to the assets.

Based on the application of the above criteria, sponsor institutions have to consolidate the sponsored entities or they have to recognise the assets in their balance sheets. This is important for the purpose of the empirical analysis because, since the implementation of the IFRS, European banks could not apply an off-balance sheet treatment for sponsored vehicles and then securitisation activities should be included in bank balance sheets (and then computed in the amount of bank total assets).

This general rule doesn't exclude a priori that, in some particular cases, ad hoc corporate structures could be used for special purpose entities, with the effect of excluding the control or the ownership by the sponsor and then avoiding their consolidation<sup>118</sup>. In such cases,

---

<sup>118</sup> Various solutions were exploited by banks in different jurisdictions. For instance, in some European jurisdictions (UK, Ireland, Netherlands), SPVs could be constituted as orphan vehicles, i.e. entities whose share capital is a nominal amount and held beneficially by a charitable trust. Another way was to set up a financial vehicle incorporated in the US, in order to exploit the more favourable treatment provided by the FASB accounting requirements for a true sale.



the amount of bank total assets might not always reflect full consolidation of sponsored entities<sup>119</sup>.

---

<sup>119</sup> However, this may be relevant for the empirical analysis only in the case of securitisation distribution. On the other hand, this problem doesn't arise in the case of securitisation retention because, even if the accounting principles for consolidation are not fully implemented, the retention per se implies the inclusion of the transferred claims in the amount of total assets for prudential purposes.

## Annex 1.C The Regulatory Treatment of Securitisation Positions in Basel II

**Appendix Table 1.3 The Risk Weights for Securitisation in the Ratings-Based Approach**

**RBA risk weights when the external assessment represents a long-term credit rating  
and/or an inferred rating derived from a long-term assessment**

| External Rating<br>(Illustrative) | Risk weights for<br>senior positions<br>and eligible<br>senior IAA<br>exposures | Base risk<br>weights | Risk weights for<br>tranches backed by<br>non-granular pools |
|-----------------------------------|---|----------------------|--|
| AAA                               | 7%  | 12%                  | 20%  |
| AA                                | 8%  | 15%                  | 25%  |
| A+                                | 10%   | 18%                  | 35%  |
| A                                 | 12%   | 20%                  |  |
| A-                                | 20%   | 35%                  |  |
| BBB+                              | 35%   | 50%                  |  |
| BBB                               | 60%   | 75%                  |  |
| BBB-                              | 100%  |                      |  |
| BB+                               | 250%  |                      |  |
| BB                                | 425%  |                      |  |
| BB-                               | 650%  |                      |  |
| Below BB- and unrated             | Deduction   |                      |  |

Source: Basel Committee (2006), *Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework - Comprehensive Version*, p.135.

## Annex 1.D Dataset Construction and Summary Statistics

This data appendix describes the steps followed in the construction of the dataset used for the empirical analysis, complementing the data presentation in Section 1.5. The choice of the data sources has been driven by two main objectives functional to the scope of the analysis: first, to capture the developments in the securitisation market in Europe from the early stages, I had to collect data both on securitisation issuances and on banks' balance sheet data possibly from the introduction of the Euro<sup>120</sup>; second, in order to ensure - over this long time span - that securitisation issuances by an originator bank could be mapped with the corresponding balance sheets of that bank, I needed to rely possibly on the same data provider or use data sources with some common identifiers.

The main issue at stake, discussed also in the data appendix for Chapter 2, is due to the relevant number of mergers and acquisitions concerning European banks since the creation of the Euro Area, which has significantly changed the structure of banking groups. Also, many entities sponsoring securitisation issuances were acquired by other banks and often were subject to several transactions of this type, also as a consequence of the distress episodes and of the bank failures during the global financial crisis. This may raise some challenges in linking appropriately the fixed income data with the balance sheets of the banking groups. While comprehensive sources are available separately for the two main data items (e.g. Dealogic DCM Analytics for fixed income issuances and SNL Financial for bank balance sheets), the mapping of these sources can be quite problematic - particularly for the years before the crisis - due to the lack of information on the banking group structure and to some issues in the reporting of the issuer entity and the originator bank for securitisation<sup>121</sup>.

The S&P Capital IQ database provided - at the time of the data download (second half of 2011) - a unique combination of bank balance sheet, fixed income and credit ratings data for the main banking groups in Europe, although with some limitations for the number of institutions and for the possibility to link these data with other sources.

In particular, S&P Capital IQ has a section on fixed income, which includes unsecured bonds, covered bonds and structured finance products. To identify the outstanding securitisation issuances in a given quarter, I run a search for the following screening criteria, for each quarter from 1999 Q1 to 2010 Q4:

1. Industry Classifications (Ultimate Parent): Banks OR Diversified Financials

---

<sup>120</sup> As discussed in 1.3, the introduction of the Euro posed an essential – although not exhaustive - step for the integration of capital markets in the EU, in order to ensure a broad-based investor base for securitisation issuances; before the introduction of the Euro, the denomination of banks' fixed income products in national currencies could somehow restrict the investor base to national investors.

<sup>121</sup> See the discussion in Annex 2.A

2. Geographic Locations (Ultimate Parent): Europe (Primary)
3. Fixed Income Security Type: Asset Backed Security OR Collateralized Mortgage Obligation OR Collateralized Loan Obligation OR Collateralized Debt Obligation<sup>122</sup>
4. Offering Date: until the end date of the considered quarter
5. Maturity Date: from the start date of the subsequent quarter
6. S&P Security Rating Action [All History]: New Rating OR Not Rated OR Upgrade OR Downgrade OR CreditWatch/Outlook Action (Preliminary Credit Ratings - Long-Term LC OR Credit Rating - Long-Term LC OR CreditWatch/Outlook)<sup>123</sup>

For each quarter, I compute the amount of securitisation issuances by summing the values of the outstanding issuances in that quarter. Then, to further exploit the data granularity, I compute the corresponding amounts at the bank-quarter level, for the different asset classes and credit rating buckets.

This dataset benefits from the availability of the credit ratings at the tranche-level. For the empirical analysis, I focus on the long-term credit rating, which is the relevant one to determine the credit quality step in the application of the ratings based method for capital requirements on securitisation. The rating information report the latest rating assigned to the security, which is used to compute the amount of risk-weighted assets in the relevant quarter. For several instruments, the ratings data includes also the history of the rating actions taken previously by S&P at the security-level; however, the available data may not always allow to identify the credit ratings at launch for all securities. Also, another potential limitation is that these structured finance data do not include the ISIN code, therefore it is not possible to link them with market data on pricing (e.g. from Bloomberg) or with the Eurosystem data on collateral eligibility (as done in Chapter 2 using Dealogic data).

S&P Capital IQ provides information also on the financial statements of the banking groups. For the purpose of the analysis, I exploit the quarterly data from the balance sheet and the income statement, in order to compute the bank-level variables for capital, profitability, liquidity, asset quality, balance sheet composition. As of now, S&P Capital IQ is now part – together with SNL Financial – of the S&P Market Intelligence Platform.

Appendix Table 1.4 presents some summary statistics for the overall sample of banks included in the analysis, for the period from 1999 Q1 to 2010 Q4. The panel dataset is

---

<sup>122</sup> Capital IQ classifies 4 types of structured products: Asset-Backed Securities (ABS), Collateralised-Mortgage Obligations (CMO), Collateralised-Loan Obligations (CLO), Collateralised-Debt Obligations (CDO). Within these categories, I can further distinguish on the basis of the underlying assets: CMOs are based on residential and commercial mortgages; ABSs can be backed by various asset types, such as credit card receivables, auto leases, home equity loans; CLOs are securitised portfolios of large corporate loans, mostly provided by loan syndicates for leveraged buy-outs; CDOs are backed by a pool of other fixed income instruments, such as asset-backed securities or corporate bonds.

<sup>123</sup> I consider both the tranches rated by S&P and the other ones unrated. This does not exclude that some tranches could have been rated by other credit rating agencies

unbalanced; however, it includes data also for the earliest part of the sample. For securitisation and balance sheet data, I present both the outstanding amounts (in € millions) and the ratios (in units). The ratios for securitisation amounts are computed with respect to total assets: the outstanding issuances are classified by asset type, issuer nationality and credit rating.

**Appendix Table 1.4 Summary Statistics**

| <b>Variable</b>   | <b>Obs</b> | <b>Mean</b> | <b>Std. Dev.</b> | <b>Min</b> | <b>Max</b> |
|---|------------|-------------|------------------|------------|------------|
| <i>Bank Balance Sheet Variables and Ratios</i>                  |            |             |                  |            |            |
| Total Capital   | 504        | 38341.19    | 21890.39         | 1820       | 117964.6   |
| Total Common Equity   | 696        | 31083.08    | 18597.17         | 1601       | 101406.7   |
| Total Assets  | 665        | 836242      | 508183.9         | 21119      | 2638365    |
| Risk Adjusted Assets  | 537        | 304664.6    | 168403.4         | 10862      | 881222.1   |
| Risk-Weighted Capital Ratio                                     | 499        | .1271365    | .0232583         | .0816162   | .2190018   |
| Risk-Weighted Common Equity Ratio                               | 537        | .1116344    | .0302366         | .0491629   | .2354243   |
| Leverage Ratio (Total Capital)                                  | 504        | .048        | .0175857         | .0152542   | .0904294   |
| Leverage Ratio (Common Equity)                                  | 665        | .0418814    | .0156491         | .0073446   | .1124575   |
| Return on Assets  | 653        | .0013137    | .0014968         | -.0109709  | .009844    |
| Non Performing Loans Ratio                                      | 507        | .0109395    | .0085998         | .000651    | .0651184   |
| Loans Deposits Ratio  | 427        | 1.169953    | .8513491         | .4024901   | 8.660161   |
| Trading Investment Ratio  | 492        | 2.238224    | 2.479072         | .0068855   | 15.47318   |
| <i>Bank-level Outstanding Securitisation Amounts and Ratios</i> |            |             |                  |            |            |
| Total Securitisation Amount                                     | 816        | 6206.726    | 15646.36         | 0          | 106371.6   |
| Total Securitisation Ratio                                      | 665        | .0064869    | .016193          | 0          | .1291329   |
| <i>By Asset Type</i>  |            |             |                  |            |            |
| Credit Card Secur. Amount                                       | 816        | 64.15883    | 288.2885         | 0          | 1559.43    |
| Credit Card Secur. Ratio  | 665        | .0000681    | .0002944         | 0          | .0021157   |
| Home Equity Loans Secur. Amount                                 | 816        | 1535.162    | 4407.14          | 0          | 34458.43   |
| Home Equity Loans Secur. Ratio                                  | 665        | .0016538    | .0050069         | 0          | .0402573   |
| CBO Secur. Amount   | 816        | 24.8515     | 89.88344         | 0          | 687.82     |
| CBO Secur. Ratio  | 665        | .0000438    | .0001396         | 0          | .0009163   |
| CDO Secur. Amount   | 816        | 409.0203    | 1221.922         | 0          | 7828.518   |
| CDO Secur. Ratio  | 665        | .0005934    | .001516          | 0          | .0081215   |
| CLO Secur. Amount   | 816        | 36.80065    | 132.1476         | 0          | 1113.94    |
| CLO Secur. Ratio  | 665        | .0000388    | .000151          | 0          | .001484    |
| Commercial Loans Secur. Amount                                  | 816        | 1474.078    | 5062.839         | 0          | 38368.7    |
| Commercial Loans Secur. Ratio                                   | 665        | .0013905    | .004483          | 0          | .0417383   |
| Personal Loans Secur. Amount                                    | 816        | 22.35504    | 108.833          | 0          | 1050.17    |
| Personal Loans Secur. Ratio                                     | 665        | .000022     | .0001004         | 0          | .0010966   |
| Residential Mortgages Secur. Amount                             | 816        | 2550.436    | 7247.976         | 0          | 53135.33   |
| Residential Mortgages Secur. Ratio                              | 665        | .0025753    | .0073375         | 0          | .0648616   |
| Mixed Receivables Secur. Amount                                 | 816        | 52.39292    | 133.2624         | 0          | 928.74     |
| Mixed Receivables Secur. Ratio                                  | 665        | .000097     | .0002386         | 0          | .0012373   |

*Continued*

| <b>Variable</b>  | <b>Obs</b> | <b>Mean</b> | <b>Std. Dev.</b> | <b>Min</b> | <b>Max</b> |
|--|------------|-------------|------------------|------------|------------|
| <b><i>Bank-Level Outstanding Securitisation Amounts and Ratios (over Total Assets)</i></b> |            |             |                  |            |            |
| <i>By Issuer Nationality</i>   |            |             |                  |            |            |
| EU Issuer Secur. Amount  | 816        | 227.1666    | 676.3788         | 0          | 3316.6     |
| EU Issuer Secur. Ratio   | 665        | .000402     | .0012019         | 0          | .0073791   |
| Non-EU Issuer Secur. Amount  | 816        | 5979.559    | 15567.21         | 0          | 105194.9   |
| Non-EU Issuer Secur. Ratio   | 665        | .0060849    | .0160191         | 0          | .1277045   |
| <i>By Issue Credit Rating</i>  |            |             |                  |            |            |
| AAA Secur. Amount  | 816        | 3375.38     | 8795.046         | 0          | 61815.99   |
| AAA Secur. Ratio   | 665        | .003273     | .0075594         | 0          | .0583121   |
| AA & A Secur. Amount   | 816        | 736.3444    | 1706.702         | 0          | 15514.71   |
| AA & A Secur. Ratio  | 665        | .0008204    | .0018907         | 0          | .0188345   |
| BBB Secur. Amount  | 816        | 254.4795    | 760.6171         | 0          | 7124.931   |
| BBB Secur. Ratio   | 665        | .0002735    | .0007045         | 0          | .0086495   |
| BB & B Secur. Amount   | 816        | 381.7074    | 1506.313         | 0          | 15845.76   |
| BB & B Secur. Ratio  | 665        | .0003634    | .0013422         | 0          | .0121179   |
| CCC Secur. Amount  | 816        | 386.6446    | 1796.403         | 0          | 20401.5    |
| CCC Secur. Ratio   | 665        | .0003794    | .0015754         | 0          | .0169002   |
| CC & C Secur. Amount   | 816        | 151.3581    | 626.1325         | 0          | 6376.934   |
| CC & C Secur. Ratio  | 665        | .0002235    | .0009019         | 0          | .0084954   |
| D Secur. Amount  | 816        | 51.60061    | 301.1712         | 0          | 5011.573   |
| D Secur. Ratio   | 665        | .0000615    | .0003673         | 0          | .0060839   |
| Non-Rated Secur. Amount  | 816        | 869.2107    | 3674.248         | 0          | 48319.89   |
| Non-Rated Secur. Ratio   | 665        | .0010924    | .0049073         | 0          | .0561732   |

Note: The bank balance sheet variables and the outstanding amounts of securitisation issuances are expressed in € millions. The data on outstanding securitisation are computed at the bank level, based on the aggregation of all the tranches issued by a given bank.

## Annex 1.E Securitisation Classified by Asset Types: Interaction with the Liquid Assets Ratio

**Appendix Table 1.5 Securitisation by Asset Types: Interaction with the Liquid Assets Ratio. Regression Estimates**

**Panel A: Regression Results, 1999Q1-2010Q4**

| VARIABLES             | (1)                 | (2)              | (3)                 | (4)                 | (5)                 | (6)                  | (7)                  | (8)                  | (9)                  | (10)                 |
|-----------------------|---------------------|------------------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                       | CapRatio            | LevRatCE         | CapRatio            | LevRatCE            | CapRatio            | LevRatCE             | CapRatio             | LevRatCE             | CapRatio             | LevRatCE             |
| CBO_1                 | 70.63***<br>(17.67) | 3.560<br>(9.928) |                     |                     |                     |                      |                      |                      |                      |                      |
| CBO_1*LiqAssets_1     | -23.08<br>(15.60)   | 1.160<br>(8.880) |                     |                     |                     |                      |                      |                      |                      |                      |
| CDO_1                 |                     |                  | 9.416***<br>(3.345) | 4.928***<br>(1.688) |                     |                      |                      |                      |                      |                      |
| CDO_1*LiqAssets_1     |                     |                  | -3.578<br>(2.723)   | -1.856<br>(1.414)   |                     |                      |                      |                      |                      |                      |
| CommLoans_1           |                     |                  |                     |                     | 1.996***<br>(0.710) | -1.154***<br>(0.371) |                      |                      |                      |                      |
| Com_1*LiqAssets_1     |                     |                  |                     |                     | -1.608**<br>(0.625) | 0.886***<br>(0.332)  |                      |                      |                      |                      |
| HomeEquity_1          |                     |                  |                     |                     |                     |                      | 1.943***<br>(0.590)  | -1.215***<br>(0.313) |                      |                      |
| HoEq_1*LiqAssets_1    |                     |                  |                     |                     |                     |                      | -1.504***<br>(0.492) | 0.895***<br>(0.264)  |                      |                      |
| ResidMort_1           |                     |                  |                     |                     |                     |                      |                      |                      | 1.627***<br>(0.433)  | -0.717***<br>(0.237) |
| Resid_1*LiqAssets_1   |                     |                  |                     |                     |                     |                      |                      |                      | -1.058***<br>(0.391) | 0.537**<br>(0.215)   |
| Bank Controls         | YES                 | YES              | YES                 | YES                 | YES                 | YES                  | YES                  | YES                  | YES                  | YES                  |
| Bank Fixed Effects    | YES                 | YES              | YES                 | YES                 | YES                 | YES                  | YES                  | YES                  | YES                  | YES                  |
| Quarter Fixed Effects | YES                 | YES              | YES                 | YES                 | YES                 | YES                  | YES                  | YES                  | YES                  | YES                  |
| R-squared             | 0.682               | 0.456            | 0.661               | 0.485               | 0.655               | 0.481                | 0.660                | 0.493                | 0.675                | 0.481                |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Panel B: Regression Results, 2003Q1-2007Q2**

| VARIABLES             | (1)<br>CapRatio     | (2)<br>LevRatCE   | (3)<br>CapRatio   | (4)<br>LevRatCE   | (5)<br>CapRatio   | (6)<br>LevRatCE   | (7)<br>CapRatio   | (8)<br>LevRatCE   | (9)<br>CapRatio   | (10)<br>LevRatCE  |
|-----------------------|---------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| CBO_1                 | 78.87***<br>(15.09) | -0.986<br>(8.412) |                   |                   |                   |                   |                   |                   |                   |                   |
| CBO_1*LiqAssets_1     | -7.088<br>(12.66)   | 11.48<br>(7.057)  |                   |                   |                   |                   |                   |                   |                   |                   |
| CDO_1                 |                     |                   | 7.330*<br>(4.044) | -0.516<br>(1.684) |                   |                   |                   |                   |                   |                   |
| CDO_1*LiqAssets_1     |                     |                   | -1.933<br>(2.898) | 1.469<br>(1.290)  |                   |                   |                   |                   |                   |                   |
| CommLoans_1           |                     |                   |                   |                   | 2.430*<br>(1.323) | 0.857<br>(0.615)  |                   |                   |                   |                   |
| Com_1*LiqAssets_1     |                     |                   |                   |                   | -0.927<br>(1.192) | -0.750<br>(0.552) |                   |                   |                   |                   |
| HomeEquity_1          |                     |                   |                   |                   |                   |                   | -0.197<br>(0.717) | -0.239<br>(0.317) |                   |                   |
| HoEq_1*LiqAssets_1    |                     |                   |                   |                   |                   |                   | -0.270<br>(0.519) | 0.248<br>(0.237)  |                   |                   |
| ResidMort_1           |                     |                   |                   |                   |                   |                   |                   |                   | -0.155<br>(0.624) | 0.0272<br>(0.279) |
| Resid_1*LiqAssets_1   |                     |                   |                   |                   |                   |                   |                   |                   | 0.203<br>(0.559)  | 0.126<br>(0.250)  |
| Bank Controls         | YES                 | YES               | YES               | YES               | YES               | YES               | YES               | YES               | YES               | YES               |
| Bank Fixed Effects    | YES                 | YES               | YES               | YES               | YES               | YES               | YES               | YES               | YES               | YES               |
| Quarter Fixed Effects | YES                 | YES               | YES               | YES               | YES               | YES               | YES               | YES               | YES               | YES               |
| R-squared             | 0.583               | 0.617             | 0.346             | 0.602             | 0.398             | 0.605             | 0.337             | 0.601             | 0.314             | 0.599             |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Panel C: Regression Results, 2007Q3-2010Q4**

| VARIABLES             | (1)<br>CapRatio     | (2)<br>LevRatCE   | (3)<br>CapRatio   | (4)<br>LevRatCE  | (5)<br>CapRatio     | (6)<br>LevRatCE   | (7)<br>CapRatio      | (8)<br>LevRatCE   | (9)<br>CapRatio      | (10)<br>LevRatCE  |
|-----------------------|---------------------|-------------------|-------------------|------------------|---------------------|-------------------|----------------------|-------------------|----------------------|-------------------|
| CBO_1                 | 126.4***<br>(42.42) | 7.350<br>(15.25)  |                   |                  |                     |                   |                      |                   |                      |                   |
| CBO_1*LiqAssets_1     | -104.5**<br>(39.67) | -8.407<br>(14.27) |                   |                  |                     |                   |                      |                   |                      |                   |
| CDO_1                 |                     |                   | 10.16<br>(6.464)  | 1.267<br>(2.206) |                     |                   |                      |                   |                      |                   |
| CDO_1*LiqAssets_1     |                     |                   | -4.221<br>(5.291) | 0.275<br>(1.818) |                     |                   |                      |                   |                      |                   |
| CommLoans_1           |                     |                   |                   |                  | 1.753*<br>(0.997)   | -0.130<br>(0.361) |                      |                   |                      |                   |
| Com_1*LiqAssets_1     |                     |                   |                   |                  | -2.031**<br>(0.793) | 0.0600<br>(0.287) |                      |                   |                      |                   |
| HomeEquity_1          |                     |                   |                   |                  |                     |                   | 3.165***<br>(0.969)  | -0.125<br>(0.355) |                      |                   |
| HoEq_1*LiqAssets_1    |                     |                   |                   |                  |                     |                   | -2.337***<br>(0.798) | 0.0871<br>(0.292) |                      |                   |
| ResidMort_1           |                     |                   |                   |                  |                     |                   |                      |                   | 2.594***<br>(0.620)  | 0.154<br>(0.234)  |
| Resid_1*LiqAssets_1   |                     |                   |                   |                  |                     |                   |                      |                   | -1.954***<br>(0.538) | -0.217<br>(0.203) |
| Bank Controls         | YES                 | YES               | YES               | YES              | YES                 | YES               | YES                  | YES               | YES                  | YES               |
| Bank Fixed Effects    | YES                 | YES               | YES               | YES              | YES                 | YES               | YES                  | YES               | YES                  | YES               |
| Quarter Fixed Effects | YES                 | YES               | YES               | YES              | YES                 | YES               | YES                  | YES               | YES                  | YES               |
| R-squared             | 0.747               | 0.680             | 0.731             | 0.689            | 0.744               | 0.679             | 0.752                | 0.679             | 0.773                | 0.687             |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Annex 1.F Securitisation Classified by Credit Ratings: Interaction with the Liquid Assets Ratio

**Appendix Table 1.6 Securitisation by Credit Ratings: Interaction with the Liquid Assets Ratio. Regression Estimates**

### Panel A: Regression Results, 1999Q1-2010Q4

| VARIABLES             | (1)<br>CapRatio      | (2)<br>LevRatCE      | (3)<br>CapRatio     | (4)<br>LevRatCE      | (5)<br>CapRatio    | (6)<br>LevRatCE    |
|-----------------------|----------------------|----------------------|---------------------|----------------------|--------------------|--------------------|
| AAA_1                 | 0.749**<br>(0.328)   | -0.475***<br>(0.175) |                     |                      |                    |                    |
| AAA_1*LiqAssets_1     | -0.895***<br>(0.279) | 0.398***<br>(0.151)  |                     |                      |                    |                    |
| AA_1                  |                      |                      | 5.439**<br>(2.288)  | -3.306***<br>(1.200) |                    |                    |
| AA_1* LiqAssets_1     |                      |                      | -4.886**<br>(2.049) | 2.611**<br>(1.098)   |                    |                    |
| A_1                   |                      |                      |                     |                      | 8.280**<br>(3.872) | -3.921*<br>(2.177) |
| A_1* LiqAssets_1      |                      |                      |                     |                      | -3.489<br>(3.738)  | 2.793<br>(2.111)   |
| Bank Controls         | YES                  | YES                  | YES                 | YES                  | YES                | YES                |
| Bank Fixed Effects    | YES                  | YES                  | YES                 | YES                  | YES                | YES                |
| Quarter Fixed Effects | YES                  | YES                  | YES                 | YES                  | YES                | YES                |
| R-squared             | 0.661                | 0.475                | 0.651               | 0.475                | 0.675              | 0.469              |

### Panel B: Regression Results, 2003Q1-2007Q2

| VARIABLES             | (1)<br>CapRatio     | (2)<br>LevRatCE    | (3)<br>CapRatio   | (4)<br>LevRatCE   | (5)<br>CapRatio    | (6)<br>LevRatCE   |
|-----------------------|---------------------|--------------------|-------------------|-------------------|--------------------|-------------------|
| AAA_1                 | 0.610<br>(0.453)    | -0.0619<br>(0.208) |                   |                   |                    |                   |
| AAA_1*LiqAssets_1     | -0.00547<br>(0.392) | 0.0986<br>(0.179)  |                   |                   |                    |                   |
| AA_1                  |                     |                    | -1.618<br>(2.635) | -0.354<br>(1.191) |                    |                   |
| AA_1* LiqAssets_1     |                     |                    | -2.209<br>(2.071) | 0.826<br>(0.967)  |                    |                   |
| A_1                   |                     |                    |                   |                   | -11.19*<br>(6.648) | -0.895<br>(3.157) |
| A_1* LiqAssets_1      |                     |                    |                   |                   | -0.680<br>(5.971)  | 2.175<br>(2.841)  |
| Bank Controls         | YES                 | YES                | YES               | YES               | YES                | YES               |
| Bank Fixed Effects    | YES                 | YES                | YES               | YES               | YES                | YES               |
| Quarter Fixed Effects | YES                 | YES                | YES               | YES               | YES                | YES               |
| R-squared             | 0.351               | 0.596              | 0.366             | 0.600             | 0.388              | 0.599             |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Panel C: Regression Results, 2007Q3-2010Q4**

| VARIABLES             | (1)                  | (2)                | (3)                | (4)               | (5)                | (6)               |
|-----------------------|----------------------|--------------------|--------------------|-------------------|--------------------|-------------------|
|                       | CapRatio             | LevRatCE           | CapRatio           | LevRatCE          | CapRatio           | LevRatCE          |
| AAA_1                 | -3.49e-05<br>(0.491) | -0.0847<br>(0.199) |                    |                   |                    |                   |
| AAA_1*LiqAssets_1     | -0.983**<br>(0.385)  | 0.107<br>(0.155)   |                    |                   |                    |                   |
| AA_1                  |                      |                    | 8.131*<br>(4.379)  | -0.904<br>(1.526) |                    |                   |
| AA_1* LiqAssets_1     |                      |                    | -7.034*<br>(3.947) | 1.074<br>(1.377)  |                    |                   |
| A_1                   |                      |                    |                    |                   | 10.79**<br>(4.566) | -0.201<br>(1.655) |
| A_1* LiqAssets_1      |                      |                    |                    |                   | -5.532<br>(4.378)  | -1.063<br>(1.585) |
| Bank Controls         | YES                  | YES                | YES                | YES               | YES                | YES               |
| Bank Fixed Effects    | YES                  | YES                | YES                | YES               | YES                | YES               |
| Quarter Fixed Effects | YES                  | YES                | YES                | YES               | YES                | YES               |
| R-squared             | 0.796                | 0.681              | 0.727              | 0.681             | 0.762              | 0.703             |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 2 Securitisation and Funding Decisions of Euro Area Banks: Evidence on ABS Issuance and Retention<sup>124</sup>

*Alessandro D. Scopelliti*

### Abstract

The chapter analyses the determinants for the issuance and the retention of asset-backed securities (ABSs) by Euro Area banks, in relation to bank characteristics, macroeconomic and financial conditions, and with regard to the incentives from monetary policy measures. Based on a granular dataset including all ABSs and covered bonds issued in the Euro Area from 2005 to 2018 Q1, and combining tranche-level information on securities with the balance sheet data for the parent banks, I first study the relative incentives for the issuance and the retention of ABSs versus covered bonds. While covered bonds are usually placed among investors, ABSs have been often retained by originator banks particularly after the crisis. I find that the full allotment policy – expanding the amount of available central bank liquidity – may have increased the probability to retain eligible ABSs particularly for banks with lower liquidity and less capital, as they were more interested in a securitise-to-repo strategy for potential access to central bank liquidity. In addition to this quantity effect, also the price effect of the interbank spread on funding costs may have contributed to the increase in ABS retention for banks subject to stronger liquidity constraints. The introduction of the Additional Credit Claims framework, by allowing for the direct pledge of a larger set of credit claims, was associated with a decrease in the retention of those ABSs backed by loans newly recognised as eligible.

JEL Classifications: G21, G23, E52, E 58

Key-words: Securitisation, Covered Bonds, Bank Liquidity, Collateral Eligibility, Full Allotment Policy

---

<sup>124</sup> I thank Mark P. Taylor, Michael McMahon, and Steven Ongena, for the very useful comments in the development of this work. I am very grateful to Marcus Miller and Alistair Milne for the inspiring conversations providing a key motivation for this work. I thank Ugo Albertazzi, Miguel Ampudia, Thorsten Beck, Björn Fischer, Dimitris Georgarakos, Victoria Ivashina, Angela Maddaloni, Francesco Mazzaferro, Tuomas Peltonen, Stephanie Stolz, Vlad Tomozei and Olaf Weeken, for the very useful discussions and suggestions in various stages of this project. I am indebted to the Bond Markets and International Operations Division at the ECB, and in particular to Christophe Beuve, Beatriz Sotomayor and Ralph Weidenfeller for the crucial market experience on the Euro Area ABS market. Also, I am thankful to the Market Operations Analysis Division at the ECB and particularly to Ad Visser, Ruth Magono, Maximilian Blau and Sebastian Weber, for providing the historical data on the Eligible Assets Database, and to Marco Corsi and Benjamin Stamer for useful clarifications on the Eurosystem collateral framework. I acknowledge the financial support from ERC ADG 2016 - GA 740272 “lending” (University of Zurich). The views expressed in this study are my own and do not necessarily reflect those of the European Central Bank, the Eurosystem or the European Systemic Risk Board.

## 2.1 Introduction

The experience of the global financial crisis has contributed to raise concerns about securitisation, due to the sometimes inappropriate use of the tranching technique to structure complex products based on high-risk high-yield assets in order to obtain short-term transaction profits (Milne, 2009)<sup>125</sup>. However, as recognised in the academic and policy debate (Bank of England and ECB, 2014), simple and transparent securitisation can be helpful for the economy, especially in bank-based systems, as it can be useful to provide funding to banks interested in financing their loan portfolio and it can contribute to alleviate potential supply-induced constraints for credit provision.

This chapter focuses on the role of securitisation as a funding source for banks and analyses the developments in the Euro Area ABS market before and after the crisis, taking a long perspective from 2005 Q1 to 2018 Q1. Over this period, asset-backed securities were used by Euro Area banks as a funding instrument in two different ways: in general, originator banks sponsored the issuance of ABSs to obtain funding from investors, by backing these products with the cash flows from their securitised loan portfolios; since the crisis, originator banks securitised existing loans and retained the issued ABSs, when eligible as Eurosystem collateral, in order to obtain liquidity in central bank refinancing operations.

Against this background, I investigate the relative incentives driving the issuance and the retention of asset-backed securities, by focusing on the financial markets developments and the monetary policy measures which could have affected the incentives of originator banks for bank funding and securitisation. The analysis is organised in two parts, in order to explore the determinants of the financing decisions taken by banks on two aspects: the choice of the instrument type and the decision about market placement or retention.

The first part of the analysis is focused on the relative choice between different financial instruments for the issuance of bank secured debt: covered bonds and asset-backed securities. Following the subprime crisis, given the concerns for the credit performance of securitisation products and the less favourable regulatory regime then introduced at the global and EU level, the market for bank secured debt has observed a significant decline in the issuances of asset-backed securities, as well as an increase in the issuances of covered bonds.

In order to compare securities based on the same type of underlying loans, I focus on a sample of debt instruments backed by mortgage loans, i.e. mortgage-backed securities (MBSs) or covered bonds, as originated or issued by Euro area banks. Conditional on issuing either of

---

<sup>125</sup> See the discussion in Milne (2009), in particular Chapter 5, on the design of “transaction deals” by investment banks. While “balance sheet” deals are undertaken by commercial banks to finance their loan portfolio, “transaction deals” are conducted by investment banks by buying loan packages on the market and by issuing complex structured products backed by high-risk, high-yield assets. The transaction generates profit as long as the revenues from the security issuances exceed the costs for the purchase of the underlying loans.

these instruments, I exploit a binary regression framework to estimate the relative probability to issue a MBS versus a covered bond. I investigate the determinants for this issuance decision, in relation to bank balance sheet characteristics and country-level macroeconomic and financial conditions. Also, I explore the differences in the retention behaviour following the issuance of the two different types of instruments.

I find that – mainly before the crisis – funding considerations due to large maturity mismatch between loans and deposits, as well as profitability motivations for banks interested in raising their returns, could have increased the relative probability to issue MBSs versus covered bonds. However, following the crisis, the concerns for the high levels of NPLs could have discouraged banks to sponsor MBSs, for the risk perceived by investors that the eventual losses on the underlying loans could affect the repayment for mezzanine and potentially senior tranches. I also document significant differences in the retention behaviour across products: only 2.85% of the covered bonds included in the sample were retained, while 43.87% of the MBSs were retained over the analysed period. Also, the retention behaviour for covered bonds was not affected by funding liquidity considerations; while the retention of MBSs was very much explained by the existing liquidity conditions of the bank (lower liquidity buffers were associated with higher retention of MBSs).

The second part of the analysis is focused on the retention behaviour of ABS originators. I explore the potential drivers for the decision to retain newly issued securitisation products, with particular attention to the role played by funding liquidity considerations for banks interested in central bank refinancing operations. In this context, I analyse some monetary policy measures potentially relevant for securitisation retention, like the fixed-rate full allotment policy for liquidity operations and the introduction of the Additional Credit Claims framework for the Eurosystem collateral eligibility.

The fixed-rate full allotment policy has been introduced by the ECB in October 2008, to increase the available amount of central bank liquidity to monetary policy counterparties. Following this measure, Euro area banks have been able to obtain the entire amount of demanded liquidity, subject to the condition of being solvent and having adequate collateral. I investigate whether and to what extent the full allotment policy may have induced some incentives for banks to securitise and retain ABSs. Provided that securitisation retention may be driven by both demand and supply factors, and in order to focus on the supply-side determinants explaining the decisions of originator banks, the identification strategy exploits the heterogeneity of banks in their ex-ante balance sheet characteristics, to study their differential response to the policy measure. I find that the full allotment policy contributed to increase the retention rate of originator banks, via the need of available collateral assets and the incentive to securitise and retain for collateral purposes. Credit institutions in weaker liquidity and capital positions – following the full allotment policy – increased their probability to retain newly

issued and collateral-eligible ABSs more than other banks, as they were more interested in potentially using retained ABSs for central bank liquidity operations.

The Additional Credit Claims (ACC) framework has been adopted by the ECB in February 2012 to expand the set of credit claims eligible as collateral for Eurosystem liquidity operations, also in relation to the implementation of the Long-Term Refinancing Operations. Before that decision, banks could use credit claims as collateral only to a limited extent<sup>126</sup> and this could explain also the incentives to securitise and retain for collateral purposes. Under the ACC framework, national central banks (NCBs) assess whether to accept additional credit claims and which assets to include in the eligibility criteria. I exploit this heterogeneity in the collateral eligibility of credit claims across origination countries and loan types to explore whether the ACC framework - by allowing for the pledge of a larger set of credit claims with the accepting NCBs - may have affected the incentives of originator banks for ABS retention. I conduct a difference-in-difference estimation, where the treatment sample includes the ABSs based on the loans newly recognised as eligible under the ACC framework, while the control sample comprehends the ABSs backed by the loans which remained non-eligible. I find that – after the ACC introduction – originator banks reduced their propensity to retain ABSs based on ACC-eligible loans, so partially reversing the retention incentives observed after the full allotment policy.

I also explore the pricing developments in the interbank market, given that they could decisively affect the relative choice of banks for interbank versus central bank funding and then indirectly the demand for collateral assets. Banks facing higher financing costs in the unsecured interbank market could indeed decide to request more liquidity from central bank refinancing operations, but in order to do so they should have enough collateral assets. I analyse whether a funding shock due to the increase in the interbank market spread - by increasing the recourse to central bank liquidity - may affect also the relative incentives for ABS retention. Banks interested in central bank financing as a substitute of interbank funding and in larger need of available eligible assets could consider to issue and retain securitisation for collateral purposes. I find that, in addition to the quantity effect of the full allotment policy, also the price effect of the interbank spread on funding costs contributed to the increase in ABS retention particularly for banks in weaker funding liquidity conditions.

## **2.2 Related Literature: Securitisation and Bank Funding Liquidity**

This chapter contributes to various strands of literature: the analysis of the determinants for securitisation issuances; the rationale for risk retention in securitisation; the distress in the

---

<sup>126</sup> According to the existing collateral eligibility rules, banks could pledge only corporate or public sector loans below certain threshold for default probability but could not post residential mortgages.

interbank markets and the funding liquidity issues of banks; the transmission of non-standard monetary policy measures via banks, particularly for central bank liquidity provision in crisis times.

### **2.2.1 The Determinants for the Issuance of Securitisation**

The financial crisis has induced a wide debate on the determinants of securitisation issuances by banks: however, most studies have explored the incentives for securitisation in the pre-crisis period, in the US and to a lesser extent in Europe. Some analyses on the securitisation of European banks have investigated the role of bank-level characteristics, like capital relief, liquidity constraints, loan quality (Affinito and Tagliaferri, 2010; Almazan, Martin-Oliver and Saurina; Farruggio and Uhde, 2015). Some other papers, focused on pre-crisis issuances, have used loan-level evidence to investigate the role of asymmetric information in the securitisation of mortgage loans (Albertazzi, Eramo, Gambacorta and Salleo, 2015) and SME loans (Albertazzi, Bottero, Gambacorta and Ongena, 2016).

Most of the literature has analysed the determinants of securitisation issuances, without considering the choice among different types of fixed income instruments. However, from the perspective of a bank treasury department, securitisation is just one of the possible funding sources a bank can use. On one hand, securitisation has some unique features, as it may serve some purposes - like the (partial) transfer of credit risk – which are not achievable with other debt securities. On the other hand, from a funding cost perspective, banks may well prefer to issue other debt instruments to get financing on the medium and long term at more favourable conditions, like covered bonds or unsecured bonds. Two recent studies have explored some aspects of the relation between securitisation and covered bonds at the bank-level. Boesel, Kool and Lugo (2018) analyse whether originator banks with a registered covered bond programme securitise a smaller amount of assets, while Carbó-Valverde, Rosen and Rodríguez-Fernández (2017) study the bank-level decision to issue MBSs or covered bonds or not to issue any debt security.

This chapter contributes to the analysis of securitisation determinants on two main aspects. First, I investigate the relative choice among funding options *at the security-level*, by modelling the relative incentives to issue MBSs versus covered bonds for all the secured debt issuances by Euro area banks from 2005 onwards. Second, to analyse the drivers of the banks' decisions about the funding instruments, I consider debt deals backed by *comparable loan portfolios* and for this purpose I develop an identification based on country-year fixed effects for the country of loan origination and the issuance year. Conditional on the issuance - in a given year - of secured debt instruments based on mortgage loans in a country, bank balance



sheet characteristics or market conditions are supposed to explain the relative probability to issue a MBS rather than a covered bond at the bank-security level.

### **2.2.2 The Rationale for Risk Retention in Securitisation**

For originator banks, the possibility to transfer credit risk - at least from a regulatory point of view - via securitisation can be an effective instrument to achieve two main objectives: reducing the risk-weighted assets in their balance sheets, and then also cleaning up their asset portfolio from some potentially non-performing claims. Despite these advantages, in various cases originator banks involved in a securitisation deal decided to retain some part of the credit risk on their balance sheets. Particularly in the US prior to the crisis, originator banks provided various forms of support to securitisation vehicles.

A bank sponsoring securitisation may retain some risk in the deal by providing some explicit or implicit support to the special purpose vehicles, both when the underlying pool includes credit claims originated by the bank itself, and when the securitisation concerns other assets. A bank provides explicit support when it offers credit or liquidity enhancement on a contractual basis (i.e. for the payment of a fee) or when it retains some tranches in the deal and the modalities of the support are defined at the time of the product issuance. Also, a bank offers implicit support when, after the asset sale, and without any previous contractual commitment, it intervenes in support of a securitisation vehicle to ensure the timely payment of investors.

Based on the US experience, some theoretical and empirical studies have analysed the key incentives and strategies of originator banks for the retention of credit risk.

First, banks may be interested in providing contractual support to securitisation vehicles, as a skin in the game mechanism to signal the quality of the underlying assets. Indeed, securitisation markets can be affected by informational asymmetries (Pennacchi, 1988), both in terms of adverse selection (as investors don't know the quality of the underlying assets so banks might be induced to securitise low quality loans), and in terms of moral hazard (as banks not exposed to the credit risk of the underlying assets don't have proper incentives to monitor borrowers after the sale). In such case, by retaining some economic interest in the securitisation, the bank signals to investors that the assets of the securitised pool are of good quality and then that the issued products are not risky (otherwise the bank wouldn't expose itself to such risk) (Gorton and Pennacchi, 1995; Albertazzi, Eramo, Gambacorta and Salleo, 2015). Demiroglu and James (2012) provide some evidence at this regard, by showing that default rates are significantly lower for securitisations in which the originator is affiliated with the sponsor or the servicer.

A second reason may regard the assignment of a credit rating for securitisation products and is in part related to the previous one, as a signalling mechanism to overcome the

informational asymmetries. Banks may offer support, in agreement with rating agencies and underwriters, to ensure that the best possible credit rating is assigned to a securitisation product. Indeed, the assignment of a specific rating (typically AAA or AA) can be extremely important for securitisation, in order to ensure an adequate demand for them by market investors (Erel, Nadaul and Stulz, 2014; Adelino, 2009; Cohen and Manuszak, 2013). However, in various cases, the quantity and the quality of the expected cash flows may not be appropriate to assign the desired rating to the issued securities, as the expected rate of delinquencies for the securitised pool could be higher than the expected probability of default required for a given issue rating.

Third, originator banks can be incentivised to provide contractual support to the special purpose vehicles, when securitisation is used by credit institutions as a funding device (e.g. a parent bank finances new loans through the funds coming from securitisation products issued by subsidiary vehicles) (Uhde and Michalak, 2010; Loutskina, 2011; Michalak and Uhde, 2012; Almazan, Martin-Oliver and Saurina, 2013). In this perspective, the credit enhancement to the securitisation process is functional to improve the funding conditions of the originator bank, as a higher rating of the product can justify a lower benchmark spread to pay on coupons and then a lower funding cost.

Fourth, banks may be incentivised to provide contractual support for regulatory arbitrage, if the type of enhancement allows them to reduce their capital requirements without actually transferring the credit risk of the exposures (Acharya, Schnabl and Suarez, 2013; Demyanyk and Loutskina, 2016). Acharya, Schnabl and Suarez (2013) study the incentives for setting asset-backed commercial paper conduits in the US and in Europe and show that liquidity-guaranteed ABCP was issued more frequently by banks with low economic capital. Indeed, by developing guarantees classified as liquidity facilities but effectively covering credit risk, banks could obtain some relief in terms of regulatory capital.

Banks can provide contractual support in various forms: retention of subordinated tranches, interest-only strips, over-collateralisation, credit guarantees or liquidity lines. In particular, Sarkisyan and Casu (2013) analyse the effects of different forms of retained interests on insolvency risk for US banks and find that credit enhancement increases their default probability, while liquidity facilities don't have a significant impact on bank risk. Moreover, the relationship between credit enhancement and insolvency risk seems to be non-linear due to the size of the outstanding securitisation amounts: indeed, credit support can have a risk-reducing effect for "small-scale" securitisers, while a risk-increasing effect for "large scale" securitisers, depending on the fraction of the assets that banks decide to securitise.

Finally, in some cases, financial institutions can also offer implicit recourse<sup>127</sup> to a sponsored vehicle - even without a previous contractual commitment - mostly for reputational reasons when the SPV is not able to repay investors. This may happen when the bank perceives that the failure to provide this support, even though not contractually required, would damage its future access to the ABS market. Higgins and Mason (2004) show the beneficial effects of implicit support for the reputation of securitisation sponsors: the recourse to securitised debt can improve their short and long-term stock returns and their long-term operating performance, by revealing that the occurred shocks are transitory and don't affect deal characteristics.

However, these explanations are mostly focused on the US experience and mainly referred to the pre-crisis developments in the securitisation market. This chapter – analysing the retention of ABSs by Euro Area banks after the crisis – highlights a new and unexplored rationale for securitisation retention: originator banks may retain newly issued ABSs for funding liquidity reasons, to increase the amount of eligible collateral assets. If this motivation holds, we can expect that banks subject to more binding liquidity constraints would be more interested in retaining newly issued ABSs than other banks. This has been observed in the Euro area and in the UK for the participation in central bank liquidity operations<sup>128</sup>. This study shows for the Euro area that - after the increase in the availability of central bank funding – originator banks with smaller liquidity buffers increased relatively more their retention of collateral-eligible ABSs than other banks. The heterogeneity in the observed effect across banks reflects their ex-ante differences in collateral needs and supports the funding liquidity explanation of securitisation retention.

### **2.2.3 Bank Liquidity Crises**

This work contributes to the analysis of the funding liquidity issues of banks in case of interbank market distress and to the study of the bank financing decisions in crisis times.

The theoretical literature has investigated two main potential channels through which an interbank market break-down can occur: the role of counterparty risk with respect to borrower banks (Freixas and Jorge, 2008; Heider, Hoerova and Holthausen, 2015) and the liquidity hoarding behaviour of banks with liquidity surplus (Allen, Carletti and Gale, 2009; Diamond and Rajan, 2011). On one hand, to deal with the counterparty risk under asymmetric

---

<sup>127</sup> Cases of implicit recourse are relatively frequent in revolving securitisations, such as those used for credit card lines, where banks might have an incentive to avoid early amortisation in case of under-performance of the asset pool. In the past, implicit recourse could also present some advantages in terms of prudential requirements: while banks were required to hold risk-based capital for contractual credit enhancement or liquidity provision, they were not expected to keep additional capital ex ante in case of implicit support, given that there is not an explicit commitment but only a posterior intervention.

<sup>128</sup> In principle, this retention behaviour for collateral purposes could have taken place also for private repo markets, if ABSs were to be accepted by private counterparties at financially convenient conditions (i.e. also in terms of haircuts).

information, banks with liquidity surplus require higher interest rate up to the point that no equilibrium rate exists in the interbank market. On the other hand, provided that creating liquidity ex-post via the liquidation of long-term assets may be costly, banks engage in liquidity hoarding by keeping large amounts of liquid assets for precautionary reasons and therefore may be less willing to lend to other banks. To tackle this market break-down, central banks can act as lenders-of-last-resort by providing funding to solvent banks however facing temporary illiquidity problems, as set in the Bagehot principles.

The empirical literature has explored the role of these channels as well as the effects of lender-of-last-resort interventions to deal with these liquidity crises. Afonso, Kovner and Schoar (2011), focusing on the US overnight interbank market during the 2008 financial crisis, find that counterparty risk plays a larger role than liquidity hoarding: straight after the Lehman bankruptcy, loan terms became more sensitive to borrower characteristics. Acharya and Merrouche (2013), analysing the UK interbank market at the time of the subprime crisis (2007-2008), document evidence of a liquidity hoarding behaviour, as riskier banks held more reserves relative to the expected payment value. For the Euro Area, Garcia-de-Andoain, Heider, Hoerova and Manganelli (2016) show that the liquidity provision by the Eurosystem replaced banks' demand for liquidity during the global financial crisis and contributed to increase the supply in the interbank market in stressed countries during the subsequent sovereign debt crisis. The interpretation of this empirical evidence has to take into account the different structures of the interbank market across jurisdictions, given the different definitions of the eligible counterparties in the monetary policy frameworks.

This chapter provides an empirical application of the liquidity hoarding behaviour for precautionary reasons that banks could implement in the case of an interbank market break-down, when the marginal funding source is not available. In this case, banks may use long-term illiquid assets (loans) held on balance sheet as underlying assets of a securitisation deal to create eligible collateral potentially for central bank liquidity. This analysis focuses on the retention of ABSs, rather than on the actual pledge of collateral with the Eurosystem, because it is important for banks not only to dispose of adequate collateral, but also to signal this availability.

#### **2.2.4 The Transmission of Unconventional Monetary Policy Measures**

This chapter relates also to the transmission of non-standard monetary policy measures via banks, particularly for the provision of central bank liquidity in crisis times.

The traditional literature on the bank-based transmission of monetary policy has focused the attention on the effects of conventional policy measures on bank credit, i.e. how banks change the conditions and/or the amounts of lending provision in response to changes in the policy rate; these studies provide evidence on the functioning of the bank lending channel

(Kashyap and Stein, 2000; Jiménez, Ongena, Peydró and Saurina, 2012) and of the risk-taking channel of monetary policy (Jiménez, Ongena, Peydró and Saurina, 2014; Maddaloni and Peydro, 2011). More recently, the design and the implementation of non-standard monetary policy by central banks in response to the global financial crisis has motivated further research on the bank-based transmission of various unconventional measures: asset purchases (Darmouni and Rodnyansky, 2017; Di Maggio, Kermani and Palmer, 2016), central bank liquidity provision (Drechsler, Drechsler, Marques-Ibanez and Schnabl, 2016; Carpinelli and Crosignani, 2018; Crosignani, Faria-e-Castro and Fonseca, 2019), and collateral framework changes (Van Bakkum, Gabarro and Irani, 2018; Cahn, Duquerroy and Mullins, 2017; Mésonnier, O'Donnell and Toutain, 2018).

The extraordinary provision of liquidity by central banks<sup>129</sup> - particularly in advanced economies - was intended to deal with the distress in the interbank markets and to minimise the negative consequences of the dry-up in the wholesale funding on the provision of bank lending to the real economy. This chapter contributes to our understanding of the bank-based transmission of central bank liquidity provision, by analysing the effects of these measures on bank funding decisions and on the management of bank liabilities. In fact, most papers have explored the effects of unconventional measures on the assets side of banks' balance sheets, focusing on the changes in bank credit provision and in the composition of banks' securities portfolios. This chapter investigates the effects of non-standard measures - like the fixed-rate full allotment policy or the additional credit claims framework - on the composition of bank liabilities and on the choice of bank funding sources. Using bank-security level data, I explore how monetary policy - by increasing the quantity of available central bank financing or changing the eligibility requirements - can affect the incentives of banks for the choice of their financing sources, in a differential way across banks based on their ex-ante heterogeneity in financial conditions.

---

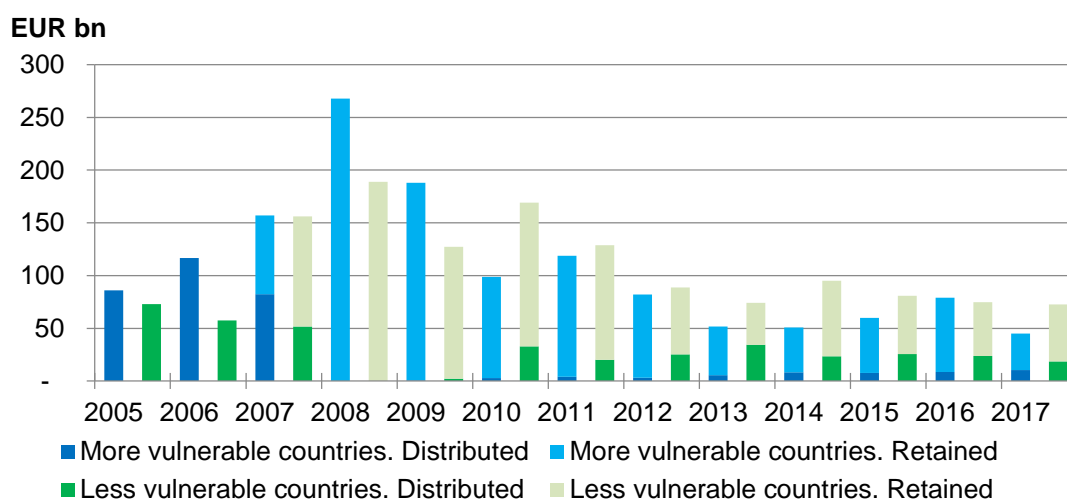
<sup>129</sup> The ECB adopted the Very Long-Term Refinancing Operations in December 2011 and February 2012, to provide liquidity directly to banks for a 3-year time period, and then the Targeted Long-Term Refinancing Operations starting from September 2014, to provide funding for a 4-year time period conditional on lending to private non-financial corporations. The Bank of England implemented - at the onset of the subprime crisis - the Special Liquidity Scheme, a collateral swap programme aimed to improve bank liquidity by allowing banks to swap illiquid assets for UK Treasury Bills; then, starting from July 2012, it also established the Funding for Lending Scheme, which was still structured as a collateral swap, but subject to a conditionality mechanism based on the amount of loans provided to the real economy. The Federal Reserve implemented the Term Securities Lending Facilities, a loan facility to promote liquidity in collateral markets, designed as a collateral swap scheme.

## 2.3 Securitisation in the Euro Area and Bank Liquidity during the Crisis

### 2.3.1 Developments in the Euro Area ABS Market

Figure 2.1 displays the trends for the annual issuance volumes of ABSs in the Euro area from 2005 until 2017. The issuances are classified in relation to groups of countries (more or less vulnerable to the crisis). Per country group and year, each bar distinguishes the distributed and the retained issuances. The chart shows that until 2006 all issuances were distributed among investors, while in 2007 some issuances were placed and others were retained<sup>130</sup>. In 2008 and 2009 almost all issuances were retained, independently from the countries. Starting from 2010, the very vast of majority of issuances in more vulnerable countries has been retained, and the same holds also for a significant majority of deals in less vulnerable countries.

**Figure 2.1 Volumes of Euro Area ABS Issuances by Country Groups (annual, 2005-2017, EUR bn)**



Source: Dealogic and JP Morgan (2018) and author's elaboration

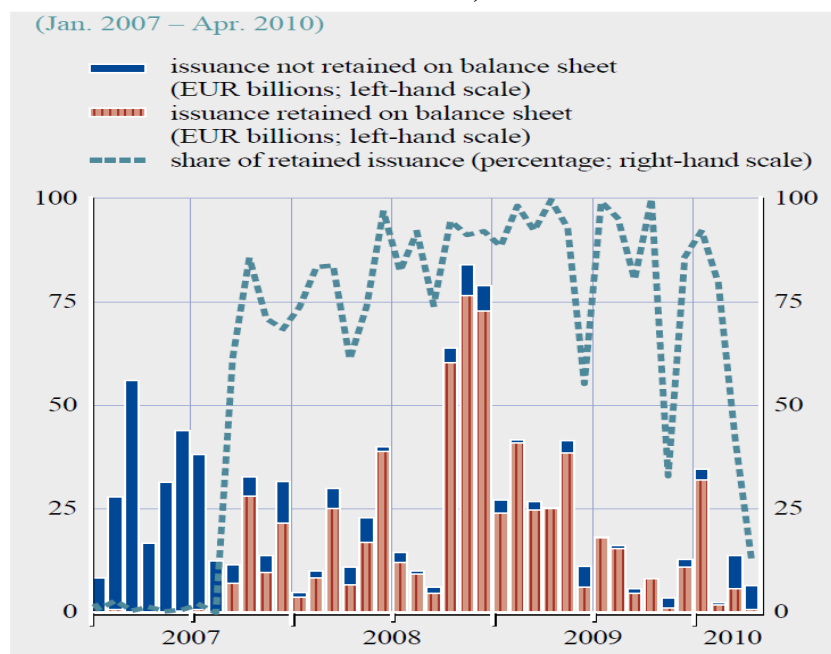
Note. More vulnerable countries – as more affected by the crisis - are Cyprus, Greece, Ireland, Italy, Spain, Portugal. Less vulnerable countries are Austria, Belgium, Finland, France, Germany, Netherlands.

Figure 2.2 provides a more focused representation – on a monthly basis - for the period from 2007 to early 2010, highlighting the retention of almost all the issuances from the last quarter of 2007 until the first quarter of 2010. Looking at the trends in the retention rate by Euro area banks (dashed line), we observe that the share of retained tranches over total issuances was different across months, but in 2008 and 2009 it was always included in a range between 75% and 100%, while before August 2007 the retention rate was close to 0%. In particular, it is interesting to observe - always in Figure 2.2 - the sudden increase in the issuance volumes of retained securitisation in the last quarter of 2008, exactly in the worst period of the global

<sup>130</sup> As it can be more easily observed from Figure 2.2, the retention behaviour started with the subprime crisis from August 2007.

liquidity crisis after Lehman's bankruptcy and following the introduction of the fixed rate full allotment policy by the Eurosystem.

**Figure 2.2 Euro Area Placed and Retained ABS Issuances. Focus: 2007-2010 (monthly, EUR bn)**

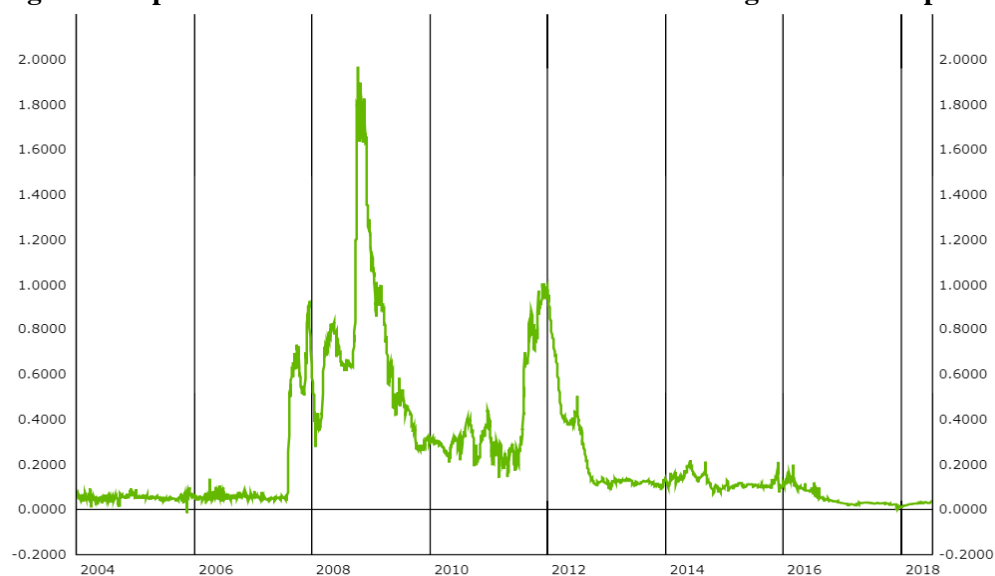


Source: ECB (2010), Financial Stability Review, June, p.78

### 2.3.2 The Funding Liquidity Issues and the Securitize-to-Repo Incentives

This liquidity crisis which affected the Euro area banking system at that time could be well observed from the developments in the unsecured interbank market. Figure 2.3 displays the trends for the spread between the 3-month Euribor rate and the Euro 3-month Overnight Index Swap (OIS). Given that the OIS is used as a measure of risk-free rate, the 3-month Euribor spread provides a measure of the perceived risk in the unsecured interbank market. We can observe that – following Lehman's bankruptcy - the 3-month Euribor-OIS Spread increased from 0.7% in mid-September 2008 to 1.81% in mid-October, corresponding to 111 basis points in one month. In a still quite significant development, following the concerns for the contagion of the sovereign debt crisis to Spain and Italy in the late summer of 2011, the same spread increased from 0.37% at the beginning of August 2011 to 0.87% at the beginning of November 2011, by 50 basis points. Also, given that the Euribor is a reference rate computed on the basis of submitted quotes from several Euro area banks, we can imagine that much larger increases in interbank funding costs affected banks in more vulnerable countries at that time.

**Figure 2.3 Spread of the 3m Euribor Rate to the 3m Overnight Index Swap Rate**



Source: ECB (2018).

Note: The data refer to the period from 2004 to 2018: the spread is expressed in percentage points

Given these funding issues of Euro area banks in the considered period, an important motivation for the retention of asset-backed securities - particularly for banks under stronger funding constraints - could have been related to the possibility to use securitisation products as collateral in the liquidity operations with central banks. Indeed, the monetary policy collateral framework of the Eurosystem allowed for a broad set of eligible instruments, including asset-backed securities, and this was important for banks interested in obtaining central bank liquidity particularly during the crisis.

Indeed, banks could pledge loans as collateral only to some limited extent (at least until some revisions of the collateral framework introduced in early 2012), but they could collect various loans in a pool of assets to set up a securitisation operation and then retain the tranches on balance sheet. These products could then be posted – if eligible - as collateral in the refinancing operations with the Eurosystem. In this perspective, banks potentially interested in obtaining central bank liquidity had the incentive to increase the amount of eligible collateral assets on balance sheet, since the availability of adequate collateral was a pre-requisite for banks to participate in the liquidity operations.

### **2.3.3 Monetary Policy Measures to Ensure Access to Central Bank Liquidity**

In the crisis period, Euro area banks made extensive use of the central bank liquidity provided by the Eurosystem, in some cases also using retained securitisation products as collateral in the refinancing operations. This was favoured by the flexibility of the ECB collateral framework, which used to recognise a broad range of eligible assets for all its liquidity



operations also before the crisis<sup>131</sup>, to ensure adequate access to central bank liquidity to all monetary policy counterparties in the Euro area.

Most importantly, the wide access of credit institutions to central bank liquidity operations during the crisis became possible thanks to some policy measures implemented by the ECB to deal with the funding liquidity issues of the Euro area banking system. In this context, we can focus our attention on the introduction of the fixed-rate full allotment policy, decided by the ECB on 8 October 2008 for the main refinancing operations to be settled from 15 October 2008 onwards and then extended in various occasions until now.

To explain the importance of this measure, it might be useful to briefly recall the modalities of Eurosystem monetary policy operations (and in particular of the main refinancing operations, MROs) under the variable-rate tenders (Cassola et al., 2013). Under this framework, the amount of liquidity that monetary policy counterparties could be allotted by the Eurosystem in the refinancing operations was capped to a pre-set amount for each operation and subject to the outcome of a liquidity auction. Banks had to submit a bid by indicating the rate they would have been willing to pay and the overall pre-set amount was allocated among bidders in relation to their bid rates. The key central bank policy rate was indeed a minimum rate for the bids that monetary policy counterparties used to submit for the MROs. Therefore, banks were able to obtain only a fraction of their liquidity demand through central bank financing and they used to manage their portfolio of collateral assets consistently with this relatively capped amount of funding they could receive.

Following the introduction of the full allotment policy, monetary policy counterparties got the chance to obtain the entire amount of demanded liquidity, under the condition of being solvent and of having adequate collateral. Moreover, the key central bank policy rate for MROs became a fixed rate at which banks could obtain the demanded liquidity. Therefore, this measure had the effect to remove the existing funding constraints that banks previously had with respect to the amount of available central bank financing.

After the introduction of the full allotment policy, and until a change in the collateral framework introduced only starting from early 2012, banks could pledge credit claims as collateral in the refinancing operations with the Eurosystem only to some limited extent and exclusively for certain types of loans. Therefore banks, in order to take advantage of this uncapped liquidity provision, could have been incentivised to securitise the existing portfolio of loans on their balance sheets in order to issue and retain asset-backed securities as a way to increase the amount of available collateral assets.

---

<sup>131</sup> For more details on the eligibility criteria, see the discussion on the collateral framework for monetary policy in Chapter 1 Section 1.3.2

Indeed, if it had been possible to post credit claims as collateral under the same valuation conditions for ABSs, banks would have not had incentive to implement a securitise-to-repo strategy. However, credit claims – as non-marketable assets – are subject to higher valuation haircuts<sup>132</sup>. In addition, only some specific types of credit claims are accepted as eligible collateral by the Eurosystem. Until December 2011, banks could pledge only credit claims to non-financial corporations and to public sector entities: therefore residential mortgages, consumer finance or auto loans were not considered as eligible collateral for the Eurosystem, while they could be used by originator banks as underlying assets for the issuance of potentially eligible securitisation products.

In December 2011, at the time of the launch of the 3-year Long-Term Refinancing Operations (LTROs), and in order to increase the amount of available collateral for banks, the ECB Governing Council decided to allow the national central banks (NCBs), as a temporary solution, to accept as collateral additional performing credit claims satisfying specific eligibility criteria. However, the responsibility entailed in the acceptance of such credit claims had to be borne by the NCB authorising their use. This implied that only some NCBs decided to take this initiative for proposing an expansion of the set of eligible credit claims. It is also important to point that these additional credit claims could be pledged only with the NCB of the country where the loans had been originated.

The ACC framework became operational in February 2012, following a decision of the ECB Governing Council approving the national eligibility criteria for the proposing NCBs. Apart from relaxing the credit threshold for the minimum probability of default for corporate loans, the introduction of the ACC framework allowed banks to pledge - though with some differences across NCBs - also other types of credit claims: 1) residential mortgages (loans to individuals); 2) pools of loans (backed by individual claims or mortgages).

## **2.4 Data**

While most of the studies on securitisation in Europe focus on the issuances or holdings in one country, this chapter takes a Euro area perspective in studying the determinants for the issuance and the retention of asset-backed securities versus covered bonds and combines tranche-level information on issuances and security-level data on collateral eligibility with the balance sheet data for the corresponding parent banks.

---

<sup>132</sup> The Eurosystem collateral framework makes a clear distinction between marketable and non-marketable assets, for the purpose of eligibility criteria and valuation haircuts. While marketable assets are fixed income instruments generally traded among market investors and then potentially with an identifiable market price, non-marketable assets like credit claims are broadly illiquid assets requiring a specific valuation process by the national central banks accepting them.

For this purpose, I collect the relevant data from different sources. At the tranche-level, I collect information on the issuances of asset-backed securities and covered bonds from Dealogic, which provides data on a large universe of fixed-income instruments with the related indications about the identity of the parent bank (for the ABS originator or the covered bond issuer) and about the retention status of individual tranches<sup>133</sup>.

Based on the ISIN codes, the tranche-level information from Dealogic are merged with the security-level data from the Eligible Assets Database of the Eurosystem, reporting the marketable assets eligible as collateral with the Eurosystem<sup>134</sup> with the corresponding security identifiers and valuation haircuts. The collateral eligibility data are publicly available on the ECB website on a daily basis from April 2010; for the monthly data before then, I use a proprietary database always from the ECB. The data on the collateral framework allow me to identify – per each date - the asset-backed securities and the covered bonds which were eligible for the refinancing operations with the Eurosystem.

At the bank-level, I use the bank balance sheet information available from S&P Market Intelligence<sup>135</sup> for the banks which were originators of asset-backed securities or issuers of covered bonds. In particular, given the importance of the potential use as collateral in the refinancing operations, and provided that the monetary policy counterparties are to be credit institutions, I focus only on those securities for which I can identify a bank as a parent company. I merge the information on bank balance sheets with the above data on secured debt issuances, in order to identify the balance sheet characteristics of the parent banks in the quarter before the issuance of the product.

Also, in order to account for country-level macroeconomic and financial conditions potentially relevant for the issuance and retention decisions, I add some country-level information from the ECB Statistical Data Warehouse, for the variables described in the following analysis.

As for the sample composition, the analysis focuses on all asset-backed securities sponsored or all covered bonds issued by banks based in the Euro area and whose ultimate parent is a credit institution established in the Euro area. The rationale for this criterion is based on two main reasons.

First, the stylised facts discussed in the previous section suggest that a potential driver of the retention behaviour could be the possibility to use the retained ABS or covered bond – if

---

<sup>133</sup> Annex 2.A provides additional explanations on the dataset construction, particularly for the security-level issuance data and the mapping with the balance sheet characteristics of originator or issuer banks.

<sup>134</sup> For the dates before April 2010, given that the related data are not publicly available on the ECB website, I thank again the Colleagues from DG-M MOA for providing the historical data about the collateral eligibility starting from 2005 and for their explanations on the features of the Eurosystem collateral framework.

<sup>135</sup> It collects - in a new joint platform - the bank balance sheet information previously provided by S&P Capital IQ and by SNL Financial.

eligible – as collateral for the refinancing operations with the Eurosystem. Then, consistently with this hypothesis, the empirical analysis focuses on some specific policy measures implemented by the Eurosystem, which may have influenced in different directions the retention decisions of originator banks<sup>136</sup>, like the introduction of the fixed-rate full allotment policy and of the ACC framework<sup>137</sup>. Given this focus on ECB policy measures, it is natural to restrict the sample to banks which can actually benefit from this funding possibility, i.e. banks based in the Euro Area, as they are by definition monetary policy counterparties for the Eurosystem.

Second, provided that the key decisions for the funding strategy of the credit institutions in a banking group are actually taken by the treasury department of the group, the sample selection requires also that the ultimate parent of the originator or issuer bank should be established in the Euro area. This sample criterion ensures that the central bank financing via the pledge of retained ABSs is considered – on a systematic basis - as an option for the funding strategies of the banking group and therefore assessed comparatively with other available financing options in the design of the funding plans and of the issuance schedule. This criterion for the sample selection implies the exclusion of those securitisation products, as well as of those covered bonds, for which the parent bank is headquartered outside of the Euro area, even if the originator or issuer bank is based in the Euro area, as in this case the key guidelines for the funding strategy would likely be designed by a non-Euro area entity.

The analysis on the issuance and retention determinants at the tranche-level is conducted for a quarterly sample of banks from the first quarter of 2005 to the first quarter of 2018. The final dataset for the Euro Area includes data for 185 banks sponsoring asset-backed securities for a total number of 3,638 tranches (of which 135 banks sponsoring mortgage-backed securities for an overall number of 2,265 tranches). Also, the dataset includes data on 169 banks issuers of covered bonds, for an overall number of 9,143 instruments.

Given the focus of this analysis on the funding decisions to finance the credit provision of banks, the dataset focuses on covered bonds and asset-backed securities, while it does not include more complex securitisation products like CDOs or CBOs, which in any case would not be eligible as collateral for monetary policy operations. While the covered bonds are typically backed by residential or commercial mortgage loans, the asset-backed securities included in the sample are based on various types of underlying assets, namely: residential and commercial mortgages, as well as auto loans, lease receivables, consumer and credit card loans, SME loans.

---

<sup>136</sup> The focus on ECB policy measures does not exclude that also other liquidity measures implemented during the crisis by other central banks, like the Bank of England, could have contributed to incentivise the securitisation retention by originator banks. Moreover, the securitisation retention incentives related to the Eurosystem liquidity provision may have significantly affected also non-Euro Area banks: in fact, subsidiaries of non-Euro Area banks established in the Euro Area can still be monetary policy counterparties of the Eurosystem; this applies also to branches of non-Euro Area banks, as long as they belong to a bank established in the European Union.

<sup>137</sup> Also, Section 2.7 on the Credit Easing Package discusses some issues for the identification strategy of some other ECB non-standard measures, including the ABS Purchase Programme.

## **2.5 Empirical Analysis: Mortgage-Backed Securities versus Covered Bonds**

Following the global financial crisis, given the related concerns for the credit risk of securitisation products and the less favourable regulatory regime introduced at the global and EU level in response to the subprime crisis, the market for secured debt instruments has observed a significant decline in the issuances of asset-backed securities, as well as an increase in the issuances of covered bonds.

While ABSs generally imply the transfer of the underlying assets from the originator to the special purpose vehicle, banks issuing covered bonds keep the underlying loans in their balance sheet, so from this point of view covered bonds are not subject to the concerns for the originate-to-distribute model as usually associated with securitisation. Moreover, given the bankruptcy-remoteness of the issuer SPV, the investors in ABSs are expected to receive the payment of principal and coupons based exclusively on the cash flows coming from the underlying pool, while the investors in covered bonds typically take advantage from the double recourse, with respect to the issuer bank and to the underlying covered pool. In this respect, covered bonds seem to reassure investors to a larger extent with regard to the possibility to receive the due payments.

### **2.5.1 The Determinants for the Issuance of MBSs vs. Covered Bonds**

#### **2.5.1.1 Empirical Strategy and Specification**

In order to understand more these developments in the funding decisions of banks, I explore the relative incentives driving the issuance (the extensive margin) of asset-backed securities versus covered bonds for comparable loan portfolios. For this purpose, I focus on a sample of Euro area banks issuing secured debt backed by mortgage loans, either mortgage-backed securities or covered bonds. Conditional on issuing either of these instruments, I exploit a binary regression framework to estimate the probability of the issuance of a MBS versus a covered bond.

Given that the markets for covered bonds and MBSs have been quite segmented at the national level within the Euro area, and provided that the developments of these markets can be significantly affected by country-level economic conditions, it is important to control for country-specific characteristics, both with the inclusion of country-level macroeconomic and financial variables, and with the introduction of country and time fixed effects (where the country fixed effects refer to the nationality of the underlying risk). The baseline specification for the analysis on the issuance of MBSs versus covered bonds is defined as follows:

$$(1) \quad P(MBS_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

where  $(\mathbf{x}'\boldsymbol{\beta}) = \alpha + \varphi_k + \psi_t + B \text{BankBalanceSheet}_{j,t-1} + \Delta \text{RiskCountryControls}_{k,t-1} + Z \text{ParentBankCountryControls}_{l,t-1} + \varepsilon_{ijt}$

where i indicates the issued security, j defines the parent bank (of the MBS originator or of the covered bond issuer), k denotes the country of the underlying assets, l characterises the nationality of the parent bank and t refers to the time of the issuance. The dependent variable is equal to 1 if the issued security is a MBS or to 0 if the security is a covered bond.

The bank balance sheet variables considered for this purpose are: for the solvency position, the leverage ratio (common equity/total assets) or the risk-weighted capital ratio (total capital/risk-weighted assets); for the funding liquidity position, the loans deposits ratio (net loans/total deposits) and the liquid assets ratio (liquid assets/total deposits and short-term borrowing)<sup>138</sup>; for the diversification of bank revenues, the ratio of net interest income to total revenues; for bank asset quality, the ratio of non-performing loans to total loans.

The relevant macroeconomic variables are grouped in two categories, depending on whether they are referred to the country of the underlying assets or to the country of the originator/issuer parent<sup>139</sup>. The macroeconomic conditions relevant for the performance of the underlying portfolio are typically the ones observed in the country of origination. For this reason the analysis considers – on a quarterly basis - the annual GDP growth rate: by capturing the aggregate income production in one country, it may explain borrowers' ability to repay their loans.

On the other hand, the macroeconomic variables more directly affecting the financing conditions of the originator/issuer bank are the ones registered in the country of operations of its parent company: for this purpose, the analysis includes – on a quarterly average basis – the annual yield on 10-year government bond and the 3-month money market rate. The yield on 10-year sovereign bonds, as a measure of long-term interest rate, reflects the financing conditions of the sovereign and therefore – given the sovereign-bank nexus – may have implications on the long-term wholesale funding costs of the banks established in that country; while the 3-month money market rate, coinciding with the 3-month Euribor rate for Euro area countries, is a measure of short-term funding costs in the unsecured interbank market and therefore is also

---

<sup>138</sup> The two measures of funding liquidity capture different aspects. The loans deposits ratio measures to what extent loans are funded via deposits: when the ratio is larger than 1, the deposits received from customers are not sufficient to finance the loans provided to borrowers; therefore, the higher is the ratio, the larger would be the extent to which the bank will have to fund the credit provision with short-term funding or wholesale debt. On the other hand, the liquid assets ratio indicates the availability of liquid assets the bank has with respect to its short-term liabilities. The loans deposits ratio is directly relevant for the choice of the funding sources (which type of debt instruments), while the liquid assets ratio is more important to explain the potential incentives for the increase of available liquid assets and therefore the retention of newly issued debt instruments.

<sup>139</sup> Although the two usually coincide, it may be well the case that a banking group headquartered in one country provides – via a subsidiary – loans to borrowers in another country.

used by credit institutions as an important pricing benchmark for floating-rate debt instruments or for variable-rate loans.

Ideally, the identification would rely on country-year fixed effects, for the country of risk and the issuance year: for the issuances - in a given year - of secured debt instruments based on mortgage loans originated in a country, the probability to issue a MBS would be modelled as a function of bank-specific characteristics, as well as of macroeconomic and financial conditions in the countries of the parent bank and of the underlying assets.

However, given the binary choice between MBSs and covered bonds, and provided that in several country-year clusters all the issued instruments would be either MBSs or covered bonds, an estimation of the probit (or logit) model would imply that various country-year clusters would be dropped with all the observations. This would lead not only to a significant reduction in observations, but also to the exclusion of some country-year clusters possibly providing relevant information. This issue may hold – but only to a lesser extent – for the inclusion of country and year fixed effects, as in this case the country or time clusters would include a larger number of observations and therefore it would be less likely that the issued securities in those clusters belong all to the same category. Moreover, I can still include country-year fixed effects in the estimation of this specification via a linear probability model, although this does not fully account for the dichotomous nature of the dependent variable.

### **2.5.1.2 Empirical Results**

Table 2.1 presents the results based on the above specifications. Panel A shows – for the entire sample period (2005Q1 – 2018Q1) - the probit specification<sup>140</sup> with country and year fixed effects (Col. 1-4), as well as the linear probability model (LPM)<sup>141</sup> with country-year and bank fixed effects (Col. 5-8). The results in Panel A do not exclude potential differences across distinct time periods, given the important structural break implied by the subprime crisis. Then, Panel B presents the results of the linear probability model with country-year fixed effects, estimated for two distinct sub-sample periods, pre-crisis (2005Q1 - 2007Q2) and post-crisis (2007Q3 - 2018Q1).

Over the entire sample period, mortgage-backed securities counted for only 18.63% of the secured debt issuances by Euro area banks, while covered bonds represented 81.37% of the sample issuances. The comparison of the two sub-sample periods suggests also a decline in the relative incentives of banks for the issuance of MBSs: the share of MBSs in secured debt deals by Euro area banks decreased from 22.23% in the pre-crisis period to 16.8% in the post-crisis period.

---

<sup>140</sup> The results obtained for the probit regressions report both the coefficients and the average marginal effect: to get the economic magnitude of the effects, the discussion is focused on the marginal effects.

<sup>141</sup> The results based on the linear probability model with country-year fixed effects are in line with the results from the probit estimation with country and year fixed effects, eventually with some slightly larger magnitude.

**Table 2.1 The Issuance of MBSs vs. Covered Bonds.**

Panel A. Probit Model with Country & Year FEs and Linear Probability Model with Country-Year FEs

| VARIABLES           | Probit Estimation         |                            |                           |                            | Linear Probability Model  |                          |                           |                          |
|---------------------|---------------------------|----------------------------|---------------------------|----------------------------|---------------------------|--------------------------|---------------------------|--------------------------|
|                     | (1)<br>Coeff              | (2)<br>AME                 | (3)<br>Coeff              | (4)<br>AME                 | (5)<br>Coeff              | (6)<br>Coeff             | (7)<br>Coeff              | (8)<br>Coeff             |
| NetLoansDepos_1     | 0.000207**<br>(9.08e-05)  | 0.000024 **<br>(1.07e-05)  |                           |                            | 0.0000275**<br>(1.04e-05) |                          | 0.000075***<br>(1.55e-05) |                          |
| LiquidAssetsRatio_1 |                           |                            | 0.0125***<br>(0.00104)    | 0.00139***<br>(0.000114)   |                           | 0.00144***<br>(0.000109) |                           | 0.00112***<br>(0.000130) |
| RoA_1               | -0.173**<br>(0.0739)      | -0.0204**<br>(0.00872)     | -0.227***<br>(0.0761)     | -0.0254***<br>(0.00847)    | -0.0351***<br>(0.00840)   | -0.0387***<br>(0.00825)  | -0.0212***<br>(0.00801)   | -0.0238***<br>(0.00798)  |
| NetIntIncTotRev_1   | 0.000548<br>(0.000532)    | 6.47e-05<br>(6.28e-05)     | 0.000579<br>(0.000559)    | 6.45e-05<br>(6.23e-05)     | 2.16e-05<br>(5.00e-05)    | 4.99e-05<br>(4.90e-05)   | 5.47e-05<br>(4.59e-05)    | 2.36e-05<br>(4.59e-05)   |
| NPLTotalLoans_1     | -0.0298**<br>(0.0148)     | -0.00352**<br>(0.00174)    | -0.0321**<br>(0.0152)     | -0.00357**<br>(0.00169)    | -0.00762***<br>(0.00167)  | -0.00754***<br>(0.00163) | 0.00171<br>(0.00252)      | 0.00206<br>(0.00251)     |
| LevCommEquity_1     | 0.108***<br>(0.0279)      | 0.0127***<br>(0.00328)     | 0.148***<br>(0.0292)      | 0.0165***<br>(0.00323)     | 0.0124***<br>(0.00331)    | 0.0164***<br>(0.00326)   | 0.00877<br>(0.00568)      | 0.0126**<br>(0.00565)    |
| GDPGrowthRate_1     | 0.0276*<br>(0.0143)       | 0.00326*<br>(0.00169)      | 0.0287**<br>(0.0145)      | 0.00320**<br>(0.00162)     |                           |                          |                           |                          |
| LongTermIntRate_1   | -0.00288***<br>(0.000566) | -0.000340***<br>(6.60e-05) | -0.00273***<br>(0.000573) | -0.000305***<br>(6.31e-05) |                           |                          |                           |                          |
| ShortTermIntRate_1  | 0.00221***<br>(0.000578)  | 0.000260***<br>(6.80e-05)  | 0.00200***<br>(0.000576)  | 0.000223***<br>(6.40e-05)  |                           |                          |                           |                          |
| Observations        | 5,847                     | 5,847                      | 5,843                     | 5,843                      | 6,209                     | 6,205                    | 6,209                     | 6,205                    |
| R-squared           |                           |                            |                           |                            | 0.622                     | 0.632                    | 0.740                     | 0.742                    |
| RiskCountry FE      | YES                       | YES                        | YES                       | YES                        | NO                        | NO                       | NO                        | NO                       |
| Year FE             | YES                       | YES                        | YES                       | YES                        | NO                        | NO                       | NO                        | NO                       |
| RiskCountry*Year FE | NO                        | NO                         | NO                        | NO                         | YES                       | YES                      | YES                       | YES                      |
| Bank FE             | NO                        | NO                         | NO                        | NO                         | NO                        | NO                       | YES                       | YES                      |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



Panel B. Linear Probability Model with Country-Year and Bank FEs for the Pre-Crisis and the Post-Crisis Periods

| VARIABLES           | 2005Q1-2007Q2            |                           |                          |                          | 2007Q3-2018Q1            |                          |                           |                           |
|---------------------|--------------------------|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|
|                     | (1)<br>Coeff             | (2)<br>Coeff              | (3)<br>Coeff             | (4)<br>Coeff             | (5)<br>Coeff             | (6)<br>Coeff             | (7)<br>Coeff              | (8)<br>Coeff              |
| NetLoansDepos_1     | 0.000051*<br>(2.74e-05)  | 0.000089***<br>(2.72e-05) |                          |                          | -0.0000083<br>(1.11e-05) | -0.000011<br>(1.27e-05)  |                           |                           |
| LiquidAssetsRatio_1 |                          |                           | 0.00329***<br>(0.000256) | 0.00301***<br>(0.000258) |                          |                          | 0.000612***<br>(0.000116) | 0.000599***<br>(0.000121) |
| RoA_1               | -0.168***<br>(0.0344)    | -0.196***<br>(0.0326)     | -0.169***<br>(0.0315)    | -0.186***<br>(0.0300)    | -0.0235***<br>(0.00800)  | -0.0125<br>(0.00786)     | -0.0240***<br>(0.00796)   | -0.0109<br>(0.00780)      |
| NetIntIncTotRev_1   | 0.00131***<br>(0.000363) | 0.00203***<br>(0.000370)  | 0.00168***<br>(0.000299) | 0.00226***<br>(0.000318) | -2.19e-05<br>(4.54e-05)  | -1.81e-06<br>(4.63e-05)  | -2.00e-05<br>(4.52e-05)   | 3.92e-07<br>(4.59e-05)    |
| NPLTotalLoans_1     | -0.0145**<br>(0.00567)   | -0.0186***<br>(0.00552)   | -0.0190***<br>(0.00533)  | -0.0214***<br>(0.00525)  | -0.00814***<br>(0.00162) | -0.00404***<br>(0.00152) | -0.00738***<br>(0.00160)  | -0.00289*<br>(0.00149)    |
| LevCommEquity_1     | -0.0266**<br>(0.0111)    |                           | -0.00796<br>(0.0105)     |                          | 0.0196***<br>(0.00323)   |                          | 0.0215***<br>(0.00321)    |                           |
| RWATotCapRatio_1    |                          | 0.0871***<br>(0.0103)     |                          | 0.0542***<br>(0.0101)    |                          | -0.000843<br>(0.00138)   |                           | -0.00208<br>(0.00139)     |
| Observations        | 1,241                    | 1,210                     | 1,241                    | 1,210                    | 4,968                    | 4,883                    | 4,964                     | 4,879                     |
| R-squared           | 0.608                    | 0.622                     | 0.655                    | 0.658                    | 0.628                    | 0.628                    | 0.630                     | 0.629                     |
| RiskCountry*Year FE | YES                      | YES                       | YES                      | YES                      | YES                      | YES                      | YES                       | YES                       |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Given the unbalanced composition of bank secured debt with respect to the two types of instruments, the specification is intended to capture the variations in the relative probability to issue MBSs versus covered bonds, as explained by bank-level and country-level characteristics. The empirical analysis highlights the relevant role of some bank balance sheet drivers in affecting this relative probability. In particular, banks with ex-ante larger maturity mismatch between loans and deposits or lower profitability displayed higher relative probability to issue securitisation. These two results observed for the entire sample period are robust also to the inclusion of both country-year fixed effects and bank fixed effects (Panel A, Col.7-8).

The loans deposits ratio indicates to what extent bank loans are financed through deposits: when deposits are not sufficient to finance credit provision, banks may use wholesale funding sources, like unsecured or secured interbank financing, which however have relatively shorter maturities than loans. To minimise this asset-liability maturity mismatch, banks with higher loans-to-deposits ratios – since they have to finance a larger fraction of loans with non-deposit sources - may be more interested in getting funding through the issuance of securitisation products. In fact, mortgage-backed securities present longer maturities which can be closely matched with the maturities of the underlying loans<sup>142</sup>, and this may be important for the financing of long-term assets like mortgages. Therefore, conditional on the extent of this maturity mismatch, MBSs could potentially be preferred to covered bonds, which are in fact based on revolving pools.<sup>143</sup>

The empirical results show that a 1-unit increase in the loans deposits ratio<sup>144</sup> was associated with an increase in the relative probability to issue MBS between 0.24 p.p. (Panel A, Col. 2) and 0.75 p.p. (Panel A, Col.7). When considering separately the two sample periods, we observe that this effect was a specific feature of the pre-crisis period (Panel B, Col.1-2), while it was not observed after the crisis (Panel B, Col. 5-6). The significant changes in the funding opportunities available to banks before and after the crisis could explain this difference. Before the crisis, banks with high loans-to-deposits ratios could decide to finance part of their loan portfolio via short-term interbank funding or via securitisation and then they could have

---

<sup>142</sup> In some cases, the securitisation deal includes some call options, which allow the issuer to repay the debt obligations in advance, like a 5-year call option (independently from the amount of loans still outstanding) and a 10% clean-up call (the issuer can repay in advance if the current amount of outstanding loans is below the 10% of the original pool). The 5-year call option is often exercised in few jurisdictions with large and regular market demand for MBSs (e.g. Netherlands), however in those cases the early repayment is mainly functional to a readjustment of the financing conditions like the coupon rate: the issuer calls the existing deal but then issues another deal of similar amount and with slightly different conditions. Since the exercise of this call option is up to the issuer, and then conditional on its assessment of the financing conditions of the existing deal, this actually confirms the suitability and the flexibility of MBS issuances in providing long-term funding to banks.

<sup>143</sup> When the underlying pool is revolving, the issuer can change the underlying assets provided that this doesn't affect the credit quality of the pool. For this reason, covered bonds do not require a close maturity matching between loans and securities.

<sup>144</sup> In the sample, the loans deposits ratio has a mean equal to 3.05, with a standard deviation equal to 3.80

incentive to issue MBSs to better align the maturities of assets and liabilities. But since the crisis, central bank liquidity has largely substituted interbank funding and, most importantly, has been available not only for short-term operations but also for relatively longer maturities and at very favourable conditions<sup>145</sup>. In this context, banks had then less incentive to choose MBS issuance as a funding instrument, unless for retention purposes as discussed in the following sections.

Bank profitability could also be an important driver for the issuance of securitisation. Banks may be interested in securitising, if this allows them to improve their economic performance via various potential channels: on the asset side, through a reallocation of credit provision towards more profitable uses, i.e. borrowers with better investment opportunities; on the liabilities side, via a reduction in bank funding costs or via a decrease in the minimum required capital thanks to the capital relief<sup>146</sup>. The results show that a 10-basis point decrease in the RoA<sup>147</sup> was related to an increase in the MBS issuance probability between 0.2% (Panel A, Col. 2) and 0.39% (Panel B, Col. 6)<sup>148</sup>. This result is confirmed across both sub-sample periods, however it is more pronounced in the pre-crisis period.

Another potential driver for securitisation could be related to risk transfer incentives. However, this may depend on the credit quality of the securitised loans: while originators may be interested in transferring the underlying assets, investors may be less willing to purchase MBSs originated by banks with riskier loan portfolios. Indeed, the results suggest that a higher credit quality of the bank loan portfolio was required for the issuance of MBSs. A 1-percent increase in the NPL ratio was related to a decrease in the relative probability to issue MBSs versus covered bonds, included in a range between 0.35% (Panel A, Col. 2-4) and 0.75% (Panel A, Col. 6). A higher NPL ratio of the originator bank could indeed raise concerns among potential MBS investors, given that they would have to rely only on the cash flows of the underlying loans; therefore, for banks with high NPL ratios, the issuance of covered bonds could have been considered as a preferable solution because of the better repayment opportunities offered by the dual recourse. This result is observed in both sub-sample periods, with some larger magnitude in the pre-crisis period.

Significant differences across the two sample periods can be observed with regard to the effects of bank capital position, particularly with regard to the common equity leverage ratio. This variable defines the actual solvency of a bank, i.e. how much capital a bank has with

---

<sup>145</sup> For the Eurosystem, we can think about the 3-year Long-Term Refinancing Operations (LTROs) or the 4-year Targeted Long-Term Refinancing Operations (TLTROs).

<sup>146</sup> See Affinito and Tagliaferri (2010), Farruggio and Uhde (2015), Boesel et al. (2018) for a discussion on the potential profitability motives for securitisation

<sup>147</sup> In the sample, the RoA has a mean equal to 0.19, with a standard deviation equal to 0.43

<sup>148</sup> When interpreting the economic magnitude of the results from this specification, we have to consider that the relative probability to issue MBSs in the sample period was slightly above 18% out of all bank secured debt issuances. Therefore, the marginal variation in issuance probability associated with specific balance sheet drivers have to be interpreted in relation to this sample average probability.

respect to its total assets. In the pre-crisis period, banks with lower common equity leverage ratios showed a higher relative probability to sponsor the issuance of MBSs: therefore, less capitalised banks seemed to have relatively more incentive to originate securitisation deals. On the contrary, in the crisis period, the common equity leverage ratio was positively associated with the relative probability of MBS issuance. This means that less capitalised banks had lower relative probability to issue MBSs, possibly because it was more difficult for weakly capitalised banks to place MBSs among market investors. In fact, in absence of granular loan-level data on the composition of the underlying assets, and given the informational asymmetries between originators and investors, lower bank capitalisation could be still perceived by market investors as a potential predictor for the risk-taking of originator banks in their credit provision.

## **2.5.2 The Retention of MBSs and Covered Bonds by Eligibility Status**

### **2.5.2.1 Empirical Strategy and Specification**

Significant differences between MBSs and covered bonds can be observed not only in the issuance process, but also in the following placement decisions. If we look at the sample of covered bonds and MBSs considered for the above analysis, we observe relevant differences in the choice whether to distribute these securities among investors or to retain them on the balance sheet of the parent bank. Over the entire sample period, only 2.85% of the covered bonds were retained by the issuer banks, while 97.15% of these securities were placed with investors. On the other hand, over the same sample period, 43.87% of the MBSs were retained by the originator banks; while 56.13% of these securities were distributed (the retention rate could be significantly higher during the crisis period).

The different propensity to distribute or to retain could be due to structural characteristics of the two types of securities, but also to the balance sheet characteristics of the parent banks issuing covered bonds or sponsoring MBSs and to macroeconomic and financial conditions. In this section, I investigate – on a comparative basis for MBSs and covered bonds – the relative determinants for the distribution or the retention at the security-level, also by distinguishing the instruments in relation to their eligibility for the Eurosystem collateral framework after the issuance<sup>149</sup>. This analysis, by comparing the retention behaviour of covered

---

<sup>149</sup> The eligibility for the Eurosystem collateral framework is granted by the national central bank (NCB) of the country of issuance following an application submitted by the issuer and an assessment of the eligibility. Depending on the timeliness of the issuer's initiative, and given the assessment process conducted by the NCB, an instrument fulfilling the criteria may be included in the list of eligible assets potentially few weeks after the issuance. For this reason I define the eligibility status of the security with respect to the quarter following the issuance. In any case, although the ECB cannot provide pre-issuance advice, the eligibility criteria are published in the General Documentation and then well available to the public. Therefore, issuers - especially if involved in previous issuances or if supported by experienced arrangers – should be able to foresee in advance whether the security may be eligible for the Eurosystem collateral framework already in the issuance process, or even develop the security design in a way to target the collateral eligibility.

bonds and MBSs, highlights some relevant facts which will be useful to introduce the study on the determinants of ABS retention in Section 2.6.

Conditional on the issuance of the instrument (MBS or covered bond depending on the specification), I estimate the probability that the parent bank (the MBS originator or the covered bond issuer) decides to distribute or to retain the security. The analysis is focused on the placement decision taken by the parent bank at the security-level at the time of the issuance. This decision is modelled in a binary regression framework as a function of bank balance sheet characteristics and of country-level macroeconomic and financial conditions. I consider also the introduction of the Eurosystem fixed-rate full allotment policy, to explore the potential implications on the retention incentives of different instruments, also in relation to their collateral eligibility. The specification is defined as follows:

$$(2) \quad P(\text{Retention}_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

$$\begin{aligned} \text{where } (\mathbf{x}'\boldsymbol{\beta}) = & \alpha + \beta \text{ BankBalanceSheet}_{j,t-1} + \gamma \text{ Full Allotment}_t \\ & + \Delta \text{ RiskCountryControls}_{k,t-1} + Z \text{ OriginatorCountryControls}_{l,t-1} \\ & + \varepsilon_{ijt} \end{aligned}$$

where  $i$  indicates the issued ABS tranche or covered bond,  $j$  defines the parent bank (of the MBS originator or of the covered bond issuer),  $k$  denotes the country of the underlying assets,  $l$  characterises the nationality of the parent bank and  $t$  refers to the time of the issuance. The dependent variable is equal to 1 if the tranche is reported to be retained at the time of the issuance or is equal to 0 if the tranche is distributed among investors. The Full Allotment dummy is equal to 1 if the full allotment for the Eurosystem refinancing operations was in place in the issuance quarter of the security, and is equal to 0 vice versa.

### 2.5.2.2 Empirical Results

Table 2.2 presents the results of the analysis, with regard to eligible and non-eligible MBSs (Panel A, respectively col. 1-4 and 5-8) and to eligible and non-eligible covered bonds (Panel B, respectively col. 1-4 and 5-8).

A key balance sheet driver of security retention could be the funding liquidity position of a bank, as measured by the liquid assets ratio. In fact, the retention of newly issued securities could be a possible way to increase the availability of liquid assets. Therefore, banks with smaller buffers of liquid assets were more likely to retain newly issued debt securities, and this was the case for all types of MBSs as well as for eligible covered bonds<sup>150</sup>.

Other balance sheet incentives for security retention could have worked differently depending on whether the issued securities were eligible for the collateral framework. We can

---

<sup>150</sup> Note that covered bonds not eligible for the collateral framework represent only a small minority of the covered bonds included in the sample (around 17%).

**Table 2.2 The Determinants of the Retention of MBSs and Covered Bonds**

Panel A. Eligible and Non-Eligible Mortgage-Backed Securities

| VARIABLES                         | Eligible MBS             |                           |                         |                           | Non-Eligible MBS        |                          |                         |                           |
|-----------------------------------|--------------------------|---------------------------|-------------------------|---------------------------|-------------------------|--------------------------|-------------------------|---------------------------|
|                                   | (1)<br>Coeff             | (2)<br>AME                | (3)<br>Coeff            | (4)<br>AME                | (5)<br>Coeff            | (6)<br>AME               | (7)<br>Coeff            | (8)<br>AME                |
| RoA_1                             | 0.334<br>(0.240)         | 0.0683<br>(0.0488)        | 0.378<br>(0.247)        | 0.0739<br>(0.0478)        | 0.0175<br>(0.166)       | 0.00354<br>(0.0336)      | -0.00178<br>(0.168)     | -0.000356<br>(0.0336)     |
| NetIntIncTotRev_1                 | 0.00281<br>(0.00270)     | 0.000574<br>(0.000551)    | 0.00366<br>(0.00278)    | 0.000715<br>(0.000540)    | 0.000857<br>(0.00209)   | 0.000173<br>(0.000423)   | 0.00108<br>(0.00209)    | 0.000216<br>(0.000419)    |
| NPLTotalLoans_1                   | 0.0729*<br>(0.0388)      | 0.0149*<br>(0.00782)      | 0.0830**<br>(0.0401)    | 0.0162**<br>(0.00765)     | -0.0774***<br>(0.0288)  | -0.0157***<br>(0.00570)  | -0.0881***<br>(0.0300)  | -0.0177***<br>(0.00585)   |
| LevCommEquity_1                   | -0.175**<br>(0.0695)     | -0.0359***<br>(0.0139)    | -0.215***<br>(0.0724)   | -0.0420***<br>(0.0135)    | 0.181***<br>(0.0500)    | 0.0367***<br>(0.00983)   | 0.186***<br>(0.0503)    | 0.0373***<br>(0.00976)    |
| LiquidAssetsRatio_1               | -0.00805***<br>(0.00295) | -0.00165***<br>(0.000581) | 0.000197<br>(0.00366)   | -0.00199***<br>(0.000552) | -0.00344*<br>(0.00180)  | -0.000696*<br>(0.000360) | -0.00179<br>(0.00204)   | -0.000804**<br>(0.000351) |
| FullAllot                         | 2.524***<br>(0.455)      | 0.516***<br>(0.0853)      | 3.227***<br>(0.531)     | 0.469***<br>(0.0498)      | 4.123***<br>(0.346)     | 0.834***<br>(0.0494)     | 4.419***<br>(0.400)     | 0.726***<br>(0.0176)      |
| FullAllot*<br>LiquidAssetsRatio_1 |                          |                           | -0.0188***<br>(0.00596) |                           |                         |                          | -0.00615<br>(0.00384)   |                           |
| GDPGrowthRate_1                   | -0.210***<br>(0.0518)    | -0.0430***<br>(0.00988)   | -0.240***<br>(0.0552)   | -0.0469***<br>(0.00993)   | -0.0455*<br>(0.0255)    | -0.00920*<br>(0.00514)   | -0.0492*<br>(0.0260)    | -0.00987*<br>(0.00519)    |
| LongTermIntRate_1                 | 0.00173<br>(0.00140)     | 0.000353<br>(0.000284)    | 0.00138<br>(0.00145)    | 0.000269<br>(0.000282)    | 0.00143<br>(0.00120)    | 0.000290<br>(0.000242)   | 0.00146<br>(0.00122)    | 0.000293<br>(0.000244)    |
| ShortTermIntRate_1                | 0.00791***<br>(0.00150)  | 0.00162***<br>(0.000285)  | 0.00874***<br>(0.00157) | 0.00171***<br>(0.000280)  | 0.00803***<br>(0.00123) | 0.00163***<br>(0.000238) | 0.00817***<br>(0.00125) | 0.00164***<br>(0.000236)  |
| Observations                      | 383                      | 383                       | 383                     | 383                       | 693                     | 693                      | 693                     | 693                       |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Panel B. Eligible and Non-Eligible Covered Bonds

| VARIABLES                         | Eligible Covered Bonds   |                            |                          |                            | Non-Eligible Covered Bonds |                         |                        |                         |
|-----------------------------------|--------------------------|----------------------------|--------------------------|----------------------------|----------------------------|-------------------------|------------------------|-------------------------|
|                                   | (1)<br>Coeff             | (2)<br>AME                 | (3)<br>Coeff             | (4)<br>AME                 | (5)<br>Coeff               | (6)<br>AME              | (7)<br>Coeff           | (8)<br>AME              |
| RoA_1                             | 0.122<br>(0.0928)        | 0.00693<br>(0.00526)       | 0.121<br>(0.0927)        | 0.00687<br>(0.00526)       | 0.0344<br>(0.436)          | 0.000718<br>(0.00909)   | 0.0277<br>(0.428)      | 0.000567<br>(0.00878)   |
| NetIntIncTotRev_1                 | -0.00132*<br>(0.000717)  | -7.48e-05*<br>(4.07e-05)   | -0.00128*<br>(0.000719)  | -7.27e-05*<br>(4.08e-05)   | -0.00514*<br>(0.00275)     | -0.000107<br>(6.55e-05) | -0.00512*<br>(0.00276) | -0.000105<br>(6.43e-05) |
| NPLTotalLoans_1                   | 0.0347**<br>(0.0145)     | 0.00197**<br>(0.000821)    | 0.0356**<br>(0.0145)     | 0.00202**<br>(0.000821)    | -0.0271<br>(0.0919)        | -0.000565<br>(0.00193)  | -0.0336<br>(0.0938)    | -0.000689<br>(0.00194)  |
| LevCommEquity_1                   | 0.121***<br>(0.0374)     | 0.00688***<br>(0.00213)    | 0.124***<br>(0.0375)     | 0.00705***<br>(0.00213)    | -0.0180<br>(0.190)         | -0.000375<br>(0.00396)  | -0.00303<br>(0.195)    | -6.21e-05<br>(0.00399)  |
| LiquidAssetsRatio_1               | -0.0163***<br>(0.00309)  | -0.000927***<br>(0.000179) | -0.0330**<br>(0.0156)    | -0.000913***<br>(0.000181) | -0.00501<br>(0.00761)      | -0.000105<br>(0.000161) | -0.0251<br>(0.0233)    | -7.96e-05<br>(0.000181) |
| FullAllot                         | 1.230***<br>(0.217)      | 0.0697***<br>(0.0126)      | 0.969***<br>(0.291)      | 0.0479***<br>(0.00633)     | 0.737<br>(0.660)           | 0.0154<br>(0.0147)      | -0.203<br>(0.988)      | 0.0109<br>(0.0173)      |
| FullAllot*<br>LiquidAssetsRatio_1 |                          |                            | 0.0178<br>(0.0160)       |                            |                            |                         | 0.0260<br>(0.0249)     |                         |
| GDPGrowthRate_1                   | 0.0116<br>(0.0157)       | 0.000656<br>(0.000888)     | 0.0115<br>(0.0156)       | 0.000651<br>(0.000886)     | 0.00784<br>(0.0697)        | 0.000163<br>(0.00145)   | -0.00211<br>(0.0693)   | -4.32e-05<br>(0.00142)  |
| LongTermIntRate_1                 | 0.00360***<br>(0.000330) | 0.000204***<br>(1.93e-05)  | 0.00360***<br>(0.000330) | 0.000204***<br>(1.92e-05)  | 0.00589**<br>(0.00282)     | 0.000123*<br>(6.95e-05) | 0.00619**<br>(0.00282) | 0.000127*<br>(6.90e-05) |
| ShortTermIntRate_1                | 0.000637<br>(0.000425)   | 3.61e-05<br>(2.42e-05)     | 0.000627<br>(0.000426)   | 3.55e-05<br>(2.43e-05)     | -0.00216<br>(0.00234)      | -4.49e-05<br>(5.04e-05) | -0.00300<br>(0.00257)  | -6.14e-05<br>(5.56e-05) |
| Observations                      | 4,443                    | 4,443                      | 4,443                    | 4,443                      | 630                        | 630                     | 630                    | 630                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

observe that in particular for the NPL ratio. The results in Panel A display that banks with higher NPL ratios increased the retention of eligible MBSs (col. 2 and 4), while decreased the retention of non-eligible MBSs. In fact, the difference in the eligibility status of MBSs may already reflect differences in the underlying credit risk of the securities, as explained by the characteristics of the securitised loans<sup>151</sup>. But, in addition to that, the eligibility may shape significantly the retention decision of the originator bank. Particularly for an originator with large NPL stocks, the choice whether to distribute or to retain could be modelled as the outcome of the relative balance between two different incentives: from the supply side, the potential interest in transferring the underlying assets for capital relief, also in consideration of the regulatory burden of NPLs; from the demand side, the difficulties in placing the MBSs originated by a bank with a risky loan portfolio. In the end, if the security is eligible, the bank may have still interest in retaining as it can pledge it as collateral; otherwise, the bank would probably prefer to distribute. This would explain the difference in the results for the NPL ratio. Similar incentives can be observed with respect to eligible covered bonds (col. 2 and 4 of Panel B).

During the period of the full allotment policy, parent banks generally increased the retention of MBSs as well as of eligible covered bonds. As discussed in more detail in Section 2.6, this retention increase in the MBS market could be the result of both supply factors - the incentive to increase the amount of available collateral assets, particularly for eligible securities - and of demand factors – the reduction in investor demand, even more relevant for non-eligible securities<sup>152</sup>. Provided that this retention behaviour was relatively widespread, it is however important to highlight that the intensity of these retention incentives – in the period of the full allotment policy – was significantly driven by the existing funding liquidity conditions of banks, particularly for eligible MBSs.

The plots presented in Figure 2.4 display the patterns of the marginal variation in the retention rate following the introduction of the full allotment policy, depending on the liquid assets ratios of the parent banks. First, we observe the significant difference in the retention rates between MBSs (up to 60% or 70%) and covered bonds (at most up to 10%). Only in the case of eligible MBSs, the marginal variation is a decreasing function of the liquid assets ratio: banks with lower buffers of liquid assets increased relatively more their retention of eligible

---

<sup>151</sup> Loan-level data for the securitised pools, as available only from 2014, could be useful in this case to control for the risk properties of the underlying assets, in order to be able to capture specifically the effect of collateral eligibility independently from other confounding factors.

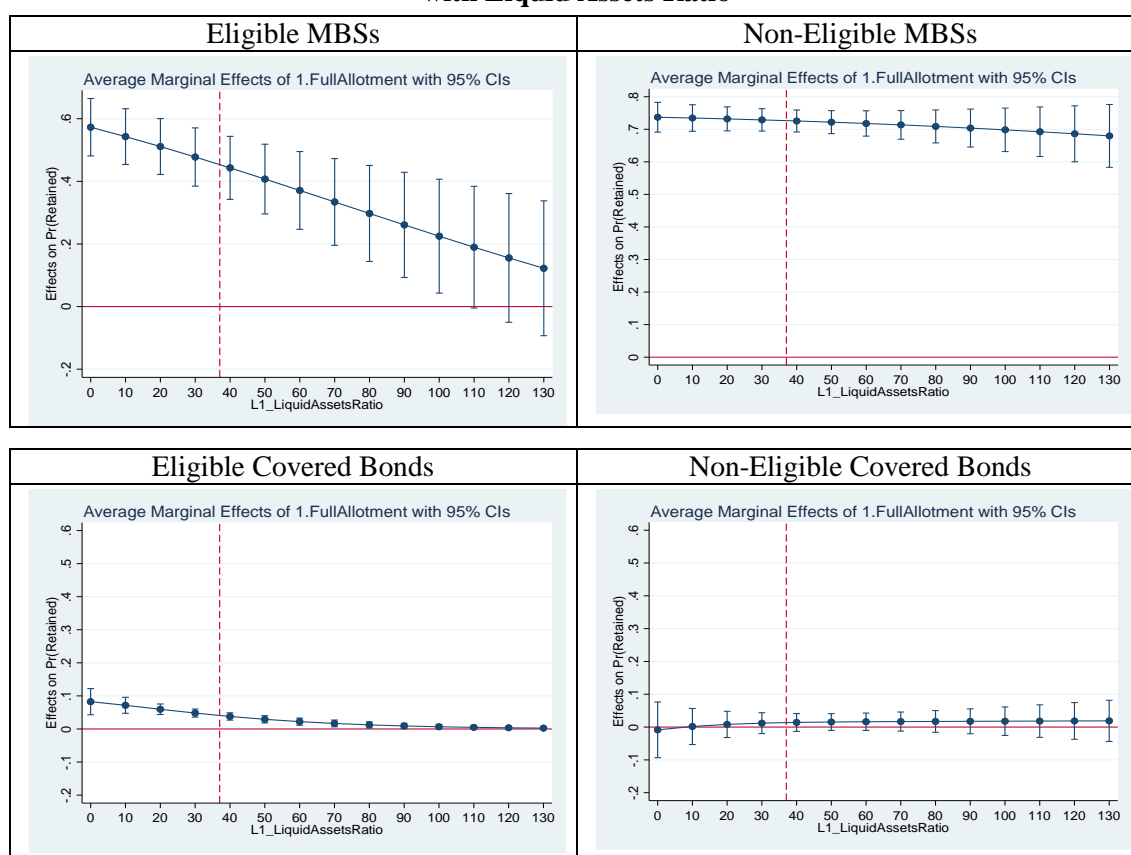
<sup>152</sup> Provided that non-eligible securities could be classified as such for their higher credit risk and that credit institutions would not be able to use them as collateral for refinancing operations, it is not surprising that during the crisis period the retention rate increased even more for non-eligible securities due to the lack of interest from the investors' side. In this case, the use of securities holdings data – unfortunately not available until 2014 – could help in disentangling potential differences in investor demand across sectors, i.e. credit institutions (acting as monetary policy counterparties) and other financial corporations, i.e. asset management companies, insurance companies and pension funds (not eligible as monetary policy counterparties).



MBSs. On the contrary, the retention rate for non-eligible MBSs (quite high due to lack of demand) is however invariant with respect to the liquidity position of the originator bank<sup>153</sup>. Moreover, the retention of eligible covered bonds under the full allotment regime doesn't seem to be dependent on the funding liquidity position of the parent bank<sup>154</sup>.

These findings highlight the existence of interesting peculiarities for the retention behaviour of originator banks in securitisation and provide the motivation for the analysis conducted in the following section.

**Figure 2.4 Retention of MBSs and Covered Bonds. Interaction of Full Allotment Policy with Liquid Assets Ratio**



<sup>153</sup> The interaction term between the full allotment dummy and the liquid assets ratios is indeed largely significant for eligible MBSs (col. 3, Panel A), while it is not significant for non-eligible MBSs.

<sup>154</sup> These results about the role of liquidity in the retention behaviour under full allotment are confirmed also when I estimate equation (2) with country fixed effects for the nationality of the underlying assets or for the nationality of the originator parent. For further discussions on the role of country-level drivers in some bank balance sheet conditions and then in the retention decisions of originator banks, see the analysis presented in Section 2.6.2.

## 2.6 Empirical Analysis: the Retention of Asset-Backed Securities by Originator Banks

The second part of the study focuses on the Euro area securitisation market and investigates the determinants for the retention decisions of originator banks at the tranche level. This analysis takes also into account the country-level drivers which may explain the heterogeneity in the balance sheet conditions of originator banks in different countries or the differences in the economic conditions of borrowers in distinct countries. Moreover, I explore how some decisions of the Eurosystem for monetary policy implementation may have affected the incentives of banks for risk retention: the introduction of the fixed-rate full allotment policy (October 2008); the extension of the collateral framework for additional credit claims (February 2012).

### 2.6.1 Baseline Probit Estimation

#### 2.6.1.1 Empirical Specification

The retention of the newly issued securitisation tranches by the originator bank has been a key feature of the Euro area ABS market following the global financial crisis, not only for mortgage-backed securities, but for all types of asset-backed securities. The analysis presented in this section investigates – at the tranche-level - the determinants of the retention decisions by originator banks, with regard to the balance sheet characteristics of originators, and with regard to the monetary policy decisions affecting the incentives for ABS retention.

Conditional on the issuance of an asset-backed security, the empirical study is aimed at estimating the probability that the originator bank decides to distribute or to retain the individual tranches at the time of the issuance. Along the specification used in equation (2), this decision is modelled in a binary regression framework as a function of bank balance sheet characteristics and of monetary policy implementation measures. The baseline specification to analyse ABS retention is defined as follows:

$$(3) \quad P(\text{Retention}_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

$$\begin{aligned} \text{where } (\mathbf{x}'\boldsymbol{\beta}) = & \alpha + \text{B BankBalanceSheet}_{j,t-1} + \gamma \text{ Full Allotment}_t \\ & + \Delta \text{ RiskCountryControls}_{k,t-1} + \text{Z OriginatorCountryControls}_{l,t-1} \\ & + \varepsilon_{ijt} \end{aligned}$$

where  $i$  indicates the issued ABS tranche,  $j$  defines the parent originator and  $t$  refers to the time of the issuance. The dependent variable is equal to 1 if the tranche is reported to be retained at the time of the issuance or is equal to 0 if the tranche is distributed among investors.

**Table 2.3 ABS Retention. Probit Baseline Specification**

| VARIABLES           | All ABSs                  |                            |                           |                            |                          |                           |                           |                            | Eligible ABSs            |                          | Non-Eligible ABSs         |                            |
|---------------------|---------------------------|----------------------------|---------------------------|----------------------------|--------------------------|---------------------------|---------------------------|----------------------------|--------------------------|--------------------------|---------------------------|----------------------------|
|                     | (1)<br>Coeff              | (2)<br>AME                 | (3)<br>Coeff              | (4)<br>AME                 | (5)<br>Coeff             | (6)<br>AME                | (7)<br>Coeff              | (8)<br>AME                 | (9)<br>Coeff             | (10)<br>AME              | (11)<br>Coeff             | (12)<br>AME                |
| RoA_1               | -0.263***<br>(0.0600)     | -0.0709***<br>(0.0159)     | -0.127*<br>(0.0715)       | -0.0339*<br>(0.0191)       | -0.306***<br>(0.0629)    | -0.0741***<br>(0.0150)    | -0.0918<br>(0.0772)       | -0.0218<br>(0.0183)        | 0.121<br>(0.136)         | 0.0281<br>(0.0315)       | -0.257***<br>(0.0888)     | -0.0697***<br>(0.0239)     |
| NPLTotalLoans_1     | -0.0339***<br>(0.0120)    | -0.00914***<br>(0.00322)   | -0.0212*<br>(0.0126)      | -0.00567*<br>(0.00337)     | -0.0586***<br>(0.0144)   | -0.0142***<br>(0.00345)   | -0.0358**<br>(0.0151)     | -0.00850**<br>(0.00358)    | 0.0125<br>(0.0218)       | 0.00292<br>(0.00507)     | -0.0470***<br>(0.0162)    | -0.0127***<br>(0.00434)    |
| RWATotCapRatio_1    | 0.0709***<br>(0.0165)     | 0.0191***<br>(0.00437)     |                           |                            | 0.0422**<br>(0.0177)     | 0.0102**<br>(0.00428)     |                           |                            |                          |                          |                           |                            |
| LiquidAssetsRatio_1 | -0.00213***<br>(0.000765) | -0.000574***<br>(0.000205) | -0.00239***<br>(0.000772) | -0.000637***<br>(0.000204) | -0.00178**<br>(0.000830) | -0.000432**<br>(0.000200) | -0.00219***<br>(0.000837) | -0.000521***<br>(0.000198) | -0.00284*<br>(0.00147)   | -0.000661*<br>(0.000338) | -0.00278***<br>(0.000931) | -0.000753***<br>(0.000249) |
| NetIntIncTotRev_1   | -0.000502<br>(0.00110)    | -0.000135<br>(0.000295)    | 0.000900<br>(0.00108)     | 0.000240<br>(0.000289)     | -0.00129<br>(0.00122)    | -0.000312<br>(0.000294)   | -0.000174<br>(0.00121)    | -4.14e-05<br>(0.000286)    | 0.00290<br>(0.00205)     | 0.000675<br>(0.000475)   | 0.000497<br>(0.00133)     | 0.000135<br>(0.000361)     |
| LevCommEquity_1     |                           |                            | -0.0805***<br>(0.0197)    | -0.0215***<br>(0.00520)    |                          |                           | -0.112***<br>(0.0220)     | -0.0265***<br>(0.00515)    | -0.109***<br>(0.0347)    | -0.0253***<br>(0.00794)  | -0.0833***<br>(0.0251)    | -0.0226***<br>(0.00670)    |
| FullAllot           | 1.939***<br>(0.150)       | 0.522***<br>(0.0365)       | 2.197***<br>(0.149)       | 0.587***<br>(0.0348)       | -0.210<br>(0.214)        | -0.0510<br>(0.0518)       | -0.180<br>(0.215)         | -0.0427<br>(0.0511)        | 1.825***<br>(0.269)      | 0.424***<br>(0.0594)     | 2.512***<br>(0.190)       | 0.681***<br>(0.0427)       |
| GDPGrowthRate_1     | -0.0990***<br>(0.0178)    | -0.0267***<br>(0.00469)    | -0.0825***<br>(0.0174)    | -0.0220***<br>(0.00457)    | -0.0347<br>(0.0246)      | -0.00842<br>(0.00596)     | -0.0309<br>(0.0243)       | -0.00734<br>(0.00578)      | -0.166***<br>(0.0331)    | -0.0386***<br>(0.00722)  | -0.0512**<br>(0.0211)     | -0.0139**<br>(0.00569)     |
| LongTermIntRate_1   | 0.00219***<br>(0.000425)  | 0.000590***<br>(0.000111)  | 0.00178***<br>(0.000421)  | 0.000476***<br>(0.000110)  | 0.00324***<br>(0.000566) | 0.000786***<br>(0.000133) | 0.00315***<br>(0.000573)  | 0.000747***<br>(0.000133)  | 0.00160**<br>(0.000790)  | 0.000373**<br>(0.000182) | 0.00195***<br>(0.000525)  | 0.000528***<br>(0.000139)  |
| ShortTermIntRate_1  | 0.00550***<br>(0.000459)  | 0.00148***<br>(0.000115)   | 0.00534***<br>(0.000452)  | 0.00143***<br>(0.000114)   | 0.00676***<br>(0.00115)  | 0.00164***<br>(0.000278)  | 0.00709***<br>(0.00116)   | 0.00168***<br>(0.000273)   | 0.00629***<br>(0.000818) | 0.00146***<br>(0.000177) | 0.00499***<br>(0.000559)  | 0.00135***<br>(0.000144)   |
| Observations        | 1,916                     | 1,916                      | 1,986                     | 1,986                      | 1,819                    | 1,819                     | 1,875                     | 1,875                      | 707                      | 707                      | 1,279                     | 1,279                      |
| IssuanceYear FE     | NO                        | NO                         | NO                        | NO                         | YES                      | YES                       | YES                       | YES                        | NO                       | NO                       | NO                        | NO                         |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### 2.6.1.2 Empirical Results

Table 2.3 presents the results of the baseline regression for ABS retention. The results in col.2 and 4 show that banks with lower profitability, lower availability of liquid assets and lower leverage ratios were more likely to retain the newly issued tranches of securitisation. This would generally suggest that the retention of ABS was more frequently implemented by banks in weaker balance sheet conditions in terms of leverage, liquidity and profitability. In particular, a 1-unit decrease in the RoA is associated with a 7.09% (col. 2) increase in the probability of tranche retention<sup>155</sup>, as less profitable banks could face higher funding costs in their wholesale market funding. Also, a 100-point decrease in the liquid assets ratio is related to a 5.74% (col. 2) increase in the probability of ABS retention<sup>156</sup>: banks with smaller buffers of liquid assets in relation to their short-term liabilities could be more exposed to potential funding shocks and then they could have more incentives to increase the amount of their liquid assets for potential collateral reasons.

The retention probability could be also a function of the credit quality of the loan portfolio of the originator bank: the results suggest that banks with a higher ratio of non-performing loans were more likely to distribute the tranches among investors. A 1-percentage point increase in the NPL ratio is associated with a 0.91 p.p. reduction in the probability of tranche retention. Banks with higher credit risk seemed to be more interested in distributing securitisation among investors, consistently with a risk transfer argument for securitisation<sup>157</sup>.

The baseline analysis uses – in distinct specifications – two different measures of solvency, the risk-weighted capital ratio and the common equity leverage ratio, to study whether they may capture different incentives potentially relevant for the retention decision by the originator bank.

The leverage ratio defines the actual solvency of a bank, i.e. how much capital a bank has with respect to its total assets, which may be relevant also for the funding costs of a bank, based on market perception. In the specification of col.4, a 1-percentage point decline in the common equity leverage ratio is associated with a 2.15% increase in the probability of securitisation retention<sup>158</sup>. Banks with higher leverage have larger need for external funding and - if perceived as riskier by market investors - may also have to pay higher financing costs, so they may be more interested in using repo operations for refinancing purposes and therefore in

---

<sup>155</sup> In this sample, the RoA presents a mean equal to 0.63 and a standard deviation equal to 0.61

<sup>156</sup> In this sample, the liquid assets ratio presents a mean equal to 40.36 and a standard deviation equal to 54.28

<sup>157</sup> In the present dataset this is studied at the bank-deal level. A possible extension of this study could be conducted, by using loan-level data for individual ABS deals, to investigate whether deals based on a riskier pool of loans present lower probability of securitisation retention, along this argument on credit risk transfer.

<sup>158</sup> In this sample, the common equity leverage ratio presents a mean equal to 6.01% and a standard deviation equal to 2.6%

increasing the amount of available collateral assets. This effect of leverage reflects then the interplay between solvency and liquidity in terms of funding costs.

The risk-weighted capital ratio reflects the features of the regulatory framework for the computation of the risk-weighted assets. In the specification of col.2, a 1-percentage point decrease in the risk-weighted capital ratio is related to a 1.91% reduction in the probability of ABS retention. This can be linked to the regulatory capital implications of ABS retention: while originator banks distributing securitisation transfer the underlying asset pool and then reduce accordingly their risk-weighted assets, banks retaining newly issued ABSs still keep the credit risk on balance sheet and so are subject to capital requirements for these securitisation exposures<sup>159</sup>. Therefore banks with lower risk-weighted capital ratios, for which the minimum capital requirements are more binding, may have less incentive to retain newly issued ABS, due to the regulatory capital implications of risk retention<sup>160</sup>.

In order to understand whether these balance sheet drivers of risk retention may work differently for ABSs depending on their collateral eligibility status, I also estimate the baseline specification separately for the two sub-samples of eligible and non-eligible ABSs. The results shown in col. 9-12 suggest the above observed effects for the funding liquidity position (liquid assets ratio ratio) and for the actual solvency (common equity leverage leverage ratio) hold both for eligible and non-eligible ABSs. However, the effects estimated for bank profitability and for the credit quality of the loan portfolio seem to be relevant only for non-eligible ABSs.

In the period following the introduction of the fixed-rate full allotment policy, banks increased significantly their probability of ABS retention, on average by 50% for the entire sample of ABSs (col. 2 and 4). When classifying the ABSs in relation to their collateral eligibility status, we observe that - in the considered period - banks could have increased the retention of eligible ABSs by around 42% and of non-eligible ABSs by around 68%. This reflects the potential interaction of demand and supply factors in the ABS market.

Given that the full allotment policy was introduced in October 2008, few weeks after Lehman's bankruptcy and in the middle of the subprime crisis, we may suppose that this retention behaviour could have been not necessarily a voluntary decision but could have been sometimes determined by a lack of demand, as in some periods investors were not interested in

---

<sup>159</sup> The capital requirements to be applied in this case may vary depending on whether the securitisation transaction is recognised to imply a "significant risk transfer" as defined in the Capital Requirements Regulation. If so, the bank can be subject to the capital requirements for securitisation positions, which can result in a reduction of the minimum required capital only if a lower risk weight is charged on the securitisation position than on the corresponding underlying assets [see Chapter 1 for an analysis of potential regulatory arbitrage incentives for banks retaining securitisations]. On the other hand, when the transaction does not fulfil the requirements for the "significant risk transfer", originator banks should be subject to the same capital requirements foreseen for the underlying assets.

<sup>160</sup> These two distinct effects of the risk-weighted capital ratio and of the common equity leverage ratio on the retention probability, as capturing different types of incentives, are confirmed also in other specifications augmented with time (year) fixed effects (see col. 6 and 8).

purchasing certain securitisation products due to their high perceived risk. At the same time, we can argue that the retention behaviour was driven by a relevant supply motivation if *individual* banks - even when able to place the issued tranches among investors - decided to retain ABSs potentially to increase the amount of available liquid assets. The analysis presented in section 5.3 identifies this differential effect of the full allotment policy, conditional on the ex-ante balance sheet conditions of individual banks.

The baseline specification includes also some macroeconomic and financial country-level quarterly controls, in order to capture potential changes in financial conditions able to affect the retention of securitisation over time. In particular, the retention probability increases in quarters with lower GDP growth rates (in the country of origination) and in quarters with higher long-term and short-term interest rates (in the country of the originator parent). Long-term interest rates are country-specific, as they are linked to the yields on 10-year sovereign bonds: given the sovereign-bank nexus, higher financing costs for the sovereign may imply also higher funding costs for the banks established in that country. Provided that banks subject to stronger funding constraints may be interested in increasing the amount of available liquid assets, this can result also in a higher probability of ABS retention. On the other hand, short-term interest rates reflect the financing conditions in the Euro area unsecured interbank market: the higher is the Euribor rate in that market, the more attractive is the central bank financing. Under unfavourable interbank market conditions, banks are more interested in retaining ABS as a way to create collateral for central bank liquidity operations.

## **2.6.2 Country Drivers in Bank Funding and Asset Quality Patterns**

The debate on the Banking Union has shown the key role of national factors in driving the patterns in bank funding conditions and asset quality across banks in different countries. This suggests that some features observed at the bank-level may be indeed driven by country-level factors.

### **2.6.2.1 Probit Estimation with Country and Year Fixed Effects**

In the baseline specification of Table 2.3, the analysis already included some country-level time-varying macroeconomic and financial variables. Nonetheless, these controls may not account for some unobserved country-level time-varying characteristics. To deal with that, the analysis presented in this section includes country and year fixed effects, and to the extent possible country-year fixed effects. As noted earlier also for the country-level controls, and given that some cross-border securitisation transactions may involve entities and borrowers from different countries, also the country fixed effects may be alternatively of two different types: as they refer either to the country of origination of the underlying assets or the country of operations of the originator parent. In the first case, the country fixed effects control for the

unobserved heterogeneity – on economic performance and institutional features - across loans originated in different countries, which could result in potential differences across securitisation deals from distinct countries<sup>161</sup>. On the other hand, the fixed effects for the nationality of the originator parent control for the unobserved heterogeneity – on debt market developments or regulatory framework – across banking groups established in different countries, which could also lead to potential differences in the funding strategies for originator parents from distinct countries<sup>162</sup>.

Ideally, it would be useful to have country-year fixed effects in the probit estimation, in alternative to country and year fixed effects. However, as discussed in Section 4.1 for the choice between two types of debt instruments, given the binary choice between distribution and retention in this case, and provided that several country-year clusters would present either all the new ABS distributed or all the new ABS retained, an estimation of the probit (or logit) model would imply that various country-year clusters would be dropped with all the observations. In any case, I can still include country-year fixed effects in the estimation of this baseline specification via a linear probability model.

Table 2.4 presents the results of the probit baseline specification augmented with country and year fixed effects (col. 1-8) and of the linear probability model with country-year fixed effects (col. 9-12). The specifications also consider separately the two measures of bank solvency.

The results in col. 1-4 refer to the probit specification with originator country and year fixed effects, while the results in col. 5-8 are based on the probit estimation with risk nationality and year fixed effects. Given that the country and year fixed effects capture some potential drivers of the risk retention behaviour, the results of this probit specification may be somehow less statistically significant than in the baseline specification.

In general, when significant, the balance sheet variables related to bank profitability (RoA) and to bank solvency (risk-weighted capital ratio and common equity leverage ratio) keep the same sign and similar magnitude as in the baseline specification. Also the country-level macroeconomic and financial controls show similar marginal effects, unless their effect is captured by the country fixed effect (the GDP growth rate in the case of risk nationality fixed effects and the long-term interest rate in presence of originator fixed effects).

However, two bank balance variables appear to be significantly affected by country-level drivers: the ratio of non-performing loans loses is never significant in the specifications

---

<sup>161</sup> For instance, we note that in some countries certain types of residential mortgages can be covered by public guarantees not present in other jurisdictions, or that in some countries loans are more frequently subject to renegotiation or restructuring than in other jurisdictions. These features may have also implications on the nature of the securitisation deals.

<sup>162</sup> As observed in the discussion of the stylised facts for the Euro Area securitisation market, the retention rate for ABS has been higher in the countries more affected by the crisis.

**Table 2.4 ABS Retention. Probit Model with Originator and Risk Country FEs and Linear Probability Model with Country-Year FEs**

| VARIABLES                | Probit Model            |                          |                         |                          | Probit Model            |                          |                         |                          | Linear Probability Model  |                           |                           |                           |
|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
|                          | (1)<br>Coeff            | (2)<br>AME               | (3)<br>Coeff            | (4)<br>AME               | (5)<br>Coeff            | (6)<br>AME               | (7)<br>Coeff            | (8)<br>AME               | (9)<br>Coeff/AME          | (10)<br>Coeff/AME         | (11)<br>Coeff/AME         | (12)<br>Coeff/AME         |
| RoA_1                    | -0.340***<br>(0.0761)   | -0.0752***<br>(0.0166)   | -0.0787<br>(0.0919)     | -0.0172<br>(0.0201)      | -0.128<br>(0.0792)      | -0.0280<br>(0.0173)      | 0.0645<br>(0.0919)      | 0.0139<br>(0.0198)       | -0.0679***<br>(0.0195)    | -0.0433**<br>(0.0197)     | -0.0400**<br>(0.0180)     | -0.00956<br>(0.0185)      |
| NPLTotalLoans_1          | -0.0133<br>(0.0185)     | -0.00294<br>(0.00409)    | 0.0121<br>(0.0188)      | 0.00265<br>(0.00411)     | -0.0137<br>(0.0169)     | -0.00299<br>(0.00369)    | 0.00878<br>(0.0176)     | 0.00189<br>(0.00379)     | 0.00218<br>(0.00502)      | 0.00164<br>(0.00473)      | -0.000928<br>(0.00438)    | 0.00193<br>(0.00427)      |
| RWATotCapRatio_1         | 0.0413*<br>(0.0217)     | 0.00915*<br>(0.00479)    |                         |                          | 0.000754<br>(0.0208)    | 0.000165<br>(0.00454)    |                         |                          | -0.00385<br>(0.00589)     |                           | 0.00233<br>(0.00516)      |                           |
| LiquidAssetsRatio_1      | 0.000957<br>(0.00103)   | 0.000212<br>(0.000227)   | 0.00105<br>(0.00102)    | 0.000229<br>(0.000222)   | 0.00194**<br>(0.000977) | 0.000424**<br>(0.000213) | 0.00145<br>(0.000970)   | 0.000311<br>(0.000208)   | 0.000377*<br>(0.000229)   | 0.000380*<br>(0.000226)   | 0.000708***<br>(0.000219) | 0.000655***<br>(0.000217) |
| NetIntIncTotRev_1        | 0.000941<br>(0.00136)   | 0.000208<br>(0.000301)   | 0.00227*<br>(0.00132)   | 0.000496*<br>(0.000288)  | 1.10e-05<br>(0.00133)   | 2.40e-06<br>(0.000290)   | 0.000452<br>(0.00128)   | 9.72e-05<br>(0.000275)   | 0.000374<br>(0.000270)    | 0.000405<br>(0.000263)    | 0.000138<br>(0.000259)    | 0.000227<br>(0.000252)    |
| LevCommEquity_1          |                         |                          | -0.104***<br>(0.0242)   | -0.0227***<br>(0.00521)  |                         |                          | -0.0902***<br>(0.0233)  | -0.0194***<br>(0.00494)  |                           | -0.0133**<br>(0.00559)    |                           | -0.0147***<br>(0.00501)   |
| FullAllot                | -0.171<br>(0.233)       | -0.0378<br>(0.0517)      | -0.0646<br>(0.237)      | -0.0141<br>(0.0519)      | 0.218<br>(0.244)        | 0.0476<br>(0.0532)       | 0.262<br>(0.245)        | 0.0563<br>(0.0526)       | -0.0649<br>(0.0488)       | -0.0577<br>(0.0488)       | -0.0430<br>(0.0500)       | -0.0377<br>(0.0495)       |
| GDPGrowthRate_1          | -0.0605**<br>(0.0284)   | -0.0134**<br>(0.00628)   | -0.0563**<br>(0.0285)   | -0.0123**<br>(0.00622)   | -0.0437<br>(0.0285)     | -0.00955<br>(0.00623)    | -0.0441<br>(0.0286)     | -0.00949<br>(0.00613)    | -0.0306***<br>(0.00913)   | -0.0313***<br>(0.00907)   | -0.0404***<br>(0.0109)    | -0.0411***<br>(0.0108)    |
| LongTermIntRate_1        | 0.000315<br>(0.000635)  | 6.98e-05<br>(0.000141)   | 0.000289<br>(0.000664)  | 6.31e-05<br>(0.000145)   | 0.00146**<br>(0.000651) | 0.000320**<br>(0.000141) | 0.00162**<br>(0.000663) | 0.000348**<br>(0.000142) | 0.00141***<br>(0.000398)  | 0.00145***<br>(0.000393)  | 0.00116***<br>(0.000246)  | 0.00111***<br>(0.000236)  |
| ShortTermIntRate_1       | 0.00663***<br>(0.00118) | 0.00147***<br>(0.000260) | 0.00686***<br>(0.00118) | 0.00150***<br>(0.000257) | 0.00515***<br>(0.00117) | 0.00113***<br>(0.000256) | 0.00557***<br>(0.00117) | 0.00120***<br>(0.000253) | 0.000917***<br>(0.000205) | 0.000911***<br>(0.000200) | 0.000795***<br>(0.000195) | 0.000840***<br>(0.000189) |
| Observations             | 1,819                   | 1,819                    | 1,875                   | 1,875                    | 1,819                   | 1,819                    | 1,875                   | 1,875                    | 1,916                     | 1,986                     | 1,916                     | 1,986                     |
| RiskCountry FE           | NO                      | NO                       | NO                      | NO                       | YES                     | YES                      | YES                     | YES                      | NO                        | NO                        | NO                        | NO                        |
| OriginatorCountry FE     | YES                     | YES                      | YES                     | YES                      | NO                      | NO                       | NO                      | NO                       | NO                        | NO                        | NO                        | NO                        |
| IssuanceYear FE          | YES                     | YES                      | YES                     | YES                      | YES                     | YES                      | YES                     | YES                      | NO                        | NO                        | NO                        | NO                        |
| RiskCountry*Year FE      | NO                      | NO                       | NO                      | NO                       | NO                      | NO                       | NO                      | NO                       | NO                        | NO                        | YES                       | YES                       |
| OriginatoCountry*Year FE | NO                      | NO                       | NO                      | NO                       | NO                      | NO                       | NO                      | NO                       | YES                       | YES                       | NO                        | NO                        |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



including country fixed effects, while the ratio of liquid assets to short-term liabilities either loses statistical significance or in one case changes sign. Indeed, the crisis experience has shown significant differences across national banking systems in the Euro area in terms of funding liquidity and non-performing loans, so it could be well the case that the heterogeneity across institutions may indeed reflect to a relevant extent differences across countries.

The role of country-level factors is further explored in the linear probability model estimation (col. 9-12). As in the probit model, profitability and leverage keep the same marginal effect, as well as all the macroeconomic and financial controls. On the other hand, the effect is not significant for the NPL ratio, while it changes sign for the liquid assets ratio.

#### **2.6.2.2 Country Drivers for Balance Sheet Conditions and MLE IV Probit Estimation**

The results observed from the inclusion of country and year fixed effects, particularly for the NPL ratio and the liquid assets ratio, could be eventually explained with regard to a potential endogeneity of these balance sheet variables with respect to country-level factors. Indeed, we could argue that the economic performance in the country of origination may affect the repayment ability of borrowers of that nationality and that this could explain the ratio of non-performing loans for the originator banks operating in that country. Although there may be well some differences in the NPL ratio across banks established in the same country, we can then suppose that a relevant component of this balance sheet measure may be captured by country-level factors.

Analogously, we could imagine that the sovereign financing conditions and the general economic conjuncture of a country may affect the funding liquidity conditions of the parent banks operating there and that this could explain to a relevant extent the liquid assets ratios of those banks. Again, this would not exclude differences in the liquid assets ratios across parent banks in the same country, but we can suppose that country-level factors may predict a significant component of this variable.

Based on these arguments, the following part of the analysis deals with the possible endogeneity of the loan portfolio credit quality and of the funding liquidity position, as related to country-level factors. I propose an instrumental variables approach to the probit estimation of the retention probability, where country dummies are used as instruments for the endogenous balance sheet variable in the reduced-form equation, so that the predicted balance sheet variable is then used in the probit estimation of the structural equation.

In the reduced-form equation, the NPL ratio and the liquid assets ratio are instrumented through the country dummies for the nationality of the underlying risk and for the nationality of the originator parent, in addition to all the exogenous variables present in the structural

equation<sup>163</sup>. The IV Probit is estimated via a maximum likelihood estimator, which is more efficient than the corresponding two-step procedure and also provides direct estimates of the parameters of interest for computing the marginal effects.

For each of the two endogenous variables, we can write the two equations as follows:

Structural Equation

$$(4) \quad P(\text{Retention}_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

$$\begin{aligned} \text{where } (\mathbf{x}'\boldsymbol{\beta}) = & \alpha + \eta \text{ EndogenousVariable}_{j,c,t-1} + \text{B BankBalanceSheet}_{j,t-1} \\ & + \gamma \text{ Full Allotment}_t + \Delta \text{ RiskCountryControls}_{k,t-1} \\ & + \text{Z OriginatorCountryControls}_{l,t-1} + \varepsilon_{i,j,t} \end{aligned}$$

Reduced-Form Equation

$$\begin{aligned} (5) \text{ EndogenousVariable}_{j,c,t-1} & \\ & = \vartheta + \delta_c + \text{B BankBalanceSheet}_{j,t-1} + \gamma \text{ Full Allotment}_t \\ & + \Delta \text{ RiskCountryControls}_{k,t-1} + \text{Z OriginatorCountryControls}_{l,t-1} \\ & + u_{i,j,t-1} \end{aligned}$$

where  $\delta_c$  indicates, depending on the specification, the country dummies for the nationality of risk or for the nationality of the originator parent.

The results of the IV Probit estimation are presented in Table 2.5. Given the probit baseline specification<sup>164</sup> in col. 1-2 for comparability purposes, col. 3-6 report the results of the IV probit using the originator parent country dummies as instruments, while col. 7-10 present the corresponding results for the IV probit using the risk nationality dummies as instruments.

From a conceptual point of view, it would be advisable to instrument the NPL ratio with the country dummies for the nationality of the underlying risk, and the liquid assets ratio with the dummies for the nationality of the originator parent. In practice, given that in the vast majority of cases the two nationalities coincide, the results don't change substantially depending on the type of used country dummies.

Provided that the results for the other balance sheet variables and for the macro controls are generally confirmed, we can focus on the two endogenous balance sheet variables – the NPL ratio and the liquid assets ratio – to compare the marginal effects from the estimation of the IV probit with the corresponding results from the probit baseline.

---

<sup>163</sup> Both the balance sheet variables and the country-level macroeconomic and financial controls are time-variant.

<sup>164</sup> From now onwards, the regression specifications presented in the tables focus on the common equity leverage ratio as a measure of bank solvency. As discussed above, this measure reflects more directly the potential nexus between solvency and liquidity which may be relevant for the funding conditions of originator banks, and therefore also for the potential decision to retain ABS.

**Table 2.5 ABS Retention. MLE IV Probit Estimation for Bank Balance Sheet Variables Explained by Country-Level Factors**

| VARIABLES             | Probit Baseline           |                            | MLE IV Probit<br>Instruments: Originator Country Dummies |                           |                           |                            | MLE IV Probit<br>Instruments: Risk Country Dummies |                           |                           |                            |
|-----------------------|---------------------------|----------------------------|--|---------------------------|---------------------------|----------------------------|--|---------------------------|---------------------------|----------------------------|
|                       | (1)<br>Coeff              | (2)<br>AME                 | (3)<br>Coeff   | (4)<br>AME                | (5)<br>Coeff              | (6)<br>AME                 | (7)<br>Coeff                                       | (8)<br>AME                | (9)<br>Coeff              | (10)<br>AME                |
| RoA_1                 | -0.127*<br>(0.0715)       | -0.0339*<br>(0.0191)       | 0.0469<br>(0.0660)                                       | 0.0127<br>(0.0179)        | -0.234***<br>(0.0802)     | -0.0624***<br>(0.0214)     | 0.0827<br>(0.0619)                                 | 0.0227<br>(0.0170)        | -0.315***<br>(0.0814)     | -0.0849***<br>(0.0222)     |
| NPLTotalLoans_1       | -0.0212*<br>(0.0126)      | -0.00567*<br>(0.00337)     | -0.00918<br>(0.0110)                                     | -0.00248<br>(0.00297)     | -0.0745***<br>(0.0226)    | -0.0199***<br>(0.00607)    | -0.00713<br>(0.0104)                               | -0.00196<br>(0.00285)     | -0.116***<br>(0.0248)     | -0.0313***<br>(0.00689)    |
| LevCommEquity_1       | -0.0805***<br>(0.0197)    | -0.0215***<br>(0.00520)    | -0.135***<br>(0.0183)                                    | -0.0364***<br>(0.00483)   | -0.0579***<br>(0.0214)    | -0.0155***<br>(0.00564)    | -0.139***<br>(0.0171)                              | -0.0383***<br>(0.00457)   | -0.0367*<br>(0.0222)      | -0.00990*<br>(0.00592)     |
| NetIntIncTotRev_1     | 0.000900<br>(0.00108)     | 0.000240<br>(0.000289)     | 0.00171*<br>(0.000972)                                   | 0.000463*<br>(0.000262)   | 0.000420<br>(0.00109)     | 0.000112<br>(0.000291)     | 0.00163*<br>(0.000919)                             | 0.000449*<br>(0.000252)   | 9.60e-05<br>(0.00108)     | 2.59e-05<br>(0.000291)     |
| LiquidAssetsRatio_1   | -0.00239***<br>(0.000772) | -0.000637***<br>(0.000204) | -0.0155***<br>(0.00109)                                  | -0.00418***<br>(0.000315) | -0.00225***<br>(0.000767) | -0.000600***<br>(0.000203) | -0.0181***<br>(0.000947)                           | -0.00497***<br>(0.000281) | -0.00215***<br>(0.000758) | -0.000579***<br>(0.000202) |
| FullAllot             | 2.197***<br>(0.149)       | 0.587***<br>(0.0348)       | 1.970***<br>(0.143)                                      | 0.532***<br>(0.0334)      | 2.197***<br>(0.148)       | 0.586***<br>(0.0338)       | 1.828***<br>(0.140)                                | 0.502***<br>(0.0338)      | 2.148***<br>(0.147)       | 0.579***<br>(0.0332)       |
| GDPGrowthRate_1       | -0.0825***<br>(0.0174)    | -0.0220***<br>(0.00457)    | -0.0491***<br>(0.0154)                                   | -0.0133***<br>(0.00411)   | -0.0675***<br>(0.0179)    | -0.0180***<br>(0.00474)    | -0.0351**<br>(0.0142)                              | -0.00965**<br>(0.00387)   | -0.0566***<br>(0.0180)    | -0.0152***<br>(0.00479)    |
| LongTermIntRate_1     | 0.00178***<br>(0.000421)  | 0.000476***<br>(0.000110)  | 0.00120***<br>(0.000379)                                 | 0.000325***<br>(0.000101) | 0.00234***<br>(0.000457)  | 0.000625***<br>(0.000120)  | 0.00111***<br>(0.000362)                           | 0.000305***<br>(9.78e-05) | 0.00272***<br>(0.000454)  | 0.000734***<br>(0.000122)  |
| ShortTermIntRate_1    | 0.00534***<br>(0.000452)  | 0.00143***<br>(0.000114)   | 0.00494***<br>(0.000415)                                 | 0.00133***<br>(0.000103)  | 0.00456***<br>(0.000538)  | 0.00122***<br>(0.000137)   | 0.00457***<br>(0.000405)                           | 0.00126***<br>(0.000103)  | 0.00386***<br>(0.000581)  | 0.00104***<br>(0.000147)   |
| Instrumented Variable |                           |                            | LiquidAssetsRatio_1                                      |                           | NPLTotalLoans_1           |                            | LiquidAssetsRatio_1                                |                           | NPLTotalLoans_1           |                            |
| Observations          | 1,986                     | 1,986                      | 1,986  | 1,986                     | 1,986                     | 1,986                      | 1,986  | 1,986                     | 1,986                     | 1,986                      |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

When the liquid assets ratio of the originator parent is predicted on the basis of originator country dummies, a 1-point decrease in the liquid assets ratio is associated with a 0.42% (col. 4) increase in the probability of risk retention; in the baseline specification, the same variation in the liquid assets ratio was related to a 0.06% (col. 2) rise in the retention probability. Similar results are observed when risk nationality dummies are used in the reduced-form equation. The increase in economic magnitude due to the use of country dummies as instruments suggests that indeed the funding liquidity position of originator banks, particularly regarding the availability of liquid assets with respect to short-term liabilities, is largely driven by country-level factors.

Similarly, when the NPL ratio is instrumented through risk nationality dummies, a 1-percent increase in the NPL ratio is related to a 3.13% (col. 10) decrease in the probability of tranche retention; in the baseline specification, the same variation in the NPL ratios is associated with a 0.57% (col. 2) reduction in the retention probability. Analogous results, though slightly smaller in magnitude, are obtained when the instruments are originator parent country dummies. Also in this case, the results show that country-level drivers are determinant for explaining the NPL ratios of originator banks and therefore the effect of the loan portfolio credit quality on their retention decisions.

### **2.6.3 Heterogeneity across Banks under the Full Allotment Policy**

#### **2.6.3.1 Full Allotment Policy and the Retention of Originator Banks**

An important policy driver of the ABS retention behaviour could be possibly related to the introduction of the fixed-rate full allotment policy, decided by the ECB on 8 October 2008. The analysis of the potential effects of the full allotment policy on the retention behaviour of originator banks requires disentangling the interaction between demand and supply in the ABS market. In order to show that the retention decision was taken by the originator banks and then was driven by supply factors, rather than being an effect of lack of demand, I exploit the heterogeneity across banks in their balance sheet characteristics and I explore whether originator banks in different ex-ante financial conditions responded differently to this monetary policy measure.

The full allotment policy was adopted to satisfy the ample demand of liquidity by the Euro area banking system, given the liquidity crisis after Lehman's bankruptcy as discussed in sections 2.2 and 2.3. However, substantial differences across banks with regard to their liquidity needs could be noticed depending on their financial conditions. Therefore, some banks were more interested than others in taking advantage of this policy measure to the extent they were subject to stronger liquidity constraints (e.g. if they were less able than others to get wholesale funding because of the perceived weakness of their financial conditions).

In addition, the actual possibility for banks to concretely benefit from this uncapped liquidity provision was conditional on the availability of liquid assets to be used as collateral in the refinancing operations. In fact, Euro area banks were in significantly different conditions with regard to their availability of liquid assets as well as with respect to the concrete possibility to acquire them, given the heterogeneity in bank balance sheet conditions.

Therefore I exploit this heterogeneity in bank financial conditions to investigate whether - following the full allotment policy - banks in higher shortage of liquid assets or in weaker financial conditions (in terms of leverage or profitability) increased relatively more their retention of newly issued ABSs; the argument would be that banks under stronger funding constraints were plausibly more interested in taking advantage of the full allotment liquidity provision and then in ensuring the availability of enough collateral assets. This approach, based on the ex-ante heterogeneity across banks to identify the differential ex-post response to a monetary policy shock, presents some similarities with the identification strategy proposed by Kaskyap and Stein (2000) – as applied in that case to the analysis of the bank lending channel. To exploit this bank heterogeneity, I introduce in the baseline probit specification an interaction term between the full allotment policy and specific balance sheet variables for originator banks to estimate the following equation:

$$(6) \quad P(\text{Retention}_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

$$\begin{aligned} \text{where } (\mathbf{x}'\boldsymbol{\beta}) = & \alpha + \text{B BankBalanceSheet}_{j,t-1} + \vartheta \text{ BankVariable}_{j,t-1} + \gamma \text{ Full Allotment}_t \\ & + \eta \text{ Full Allotment}_t * \text{BankVariable}_{j,t-1} + \Delta \text{ RiskCountryControls}_{kt-1} \\ & + \text{Z OriginatorCountryControls}_{lt-1} + \varepsilon_{ijt} \end{aligned}$$

Provided that - under the full allotment regime - originator banks retained ABS more frequently, I explore whether this marginal increase in the retention probability was indeed a function of the weakness in the existing financial conditions of individual banks. This would confirm the hypothesis that the retention decision was driven by supply factors related to the financial conditions of originator banks and not by lack of demand from investors.

### 2.6.3.2 Empirical Results and Interaction Plots for the Full Allotment Policy

Table 2.6 presents the results of the probit specification including the interaction terms with the balance sheet variables. Moreover, I compute the average marginal effect of the full allotment policy for different values of each balance sheet variable and I plot the pattern of these marginal effects with a 95% confidence interval. Figure 2.5 presents the plots of this interaction: the x-axis indicates the value of each balance sheet variable, while the y-axis denotes the economic magnitude of the marginal effect; also, the dashed line indicates the mean of the balance sheet variable.

The interaction with the liquid assets ratio displays that the marginal increase in the probability of risk retention following the full allotment policy is decreasing for banks with a higher liquid assets ratio. Therefore, provided that in general all banks increased their ABS retention under the full allotment regime, banks with lower availability of liquid assets responded to this policy measure by increasing relatively more the probability to retain newly issued securitisation tranches. Indeed, ABS retention allowed banks with a more limited amount of liquid assets to increase the amount of available collateral assets that they could potentially use in central bank refinancing operations<sup>165</sup>.

Fig. 2.5 presents also the interactions with the two measures of solvency, the common equity leverage ratio and the risk-weighted capital ratio. The results observed from these interactions can be linked to the arguments discussed for the baseline specification. The marginal increase in the retention probability – given the full allotment policy – was larger for banks with lower common equity leverage ratios and with higher risk-weighted capital ratios. The cross-bank variation depending on the leverage ratio of originator banks is relatively wide: lower capitalisation levels led to a larger marginal increase in the retention probability, from a 30% increase for banks with a leverage ratio at the 90<sup>th</sup> percentile to a 61% increase for banks with a leverage ratio at the 10<sup>th</sup> percentile. This reflects the interplay between actual solvency and funding conditions: lowly capitalised banks, being subject potentially to higher funding costs, may be more interested in retaining ABS for collateral purposes. On the other hand, the cross-bank variation in relation to the risk-weighted capital ratio is considerably smaller: higher risk-adjusted capital ratios are associated with a negligible marginal increase in the retention probability. Therefore, potential incentives related to the regulatory capital implications of risk retention may play only a minor role, if any.

Finally, Fig. 2.5 shows the interactions with the RoA and the NPL ratio. The two plots suggest that the marginal increase in the retention probability – given the full allotment policy – was significantly larger for banks with higher NPL ratios and lower profitability. Higher NPL ratios decreased the marginal increase in the retention probability, from a 45% increase for banks with a NPL ratio at the 10<sup>th</sup> percentile to a 59% increase for banks with a NPL ratio at the 90<sup>th</sup> percentile. The cross-bank variation depending on the RoA is even larger: lower profitability increases the marginal rise in the retention probability, from a 34% increase for banks with a RoA at the 90<sup>th</sup> percentile to a 62% increase for banks with a RoA at the 10<sup>th</sup> percentile. Banks with lower profitability and higher NPL ratios may be perceived as riskier by market participants, and therefore encounter larger difficulties on wholesale funding markets,

---

<sup>165</sup> To show that this result is specifically related to the retention of ABSs pledgeable for central bank refinancing operations, in 5.3.5 I estimate the same regression separately for eligible and non-eligible ABSs. The plots in Fig. 6 highlight that the effect described above for the interaction with the liquid assets ratio is indeed specific for eligible ABSs, while it is not observed for non-eligible ABSs.

therefore they could retain ABS more to increase the am<sup>166</sup>. The two effects could be linked, given that banks with high ratios of non-performing loans also tend to have lower profitability because of the losses on such loans; at the same time, low profitability may have also other reasons and so an even larger impact on the funding conditions and decisions of originator banks.

---

<sup>166</sup> In addition, for the NPL ratio, there could be also a potential demand effect, as banks with higher NPL ratios could have more difficulties in placing ABS among market participants. This could happen particularly if the issued securitisation products are based on underlying pools including non-performing assets, but it may hold also if the underlying pools include only performing assets, both because of asymmetric information and because of the perceived riskiness of the lending practices of originator banks. As suggested earlier, the use of loan-level data for individual loans would allow for a more in-depth investigation of these aspects.

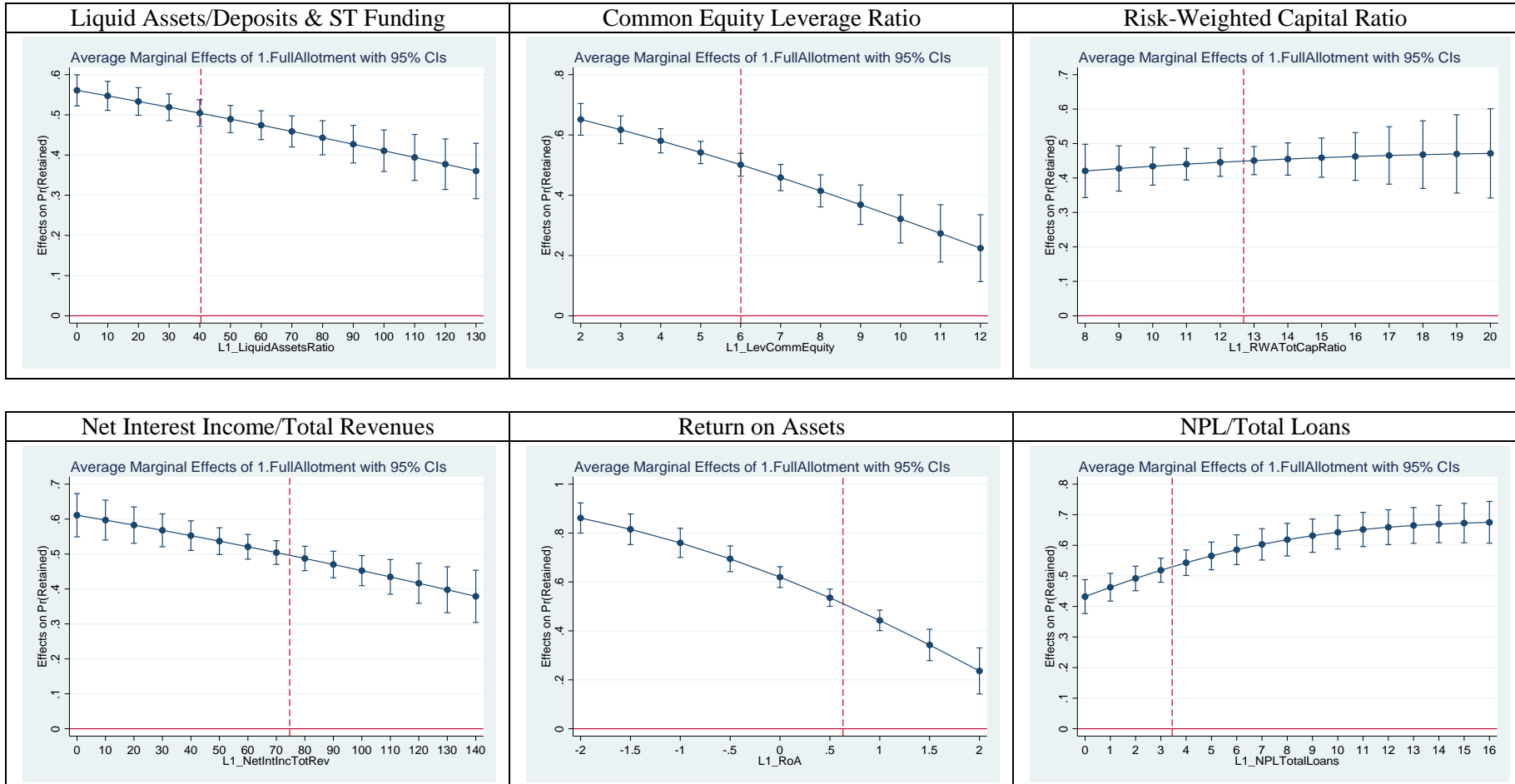
**Table 2.6 ABS Retention. The Interaction between the Full Allotment Policy and Originator Bank Balance Sheet Conditions**

| VARIABLES                         | (1)<br>Coeff             | (2)<br>AME                | (3)<br>Coeff              | (4)<br>AME                 | (5)<br>Coeff              | (6)<br>AME                 | (7)<br>Coeff              | (8)<br>AME                 | (9)<br>Coeff             | (10)<br>AME                | (11)<br>Coeff            | (12)<br>AME               |
|-----------------------------------|--------------------------|---------------------------|---------------------------|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|--------------------------|----------------------------|--------------------------|---------------------------|
| RoA_1                             | -0.142*<br>(0.0735)      | -0.0378*<br>(0.0194)      | -0.247***<br>(0.0606)     | -0.0663***<br>(0.0161)     | -0.0882<br>(0.0728)       | -0.0233<br>(0.0192)        | -0.0825<br>(0.0719)       | -0.0216<br>(0.0188)        | -0.0706<br>(0.0732)      | -0.0186<br>(0.0192)        | 0.441***<br>(0.113)      | -0.00542<br>(0.0200)      |
| NetIntIncTotRev_1                 | 0.000896<br>(0.00109)    | 0.000237<br>(0.000287)    | -0.000621<br>(0.00111)    | -0.000167<br>(0.000297)    | 0.00630***<br>(0.00178)   | 0.000535*<br>(0.000288)    | 0.00123<br>(0.00110)      | 0.000322<br>(0.000287)     | 0.000941<br>(0.00109)    | 0.000248<br>(0.000286)     | 0.00241**<br>(0.00114)   | 0.000628**<br>(0.000296)  |
| LevCommEquity_1                   | -0.0743***<br>(0.0201)   | -0.0197***<br>(0.00528)   |                           |                            | -0.0822***<br>(0.0199)    | -0.0217***<br>(0.00519)    | 0.0469*<br>(0.0284)       | -0.0136***<br>(0.00511)    | -0.0918***<br>(0.0201)   | -0.0242***<br>(0.00519)    | -0.0595***<br>(0.0203)   | -0.0155***<br>(0.00524)   |
| LiquidAssetsRatio_1               | -0.00197**<br>(0.000781) | -0.000521**<br>(0.000206) | -0.00204***<br>(0.000768) | -0.000547***<br>(0.000205) | -0.00251***<br>(0.000779) | -0.000663***<br>(0.000204) | -0.00231***<br>(0.000791) | -0.000606***<br>(0.000205) | 0.000377<br>(0.000943)   | -0.000914***<br>(0.000206) | -0.00171**<br>(0.000799) | -0.000445**<br>(0.000207) |
| NPLTotalLoans_1                   | -0.147***<br>(0.0354)    | -0.0199***<br>(0.00508)   | -0.0325***<br>(0.0121)    | -0.00874***<br>(0.00322)   | -0.0228*<br>(0.0127)      | -0.00603*<br>(0.00336)     | -0.0169<br>(0.0126)       | -0.00444<br>(0.00330)      | -0.0235*<br>(0.0127)     | -0.00618*<br>(0.00332)     | -0.0378***<br>(0.0130)   | -0.00984***<br>(0.00335)  |
| RWATotCapRatio_1                  |                          |                           | 0.0220<br>(0.0324)        | 0.0150***<br>(0.00498)     |                           |                            |                           |                            |                          |                            |                          |                           |
| FullAllot                         | 1.829***<br>(0.174)      | 0.493***<br>(0.0181)      | 1.140**<br>(0.473)        | 0.457***<br>(0.0205)       | 2.837***<br>(0.228)       | 0.494***<br>(0.0172)       | 3.348***<br>(0.249)       | 0.501***<br>(0.0172)       | 2.609***<br>(0.175)      | 0.502***<br>(0.0171)       | 2.853***<br>(0.181)      | 0.501***<br>(0.0182)      |
| FullAllot*<br>NPLTotalLoans_1     | 0.141***<br>(0.0365)     |                           |                           |                            |                           |                            |                           |                            |                          |                            |                          |                           |
| FullAllot*<br>RWATotCapRatio_1    |                          |                           | 0.0662*<br>(0.0373)       |                            |                           |                            |                           |                            |                          |                            |                          |                           |
| FullAllot*<br>NetIntIncTotRev_1   |                          |                           |                           |                            | -0.00851***<br>(0.00223)  |                            |                           |                            |                          |                            |                          |                           |
| FullAllot*<br>LevCommEquity_1     |                          |                           |                           |                            |                           |                            | -0.202***<br>(0.0340)     |                            |                          |                            |                          |                           |
| FullAllot*<br>LiquidAssetsRatio_1 |                          |                           |                           |                            |                           |                            |                           |                            | -0.00779***<br>(0.00157) |                            |                          |                           |
| FullAllot*<br>RoA_1               |                          |                           |                           |                            |                           |                            |                           |                            |                          |                            | -0.934***<br>(0.134)     |                           |
| GDPGrowthRate_1                   | -0.0990***<br>(0.0180)   | -0.0262***<br>(0.00468)   | -0.102***<br>(0.0178)     | -0.0274***<br>(0.00468)    | -0.0807***<br>(0.0173)    | -0.0213***<br>(0.00451)    | -0.0707***<br>(0.0174)    | -0.0185***<br>(0.00452)    | -0.0819***<br>(0.0175)   | -0.0215***<br>(0.00454)    | -0.0784***<br>(0.0177)   | -0.0204***<br>(0.00454)   |
| LongTermIntRate_1                 | 0.00162***<br>(0.000421) | 0.000430***<br>(0.000110) | 0.00229***<br>(0.000429)  | 0.000614***<br>(0.000112)  | 0.00195***<br>(0.000427)  | 0.000514***<br>(0.000110)  | 0.00199***<br>(0.000432)  | 0.000520***<br>(0.000111)  | 0.00175***<br>(0.000422) | 0.000461***<br>(0.000109)  | 0.00188***<br>(0.000423) | 0.000489***<br>(0.000108) |
| ShortTermIntRate_1                | 0.00534***<br>(0.000449) | 0.00142***<br>(0.000112)  | 0.00555***<br>(0.000460)  | 0.00149***<br>(0.000114)   | 0.00525***<br>(0.000453)  | 0.00139***<br>(0.000113)   | 0.00518***<br>(0.000455)  | 0.00136***<br>(0.000113)   | 0.00552***<br>(0.000461) | 0.00145***<br>(0.000114)   | 0.00516***<br>(0.000453) | 0.00134***<br>(0.000112)  |
| Observations                      | 1,986                    | 1,986                     | 1,916                     | 1,916                      | 1,986                     | 1,986                      | 1,986                     | 1,986                      | 1,986                    | 1,986                      | 1,986                    | 1,986                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Figure 2.5 ABS Retention. The Interaction of the Full Allotment Policy with the Existing Bank Balance Sheet Conditions**



### 2.6.3.3 The Role of Short-Term Interbank Market Distress

The introduction of the full allotment policy had the effect to increase the amount of liquidity that monetary policy counterparties could obtain from the Eurosystem. In this perspective, the above analysis describes the effect of an increase in the quantity of central bank financing on the ABS retention behaviour of originator banks. The observed impact on the retention probability for banks – particularly those in weaker funding conditions – reflects a corresponding quantity effect on the demand of collateral assets by banks, which indeed had the incentive to use retained securitisation for this purpose.

In addition to this quantity effect of central bank financing, also a price effect determined by bank relative funding costs could have further contributed to this retention behaviour. In general, the relative incentives for a bank to take central bank or interbank market liquidity for funding purposes depend on the relative costs of these two financing sources. In fact, when the full allotment policy was introduced, banks had to face particularly high funding costs in the unsecured interbank market, though with some differences. In this context, central bank funding was relatively more affordable, also due to the series of policy rate reductions decided by the ECB.

A useful indicator for the distress in the unsecured interbank market is the spread between the 3-month Euribor rate and the Euro 3-month Overnight Index Swap (OIS), providing a measure of the perceived risk in the unsecured interbank market. The higher is the spread in the interbank market, the higher is the relative pricing incentive to use secured funding sources, particularly central bank financing in absence of quantity constraints<sup>167</sup>.

To use secured funding and particularly central bank financing, banks needed adequate collateral. This highlights again the importance of taking into account the heterogeneity across banks in the availability of liquid assets or in the possibility to acquire them, as analysed in the previous sub-section. I exploit these differences in the ex-ante balance sheet conditions of originator banks to study the transmission channel of the price effect induced by the interbank market spread, which could have strengthened the previously examined quantity effect for central bank funding. Controlling for the full allotment policy, I investigate the role of this funding cost channel on the retention behaviour, by analysing how banks in different financial conditions responded to an increase in interbank funding costs.

I estimate the following probit regression, where I introduce interaction terms between the 3-month Euribor rate and the balance sheet variables:

$$(7) \quad P(\text{Retention}_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

---

<sup>167</sup> Given the difference in the funding costs through the two sources, the importance of the full allotment policy was exactly in removing these quantity constraints.

$$\begin{aligned}
\text{where } (x' \beta) = & \alpha + \beta \text{ BankBalanceSheet}_{jt-1} + \vartheta \text{ BankVariable}_{jt-1} \\
& + \lambda \text{ InterbankSpread}_{t-1} + \eta \text{ InterbankSpread}_{t-1} * \text{ BankVariable}_{jt-1} \\
& + \gamma \text{ Full Allotment}_t + \Delta \text{ RiskCountryControls}_{kt-1} \\
& + Z \text{ OriginatorCountryControls}_{lt-1} + \varepsilon_{ijt}
\end{aligned}$$

#### 2.6.3.4 Empirical Results and Interaction Plots for the Interbank Market Spread

Table 2.7 presents the results of the estimation. As for the full allotment policy, I compute the average marginal effect of a 1-basis point increase in the 3-month Euribor spread for different values of the relevant balance sheet variable and I represent the corresponding plots in Figure 2.6.

The results in Table 2.7 show that just a 1-basis point increase in the 3-month Euribor spread is associated with an increase in the probability of ABS retention included in a range between 0.5% and 0.6%. This implies that an increase of 100 basis points in the interbank spread, as it happened during the most acute phases of the global financial crisis, could lead to a rise in the ABS retention rate by more than 50%. Even with this pricing measure for the interbank market stress, the introduction of the full allotment policy still contributes significantly to increase the retention probability, in a range between 13% and 19% depending on the specifications. These results highlight that, along with the quantity effect of the full allotment policy – relatively persistent during the implementation period, also the price effect of the interbank market spread contributed to further increase the retention behaviour of originator banks, with variations across time depending on the magnitude of this spread.

The plots in Figure 2.6 illustrate the role of bank balance sheet heterogeneity in the response of originator banks to an increase in the Euribor spread in the interbank market. The marginal increase in the probability of ABS retention – for a given increase in interbank market spread - was larger for banks in weaker financial conditions in terms of liquidity, leverage and capital.

As observed for the full allotment policy, the cross-bank variation depending on the liquid assets ratio could be quite large: just for a 1-basis point increase in the Euribor spread, lower liquid assets ratios led to a wider marginal increase in the retention probability, from a 0.44% increase for banks at the 90<sup>th</sup> percentile of the liquid assets ratio distribution to a 0.67% increase for banks at the 10<sup>th</sup> percentile of the distribution. Banks with lower availability of liquid assets reacted to less favourable conditions in the interbank market by increasing relatively more their retention of newly issued ABS. This underlines the role of balance sheet-induced supply factors in explaining the retention by originators.

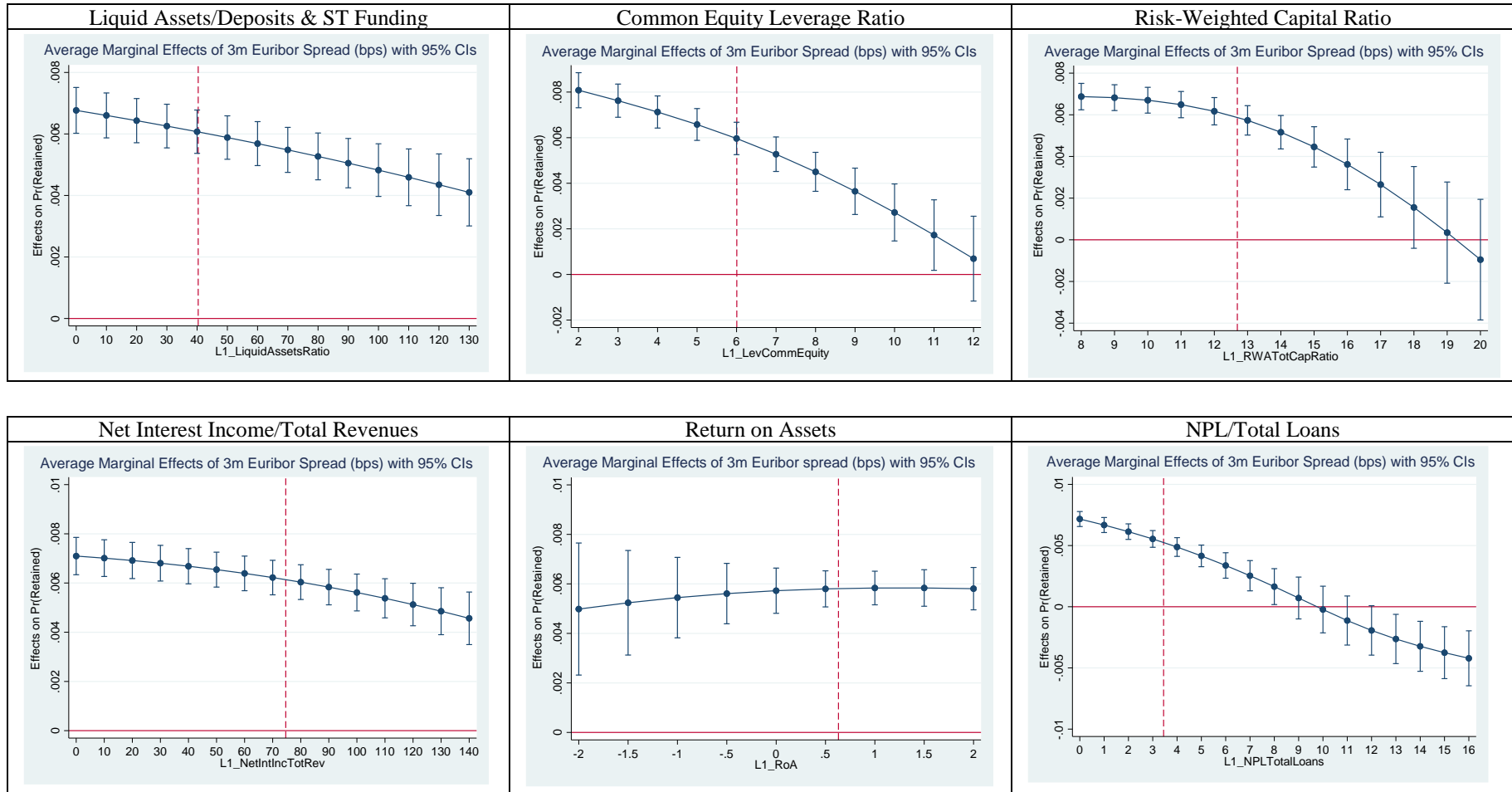
Also differences in the actual solvency of originator banks may lead to substantial heterogeneity in the response to higher interbank market spread. Consistently with the potential implications of solvency on funding conditions, lowly capitalised banks increased their

**Table 2.7 ABS Retention. The Interaction between Interbank Market Spread and Originator Bank Balance Sheet Conditions**

| VARIABLES                               | (1)<br>Coeff              | (2)<br>AME                 | (3)<br>Coeff              | (4)<br>AME                 | (5)<br>Coeff               | (6)<br>AME                 | (7)<br>Coeff              | (8)<br>AME                | (9)<br>Coeff               | (10)<br>AME               | (11)<br>Coeff             | (12)<br>AME                |
|---|---------------------------|----------------------------|---------------------------|----------------------------|----------------------------|----------------------------|---------------------------|---------------------------|----------------------------|---------------------------|---------------------------|----------------------------|
| RoA_1                                   | -0.170**<br>(0.0716)      | -0.0419**<br>(0.0175)      | -0.319***<br>(0.0612)     | -0.0803***<br>(0.0152)     | -0.230***<br>(0.0749)      | -0.0576***<br>(0.0187)     | -0.149**<br>(0.0726)      | -0.0371**<br>(0.0180)     | -0.128*<br>(0.0734)        | -0.0321*<br>(0.0184)      | -0.233**<br>(0.0956)      | -0.0429**<br>(0.0183)      |
| NetIntIncTotRev_1                       | 0.00156<br>(0.00110)      | 0.000384<br>(0.000271)     | -0.00164<br>(0.00111)     | -0.000413<br>(0.000279)    | 0.00456***<br>(0.00143)    | 0.000193<br>(0.000265)     | 0.000518<br>(0.00111)     | 0.000129<br>(0.000276)    | 0.000261<br>(0.00108)      | 6.56e-05<br>(0.000272)    | 0.000814<br>(0.00110)     | 0.000206<br>(0.000277)     |
| LevCommEquity_1                         | -0.0824***<br>(0.0202)    | -0.0202***<br>(0.00492)    |                           |                            | -0.0763***<br>(0.0203)     | -0.0191***<br>(0.00503)    | 0.0246<br>(0.0253)        | -0.0177***<br>(0.00481)   | -0.0823***<br>(0.0205)     | -0.0207***<br>(0.00509)   | -0.0874***<br>(0.0204)    | -0.0221***<br>(0.00508)    |
| LiquidAssetsRatio_1                     | -0.00242***<br>(0.000789) | -0.000594***<br>(0.000192) | -0.00209***<br>(0.000782) | -0.000525***<br>(0.000196) | -0.00228***<br>(0.000777)  | -0.000570***<br>(0.000193) | -0.00162**<br>(0.000797)  | -0.000401**<br>(0.000197) | 0.00108<br>(0.00109)       | -0.000447**<br>(0.000189) | -0.00248***<br>(0.000792) | -0.000627***<br>(0.000198) |
| NPLTotalLoans_1                         | 0.0252*<br>(0.0141)       | -0.0167***<br>(0.00323)    | -0.0540***<br>(0.0119)    | -0.0136***<br>(0.00295)    | -0.0258**<br>(0.0124)      | -0.00647**<br>(0.00309)    | -0.0298**<br>(0.0122)     | -0.00739**<br>(0.00303)   | -0.0250**<br>(0.0125)      | -0.00628**<br>(0.00314)   | -0.0303**<br>(0.0125)     | -0.00765**<br>(0.00316)    |
| RWATotCapRatio_1                        |                           |                            | 0.149***<br>(0.0219)      | 0.0106***<br>(0.00410)     |                            |                            |                           |                           |                            |                           |                           |                            |
| SpreadEuribor_1                         | 0.0325***<br>(0.00212)    | 0.00499***<br>(0.000344)   | 0.0722***<br>(0.00711)    | 0.00521***<br>(0.000368)   | 0.0347***<br>(0.00325)     | 0.00604***<br>(0.000356)   | 0.0445***<br>(0.00367)    | 0.00574***<br>(0.000347)  | 0.0281***<br>(0.00208)     | 0.00593***<br>(0.000354)  | 0.0213***<br>(0.00210)    | 0.00578***<br>(0.000353)   |
| SpreadEuribor_1*<br>NPLTotalLoans_1     | -0.00333***<br>(0.000447) |                            |                           |                            |                            |                            |                           |                           |                            |                           |                           |                            |
| SpreadEuribor_1*<br>RWATotCapRatio_1    |                           |                            | -0.00383***<br>(0.000525) |                            |                            |                            |                           |                           |                            |                           |                           |                            |
| SpreadEuribor_1*<br>NetIntIncTotRev_1   |                           |                            |                           |                            | -0.000136***<br>(3.11e-05) |                            |                           |                           |                            |                           |                           |                            |
| SpreadEuribor_1*<br>LevCommEquity_1     |                           |                            |                           |                            |                            |                            | -0.00351***<br>(0.000513) |                           |                            |                           |                           |                            |
| SpreadEuribor_1*<br>LiquidAssetsRatio_1 |                           |                            |                           |                            |                            |                            |                           |                           | -0.000104***<br>(2.42e-05) |                           |                           |                            |
| SpreadEuribor_1*<br>RoA_1               |                           |                            |                           |                            |                            |                            |                           |                           |                            |                           | 0.00231<br>(0.00198)      |                            |
| FullAllot                               | 0.790***<br>(0.119)       | 0.194***<br>(0.0284)       | 0.500***<br>(0.124)       | 0.126***<br>(0.0308)       | 0.662***<br>(0.119)        | 0.166***<br>(0.0290)       | 0.655***<br>(0.119)       | 0.163***<br>(0.0289)      | 0.715***<br>(0.119)        | 0.180***<br>(0.0290)      | 0.712***<br>(0.118)       | 0.180***<br>(0.0291)       |
| GDPGrowthRate_1                         | -0.0208<br>(0.0168)       | -0.00511<br>(0.00413)      | -0.0189<br>(0.0173)       | -0.00475<br>(0.00435)      | -0.0113<br>(0.0170)        | -0.00283<br>(0.00424)      | -0.0183<br>(0.0171)       | -0.00455<br>(0.00423)     | -0.00948<br>(0.0170)       | -0.00238<br>(0.00428)     | -0.0133<br>(0.0171)       | -0.00337<br>(0.00432)      |
| LongTermIntRate_1                       | 0.00308***<br>(0.000380)  | 0.000758***<br>(8.93e-05)  | 0.00319***<br>(0.000406)  | 0.000802***<br>(9.78e-05)  | 0.00266***<br>(0.000381)   | 0.000666***<br>(9.23e-05)  | 0.00260***<br>(0.000382)  | 0.000645***<br>(9.16e-05) | 0.00251***<br>(0.000385)   | 0.000631***<br>(9.39e-05) | 0.00268***<br>(0.000385)  | 0.000678***<br>(9.39e-05)  |
| Observations                            | 1,986                     | 1,986                      | 1,916                     | 1,916                      | 1,986                      | 1,986                      | 1,986                     | 1,986                     | 1,986                      | 1,986                     | 1,986                     | 1,986                      |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Figure 2.6 ABS Retention. The Interaction of the 3-month Euribor Spread with the Existing Bank Balance Sheet Conditions**



retention of ABS - following an interbank spread widening – more than highly capitalised banks. Looking at the sample distribution of the common equity leverage ratio, for a 1-basis point increase in interbank spread, banks at the 10<sup>th</sup> percentile increased their retention probability by 76%, while banks at the 90<sup>th</sup> percentile increased their retention probability by 22%. Qualitatively analogous results are obtained in this case also for the risk-weighted capital ratio.

Finally, the marginal increase in the retention probability for an increase in the interbank spread was lower for banks with higher NPL ratios. This can be explained in relation to the particular price effect of an interbank spread increase (as opposed to the quantity effect of the full allotment): the funding costs in the interbank market have to be compared with the financing costs of the central bank liquidity obtained by pledging ABS. In fact, securitising loan portfolios with high NPLs can result either in the non-eligibility or in a lower credit rating of the issued ABS, which would imply higher haircuts and then still potential higher cost of central bank financing.

#### **2.6.3.5 Full Allotment and Interbank Market Developments for Eligible and Non-Eligible ABSs**

The above analysis showed that the two funding shocks, related to the full allotment policy and to the interbank market spread, affected the incentives for ABS retention in a heterogeneous way depending on the ex-ante balance sheet conditions of originator banks. Now I want to explore whether this differential effect of funding shocks depending on the ex-ante liquidity position of the originator banks could be observed distinctly for eligible versus non-eligible ABSs. I estimate the equations (6) and (7) - including the interactions with the liquid assets ratios – separately for eligible and non-eligible ABSs and I plot the marginal effects of the two funding shocks in relation to the liquid assets ratio of the originator bank.

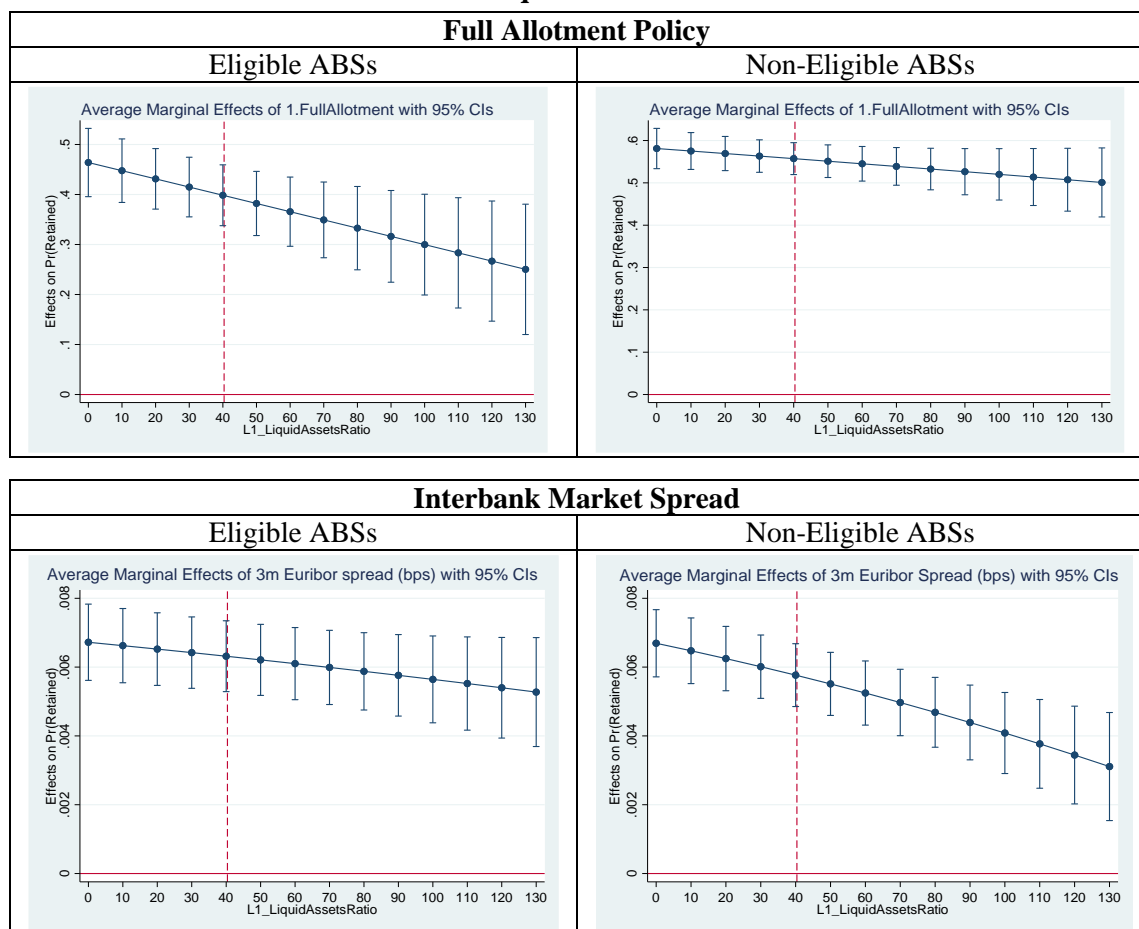
The plots displayed in Figure 2.7 show that the full allotment policy increased the retention of both eligible and non-eligible ABSs, as observed in Table 2.3. However, while the rise in the retention of eligible ABSs was significantly dependent on the ex-ante liquidity conditions of the originator bank, the corresponding increase in the retention of non-eligible ABSs was subject to only minor variations for banks in different liquidity conditions. In fact, the full allotment policy – by increasing the quantity of central bank financing – incentivised banks to retain ABSs differently in relation to their needs of liquid assets. However, this effect holds only for those ABSs which – as eligible - could be actually used to satisfy the additional collateral needs induced by the full allotment.

I conduct the same exercise also for an increase in the interbank market spread, taking into account however the different nature of this funding shock – as affecting the relative costs of funding through different sources. In this case, the increase in the Euribor spread induced

banks to retain more ABSs, both eligible and non-eligible and this marginal rise in the retention probability was indeed larger for banks with lower liquid assets ratios. But in this case of the interbank market spread the effect heterogeneity in relation to the liquid assets ratio could be observed for both eligible and non-eligible ABSs.

To explain this, we may need to consider that a funding shock in the interbank market spread can have two parallel effects: a collateral channel, i.e. increase the need of liquid assets for potential secured financing if less expensive (more directed towards eligible ABSs); as well as a floating rate channel, i.e. increase the funding costs for all wholesale funding sources linked to the Euribor benchmark (concerning all types of ABSs). In fact, an increase in the Euribor spread, by raising the relative incentive for central bank financing, can incentivise all banks to retain ABSs for precautionary reasons. At the same time, provided that ABSs are generally floating-rate notes, an increase in the Euribor raises the funding costs related to the placement of ABSs among market investors therefore increasing the retention behaviour. The distinct effects for eligible and non-eligible ABSs would then depend on the relative balance of the above collateral channel and floating rate channel.

**Figure 2.7 ABS Retention. Interaction of Full Allotment and Interbank Market Spread with Liquid Assets Ratio**



## **2.6.4 The Introduction of the Additional Credit Claims Framework**

### **2.6.4.1 Empirical Strategy**

In February 2012, the ECB extended the collateral framework to additional credit claims (ACC) not included in the General Documentation, by allowing national central banks (NCBs) to accept additional performing loans subject to specific eligibility criteria. However, since the responsibility related to the acceptance of such loans was to be borne by the relevant NCBs, only some of them decided to allow for this extension of the eligible credit claims, given the issues related to the evaluation of their credit risk. Given that loans could be posted as collateral only in their country of origination, this implied also some heterogeneity across banks operating in different countries with regard to the possibility to pledge credit claims.

I investigate whether this decision could have played some role in the retention decisions of originator banks. Indeed, before this extension in the collateral framework, banks could be induced to retain ABSs because the possibility to pledge directly credit claims was limited only to some categories of loans and subject to restrictive criteria. Then, the acceptance of additional credit claims as collateral by the NCBs could have potentially reduced the incentive for this retain-to-repo strategy of originator banks. However, this could have been the case only in the countries where the NCBs extended the use of credit claims eligible as collateral.

The cross-country heterogeneity in the decisions of NCBs - about whether to accept additional credit claims and which assets to include in the eligibility criteria - provides a useful setting for an empirical analysis aimed at studying the potential effects of the ACC introduction on the ABS retention behaviour of originator banks. Therefore, I exploit the differences in the collateral policy of NCBs in their eligibility requirements, to study whether and to what extent - after the ECB decision on the ACC framework - the probability of securitisation retention has changed for the ABSs backed by loans which have been recognised as eligible collateral by the relevant NCB in the country of origination.

If the main motivation for ABS retention was in fact related to the retain-to-repo strategy, we would expect that the counterparties of NCBs authorising such use would have decreased their probability of retaining newly issued ABSs, as they would not need (or would need less) to use retained securitisation as adequate collateral; also, we would expect that this probability of securitisation retention would have not substantially changed for those counterparties of national central banks not allowing for that.

A positive decision on the adoption of the ACC framework could have been taken by national central banks depending on the existing development of internal tools available for the credit risk assessment of loans, as based on rating methodologies and acquired expertise in this field. While the development of internal credit assessment capabilities was a necessary



condition for benefiting from this opportunity, at the time of the ACC introduction national central banks still presented some differences on the availability of the necessary infrastructure and this could have played a relevant role in their decision to eventually benefit from this opportunity<sup>168</sup>. Therefore the decisions taken by NCBs on the ACC eligibility can be considered as relatively exogenous with respect to the retention behaviour of originator banks in individual countries and it should not be affected by other factors potentially relevant for the ABS retention.

To discuss the plausibility of the unconfoundedness assumption, we could wonder whether other factors potentially relevant for the retention behaviour, as observed in the previous analysis, could have played some role in the decisions of NCBs with regard to the ACC introduction, like the funding liquid position and the credit quality of loan portfolio. One could argue that NCBs may have decided to expand the eligibility of credit claims if their banking systems were in particularly weaker liquidity conditions, to increase the amount of available collateral consistently with the purpose of this measure. However, the classification of NCBs in the two groups – particularly on the eligibility of residential mortgages, the most sizeable addition for credit claims - shows that actually some NCBs in countries less affected by the crisis benefited substantially from this measure, while some NCBs in more vulnerable countries decided not to take initiative on that.

Moreover, we could also consider a related argument on credit risk: provided that the eligibility of additional credit claims could have encouraged some credit expansion<sup>169</sup>, some NCBs in countries more affected by the crisis could have decided not to use this option to avoid a loosening of lending standards, while taking into account the existing stocks of NPLs. In fact, if we look at the component of the NPL ratios driven by country-level factors<sup>170</sup> - we notice that banks with higher NPL ratios showed lower probability to retain ABSs: therefore, in case the NCB of the relevant country had decided not to accept the additional claims, we would have ex-ante a lower retention probability of some ABS products which were not treated (as based on loans not eligible as collateral), and this could imply a potentially decreasing bias in the estimate of the effect of the ACC introduction on treated ABSs. This would actually suggest that the effect could be even larger than the one estimated.

---

<sup>168</sup> Also the press release from December 2011 announcing the first decision on the measures to increase collateral availability state the aim to enhance the Eurosystem internal credit assessment capabilities and encourages “potential external credit assessment providers (rating agencies and providers of rating tools), and commercial banks that use an internal ratings-based system, to seek Eurosystem endorsement under the Eurosystem Credit Assessment Framework”.

<sup>169</sup> See for instance Cahn et al (2017) and Mésonnier et al. (2017) for the analysis of the credit effects of the ACC introduction

<sup>170</sup> See in particular the analysis in Table 2.5 based on the IV Probit estimation for NPL ratios, using country-level factors.

### 2.6.4.2 Empirical Specification and Results

Table 2.8 presents the results of a Diff-in-Diff analysis on the effects of the ACC introduction for the securitisation products which could have been affected by this treatment, given the heterogeneous implementation of the ACC framework across countries and asset types.

Col. 1-4 report – for comparability purposes - the results of the baseline probit specification for the period following the introduction of the full allotment policy, i.e. from 2008 Q1 until 2018 Q1. The focus on this subsample is justified as we are interested in exploring the potential role of the ACC framework in reducing the retention incentives which took place under the full allotment regime. The results presented in col. 2 and 4 confirm the drivers for ABS retention already observed in previous specifications for the whole sample period: banks with lower profitability, smaller liquidity buffers and lower capital levels showed higher likelihood to retain newly issued ABSs; at the same time, banks with higher NPL ratios displayed lower probability of ABS retention<sup>171</sup>.

In col. 5-8, I augment the baseline specification to estimate the impact of the ACC introduction on ABS retention. The implementation features of this measure as described above would suggest the use of a Diff-in-Diff setting, to investigate the potential changes in the retention behaviour for the securitisation products affected by this treatment (eligibility of the underlying credit claims for the collateral framework and therefore less incentive to retain newly issued ABSs<sup>172</sup>). In this case, the treatment sample would include the ABSs based on the loans which were recognised as eligible under the ACC frameworks decided by national central banks; while the control sample would comprehend the ABSs backed by the loans which remained non-eligible, as the relevant NCBs either did not extend the set of eligible credit claims or they did so only for other categories of loans<sup>173</sup>. I estimate the equation:

$$(8) \quad P(\text{Retention}_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

$$\begin{aligned} \text{where } (\mathbf{x}'\boldsymbol{\beta}) = & \alpha + \gamma_0 ACC_t + \gamma_1 NCB\_ELIG_k + \gamma_2 ACC_t * NCB\_ELIG_k \\ & + B \text{ BankBalanceSheet}_{j,t-1} + \Delta \text{ RiskCountryControls}_{k,t-1} \\ & + Z \text{ OriginatorCountryControls}_{l,t-1} + \varepsilon_{ijt} \end{aligned}$$

<sup>171</sup> Also, in terms of macroeconomic and financial controls, the retention probability was higher in quarters of lower growth rates in the countries of origination, as well as in quarters characterised by higher interbank market rates and higher sovereign bond yields in the countries of the parent banks.

<sup>172</sup> Potentially, the ACC introduction could be associated with less incentive not only to retain, but also to issue, in case the only reason for issuance was the securitise-to-repo strategy. In those circumstances, any potential reduction in issuances – which could be explained counterfactually by the ACC - would be on top of the result already observed for the decreased retention of issued securities.

<sup>173</sup> Among the countries of origination for ABSs, the national central banks of Austria, Cyprus, France, Greece, Italy, Ireland and Portugal increased the maximum threshold for the probability of default (PD) in corporate loans, as well as they included individual or pools of residential mortgages among the eligible claims. Also, Banco de Portugal included consumer loans among eligible loans. Finally, Banco de España only increased the PD threshold, but did not extend the set of eligible loans for other credit categories.

where  $ACC_t$  is a dummy equal to 1 if the ABS was issued after the approval of the ACC national frameworks by the ECB,  $NCB\_ELIG_k$  is a dummy equal to 1 if the issued ABS is based on a type of underlying loans which have been recognised - under the ACC framework - as eligible credit claims by the NCB of the country of origination. While the coefficient  $\gamma_0$  controls for the changes in the retention behaviour before and after the ACC introduction, the coefficient  $\gamma_1$  considers the differences in the retention rate between the treated ABSs (based on loans eligible for the ACC in the country of origination) and the untreated ABSs. Therefore, the coefficient  $\gamma_2$  for the interaction of the two dummies measures the differential effect of the ACC introduction for the ABSs which have been affected by the ACC eligibility treatment.

The results in col. 6 and 8 for different specifications<sup>174</sup> show that in general the period following the ACC introduction displayed a lower retention rate for newly issued ABSs, with a reduction included in a range between 14% and 16% with respect to the previous period (2008Q4- 2011Q4). This could be due to various possible factors, including the general improvement of the funding liquidity conditions of Euro area banks after the response to the Lehman crisis. Moreover the treated ABSs, i.e. based on loans recognised as eligible under the ACC framework, showed on average a higher retention rate by 8% or 9% depending on the specifications – when compared with untreated ABSs. Most importantly, the coefficient of interest  $\gamma_2$  highlights that the introduction of the ACC framework reduced the retention probability for ABSs based on ACC-eligible loans to a significant extent, estimated in a range between 12% and 16%.

This means that – following the ACC introduction – originator banks reduced in particular the retention of those ABSs backed by loans which could have been directly pledged as collateral with the relevant NCB in the country of origination. Based on these results, the ACC seemed to play a significant role in partially reversing the incentives for ABS retention, as related to the introduction of the full allotment policy. Also, this is even more relevant if we consider that the ACC framework was announced together with the 3-year Long-Term Refinancing Operations (LTROs) in December 2011 and then became operational after the first and before the second operation of these LTROs<sup>175</sup>. Considering the very significant amount of liquidity provided with these operations and then the considerable amount of collateral required for this purpose, it is remarkable how this change in the collateral framework - by enhancing the use of credit claims as collateral - induced a relevant reduction in ABS retention, even in a period of high collateral demand by Euro area banks.

---

<sup>174</sup> Including as usual the risk-weighted capital ratio or the common equity leverage ratio

<sup>175</sup> The first operation took place on 21 December 2011 and provided EUR 489 billion to 523 banks. The second one took place on 29 February 2012 and allotted EUR 530 billion to 800 institutions.

**Table 2.8 ABS Retention. The Introduction of the Additional Credit Claims (ACC) Framework**

| VARIABLES           | 2008 Q4 – 2018 Q1        |                           |                          |                           | 2008 Q4 – 2018 Q1        |                           |                          |                           |
|---------------------|--------------------------|---------------------------|--------------------------|---------------------------|--------------------------|---------------------------|--------------------------|---------------------------|
|                     | (1)<br>Coeff             | (2)<br>AME                | (3)<br>Coeff             | (4)<br>AME                | (5)<br>Coeff             | (6)<br>AME                | (7)<br>Coeff             | (8)<br>AME                |
| RoA_1               | -0.243**<br>(0.0954)     | -0.0613**<br>(0.0239)     | -0.555***<br>(0.0783)    | -0.146***<br>(0.0194)     | -0.243**<br>(0.0976)     | -0.0593**<br>(0.0236)     | -0.576***<br>(0.0805)    | -0.147***<br>(0.0194)     |
| NetIntIncTotRev_1   | -0.000198<br>(0.00132)   | -4.99e-05<br>(0.000334)   | -0.00111<br>(0.00138)    | -0.000291<br>(0.000363)   | 0.000499<br>(0.00137)    | 0.000122<br>(0.000335)    | -0.000903<br>(0.00141)   | -0.000231<br>(0.000360)   |
| LevCommEquity_1     | -0.144***<br>(0.0253)    | -0.0363***<br>(0.00609)   |                          |                           | -0.156***<br>(0.0260)    | -0.0381***<br>(0.00605)   |                          |                           |
| LiquidAssetsRatio_1 | -0.00604***<br>(0.00127) | -0.00152***<br>(0.000309) | -0.00427***<br>(0.00122) | -0.00112***<br>(0.000315) | -0.00637***<br>(0.00129) | -0.00155***<br>(0.000303) | -0.00441***<br>(0.00123) | -0.00112***<br>(0.000308) |
| NPLTotalLoans_1     | -0.0486***<br>(0.0143)   | -0.0123***<br>(0.00356)   | -0.0761***<br>(0.0137)   | -0.0201***<br>(0.00349)   | -0.0209<br>(0.0165)      | -0.00509<br>(0.00402)     | -0.0488***<br>(0.0160)   | -0.0124***<br>(0.00404)   |
| RWATotCapRatio_1    |                          |                           | 0.0279<br>(0.0195)       | 0.00736<br>(0.00512)      |                          |                           | 0.0381*<br>(0.0199)      | 0.00972*<br>(0.00505)     |
| ACC                 |                          |                           |                          |                           | -0.642***<br>(0.152)     | -0.157***<br>(0.0361)     | -0.545***<br>(0.148)     | -0.139***<br>(0.0369)     |
| ACCNCB              |                          |                           |                          |                           | 0.326*<br>(0.184)        | 0.0794*<br>(0.0446)       | 0.360**<br>(0.183)       | 0.0920**<br>(0.0464)      |
| ACC_ACCNCB          |                          |                           |                          |                           | -0.481*<br>(0.284)       | -0.117*<br>(0.0690)       | -0.637**<br>(0.287)      | -0.163**<br>(0.0730)      |
| GDPGrowthRate_1     | -0.0462**<br>(0.0190)    | -0.0117**<br>(0.00476)    | -0.0602***<br>(0.0199)   | -0.0159***<br>(0.00519)   | -0.0460**<br>(0.0202)    | -0.0112**<br>(0.00490)    | -0.0604***<br>(0.0210)   | -0.0154***<br>(0.00533)   |
| LongTermIntRate_1   | 0.00330***<br>(0.000453) | 0.000831***<br>(0.000106) | 0.00334***<br>(0.000451) | 0.000881***<br>(0.000110) | 0.00198***<br>(0.000548) | 0.000483***<br>(0.000132) | 0.00226***<br>(0.000536) | 0.000578***<br>(0.000134) |
| ShortTermIntRate_1  | 0.00185***<br>(0.000450) | 0.000467***<br>(0.000112) | 0.00206***<br>(0.000467) | 0.000544***<br>(0.000120) | 0.00117**<br>(0.000463)  | 0.000286**<br>(0.000112)  | 0.00151***<br>(0.000474) | 0.000385***<br>(0.000120) |
| Observations        | 1,088                    | 1,088                     | 1,075                    | 1,075                     | 1,088                    | 1,088                     | 1,075                    | 1,075                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 2.7 The Credit Easing Package and Avenues for Further Research

More recently other monetary policy measures related to the ABS market – like in particular the Asset-Backed Security Purchase Programme (ABSPP) - were introduced to further enhance the transmission of monetary policy, by facilitating the credit provision to the real economy, and to increase the diversification of funding sources for banks, by contributing so also to the revitalisation of the Euro area securitisation market. In this respect, the measures of the credit easing package adopted in June 2014 – and including, along the ABSPP, also the Targeted Long-Term Refinancing Operations (TLTROs) as well as the third Covered Bond Purchase Programme (CBPP3) - could have provided a relevant contribution to improve the incentives of originator banks in deal origination and could have possibly affected banks' incentives for securitisation distribution or retention, though in different ways depending on the measures.

The TLTROs are four-year refinancing operations intended to provide central bank liquidity to banks, under the condition that they should extend credit to Euro area non-financial corporations. They have been implemented in two series with some slightly different technical details, the TLTRO-I from September 2014 and the TLTRO-II from June 2016<sup>176</sup>. The TLTROs could have affected the incentives of originator banks in the ABS market mainly via the availability of a large additional amount of central bank liquidity, which was provided to banks - under the full allotment regime - at zero or even negative interest rate. The quantity effect of central bank funding availability, coupled with the price effect of the rate decrease in the refinancing operations, could have further increased the retention behaviour of originator banks, given that retained ABSs could be pledged as collateral for TLTRO refinancing. From a funding cost point of view, the participation in the TLTROs via the pledge of retained ABSs - potentially at negative interest rate as in the second operation series – could provide funding at more favourable conditions than the public placement of ABSs among market investors.

The CBPP3 and the ABSPP are outright purchase programmes, which have been implemented by the Eurosystem starting respectively from October and November 2014. These two private sector programmes, targeted to the purchase of covered bonds and ABSs<sup>177</sup>, have generally contributed to a spread compression for both types of securities, therefore lowering

---

<sup>176</sup> While the TLTRO-I provided a conditionality scheme mostly focused on lending volumes, the TLTRO-II included also a pricing incentive mechanism regarding the costs of the refinancing operations. In general, the interest rate applied to the TLTRO-II was fixed at the MRO rate, i.e. 0%; however banks exceeding a defined benchmark could obtain – for the entire duration of the operation – a decrease in the interest rate up to the deposit facility rate (-0.40%), meaning that banks would actually be paid an interest rate on their central bank borrowing. These very favourable funding conditions, although conditional to the lending provision, induced banks to make large use of this funding opportunity, for an overall gross amount of EUR 740 billion for the four TLTRO-II operations (compared with an overall gross amount of EUR 432 billion for the eight TLTRO-I operations)

<sup>177</sup> Given the different size and liquidity conditions of the markets for ABSs and covered bonds, the purchased amounts under the two programmes have been significantly different: at the end of June 2018, the net holdings were equal to EUR 254.42 billion for the CBPP3 and to EUR 27.45 billion for ABSPP.

the funding costs of Euro area banks via the issuance of secured debt instruments. As discussed in the studies on large scale asset purchases, this spread compression has been directly observed for the securities purchased by the Eurosystem, but it could have affected indirectly also non-eligible securities within the same asset classes, depending on the extent of a potential portfolio rebalancing effect. In fact, the latter could have taken place only if investors were actually willing to consider non-eligible securities as substitutes to the eligible ones. On this matter, investors may have indeed different preferences: for instance, banks acting as monetary policy counterparties may have stronger preferences for collateral-eligible securities, while insurance companies and pension funds may be more interested in the long-term returns of securities.

In addition, the reduction in the risk premia for covered bonds and ABSs could have incentivised banks to increase the issuances of these securities to be distributed among market investors. However, this effect on distributed issuances could have been observed only if banks did not have other cheaper funding sources. In practice, the funding costs for central bank liquidity under the TLTROs could be still perceived as more attractive than the financing costs for the issuance of ABSs and perhaps also of covered bonds, even after the spread compression induced by outright purchases. In fact, also under the implementation of the ABSPP and of the CBPP3 relevant differences could be observed in the pricing of covered bonds and ABSs, given the investor preferences for covered bonds due to their more favourable regulatory treatment. Therefore some covered bonds - depending on the perceived credit risk of issuer banks - could be still priced at conditions eventually comparable to central bank financing, while distributed ABSs were generally placed at more expensive conditions than the cost of central bank liquidity. For this reason, the potential issuance incentives related to a reduction in market premia could have eventually benefited more covered bonds than ABSs.

Based on the above considerations, an analysis of the effects of the credit easing package adopted in June 2014 on ABS issuance and retention would require to consider all the potential interactions across policy measures: the competition with the more attractive conditions of central bank financing under the TLTROs; the reduction in the funding costs for the market placement of covered bonds and ABSs under the implementation of the ABSPP and of the CBPP3; the extent of the portfolio rebalancing effect of outright purchases within and across asset classes, also after the introduction of the wider Asset Purchase Programme<sup>178</sup>; the regulatory advantage for covered bonds versus ABSs as related to the implementation of the

---

<sup>178</sup> The Asset Purchase Programme includes, along with the ABSPP and the CBPP3, the Public Sector Purchase Programme (PSPP) from March 2015 and the Corporate Sector Purchase Programme (CSPP) from June 2016.

Basel III accord and of the CRD4 package<sup>179</sup>; the potential incentives to improve the credit quality of the underlying assets, as induced by the Eurosystem ABS loan-level initiative<sup>180</sup>.

The simultaneity of several policy measures of different type but all affecting the ABS market may raise some challenges for the counterfactual estimation of the effects of this complex policy package, as it might be difficult to disentangle the contribution of the individual measures. The dataset used in this chapter, based on the matching of security-level data on issuances and collateral eligibility with bank-level balance sheet information, may not fully account for the heterogeneity in investor demand across securities or for the differences in underlying asset pools across ABSs; also, the current dataset - while reflecting financial market trends for interbank market and sovereign bond yields - does not include the pricing developments of individual ABSs and covered bonds in primary and secondary markets. In order to complement the existing data sources, the availability of new data starting from 2014 – both on the composition of the securitised credit claims and on the securities holdings at the sectoral or group level - could be useful to investigate at a more granular level the incentives of originators and investors in the ABS market, with respect to the credit quality of the asset pools and to the investor base of securitisation products. Also, market pricing information at the ISIN-level would also provide relevant indications about the potential effects of policy measures on the financing costs through the placement of ABSs and covered bonds.

When focusing on a specific policy measure, a counterfactual evaluation would require the definition of treatment and control samples for ABSs with comparable ex-ante characteristics. First, the identification of the treatment sample assumes the possibility to correctly characterise the treatment: even if we suppose that the portfolio rebalancing effect may be limited in the ABS market due to the perception of a limited substitutability, we should be able to identify the securities which would be affected by central bank purchases. Second, the small number of issuances in the last few years might also raise some issues in identifying the control sample. In fact, the ABS issuances over the recent years have been mostly driven by bank-specific debt funding strategies, i.e. only few banks have been operating in the ABS market as they have established a reputation of experienced originators and therefore are expected by market participants to sponsor a given number of deals. In this context, it might be more difficult to find comparable ABS issuances to define the counterfactual.

The analysis of the ABS Purchase Programme provides an interesting example of the potential challenges in this treatment evaluation. The ABSPP could be associated with different incentives regarding ABS retention: on one hand, originator banks could be less interested in

---

<sup>179</sup> The Basel III accord has been implemented in the EU with the CRD4 package, including the Capital Requirements Regulation (CRR), Reg. 575/2013, and the Capital Requirements Directive 4, Dir. 36/2013. Both entered into force on 1 January 2014

<sup>180</sup> The reporting obligations under the ABS loan-level initiative of the Eurosystem were introduced for different types of underlying assets in different dates from January 2013 to April 2014.

retaining the full tranche, to the extent that fully retained ABSs could not be object of purchases until a third party investor purchases part of the tranche; on the other hand, subject to the market placement of some part of the tranche, originators may still want to retain a larger part in case they may be interested in selling the securities to the ECB under the ABSPP. In general, the treatment corresponding to the programme implementation could be defined either as the actual purchase of a specific ABS by the Eurosystem or as the eligibility of a given instrument for ABSPP purchases. From the viewpoint of the originator at the time of the issuance, the key relevant feature would be indeed the (potential) eligibility of the instrument for ABSPP purchases: the originator may design the structuring process differently depending on whether it wants to target the ABSPP eligibility.

In fact, the eligibility for the ABSPP is the outcome of a due diligence process conducted by the Eurosystem for individual instruments: in this perspective, the collateral framework eligibility is a necessary but not sufficient condition for the ABSPP-eligibility. Given that the outcome of this due diligence process at the ISIN-level is not publicly available, the main criterion based on public information would be to define the ABSPP eligibility treatment at least on the basis of the collateral framework eligibility<sup>181</sup>. This modelling choice may however present some limitations, not only from a technical viewpoint related to monetary policy implementation, but also from an identification perspective regarding the differences between the two groups. In fact, the ABSs eligible or not eligible for the collateral framework can be different in terms of risk characteristics and market pricing and this may cast some doubts on the comparability of the two groups<sup>182</sup>.

In order to increase the ex-ante comparability of the two samples, some additional information might be useful to allow for a more detailed matching of treated and control ABSs. On the supply side, the details on the loan-level composition of the underlying asset pools may be useful to control for the credit risk of the issued ABSs and then to identify instruments with more comparable risk properties: in this way the risk transfer incentives of originator banks would not significantly differ across products at the time of the issuance. On the demand side, the information on the securities holdings of the issued ABSs could be useful to control for the investor demand of individual ABSs and then to detect instruments with a similar investor base<sup>183</sup>: in this way it would be possible to match products which would have similar potential market demand at the time of the issuance. The use of these additional information sources would provide relevant inputs to further disentangle demand and supply factors in the ABS

---

<sup>181</sup> This would probably imply an upward bias in the size of the treatment sample, as some collateral-eligible transactions may not be considered for ABSPP purchases for due diligence considerations.

<sup>182</sup> Taking into account the potential issues for the definition of the treatment and control groups, Annex 2.B reports some preliminary evidence on the potential effects of the ABSPP on the probability of ABS retention.

<sup>183</sup> In presence of established originators with a regular market presence, the investor base from the previous issuances in the same series could actually provide a good indication of the investors interested in the new securities.



market and then it would contribute to improve the counterfactual design in the treatment evaluation.

## **2.8 Conclusions**

The chapter provides novel and relevant contributions to explain the determinants of the funding choices by Euro Area banks for the issuance of secured debt, with particular focus on two aspects. First, it studies – at the tranche-level - the determinants for the issuance of mortgage-backed securities versus covered bonds, with particular regard to the bank balance sheet characteristics and to the financial conditions in the countries of the originator or of the assets. Second, it investigates how monetary policy decisions and financial markets developments may affect the relative incentives for the retention versus the placement of newly issued ABSs by originator banks.

The retention of ABSs by Euro area banks in the analysed period was mainly intended to increase the amount of available collateral assets for potential use in the refinancing operations with the Eurosystem. Therefore, the decision for placement and retention can be also interpreted as the relative choice between two funding sources: the wholesale debt market for securitisation and central bank liquidity obtained eventually via the pledge of retained ABSs. By using the differential response of banks in ex-ante different funding conditions, I find a supply-induced effect of the full allotment policy on the retention behaviour of originator banks. Credit institutions in weaker liquidity and capital positions – following this measure – increased their probability to retain newly issued ABSs more than banks in stronger conditions. I investigate also the analogous effect of a funding shock due to the increase in the interbank market spread, inducing an increase in the funding costs in the interbank market.

This analysis could be further extended on two aspects. First, the use of loan-level data on the underlying ABS pool may provide further indications on the motivations for the specific issuance and placement decision of an originator bank. Second, security-level information on the holdings of these securities may offer some inputs to explain the demand dynamics in the securitisation market. In both cases, these additional sources of information would be available only starting from 2014, therefore they may be used to study the most recent developments in unconventional monetary policy and financial markets developments. In particular, they could provide relevant inputs to investigate the effects of some ongoing policy measures aimed at revitalising the ABS market, like the ABSPP and the STS securitisation initiative, while taking into account the interactions with other related policy measures. This would then contribute to a better understanding of the evolution of the securitisation market, also in a forward-looking perspective.

## 2.9 ANNEX

### **Annex 2.A Dataset Construction and Security Issuances**

This data appendix provides further information on the construction of the dataset used for the empirical analysis in Chapter 2, complementing the data presentation in Section 2.4, particularly for the issuances of fixed income instruments.

This dataset presents some analogies with the one used for Chapter 1, but in fact includes many new elements due to the scope of the analysis. The choice of the data sources has been guided by three main objectives: first, to investigate the determinants for the retention decisions of originator banks, I had to retrieve security-level information on the distribution or the retention of securitisation products; second, to link the data on securitisation issuances with the information on the collateral eligibility, I had to collect security-level data including at least a common identifier, i.e. the ISIN code, with the Eligible Assets Database of the Eurosystem; third, to compare the securitisation behaviour across different time periods for distribution and retention, I had to obtain data on securitisation and bank balance sheets also for some years in the pre-crisis time.

Given these objectives, the analysis of this chapter could not be developed with the dataset employed in the previous chapter, as the securitisation data from Capital IQ do not include information on the ISIN code and on the distribution vs. retention. Therefore, for the security-level information on securitisation and covered bonds, this study uses the fixed income data from Dealogic DCM Analytics, which include also details on the retention of individual tranches and on the ISIN code of the securities. In this way, I know both whether the instrument can be pledged as collateral with the Eurosystem and whether it is distributed or retained by the originator bank (for securitisation) or by the issuer bank (for covered bonds).

However, Dealogic DCM Analytics presents some potential issues for the mapping of fixed income data with bank balance sheet information. Indeed, it reports information on the originator of a securitisation deal and on the issuer of a covered bond, as well as indications about the ultimate parent of the bank; and the latter is particularly important for the analysis on banks' funding decisions, as they are taken at the group-level by the treasury department. However, in DCM Analytics, this indication of the ultimate parent is based on the group structure at the time of the data download. This raises significant issues for an empirical analysis on the bank-level determinants of issuance, which includes also the years before the global financial crisis.

For instance, for a fixed income product issued in early 2005, the data report the ultimate parent of the issuer or originator bank at the time of the data query, like mid-2018 in

this case. However, to characterise the bank balance sheet characteristics relevant for the issuance decision, I need to identify the ultimate parent bank at the time of the issuance. As anticipated in the Annex 1.D, several transactions of merger and acquisitions were undertaken in the Euro Area banking sector, both in the early 2000 and following the global financial crisis and the sovereign debt crisis. Also, some banks were subject to several acquisition operations since the time of the security issuance<sup>184</sup>: therefore, in order to identify the ultimate parent group at the issuance, it has been necessary to reconstruct the entire history of the M&A transactions for a given bank.

I had to conduct this manual check not only at the bank-level, but also at the security-level, given that the same bank could belong to different parent groups in different periods (with consequent implications for the assignment of the security issuance to the relevant banking group). For this purpose, I used the information on the structure of banking groups from various sources: S&P Market Intelligence; bank-specific information from rating agencies (mainly Moody's and S&P); decisions of the EU Commission in the restructuring process of banks benefiting from some form of crisis support by national authorities. Based on the available information, I could perform this assignment of the securities to the relevant banking group for all the issuances of covered bonds and asset-backed securities issued in the Euro Area since 2005<sup>185</sup>.

A similar issue has been highlighted in few other studies on the debt issuances by European banks: it has been just discussed by Camba-Mendez, Carbo-Valverde and Rodriguez-Palenzuela, but it has been addressed only by van Rixtel, Romo Gonzalez and Yang (2015). They analyse the issuances of unsecured senior and subordinated bonds and of covered bonds, but do not consider securitisation products. Given the additional issues of securitisation issuance data due to the deal structure involving different entities, this study provides a relevant contribution also from the data viewpoint, by linking the issuances of covered bonds and asset-backed securities to the bank balance sheet characteristics of the (issuer or originator) banking groups and to the collateral eligibility of the individual instruments.

---

<sup>184</sup> Just to give an example, Antonveneta was initially taken over by ABN Amro Amro and then purchased by Banco Santander, which sold it to Monte dei Paschi di Siena. This multiple series of acquisition operations is a feature common also to many savings banks in Spain, which went through a gradual process of consolidation first via the institutional protection schemes and then via the acquisition by major commercial banking groups.

<sup>185</sup> Going further bank would have required the availability of further and older information on mergers and acquisitions occurring before 2004 and in any case was not necessary for the purpose of the analysis.

## Annex 2.B ABS Retention. The Introduction of the ABSPP

Appendix Table 2.1 reports some preliminary evidence on the potential effects of the ABSPP on the probability of ABS retention, based on the estimation of a difference-in-difference equation along the lines discussed in Section 2.7. While on one hand collateral eligible ABSs generally displayed lower retention probability (because of higher market demand) than non-eligible ABSs, on the other hand originator banks may have marginally increased their retention of collateral-eligible ABSs following the ABSPP introduction. This is observed across different specifications. This could have various possible drivers, also related to the developments of the ABS market in presence of more attractive funding sources. Therefore, more accurate information on ABS demand – based either on bid-to-cover data at the pricing or on post-issuance securities holdings – could provide additional relevant inputs for this analysis.

**Appendix Table 2.1 ABS Retention. The Introduction of the ABS Purchase Programme**

| VARIABLES          | 2012 Q1 – 2018 Q1    |                        |                       |                        |
|--------------------|----------------------|------------------------|-----------------------|------------------------|
|                    | (1)<br>Coeff         | (2)<br>AME             | (3)<br>Coeff          | (4)<br>AME             |
| ABSPP              | 0.0262<br>(0.424)    | 0.00737<br>(0.119)     | -3.683<br>(103.5)     | -0.978<br>(27.46)      |
| ABSPPelig          | -1.480***<br>(0.273) | -0.416***<br>(0.0705)  | -1.589***<br>(0.260)  | -0.422***<br>(0.0631)  |
| ABSPP*ABSPPelig    | 0.672*<br>(0.348)    | 0.189*<br>(0.0969)     | 0.640*<br>(0.332)     | 0.170*<br>(0.0874)     |
| LevCommEquity_1    | 0.132<br>(0.180)     | 0.0370<br>(0.0504)     |                       |                        |
| RoA_1              | 0.774**<br>(0.309)   | 0.217**<br>(0.0851)    |                       |                        |
| GDPGrowthRate_1    | -0.0557<br>(0.102)   | -0.0156<br>(0.0286)    | -0.226**<br>(0.0904)  | -0.0599**<br>(0.0236)  |
| LongTermIntRate_1  | 0.00227<br>(0.00211) | 0.000638<br>(0.000590) | 0.000191<br>(0.00209) | 5.08e-05<br>(0.000555) |
| ShortTermIntRate_1 | 0.00110<br>(0.00350) | 0.000310<br>(0.000983) | 0.00460<br>(0.00630)  | 0.00122<br>(0.00167)   |
| Observations       | 426                  | 426                    | 533                   | 533                    |
| Bank FE            | YES                  | YES                    | YES                   | YES                    |
| IssuanceYear FE    | NO                   | NO                     | YES                   | YES                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### **3 Rules and Discretion(s) in Prudential Regulation and Supervision: Evidence from EU Banks in the Run-Up to the Crisis<sup>186</sup>**

Angela Maddaloni<sup>187</sup> and Alessandro D. Scopelliti

#### **Abstract**

Prior to the financial crisis, prudential regulation in the EU was implemented non-uniformly across countries, as options and discretions allowed national authorities to apply a more favourable regulatory treatment. We exploit the national implementation of the Capital Requirements Directive and derive a country measure of regulatory flexibility (for all banks in a country) and of supervisory discretion (on a case-by-case basis). Overall, we find that banks established in countries with a less stringent prudential regime were more likely to require public support during the crisis. We investigate the channels through which a more lenient prudential regulation may have led to greater financial vulnerability of banks. Using an instrumental variable approach, we focus on the component of balance sheet risk-taking explained by the prudential framework incentives and analyse how this affects bank resilience. More regulatory flexibility is associated with higher share of non-interest income, lower ratios of liquid assets and larger credit provision, leading to higher probability of distress. At the same time, in jurisdictions with more supervisory discretion, banks may have been induced to control the lending amount and to hold larger buffers of liquid assets, though by increasing sovereign exposures.

JEL Classification: G01; G21; G28

Keywords: Prudential Regulation and Supervision; European Banking; Cross-country Heterogeneities; Rules versus Discretion; Banking Union

---

<sup>186</sup> We thank the comments and suggestions by Carlo Altavilla, Thorsten Beck, Markus Behn, Francesco Cannata, Daniel Foos, Juan Carlos Gozzi, Jose Guedes, Victoria Ivashina, Michael McMahon, Marcus Miller, Alistair Milne, Steven Ongena, Mark P. Taylor, Thomas Vlassopoulos and Michael Wedow, and the participants at the SUERF Colloquium “The SSM at 1”, the European Finance and Banking Conference, the 57<sup>th</sup> Conference of the Italian Economic Association, the 25<sup>th</sup> International Rome Conference on Money, Banking and Finance, the IFABS 2017 conference in Oxford, the 2017 FINEST Conference and the 1st Annual Workshop of ESCB Research Cluster 3. Scopelliti acknowledges financial support from ERC ADG 2016 - GA 740272 “lending” (University of Zurich). Some results have been mentioned in a research bulletin article on “Prudential regulation, national differences and banking stability”, published as a ECB Research Bulletin Article No.58 in May 2019. The views presented in this paper are those of the authors and should not be attributed to the European Central Bank or the Eurosystem.

<sup>187</sup> Angela Maddaloni (European Central Bank): [angela.maddaloni@ecb.europa.eu](mailto:angela.maddaloni@ecb.europa.eu).

### 3.1 Introduction

In the aftermath of the global financial crisis and of the Euro Area sovereign debt crisis, an important academic and policy debate has developed on the role of prudential regulation in the prevention of banking crises. In particular, the debate focused around the question whether the prudential framework was instrumental in spurring the crisis and if a more stringent prudential framework could have contributed to avoid or reduce the intensity of the recent banking crises in advanced economies.

A potential challenge for an empirical study on this issue is that a bank-level cross-country analysis would require two major elements: a sample of banks from different countries but subject to a *harmonised regulatory framework*, so to allow for direct comparability of some specific features across countries; a relevant *source of variation in prudential regulation* across jurisdictions before the crisis, with potential implications on risk-taking incentives for banks subject to different prudential regimes.

The EU framework for prudential regulation provides a good setting for an empirical analysis on this topic. The EU prudential regime before the crisis was based on some key principles defined at the EU level, but implemented at the country level through national acts of transposition. In particular, the *national options and discretions* – allowed by the EU directives and left to the exercise of national legislators and supervisors – provided a source of variation in prudential regulation across EU countries for the determination of capital requirements. We exploit the heterogeneous implementation of national options and discretions pre-crisis - following the adoption of the Capital Requirements Directives (CRD) - in order to analyse the crisis resilience of banks subject to different national regimes.

Within the prudential framework defined by the Capital Requirements Directives, implementing the Basel II accord, national authorities had the opportunity to apply the capital adequacy requirements with different degrees of stringency, exploiting the regulatory flexibility and the supervisory discretion allowed by 152 options and discretions. Using this information we construct novel indicators of *flexibility* and *discretion* in prudential regulation. We exploit country-level information on the CRD implementation in national systems and we classify the national options and discretions in two main categories: whether they enable national regulators to establish a more favourable treatment for all banks (*regulatory flexibility*), or whether they assign to national supervisors the prerogative to waive some regulatory requirements for specific banks based on a case-by-case assessment (*supervisory discretion*). We use these indicators to investigate whether banks established in different countries and subject to distinct regulatory frameworks had a different probability to be in distress as a consequence of the financial crisis.

Our analysis yields a series of interesting results. We find that credit institutions established in countries with less stringent prudential regulation were more likely to require

public support during the global financial crisis. A 1-point increase in the overall indicator, corresponding to the exercise of a national option on a specific legal provision and implying the application of a more favourable regulatory treatment for banks, is associated with a 1.23 percentage point increase in the probability of a bank in that country to require public support during the crisis. This result is broadly confirmed across various measures of government intervention, i.e. recapitalisations, credit guarantee schemes, liquidity provision. Importantly, this result holds also when controlling for bank size in line with too-big-to-fail argument (i.e., larger banks are more likely to receive public support because of their systemic status).

We also explore the potential trade-off between *rules* and *discretion* in the design of prudential regulation. General rules define the regulatory treatment for all banks in a given country, without requiring a previous supervisory assessment; while supervisory discretions assign to the supervisor the power to authorise specific banks to apply a more permissive treatment, based on a case-by-case examination. The results suggest that the provision of a more lenient treatment may affect negatively the stability of banks both under regulatory flexibility and under supervisory discretion.

However, when developing our analysis for banks of different size, we observe that the incentive structure of these two dimensions works quite differently for large and medium-small banks. In fact, we find that supervisory discretion has more negative repercussions on the stability of large banks, as they are able to exert more influence on the outcome of the supervisory assessment and then to obtain the provision of a more favourable treatment even when undertaking significant risk. On the other hand, regulatory flexibility increases the probability of bank distress particularly for medium and small banks, which in fact are not in the position to benefit from supervisory discretion as large banks also due to lack of resources.

Next, we analyse the potential reasons why banks subject to less stringent pre-crisis prudential regulation showed higher probability of requiring public support during the crisis. We investigate the channels through which a laxer prudential framework could have led to higher financial vulnerability of credit institutions over the crisis. We focus on some determinants which have been highlighted in the aftermath of the crisis as potential sources of risk for banking stability: the provision of “excessive” lending, the reliance on non-interest income sources and the inadequacy of liquidity buffers. We document that, in countries with more regulatory flexibility, banks had lower ratios of liquid assets, higher shares of non-interest income, and larger credit provision (suggesting a potential risk-taking channel induced by a more lenient regulation). While, in countries with more supervisory discretion, banks extended a more limited amount of loans and held larger buffers of liquid assets, though via wider exposures to government bonds.

We find some evidence that a more lenient prudential framework might have spurred larger lending provision hindering the stability of banks. In fact, bank lending in countries with

more regulatory flexibility is associated with higher likelihood of requiring all types of bailout during the crisis. This effect is driven by the lending behaviour of medium and small banks and concerns mostly residential mortgages, in line with the evidence on the bust of the housing bubble and the losses for the banks involved in residential real estate. We examine also the credit quality of bank loans and we find that the lending provision to riskier borrowers – as explained by a laxer prudential regime and leading to higher ratios of non-performing loans – increased significantly the probability of bank distress. This is consistent with other studies showing that lending standards may be softened more in an environment of less stringent capital requirements (see Maddaloni and Peydró, 2011 and 2013).

At the same time, we observe that supervisory discretion may play some role in limiting the share of bank assets invested in loans. Therefore, lending activity explained by higher supervisory discretion is generally associated with a lower probability to receive public support. This effect is stronger for large banks, although it concerns also medium and small banks. However, the economic significance of this positive effect from supervisory discretion is overall smaller than the one of the negative effect from regulatory flexibility.

We also explore the composition of bank revenues, and in particular the share of bank income from non-interest sources, as an indicator of less traditional and potentially riskier activities. Indeed, we find evidence that a larger reliance on non-interest income sources – as explained by laxer prudential regulation - increased the probability of a bailout and in particular of recapitalisation and liquidity support (see also recent evidence by Xu, Hu and Das, 2019).

The regulatory framework set by the CRD contained provisions for the determination of capital requirements and the pursuit of the business of credit institutions. No explicit rules concerned bank liquidity. Nevertheless, some possible spillovers between capital regulation and bank liquidity behaviour could be envisaged (see among others Admati, DeMarzo, Hellwing and Pfleiderer, 2013; Rochet and Vives, 2004). First, we document that in countries with more regulatory flexibility, banks have been holding lower liquidity buffers, differently from countries with higher supervisory discretion. A formal analysis linking liquidity buffers with the prudential framework points to the presence of spillovers across regulatory instruments. Banks with lower liquidity buffers, as explained by a more flexible regulatory framework – which established only capital requirements, were more likely to receive public support.

Although the regulatory treatment in the Basel accord establishes that the exposures to government bonds are not subject to risk-weighted capital for credit risk, the experience of the Euro Area sovereign debt crisis shows that this exposure has represented for some EU countries an important source of risk. We document that, in countries where credit institutions were subject to more supervisory discretion, banks tended to have larger exposures to government



bonds<sup>188</sup> (this may possibly reflect a moral suasion argument: see for instance Ongena, Popov and Van Horen, 2019; Altavilla, Pagano and Simonelli, 2017). We analyse whether these large holdings of government securities may have resulted in higher risk taken by the banks. Indeed, we show that holdings of sovereign debt associated with a laxer prudential environment are positively associated to a higher probability of requiring a bailout. Our results support the existence of a strong sovereign-bank nexus especially in countries where supervisors retain a high level of discretion and suggest that this nexus may have had a detrimental effect on financial stability even ahead of the full realisation of the Euro Area sovereign debt crisis.

Our analysis is related to the policy debate which brought to the establishment of the Banking Union. The creation of the Banking Union was undertaken by the EU to address the significant concerns, due to the crisis experience, that the regulatory flexibility and supervisory discretion allowed at the national level in the pre-existing EU prudential framework could have produced negative implications for financial stability. Following the banking crisis in the EU, academics and policy-makers have argued that the heterogeneity in the national implementation of regulatory and supervisory standards might have spurred differences in the risk-taking of credit institutions across EU countries before the crisis. Overall this resulted in negative spillovers on public finances as national governments intervened in support of distressed credit institutions, thus contributing to the intensification of a vicious sovereign-bank nexus. Our results provide some support to this argument. However, they also underline that different sources of risk may interact in different ways with national options and provisions.

The rest of the paper proceeds as follows. Section 3.2 provides a literature review while Section 3.3 illustrates the framework for bank regulation in the EU and Section 3.4 presents the construction of the indicator for prudential regulation in the EU. Sections 3.5 and 3.6 describe respectively the methodological setup and the data. Section 3.7 discusses the results, and Section 3.8 presents the conclusions.

## **3.2 Related Literature**

This paper relates to various strands of the banking literature: the relation between capital requirements and bank risk-taking; the design of prudential regulation and supervision in a supranational setting; the determinants of bank distress episodes and public support to banks in crisis times. We briefly review these strands of literature and describe our related contribution.

### *Capital requirements and bank risk-taking*

Various studies in the empirical literature investigate the relationship between the stringency of banking regulation and supervision and various aspects of banking system

---

<sup>188</sup> Before the crisis, government securities were generally considered – independently from the issuer country – as the safest type of liquid assets.

performance, such as stability, efficiency and loan provision. Many of these analyses are developed using the data from the Bank Regulation and Supervision Survey, conducted by the World Bank at the cross-country level since 2001<sup>189</sup>. The studies based on this survey find mixed results on the effectiveness of capital regulation in reducing bank risk-taking and promoting the stability of national banking systems.

Using the first wave of the World Bank Survey, Barth, Caprio and Levine (2004) conduct a cross-country analysis on multiple regulatory and supervisory practices, but they provide a cautious assessment on the beneficial effects of capital regulation, when controlling for other features of bank regulation and supervision. They observe that capital regulation stringency is negatively linked with the ratio of non-performing loans, but they do not find conclusive evidence on the relation between capital regulation and banking crises. Other studies use more granular data at the bank-level, to control for the heterogeneity in bank balance sheet characteristics and corporate governance, which could also affect bank risk-taking. For instance, Laeven and Levine (2009) find that the actual sign of the marginal effect of regulation on risk varies with ownership concentration: stricter capital regulations and more stringent activity restrictions are associated with greater risk for banks where large owners have substantial cash flow rights; while they have opposite effect in widely held banks.

Some papers exploit the cross-country heterogeneity in regulation and supervision to study whether multinational banks with cross-border operations may have taken advantage from more lenient national prudential frameworks. Buch and DeLong (2008) examine cross-border bank mergers and find that the supervisory structures of the partners' countries influence changes in the post-merger total risk. In fact, the total risk of the new post-merger entity increases when the target bank is located in a country with stronger supervision, which limits the risky activities of the local banks: in this case, an acquirer entering a country with strong supervision can shift risk back to its home country. Houston, Lin and Ma (2012) study the effects of cross-country regulatory differences on international bank flows and show that banks have transferred funds to markets with less stringent banking regulation; this could have restricted the ability of national regulators to limit bank risk-taking. These links between regulatory differences and bank flows are however stronger when the recipient country is a developed country with strong property and creditor rights, as a strong institutional environment is a condition to explain these regulation-driven bank capital flows. Ongena, Popov and Udell (2013) investigate the cross-border spillover effects of bank regulation through the lending activities of large multinational banks. Using survey data on business lending by banks to firms in 16 countries, they show that tighter restrictions on bank activities, and to a lesser extent

---

<sup>189</sup> For a presentation of this survey and a discussion of the various theoretical and empirical arguments on banking regulation and supervision, see Barth, Caprio and Levine (2006). The survey explores multiple regulatory and supervisory practices, like regulatory restrictions on bank activities and market entry, capital adequacy requirements, deposit insurance design, supervisory power and independence, information disclosure and market monitoring.

higher capital requirements in domestic markets, are associated with lower bank lending standards abroad.

The studies based on the World Bank Survey<sup>190</sup> use indicators of capital regulation which are developed for global comparisons. When these indicators are used to compare countries with significant regulatory harmonisation, as it is the case for EU countries, they may not be able to fully capture the granularity of national differences. Our study contributes to this literature by proposing new country-level indicators of prudential regulation, which are based on the national implementation of a common regulatory framework, as the one set in the EU by the Capital Requirements Directive. The existence of many options and discretions allows us to compare how different national authorities decided to apply and enforce each individual legal provision. This increases the comparability of the national decisions in the design of prudential regulation and the exercise of prudential supervision.

*The design of banking regulation and supervision in a supranational context*

The design of prudential frameworks raises some important issues and trade-offs already in the context of single jurisdictions, but it may entail additional layers of complexity in a multi-country setting, where national authorities are entitled to determine the rules of prudential regulation and the modalities of banking supervision. The academic and policy debate has highlighted two main views, as reflected in the trade-off between the level-playing field principle and the proportionality principle.

The traditional view, based on the level-playing field principle, is that differences in the regulatory burden across banks established in different countries may induce potential distortions to competition. This may incentivize national legislators to relax prudential requirements for national banks to improve their competitive positions with respect to the credit institutions in other countries, possibly with negative consequences on financial stability. This view has been highly influential in policy environments. Based on these arguments, the Basel Committee for Banking Supervision (Goodhart, 2011) has been promoting the international coordination among banking regulators and supervisors since 1974; also, as discussed more extensively in the next section, EU authorities have been leading a process aimed before at the regulatory harmonization across EU countries and then at the creation of a Single Rulebook.

The theoretical literature provides some support to this argument. Dell’Ariccia and Marquez (2006) analyse the competition in setting regulatory standards among independent bank regulators with financially integrated jurisdictions, to study the incentives to form a regulatory union. They show that Nash competition reduces regulatory standards relative to a centralized solution. On the other hand, centralized regulation may imply a loss of flexibility as the same standards would be applied in jurisdictions with potentially different characteristics:

---

<sup>190</sup> See also Brewer III, Kaufman and Wall, 2008; Angkinand, 2009; Fonseca and González, 2010; Klomp and de Haan, 2012

therefore, centralized regulation can emerge more likely across relatively homogeneous countries. Boyer and Kempf (2018) extend this game-theoretic approach to study the efficiency of modern banking regulation including also liquidity requirements: in financially integrated systems, as banks freely choose their locations, regulatory arbitrage may restrict the capacity of regulators to use their instruments efficiently. This further supports the argument for regulatory harmonisation and even for a single rulebook applicable to banks established in integrated jurisdictions.

Acharya (2003) investigates the desirability of the international convergence of capital adequacy regulation in a two-economy model of financial integration. He finds that regulatory competition leads to worst regulation. However, he highlights the need for a joint analysis of minimum capital requirements (ex-ante) and of resolution policies (ex-post), arguing that the optimal design of capital requirements should take into account the extent of forbearance in resolution policies<sup>191</sup>. Therefore, international coordination in capital regulation is desirable only if accompanied by the standardisation of resolution policies.

The theoretical literature has also highlighted some potential limits of the approach aimed at establishing a level-playing field (Morrison and White, 2009 and 2005). Morrison and White (2009) show that in general level-playing fields impose the standards of the weakest regulator on the best-regulated economies, although they may be desirable in presence of high capital mobility. In fact, multinational banking may mitigate the cherry-picking effect from the existence of different national regulations, and so reduce the damage that a level playing field causes in the best-regulated economies.

Another important strand of literature investigates the trade-offs related to the allocation of banking supervision tasks<sup>192</sup> in supranational or federal contexts, also taking into account the potential interest divergences and/or inconsistencies among different supervisors. Focusing on the US, Agarwal, Lucca, Seru and Trebbi (2014) analyse the effects of the rotation between state and federal supervisors for state-chartered banks and they find that federal supervisors are twice as likely as state supervisors to apply a lower CAMELS rating. Some theoretical studies, also in connection with the developments of the EU Banking Union, have investigated why local supervisors may have the incentive to be more lenient than central supervisors. For instance, Carletti, Dell’Ariccia and Marquez (2019) study the behavior of supervisors when a centralized agency is entitled to take all decisions on banks, but relies on local supervisors to collect the necessary information. They investigate the implications of this principal-agent

---

<sup>191</sup> The argument – symmetric to the one for regulatory policies - would be that banks in more forbearing regimes take more risk, with negative profit spillovers on banks in less forbearing regimes. As these banks may be forced to exit the market, their resolution authorities may then adopt greater forbearance, with the result that all national authorities will converge to the worst level of forbearance.

<sup>192</sup> For a survey on the design of banking supervision and for a discussion on the trade-offs related to the allocation of the supervisory tasks to a “central” authority rather than to a “local” authority, see Ampudia, Beck, Beyer, Colliard, Leonello, Maddaloni and Marqués-Ibáñez (2019).

problem between the central and the local supervisors: on one hand, information collection may be inferior and this may increase bank risk-taking; on the other hand, a tougher central supervisor may increase regulatory standards.

Our paper contributes to this literature in two dimensions. First, it brings to the data the question about the financial stability rationale of a regulatory level-playing field across financially integrated jurisdictions, by making use of the unique institutional setting of EU countries. This allows us to test some of the arguments proposed in the theoretical studies. Second, while existing studies focus mainly on the stringency of the prudential frameworks, we add another dimension as we introduce the trade-off between rules and discretion, taking advantage of the design of national options and discretions. While a more lenient prudential regulation may have some risk-taking implications for banks, the way this more favourable regulatory treatment is provided (general rules for all or supervisory discretion based on a case-by-case assessment) may play a crucial role in affecting banks' incentives.

#### *The determinants of bank distress and public support during the financial crisis*

In the aftermath of the global financial crisis, various studies have investigated the differences across banks before the crisis to identify the bank balance sheet characteristics and the risk-taking behaviours which could have contributed to the fragility of some banks. Some studies have examined banks' performance by using market-based measures of stock returns and systemic risk.

Demirguc-Kunt, Detragiache and Merrouche (2013) study whether better capitalised banks experienced higher stock returns during the crisis, focusing on a sample of banks from 12 countries. While before the crisis differences in capital did not have much impact on stock returns, during the crisis a stronger capital position was associated with better stock performance. Moreover, this relationship has been observed to be stronger when measuring capital with the leverage ratio than with the risk-weighted capital ratio, as market participants seemed to assess risk-adjusted measures as less able to properly reflect risks. The work by Gambacorta and Shin (2018) also shows that better capitalized banks can borrow at cheaper rates and in turn increase credit at faster pace, which could spur higher risk-taking during economic upturns. Beltratti and Stulz (2012) estimate the relation between bank characteristics in 2006 and the stock returns of banks from mid-2007 to end-2008 for a sample of listed banks from 32 countries. Their evidence shows that more fragile banks had more short-term market funding and higher leverage. They investigate also the potential role of regulation, i.e. whether laxer regulation led banks to take more risks, using the country-level indicators from the World Bank Survey. They don't find significant correlations between national regulatory differences and banks' crisis performance, except for a positive relation between activity restrictions and bank performance. Altunbas, Manganeli and Marques-Ibanez (2017) analyse – for a sample of EU and US banks - the pre-crisis bank characteristics which were associated with higher

likelihood of default during the crisis. Banks following aggressive credit expansion policies, with unstable funding and large size experienced ex-post higher distress, as shown by some measures of realized risk, like public financial assistance or systemic risk measures computed on the basis of stock market movements. Developments in real estate also explain the build-up of risk particularly for banks with the above features.

Some papers investigate the determinants of public support to banks during the global financial crisis, particularly in Europe. Rose and Wieladek (2012) examine public intervention to UK banks, using a multinomial logit for different types of measures (capital injections, nationalisations or liquidity schemes). They find evidence in support of the too-big-to-fail hypothesis, as the relative size of a bank (with respect to the size of the national banking system) had a large positive and non-linear effect on the probability of public support. Acharya, Steffen and Steinruecke (2018) study the governments' decisions for public support to distressed banks in the euro area from 2007 to 2009 and investigate whether fiscal constraints faced by governments may reduce the likelihood or delay the time of public bailout decisions. Using an exponential hazard model to estimate the timing of public intervention, they find that governments with lower fiscal capacity and in countries with weakly capitalized banking sectors<sup>193</sup> delayed capital injections. Also, the estimation of a Tobit model for aid amounts shows that more fiscally constrained governments granted smaller recapitalization amounts.

Some other studies take a longer time perspective, by analysing the determinants of bank performance also in previous distress episodes before the global financial crisis. Berger and Bowman (2013) examine how capital affected the performance of US banks across financial crises from 1984 to 2010, investigating the developments in banks' survival probability and market share before and after episodes of banking and market crises. They find that capital contributed to improve the performance of small banks at all times, while it enhanced the performance of medium and large banks primarily during banking crises. Poghosyan and Cihak (2011) study the determinants of distress events for EU banks from 1997 to 2008, by estimating a logit model for the probability of distress episodes, as identified based on financial news. Their results show that the probability of distress was negatively associated with the level of bank capitalization and earnings, and was positively related to loan loss provisions; in addition, the random effects logit estimations suggest some evidence of risk convergence across EU countries over this long time span.

Our analysis contributes to this literature by exploring the potential endogeneity of bank balance sheet conditions with respect to the regulatory framework, in the context of the determinants of banks' fragility. We note that national differences in the implementation of the EU prudential framework had implications on the balance sheet management of banks located

---

<sup>193</sup> This finding for euro area banks is consistent with previous empirical evidence for banking crises in emerging markets (Brown and Dinc, 2005 and 2011)

in different countries. Therefore, we instrument some balance sheet variables identified in the literature as potential measures of risk-taking with the regulatory indicators to investigate the differences in the crisis resilience of banks.

### **3.3 Bank Regulation in the EU**

The discussion in the EU concerning the Banking Union and the establishment of the Single Supervisory Mechanism (SSM) has focused, among various aspects, on the importance of a level-playing field in banking regulation. This is necessary to make sure that the SSM can treat similar situations in a homogeneous way, but it may not be sufficient to ensure the financial stability of national banking systems.

On the one hand, a level-playing field limits the possibility that, in the presence of different legislations applicable to banks in distinct countries, a single European Supervisor in charge of enforcing the application of prudential rules may have to judge similar cases in different way<sup>194</sup>, with potentially negative implications for the effectiveness of the Single Supervision. On the other hand, the level-playing field – in order to improve the soundness of the system - has to be established on the ground of high and rigorous standards for prudential regulation.

The empirical analysis presented in this paper suggests that a common framework allowing for multiple options and discretions may be exploited by national authorities to significantly reduce the stringency of the prudential regime, with potentially undesirable effects on bank risk-taking and crisis resilience.

In order to illustrate the features of this institutional setting, we summarize the main steps in the developments of EU banking regulation. The case for an effective harmonization in bank regulation across EU countries was firstly promoted in the late 1990s and early 2000s, in order to ensure the full implementation of the Single Market for Financial Services. At that time, the key economic rationale for a level-playing field in bank regulation in the EU was to establish homogeneous competitive conditions for credit institutions established in different countries. In absence of a common regulatory framework, differences in the regulatory burden across national legislations may have induced potential distortions to competition. In turn, this could incentivize national legislators to relax prudential requirements for national banks to improve their competitive positions among the credit institutions in the EU Single Market. For this reason, some degree of harmonization was needed in order to avoid a “race to the bottom”, as a potentially inefficient outcome (in terms of social welfare) of this game among national legislators.

---

<sup>194</sup> This issue has been stressed by policy-makers and supervisors also in public speeches and engagements. See for instance Lautenschläger (2016).

In 2000, the EU adopted a single Banking Directive (Dir. 12/2000) to replace and coordinate the existing directives and to improve the consistency of the regulatory framework for the activities of credit institutions in the EU. The Banking Directive was based on the principles of the Basel I agreement (established in 1988 and integrated in 1996 with the amendment for market risk).

Then, the adoption of the Basel II Accord in 2004 prompted an implementation process in the EU through two directives: a recast of the Banking Directive (Dir. 48/2006) and the Capital Adequacy Directive (Dir. 49/2006). The proposal was adopted by the EU Commission already in 2004 and was discussed by the EU Council and the Parliament in the course of 2005. The national acts of implementation were adopted by Member States in the course of 2006, but in general – given the long process of negotiation for the new accord – banks had started to adjust their business models well in advance of the formal implementation.

The national options and discretions provided in the Capital Requirements Directive (CRD) were designed to counterbalance the setting of a level-playing field with the application of a proportionality principle at the national level. They were introduced also to take into account some pre-existing country differences in the structure and the business models of national banking systems: consequently, the exercise of the specific options and discretions by national authorities reflected also the previously different approaches to prudential regulation and supervision across EU countries. At the same time, it is important to recall that the introduction of Basel II in 2004 set a very significant game changer in prudential regulation, also because it concerned many new areas uncovered under Basel I. Therefore, the CRD framework adopting Basel II presented – in many areas not subject to regulation before – significantly new options and discretions whose exercise national authorities were required to assess for the very first time, and for which there were not existing national experiences.

The occurrence of the global financial crisis in 2008 put into question the effectiveness of this regulatory framework and the existence of national options and discretions. First, the framework could have been inadequate to discipline the prudential conduct of banking groups with significant cross-border activities<sup>195</sup>. Also, given that credit institutions in distinct countries were subject to – at least partially - different regulatory frameworks for capital requirements, it was argued that national differences in prudential regulation could have played some role in the risk-taking of banks of different nationalities.

In principle, the regulation of cross-border banking groups could benefit from the application of the “home versus host” principles, disciplining in which cases the supervisors should apply the rules of the home country for the banking group and the rules of the host country for the subsidiaries. However, this could tackle the inconsistencies in regulation across countries only at the level of the individual cross-border banking groups. In fact, the differences

---

<sup>195</sup> In some cases, for a few banking groups, the amount of cross-border assets could be as large as the size of domestic assets.



in the prudential frameworks across national banking systems, and the consequent implications in terms of risk-taking, could not be dealt with via a solution applicable only to individual institutions, but required a regulatory solution at the system level.

For these reasons, when the Basel Committee adopted the new Basel III accord in 2011, the European Commission proposed to implement the new prudential requirements in the EU through a Single Rulebook, in order to establish a uniform regulatory framework across EU countries. Then the new legislative package finally adopted by the EU included a regulation, directly applicable in all countries (Reg. 575/2013) and a directive, still subject to national implementation (Dir. 36/2013). The CRD 4/CRR package is a key step for the Single Rulebook, in coordination with the Regulatory Technical Standards of the European Banking Authority (EBA). However, it still contains a relevant amount of national options and discretions.

The Single Rulebook was originally designed to ensure consistency in prudential regulation across EU countries, in a context where the key tasks for prudential supervision were still assigned to national authorities. Then, the need for a further integration in the banking sector policies, and in particular for a consistent application and enforcement of the Single Rulebook, led the European Council in June 2012 to take the decision to launch the Banking Union, based ideally on three main pillars, the Single Supervision, the Single Resolution (both already in force) and the European Deposit Insurance Scheme (the latter still to be established). In this framework, the Single Rule-Book provided the necessary common regulatory ground for the Single Supervision and Resolution Mechanisms<sup>196</sup>.

### **3.4 A Novel Indicator for Prudential Regulation in the EU**

In order to investigate the potential implications of laxer prudential regulation on bank risk and on crisis resilience, we focus on the regulatory framework established through the Capital Requirements Directives in the pre-crisis period (from 2005 to 2007) and we construct country indicators of regulatory flexibility and supervisory discretion in prudential regulation. All EU Member States adopted the Basel I and then the Basel II standards through the implementation of EU directives [in particular Dir. 48/2006 and Dir. 49/2006 for Basel II]. However, the directives allowed for several options and national discretions, which de facto created important cross-country differences in the implementation of standards.

---

<sup>196</sup> The ECB, in its capacity as the competent authority for significant institutions in the context of the SSM, has undertaken an initiative with regard to the options and discretions available to the supervisory authorities. See the Regulation and the Guide of the ECB on the exercise of options and discretions for significant institutions in Union Law (March 2016). More recently, also in relation to less significant institutions subject to the direct supervision of national competent authorities, the ECB has conducted extensive work on harmonising national options and discretions, with the publication of a Guideline and a Recommendation for national competent authorities (April 2017).

The European Banking Authority (EBA) provides accurate information on these issues, following up on a request of the EU Commission. The EBA reports<sup>197</sup> which countries adopted such discretions in the CRD framework and how they exerted them. It also provides a qualitative assessment, based on a survey across Members States and the industry, of the impact of each national option and discretion on the level-playing field and the capital requirements of credit institutions. We build an indicator of prudential regulation based on the EBA report. Whenever necessary we integrate with information drawn from the directives.

Given the large number of national options and discretions (152 as identified by the EBA), as well as the different impact of such options on capital requirements and regulatory burden, we construct a quantitative index capturing the degree of flexibility and discretion in prudential regulation in each country. The ability to exercise an option as defined in the CRD generally implies a more lenient regulatory treatment. We construct the indicator such that the exercise of a regulatory option in a given country translates in positive values of the indicator. Thus, a higher value of the indicator reflects a more permissive treatment for all credit institutions or for some of them (depending on the option being subject to supervisory approval or not).

We calculate an Overall Indicator of prudential regulation and two sub-indicators of Regulatory Flexibility and Supervisory Discretion. This distinction is related to the classification of the *national options and discretions* in two main categories, depending on whether the exercise of the option implied a more favourable regulatory treatment for all credit institutions in one country or only for individual banks assessed on a case-by-case basis, following an ad hoc supervisory decision. Therefore the Regulatory Flexibility indicator refers to general options and discretions that – if exerted by the Member State - allowed for a more flexible banking regulation for all banks established in that country, as they relaxed the prudential requirements<sup>198</sup> or reduce some regulatory burden in terms of disclosure.<sup>199</sup> The Supervisory Discretion indicator is built on the case-by-case options and discretions which attribute specific powers to the competent supervisory authorities, such that they are entitled to authorize the application of a more favourable regulatory regime for specific credit institutions. The Overall Indicator is constructed as the sum of the two sub-components for Regulatory Flexibility and Supervisory Discretion.

Some examples of national options and discretions classified as regulatory flexibility and supervisory discretion may provide an idea about the prerogatives of national authorities

---

<sup>197</sup> The “Technical advice to the European Commission on options and discretions” was adopted in 2008 by the Committee of European Banking Supervisors, which was actually succeeded by the European Banking Authority on 1 January 2011. See CEBS (2008)

<sup>198</sup> For instance, through some discretion in the implementation of accounting rules for own funds or item deductions, as well as in the application of the standardized or of the internal rating approaches.

<sup>199</sup> For example, through some discretion in the disclosure framework for consolidated entities in banking groups

and the potential impact of these options on banks' incentives for risk-taking. For instance, regulatory flexibility allowed national authorities to set the definition of loan default in the IRB approach on credit risk, within a range between 90 and 180 days past due. A more lenient definition for the banks located in a certain country could have raised forbearance incentives with respect to non-performing loans. Also, Member States could take advantage of the regulatory flexibility to apply a lower risk weight to short-term interbank exposures, for credit risk in the standardized approach; by reducing the regulatory costs for interbank loan supply, this could have encouraged the provision of interbank lending but also the reliance of banks on this short-term funding source.

On the other hand, supervisory discretion allowed national supervisors – based on a case-by-case assessment - to provide a more favourable treatment in various areas, including those relevant for the sovereign-bank nexus. For instance, subject to discretion of national supervisory authorities, the 0% risk weight treatment for EU sovereign bond exposures could be extended also to banks' exposures guaranteed by the Governments; this might have incentivized banks to increase those exposures which could benefit from sovereign guarantees. Also, national competent authorities could decide – on a case-by-case basis - to apply lower risk weights to the exposures to public sector entities; this may have raised incentives to provide loans to public sector entities, particularly if guaranteed by the government. Moreover, for the determination of the position risk in the trading book, including market risk, subject to the discretion of the national authorities, a 0% weighting could be assigned to debt securities issued by governments and some credit institutions, provided that these securities were denominated and funded in domestic currency.

More generally, the CRD framework considered in this paper contained options and discretions related to various relevant areas: the capital treatment of participations in insurance companies; the counterparty credit risk for derivatives contracts cleared with central counterparties; the credit risk for the lending exposures secured by residential or commercial real estate; the list of the entities eligible for the provision of unfunded credit protection; the specific risk requirements for trading book items; the trading book treatment of the underwriting of debt and equity instruments. Most of these options and discretions allow for a more favourable regulatory treatment. However, this doesn't mean necessarily that the bank behaviour allowed by these options implies overall higher risk. For example, one of the rationales for the differentiation in terms of regulatory treatment is to reflect different bank business models.

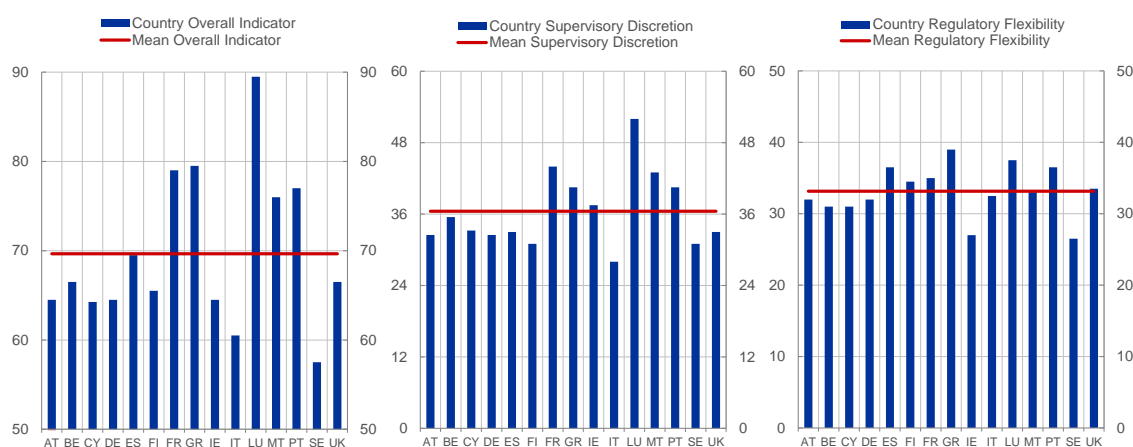
Based on the large set of national options and discretions, the indicators built for this analysis address different aspects of the prudential framework set in Basel II and in the CRD framework. We consider nine categories related to the implementation of the directive:

1. Definition of own funds
2. Scope of application
3. Counterparty risk
4. Standardised approach
5. IRB approach
6. Credit risk mitigation
7. Operational risk
8. Qualifying holdings
9. Trading book

For each of these categories we examined all the options that were allowed, inputting 1 for an option that indeed would increase regulatory flexibility or supervisory discretion and 0 otherwise. Moreover, acknowledging that not all the options had the same possible impact, we weight the input by 0.5 or 1, depending on the importance, as highlighted in the EBA report<sup>200</sup>.

Figure 3.1 displays the values of the overall indicator of Prudential Regulation and of the two sub-indicators of Supervisory Discretion and Regulatory Flexibility for the 15 EU countries in our sample.

**Figure 3.1 The Indicator of Prudential Regulation across EU Countries**



Note. The charts display – for 15 EU Member States in our sample – the values of the overall indicator of prudential regulation (left-hand) and of the indicators of supervisory discretion (middle) and regulatory flexibility (right-hand), as well as the corresponding averages across countries. The indicators are computed based on the exercise – by national authorities – of the options and discretions set in the Capital Requirements Directives.

<sup>200</sup> See Annex 3.A for details on the individual options and discretions. Specific details about the exercise of options and discretions are not available for the Netherlands and Denmark.

### 3.5 Empirical Specification

Given the significant differences in the stringency of the pre-crisis banking regulation across EU countries, we investigate the relationship between the degree of flexibility and discretion in the pre-existing national prudential regimes and the probability of a bank to be in distress during the crisis period.

Based on the above described indicators of prudential regulation and supervision, and controlling for bank-specific characteristics and country-specific factors, we examine whether pre-existing cross-country heterogeneities in banking regulation may explain, in isolation or in combination with other factors, differences in the stability of credit institutions located in distinct countries during the crisis period.

The main hypothesis to be tested in our baseline specification is whether banks established in countries with a less stringent prudential framework were more likely to receive public support measures during the financial crisis. In fact, for the period of the global financial crisis (2008-2010), the episodes of bank distress can be extensively identified based on the measures of public support to banks, given that governments implemented various forms of public intervention without any significant constraints at the EU or at the national level<sup>201</sup>.

For this purpose, we estimate a probit model for the probability of receiving a government bail-out as in equation (1):

$$(1) \quad P(\text{Support}_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

where  $(\mathbf{x}'\boldsymbol{\beta}) = \alpha + \beta \text{Regul}_{jt-1} + \gamma \text{BankVariables}_{ijt-1} + \delta \text{MacroControls}_{jt-1} + \varepsilon_{ijt}$

where  $i$  denotes the bank,  $j$  identifies the country,  $t$  refers to the crisis period between 2008<sup>202</sup> and 2010 and  $t-1$  indicates the period from 2005 to 2007, which is the relevant time period for the design and the implementation of the CRD framework. The bank-level variables and the country-level variables are computed as averages for the period 2005-2007.

The dependent variable is a dummy equal to 1 in case public support for a bank has taken place and 0 otherwise. We consider either a dummy for any type of public support, or dummies related to particular measures of financial assistance (recapitalisations, guarantees on bank liabilities or access to liquidity facilities). We control for bank characteristics, including bank size (as the log of total assets) and profitability (the return on average equity). We also

---

<sup>201</sup> To deal with the gravity of the global financial crisis and in the attempt to minimize the consequences of bank distress on the real economy, the EU Commission did not raise objections – in the context of the state aid control - to the implementation of these national measures, as they were deemed as necessary to remedy a serious disturbance in the economies of Member States (see Art. 103 (3) (b) of the Treaty on the Functioning of the European Union). In addition, the Commission's 2008 Banking Communication did not require – as a condition for the approval of the state aid – any mandatory burden-sharing measure for shareholders or subordinated bondholders, which could have otherwise disincentivised national authorities from the activation of this public intervention.

<sup>202</sup> The first public banking intervention was the nationalization of Northern Rock by the UK Government.

include some variables for bank balance sheet composition: on the asset side, the ratio of net loans to total assets, and the ratio of sovereign bond exposures to total assets; on funding liquidity, the ratio of liquid assets to deposits and short-term liabilities; on income sources, the ratio of non-interest income to total revenues. We control also for country-specific macroeconomic variables: the GDP growth rate; the short-term rate, proxied by the 3-month interbank rate; the long-term interest rate, proxied by the yield on 10-year government bonds. This is our baseline specification. We estimate the model using the overall prudential indicator and the two sub- indicators to explore the roles of different dimensions of the prudential environment.

### **3.5.1 Rules versus Discretion in Prudential Regulation**

The national options and discretions in the EU banking legislation generally allowed for a more lenient regulatory treatment for banks. However, this more lenient regime could be established either through general legal provisions applicable to all institutions or through ad hoc supervisory discretions to be authorised for specific banks on a case-by-case basis.

We investigate the financial stability implications of these two different approaches to micro-prudential regulation. For this purpose, we take advantage of the peculiar construction of our indicator, which includes the two sub-components of regulatory flexibility and supervisory discretion. We estimate the model in (1) by using either regulatory flexibility or supervisory discretion as key explanatory variables for the laxness of the prudential framework and we estimate the probit equations for all types of public support.

Both regulatory flexibility and supervisory discretion measure the provision of a more favourable regime to banks for prudential requirements, however this applies to different sets of banks depending on the type of option (to all banks vs. specific banks on a case-by-case basis). Different theoretical arguments can be recalled to assess the pros and cons of these two approaches and the implications for the stability of the banking sector<sup>203</sup>.

On the one hand, a mechanism design argument would suggest that the application of a more favourable treatment for specific institutions based on a case-by-case assessment by the supervisory authority could limit potential risk-taking incentives. Under regulatory flexibility, all banks benefit from a more permissive treatment, without being subject to a supervisory decision: so credit institutions might not have the incentive to internalise possible consequences from excessive risk-taking, as they would not bear the negative consequences from that – at least not in terms of prudential requirements. Under supervisory discretion, instead, banks can

---

<sup>203</sup> The literature on rules and discretion in prudential policy is still relatively limited. For example, Walther and White (2019), and Agur and Sharma (2013) analyze this topic in the perspective, respectively, of banking resolution and macro-prudential policy. These issues have been discussed also, using a qualitative approach, by some recent studies in the fields of political science and public policy

take advantage of a less stringent regime only after an ad hoc supervisory decision: in such cases, banks may have stronger incentives to undertake a more prudent conduct, in order to fulfil the conditions required by the supervisory authority for the approval of a more favourable regulatory treatment.

On the other hand, a *regulatory capture* argument<sup>204</sup> could lead to an opposite outcome, and be supportive of general rules for all institutions to enhance financial stability. If supervisory authorities are potentially subject to regulatory capture, the provision of supervisory discretion to be exercised on a case-by-case basis could lead to various lobbying attempts by individual credit institutions to obtain ad hoc waivers from the implementation of some onerous requirements. In this case, it is not obvious that a more lenient treatment would be applied only to the institutions in sounder financial conditions. Actually, this set-up could lead to more risk-taking either from more vulnerable institutions or from banks able to devote substantial resources and efforts to lobbying activity.

### **3.5.2 Bank Size: Large versus Small Banks**

Bank size plays an important role in our analysis for at least two main reasons. First, large banks may benefit from their potential too-big-to-fail status. Being of systemic relevance at the national level or at the EU level, their failure could raise systemic risk for the entire financial system. This may induce public authorities to intervene in support of these institutions when they may be in financial distress. For instance, the analysis conducted by Rose and Wieladek (2011) for UK banks identifies bank size as a key determinant for the probability to receive public support at the time of the global financial crisis, particularly in absence of alternative bail-in solutions. For this reason, we include bank size as an explanatory variable in the baseline specification of our probit regression: independently from risk profile considerations, larger banks could be more likely to obtain some form of public intervention.

In addition to the too-big-to-fail argument for public bailouts, large and small banks may differ significantly in two main aspects: first, their ability to benefit from supervisory discretion or regulatory flexibility; second, their risk-taking propensity in response to a more lenient prudential framework. These differences could affect the interplay between prudential framework and bank risk-taking and ultimately the implications on financial stability. We address these two potential sources of heterogeneity across banks of different size by using respectively the following empirical approaches: the estimation for different subsamples of banks and the study of the interaction between regulatory leniency and bank size.

One important difference between large and medium-small banks regards their interaction with supervisory authorities. Large banks may have some negotiation power with

---

<sup>204</sup> See the discussion by Goodhart (2011) on the regulatory capture hypothesis

supervisors, or may dispose of more resources for lobbying activities or for sophisticated legal compliance than small banks. This may be particularly relevant for supervisory discretion: if some banks are able to exert an influence on the outcome of the supervisory assessment, competent authorities could more likely authorize the application of a favourable regulatory treatment to those banks (even if they may not appropriately fulfil the required prudential assessment), in line with a regulatory capture hypothesis. If so, the probability that supervisory discretion might lead to a risk-taking behaviour beyond the actual risk-bearing capacity of the institution could be higher for large banks. On the contrary, medium and small banks – given that they would have more limited possibility to influence the supervisory decisions on case-by-case discretions – may be more interested in taking advantage of the regulatory flexibility allowed for all banks when available. Then, although regulatory flexibility may raise risk-taking incentives for all banks, the probability that this may be conducive to financial distress of individual institutions could be larger for medium and small banks<sup>205</sup>.

We investigate these hypotheses on the ability of banks of different size to benefit from supervisory discretion and regulatory flexibility, by estimating the probit regression separately for two subsamples of large and medium-small banks. This approach can be relevant as long as we can identify some discrete threshold above and under which banks may show significant differences in their organization and behaviour, also with respect to the regulatory framework. For this classification, we use a threshold for the amount of total assets, corresponding to the one adopted by the Single Supervisory Mechanism to distinguish significant and less significant institutions<sup>206</sup>: the banks with an amount of total assets equal to or above EUR 30 billion are included in the subsample for large banks<sup>207</sup>; while the remaining ones are in the subsample for medium and small banks.

Another important difference across banks of different size concerns their risk propensity, which could depend on the extent to which individual institutions bear directly the consequences of their risk-taking. The potential too-big-to-fail status of a bank could be relevant

---

<sup>205</sup> In addition, some of the options allowed by regulatory flexibility concern the provisions for the standardized approach, which is used mostly by medium and small banks. While various options subject to supervisory discretion concern the IRB approach, which is mainly used by large banks.

<sup>206</sup> In the context of the SSM, significant institutions are the ones supervised directly by the ECB via the joint supervisory teams, while less significant institutions are the ones subject to the direct supervision of national competent authorities, under the oversight of the ECB. The significance is determined on the basis of various criteria to identify the systemic nature of the institutions. While bank size is the most relevant one (i.e. all the banks satisfying the EUR 30 billion threshold are defined as significant), other criteria are also used to complement the first one: the economic importance at the country-level; the existence of cross-border activities; and the request of public financial assistance from the European Stability Mechanism (ESM).

<sup>207</sup> For the application of this quantitative threshold, we consider the average amount of total assets by bank in the years from 2005 to 2007 (all the amounts are converted in euros for the banks operating outside of the euro area). The sample of large banks in the 17 EU countries includes 157 banks (137 banks when excluding Denmark, Luxembourg, and Netherlands as in the analysed sample); while the sample of medium and small banks include 429 banks (366 banks when excluding Denmark, Luxembourg, and Netherlands)



to explain not only the probability to receive a public bailout, but also the size of the implicit subsidy related to that. This may drive some heterogeneity across banks in their risk-taking behaviour. Even when both large and small banks would be subject to the same prudential framework, the too-big-to-fail subsidy could in fact induce stronger risk-taking incentives for large banks. While small banks – as less likely to receive public bailout in case of distress – would have to fully internalize the consequences of their risk-taking behaviour, large banks could undertake additional risk-taking under the expectation that they could benefit from some form of public intervention in case of financial distress.

To explore this hypothesis, we introduce in the probit regression an interaction term between the prudential regulation indicators and bank size, to analyse potential differences across banks in their responsiveness to supervisory discretion and regulatory flexibility. Therefore, we estimate the following regression:

$$(2) \quad P(\text{Support}_{i,j,t}) = \Lambda(\mathbf{x}'\boldsymbol{\beta})$$

$$\text{where } (\mathbf{x}'\boldsymbol{\beta}) = \alpha + \beta_1 \text{Regul}_{jt-1} + \beta_2 \text{Regul}_{jt-1} * \text{Size}_{ijt-1} + \beta_3 \text{Size}_{ijt-1} \\ + \gamma \text{BankVariables}_{ijt-1} + \delta \text{MacroControls}_{jt-1} + \varepsilon_{ijt}$$

In this way, we study how a less stringent prudential regulation interplay with banks' size in determining their risk-taking incentives and therefore their probability to be in distress.

### 3.5.3 Prudential Regulation and Banks' Balance Sheet Management

We explore the potential channels through which a less stringent prudential framework could have led to financial distress of credit institutions and to greater need of government support during the global financial crisis. We focus on some balance sheet variables potentially related to bank risk taking: on asset composition, the ratio of loans to total assets, the ratio of sovereign bond exposures to total assets; on income sources, the ratio of non-interest income to total revenues; on funding liquidity, the ratio of liquid assets to deposits and short-term liabilities. These measures are all linked to different sources of risk that banks may have undertaken in their balance sheet management.

Financial distress may have realized because banks engaged in *excessive* lending, or were overly dependent on income from less traditional sources, like proprietary trading and holdings of complex structured products. Banks may have also been in need of liquidity assistance because of low liquidity buffers. We also monitor the ratio of total assets held in sovereign securities. Although the exposures to government bonds were not subject to risk weights under the standardized approach for credit risk, we want to understand whether other

national differences in prudential regulation could have had some implications for banks' sovereign debt exposures<sup>208</sup>.

We investigate whether banks subject to a more lenient prudential regime (based on the national implementation of capital requirements) showed more risk-taking in the pre-crisis period. However, we cannot exclude that the prudential framework designed by national authorities in the CRD implementation may have reflected some pre-existing characteristics of national banking systems. This may raise some concerns about the direction of the relationship between the laxness of prudential regulation and the riskiness of business models.

For this purpose, we focus on the ex-post changes in the balance sheet variables, by comparing them before and after the CRD adoption. This allows us to single out the ex-ante characteristics of national banking systems, so that we can study how the business models of banks subject to different national prudential frameworks changed after the adoption of the CRD by Member States.

We provide some descriptive evidence on the correlation between the prudential regulation indicators (based on the CRD implementation) and the changes in bank risk-taking variables (occurred after the CRD adoption). These changes are computed as the differences in the country weighted averages of the above variables for the periods before and after the CRD introduction.

Then, we conduct a regression analysis at the bank-year level to explore the role of prudential regulation incentives as potential drivers of bank balance sheet developments before the crisis. We estimate the following linear regression for the balance sheet risk-taking variables.

$$(3) \text{BalanceSheetRisk}_{i,j,t} = \alpha + \beta \text{Regul}_{jt-1} + \gamma \text{Bank Controls}_{i,j,t-1} + \delta \text{MacroControls}_{jt-1} + \varepsilon_{i,j,t}$$

where  $\text{BalanceSheetRisk}_{i,j,t}$  refer to each one of the variables for balance sheet risk-taking, while  $\text{Bank Controls}_{i,j,t-1}$  include the bank variables for size and profitability, and  $\text{MacroControls}_{jt-1}$  consider the GDP growth rate, the yield on 10-year government bonds and the interbank

In this case we can exploit the panel dimension of the data, particularly useful to track the gradual adjustments in banks' balance sheets. Therefore, we run a pooled regression using one-year lagged variables for the period from 2005 to 2007, corresponding to the implementation of Basel II and of the Capital Requirements Directive by national authorities.

---

<sup>208</sup> This seems particularly relevant in light of the euro area sovereign debt crisis which brought stress to banks more heavily exposed to sovereign bonds.

We cluster standard errors at the bank-level to account for the correlation in the unobserved component of the observations for the same bank.

In this way, we explore whether and to what extent the incentives from prudential regulation may have shaped the management of banks' assets and liabilities before the global financial crisis. Also, we investigate how supervisory discretion and regulatory flexibility may have influenced differently the management of the same balance sheet characteristics.

### 3.5.4 Prudential Regulation, Bank Balance Sheets and Realised Risks

The analysis on prudential regulation indicators and risk-taking variables provides some indications about the role that regulatory incentives may play for banks' balance sheet management. If so, the risk-taking balance sheet characteristics of the banks in a given country may be – to some extent – endogenously explained by the design of the national prudential framework, also in terms of regulatory flexibility and supervisory discretion. In this case, the risk-taking variable would be an endogenous regressor and we could not have it in the same regression with the prudential regulation indicators. In fact, provided that prudential regulation affects the probability of banks' distress by shaping their strategies for balance sheet management, we can use the prudential regulation indicators as instruments – together with other bank-specific characteristics - to explain the variables for balance sheet risk-taking.

To investigate how prudential regulation may be associated to the risk taken through these different channels, we estimate a probit model with instrumental variable as below:

$$(4) P(\text{Support}_{i,j,t}) = \Phi(\mathbf{x}'\boldsymbol{\beta})$$

$$\text{where } (\mathbf{x}'\boldsymbol{\beta}) = \alpha_2 + \beta_2 \text{BalanceSheetRisk}_{ijt-1} + \gamma_2 \text{BankControls}_{ijt-1} \\ + \delta_2 \text{MacroControls}_{jt-1} + \varepsilon_{ijt}$$

The model comprises a reduced form equation<sup>209</sup> for the balance sheets variables in which respectively the loans to assets ratio, the non-interest income ratio, the liquid assets ratio or the government securities ratio are dependent variables and they are regressed on the regulatory indicators as:

$$(5) \text{BalanceSheetRisk}_{i,j,t-1} \\ = \alpha_1 + \beta_1 \text{Regul}_{jt-1} + \gamma_1 \text{Bank Controls}_{i,j,t-1} + \delta_1 \text{MacroControls}_{j,t-1} \\ + u_{i,j,t}$$

---

<sup>209</sup> In a two-stage least square setting, we could define this equation also as a first-stage regression, i.e. we estimate the first-stage regression with the instruments and then we use the fitted values in the second-stage regression. In this analysis, we use a maximum likelihood estimation, both because it is more efficient than the two-step procedure, and because it provides direct estimates of the parameters of interest for computing the marginal effects.

This estimation allows us to assess the increase in the probability to have received government support due to the identified risk channels, as we consider only the part of the balance sheet measures that is explained by the regulatory framework. We estimate this regression for the overall sample of banks. Then, using the same classification introduced in the previous sections, we conduct this analysis also for the two subsamples of large and medium-small banks, to explore whether the transmission channels of prudential regulation to risk-taking may work differently for banks of different size.

It has to be acknowledged that the national options and discretions implemented as part of the CRD may reflect, at least in part, a pre-existing situation which was then enshrined in the approved prudential environment. Therefore, our framework may not allow for a clear identification of a causality relationship between the prudential environment and changes in the risk taken by banks ahead of the financial crisis. At the same time, we can assess whether the prudential environment was conducive to a lower risk allocation by effectively curbing risk-taking in some domain. We address these points with some descriptive analysis in Section 3.7.3.

In addition, we can also shed some light on regulatory spillovers. The CRD provided a regulatory framework for the definition of capital requirements. The Basel 2 framework did not foresee the use of other regulatory instruments and in particular of liquidity requirements. Therefore, the observed liquid assets ratios and the sovereign holdings may be considered somewhat exogenous to the main focus of the Capital Requirements Directive. The presence of a significant relationship between holdings of liquid assets and the prudential environment can therefore be interpreted as resulting from regulatory spillovers.

## **3.6 Data**

We combine four sources of information: a) bank-level measures of public support during the crisis (mainly based on the EU Commission archive); b) bank balance sheet variables (from Bankscope); c) country-level indicators of prudential regulation (as presented in Section 3.4); d) country-level macro variables.

### **3.6.1 Public Support to Banks**

Given the extensive policy response to the banking crisis through various forms of public support, we consider the measures of financial assistance implemented by EU Governments for banks<sup>210</sup>: capital injections, guarantees on bank liabilities, asset protection schemes and liquidity facilities (see also Stolz and Wedow, 2010).

---

<sup>210</sup> See Laeven and Valencia (2012) for a cross-country analysis of banking crises in a global sample.

Although these measures were enacted by national governments, EU law required the approval by the EU Commission of state aid measures, to ensure homogeneity of criteria in the public support of the financial sector across EU countries and in order to avoid potential distortions to competition in the Single Market. Thus, the conditions required to authorise the provision of financial assistance to credit institutions in distress were set consistently across EU countries. This allows comparing measures of public support implemented in different countries and to consider them jointly as episodes of bank distress.

We collect the information on bank support measures from the decisions of the European Commission (integrated with ad-hoc research using public national sources) on the approval of state aid to the financial sector and we classify the various forms of support received by each bank. We restrict our analysis to the measures of crisis support implemented by EU countries from the beginning of 2008 to December 2010, in order to concentrate on the episodes of bank distress which can reasonably be linked to risk-taking conducts adopted by banks in the pre-crisis period<sup>211</sup>.

Table 3.1 presents summary statistics of such measures for the banks established in 17 EU countries (EU15, Cyprus and Malta) with a minimum value of total assets of €5 billion, based on the balance sheet data for the period 2000-2008.

The table shows that among the various forms of support, recapitalisations were the most common measures, immediately followed by credit guarantees: indeed, on average, 12.64% of the banks in our sample received capital injections, while 7.76% of the institutions benefited from credit guarantees. Importantly, these banks held a larger share of the total bank assets in our sample, 44.85% and 18.30% respectively. Asset relief schemes and liquidity facilities were relatively less common: the percentage of banks receiving such measures was equal to, respectively, 3.16% and 2.01% of the overall sample.

---

<sup>211</sup> We aim to exclude the episodes of bank distress which were determined later on, as a consequence of the peak of the euro area sovereign crisis, the double dip recession affecting various EU countries, and the increase of non-performing loans for several credit institutions.

**Table 3.1 Measures of Public Support to Banks by Country and Type**

| COUNTRY           | RECAPITALISATIONS |               |               | GUARANTEES |              |               | ASSET RELIEF |              |               | LIQUIDITY SUPP. |              |              | ANY SUPPORT |               |               | ALL BANKS  |       |
|-------------------|-------------------|---------------|---------------|------------|--------------|---------------|--------------|--------------|---------------|-----------------|--------------|--------------|-------------|---------------|---------------|------------|-------|
|                   | No. Inst.         | Perc. Inst.   | Perc. Assets  | No. Inst.  | Perc. Inst.  | Perc. Assets  | No. Inst.    | Perc. Inst.  | Perc. Assets  | No. Inst.       | Perc. Inst.  | Perc. Assets | No. Inst.   | Perc. Inst.   | Perc. Assets  | No.        | Inst. |
| AUSTRIA           | 6                 | 16.22%        | 46.32%        | 6          | 16.22%       | 43.67%        | 3            | 8.11%        | 7.88%         | 0               | 0.00%        | 0.00%        | 7           | 18.92%        | 47.53%        | 37         |       |
| BELGIUM           | 3                 | 18.75%        | 83.65%        | 2          | 12.50%       | 65.00%        | 3            | 18.75%       | 83.65%        | 0               | 0.00%        | 0.00%        | 3           | 18.75%        | 83.65%        | 16         |       |
| CYPRUS            | 0                 | 0.00%         | 0.00%         | 5          | 62.50%       | 73.00%        | 0            | 0.00%        | 0.00%         | 0               | 0.00%        | 0.00%        | 5           | 62.50%        | 73.00%        | 8          |       |
| GERMANY           | 9                 | 5.49%         | 29.98%        | 8          | 4.88%        | 22.23%        | 6            | 3.66%        | 19.85%        | 0               | 0.00%        | 0.00%        | 11          | 6.71%         | 30.41%        | 164        |       |
| DENMARK           | 0                 | 0.00%         | 0.00%         | 8          | 66.67%       | 80.05%        | 0            | 0.00%        | 0.00%         | 0               | 0.00%        | 0.00%        | 8           | 66.67%        | 80.05%        | 12         |       |
| GREECE            | 8                 | 72.73%        | 86.26%        | 6          | 54.55%       | 81.20%        | 0            | 0.00%        | 0.00%         | 7               | 63.64%       | 84.79%       | 8           | 72.73%        | 86.26%        | 11         |       |
| SPAIN             | 29                | 30.53%        | 20.34%        | 0          | 0.00%        | 0.00%         | 2            | 2.11%        | 1.16%         | 2               | 2.11%        | 1.16%        | 29          | 30.53%        | 20.34%        | 95         |       |
| FINLAND           | 0                 | 0.00%         | 0.00%         | 0          | 0.00%        | 0.00%         | 0            | 0.00%        | 0.00%         | 0               | 0.00%        | 0.00%        | 0           | 0.00%         | 0.00%         | 6          |       |
| FRANCE            | 11                | 20.37%        | 83.57%        | 1          | 1.85%        | 4.93%         | 1            | 1.85%        | 4.93%         | 0               | 0.00%        | 0.00%        | 11          | 20.37%        | 83.57%        | 54         |       |
| IRELAND           | 5                 | 23.81%        | 50.77%        | 1          | 4.76%        | 9.95%         | 5            | 23.81%       | 50.77%        | 0               | 0.00%        | 0.00%        | 5           | 23.81%        | 50.77%        | 21         |       |
| ITALY             | 4                 | 4.60%         | 13.71%        | 0          | 0.00%        | 0.00%         | 0            | 0.00%        | 0.00%         | 0               | 0.00%        | 0.00%        | 4           | 4.60%         | 13.71%        | 87         |       |
| LUXEMBOURG        | 1                 | 1.96%         | 5.99%         | 1          | 1.96%        | 0.58%         | 0            | 0.00%        | 0.00%         | 1               | 1.96%        | 0.28%        | 3           | 5.88%         | 6.85%         | 51         |       |
| MALTA             | 0                 | 0.00%         | 0.00%         | 0          | 0.00%        | 0.00%         | 0            | 0.00%        | 0.00%         | 0               | 0.00%        | 0.00%        | 0           | 0.00%         | 0.00%         | 2          |       |
| NETHERLANDS       | 6                 | 18.18%        | 57.51%        | 7          | 21.21%       | 58.83%        | 1            | 3.03%        | 33.06%        | 1               | 3.03%        | 4.57%        | 9           | 27.27%        | 59.04%        | 33         |       |
| PORTUGAL          | 0                 | 0.00%         | 0.00%         | 5          | 29.41%       | 69.13%        | 0            | 0.00%        | 0.00%         | 1               | 5.88%        | 1.84%        | 5           | 29.41%        | 69.13%        | 17         |       |
| SWEDEN            | 1                 | 9.09%         | 40.87%        | 2          | 18.18%       | 16.38%        | 0            | 0.00%        | 0.00%         | 0               | 0.00%        | 0.00%        | 3           | 27.27%        | 57.24%        | 11         |       |
| UNITED KINGDOM    | 5                 | 7.04%         | 41.63%        | 2          | 2.82%        | 1.81%         | 1            | 1.41%        | 27.11%        | 2               | 2.82%        | 1.81%        | 5           | 7.04%         | 41.63%        | 71         |       |
| <b>ALL SAMPLE</b> | <b>88</b>         | <b>12.64%</b> | <b>44.85%</b> | <b>54</b>  | <b>7.76%</b> | <b>18.30%</b> | <b>22</b>    | <b>3.16%</b> | <b>18.03%</b> | <b>14</b>       | <b>2.01%</b> | <b>1.66%</b> | <b>116</b>  | <b>16.67%</b> | <b>47.96%</b> | <b>696</b> |       |

Source: European Commission and authors' calculations.

### 3.6.2 Bank Characteristics

We collect balance sheet data from Bankscope for banks established in 17 EU countries (EU15, Cyprus and Malta<sup>212</sup>), including in our sample only banks with a minimum amount of total assets of €5 billion, based on the balance sheet data for the period 2000-2008<sup>213</sup>.

To merge the various data sources, we have to exclude the banks in those countries with missing information for the prudential regulation indicator, i.e. Denmark and Netherlands. In addition, we need to drop observations also for Luxembourg, for its peculiar nature as a financial hub with a favorable regulatory framework but with many subsidiaries of foreign institutions, which usually received financial support from the Governments of their own countries of establishment. This restricts our sample for the empirical analysis to 14 EU countries: Austria, Belgium, Cyprus, Germany, Greece, Finland, France, Ireland, Italy, Malta, Portugal, Spain, Sweden, United Kingdom.

Table 3.2 presents summary statistics at the country-level for some bank balance sheet characteristics, for the following periods: 2000-2004, i.e. the time before the adoption of Basel II; 2005-2007, the period of the Basel II implementation in the EU via the CRD framework; 2008-2010, the time of the global financial crisis. The comparison between the first two periods is important for the analysis of the regulatory incentives potentially related to the CRD framework. Panel A reports some variables on balance sheet and income composition, while Panel B refers to capital, profitability and asset quality.

The country-level variables are computed as weighted averages for the banks in each country, first computing bank-level averages across the years and then using the amount of total assets for each bank as a weight. We report also the corresponding variables at the EU level, for Euro Area countries and for the other countries. Within the Euro Area, we present separately the “vulnerable” countries (i.e. those more affected by the Euro Area sovereign debt crisis) and the “non-vulnerable” countries, to explore potential differences existing well before the crisis.

In fact, despite the significant harmonisation process conducted on the regulatory framework, the national banking systems in the EU – particularly before the creation of the Banking Union – still displayed some relevant differences in their business models, which can be gauged from the analysis of some bank balance sheet characteristics.

The loans to assets ratio indicates the share of bank assets used to extend credit to the real economy, in line with the idea of traditional banking business; at the same time, excessive

---

<sup>212</sup> To ensure larger sample homogeneity, we don't include the Eastern European countries which accessed the EU in 2004 and 2007, given the significant differences between their national banking systems and the ones of existing EU countries at that time. Therefore, the aggregate figures presented for EU banks in this section refer to EU 17 (EU 15 plus Cyprus and Malta).

<sup>213</sup> To limit the reduction of the sample size, we have considered banks reaching that minimum for at least one year in the considered period.

**Table 3.2 Country-level Characteristics of EU Banking Sector**

**Panel A. Balance Sheet Composition**

| Country                  | Loans Assets Ratio |           |           | Government Securities Ratio |           |           | Liquid Assets Ratio |           |           | Non-interest Income Ratio |           |           |
|--------------------------|--------------------|-----------|-----------|-----------------------------|-----------|-----------|---------------------|-----------|-----------|---------------------------|-----------|-----------|
|                          | 2000-2004          | 2005-2007 | 2008-2010 | 2000-2004                   | 2005-2007 | 2008-2010 | 2000-2004           | 2005-2007 | 2008-2010 | 2000-2004                 | 2005-2007 | 2008-2010 |
| <b>AUSTRIA</b>           | 51.81              | 52.37     | 56.92     | 3.41                        | 4.76      | 6.03      | 36.65               | 36.64     | 32.13     | 18.83                     | 20.23     | 15.46     |
| <b>BELGIUM</b>           | 41.86              | 39.76     | 47.26     | 17.55                       | 5.84      | 14.42     | 21.01               | 35.85     | 27.39     | 18.14                     | 13.63     | 5.38      |
| <b>CYPRUS</b>            | 52.50              | 53.03     | 60.59     | 6.52                        | 4.97      | 3.65      | 38.37               | 32.54     | 24.93     | 21.58                     | 17.29     | 20.11     |
| <b>GERMANY</b>           | 42.93              | 34.96     | 37.09     | 7.09                        | 5.12      | 3.94      | 61.30               | 68.77     | 59.13     | 13.12                     | 14.70     | 11.07     |
| <b>DENMARK</b>           | 61.10              | 65.13     | 65.76     | 1.08                        | 1.45      | 2.05      | 49.93               | 72.43     | 50.99     | 8.76                      | 10.25     | 10.48     |
| <b>GREECE</b>            | 51.02              | 62.04     | 67.62     | 20.52                       | 10.83     | 9.80      | 21.40               | 26.31     | 14.72     | 18.79                     | 19.02     | 12.40     |
| <b>SPAIN</b>             | 57.96              | 66.47     | 65.42     | 14.55                       | 4.85      | 6.27      | 16.79               | 24.66     | 19.77     | 19.22                     | 19.55     | 17.00     |
| <b>FINLAND</b>           | 59.16              | 52.35     | 42.80     | 0.35                        | 1.97      | 0.72      | 26.72               | 49.67     | 42.33     | 19.23                     | 22.16     | 27.20     |
| <b>FRANCE</b>            | 38.12              | 34.68     | 39.69     | 7.40                        | 6.95      | 6.54      | 42.82               | 83.35     | 53.05     | 23.61                     | 24.45     | 19.78     |
| <b>IRELAND</b>           | 53.08              | 59.59     | 56.37     | 9.51                        | 6.44      | 5.57      | 25.13               | 36.60     | 30.87     | 15.64                     | 11.19     | 5.17      |
| <b>ITALY</b>             | 59.89              | 60.83     | 64.98     | 1.65                        | 4.94      | 5.97      | 36.07               | 39.45     | 30.18     | 25.86                     | 23.93     | 18.74     |
| <b>LUXEMBOURG</b>        | 23.64              | 27.55     | 35.22     | 8.56                        | 6.68      | 7.56      | 57.85               | 53.54     | 48.76     | 14.52                     | 15.72     | 14.45     |
| <b>MALTA</b>             | 49.45              | 50.31     | 55.75     | 16.08                       | 8.27      | 10.51     | 28.80               | 22.00     | 28.53     | 17.31                     | 19.22     | 17.60     |
| <b>NETHERLANDS</b>       | 50.40              | 44.75     | 53.11     | 11.30                       | 7.13      | 3.22      | 23.58               | 50.11     | 33.26     | 33.19                     | 29.14     | 17.43     |
| <b>PORTUGAL</b>          | 65.14              | 66.86     | 69.06     | 3.63                        | 3.15      | 5.41      | 20.33               | 25.24     | 17.36     | 17.92                     | 19.47     | 18.34     |
| <b>SWEDEN</b>            | 63.15              | 59.31     | 58.96     | 3.52                        | 2.43      | 2.88      | 22.80               | 47.28     | 39.46     | 15.86                     | 21.05     | 20.37     |
| <b>UNITED KINGDOM</b>    | 57.68              | 50.15     | 43.54     | 3.90                        | 4.69      | 6.84      | 27.24               | 49.02     | 45.14     | 25.99                     | 27.03     | 27.03     |
| <b>EU</b>                | 48.38              | 46.16     | 47.85     | 7.41                        | 5.42      | 5.87      | 39.50               | 55.08     | 42.93     | 20.46                     | 21.57     | 17.84     |
| <b>Non-EA</b>            | 58.65              | 52.32     | 47.09     | 3.82                        | 4.31      | 6.09      | 28.85               | 50.47     | 44.95     | 23.05                     | 25.01     | 24.94     |
| <b>EA</b>                | 45.76              | 44.26     | 48.10     | 8.33                        | 5.78      | 5.80      | 42.28               | 56.52     | 42.29     | 19.79                     | 20.50     | 15.60     |
| <b>Non-Vulnerable EA</b> | 42.52              | 37.76     | 42.00     | 8.35                        | 6.02      | 5.61      | 46.45               | 64.85     | 49.13     | 19.36                     | 20.55     | 15.33     |
| <b>Vulnerable EA</b>     | 58.36              | 63.18     | 64.62     | 8.27                        | 5.21      | 6.22      | 26.07               | 32.29     | 23.87     | 21.44                     | 20.38     | 16.32     |



**Panel B. Capital, Profitability and Asset Quality**

| Country                  | Return on Average Equity |           |           | Equity Assets Ratio |           |           | Regulatory Capital Ratio |           |           | NPL Ratio |           |           |
|--------------------------|--------------------------|-----------|-----------|---------------------|-----------|-----------|--------------------------|-----------|-----------|-----------|-----------|-----------|
|                          | 2000-2004                | 2005-2007 | 2008-2010 | 2000-2004           | 2005-2007 | 2008-2010 | 2000-2004                | 2005-2007 | 2008-2010 | 2000-2004 | 2005-2007 | 2008-2010 |
| <b>AUSTRIA</b>           | 9.92                     | 15.24     | 3.46      | 4.36                | 5.69      | 6.23      | 11.78                    | 11.40     | 12.18     | 4.30      | 3.84      | 7.04      |
| <b>BELGIUM</b>           | 12.71                    | 16.28     | -5.46     | 4.62                | 4.40      | 3.69      | 11.46                    | 10.73     | 16.17     | 1.80      | 1.46      | 3.00      |
| <b>CYPRUS</b>            | 6.57                     | 17.05     | 9.82      | 8.38                | 7.18      | 7.99      | 13.23                    | 12.77     | 12.26     | 8.15      | 5.92      | 6.08      |
| <b>GERMANY</b>           | 3.39                     | 10.28     | -5.92     | 2.79                | 3.16      | 2.83      | 11.50                    | 12.41     | 13.62     | 4.46      | 3.07      | 3.66      |
| <b>DENMARK</b>           | 12.34                    | 14.07     | 3.14      | 4.22                | 4.07      | 3.71      | 11.21                    | 10.79     | 14.92     | 0.37      | 0.62      | 2.59      |
| <b>GREECE</b>            | 12.23                    | 17.26     | 0.15      | 7.02                | 6.78      | 5.98      | 12.75                    | 12.24     | 11.33     | 5.29      | 5.12      | 7.41      |
| <b>SPAIN</b>             | 12.97                    | 15.93     | 8.99      | 5.96                | 6.06      | 5.53      | 11.41                    | 12.01     | 12.54     | 1.41      | 0.86      | 4.35      |
| <b>FINLAND</b>           | 14.81                    | 11.87     | 8.73      | 7.18                | 8.45      | 5.45      | 14.46                    | 16.14     | 14.02     | 0.44      | 0.93      | 1.79      |
| <b>FRANCE</b>            | 10.63                    | 12.70     | 1.81      | 4.06                | 3.84      | 3.70      | 11.16                    | 10.71     | 11.71     | 3.98      | 2.99      | 3.98      |
| <b>IRELAND</b>           | 15.93                    | 19.34     | -20.75    | 4.00                | 3.74      | 3.54      | 14.35                    | 11.89     | 12.35     | 1.03      | 0.65      | 5.18      |
| <b>ITALY</b>             | 9.45                     | 10.34     | 4.96      | 5.90                | 7.16      | 7.38      | 10.14                    | 9.87      | 11.69     | 2.28      | 5.02      | 7.44      |
| <b>LUXEMBOURG</b>        | 13.46                    | 14.53     | 7.79      | 3.77                | 4.37      | 5.41      | 15.28                    | 14.07     | 15.11     | 2.32      | 1.67      | 3.15      |
| <b>MALTA</b>             | 12.47                    | 18.64     | 14.35     | 6.78                | 6.85      | 6.36      | 15.24                    | 13.39     | 11.69     | 9.52      | 5.97      | 3.84      |
| <b>NETHERLANDS</b>       | 16.25                    | 18.71     | -1.66     | 3.78                | 3.98      | 3.52      | 12.53                    | 13.12     | 16.41     | 2.01      | 1.31      | 2.34      |
| <b>PORTUGAL</b>          | 14.50                    | 14.92     | 8.04      | 4.50                | 5.15      | 5.56      | 9.88                     | 11.15     | 11.21     | 2.10      | 1.55      | 2.44      |
| <b>SWEDEN</b>            | 15.13                    | 18.60     | 10.33     | 4.27                | 3.96      | 4.13      | 10.20                    | 10.13     | 12.06     | 1.44      | 0.60      | 1.29      |
| <b>UNITED KINGDOM</b>    | 13.93                    | 15.50     | -1.63     | 5.54                | 4.23      | 4.03      | 12.27                    | 12.24     | 14.45     | 2.38      | 1.67      | 4.77      |
| <b>EU</b>                | 10.21                    | 14.10     | 0.16      | 4.26                | 4.38      | 4.17      | 11.61                    | 11.65     | 13.28     | 2.73      | 2.36      | 4.20      |
| <b>Non-EA</b>            | 13.88                    | 15.73     | 0.11      | 5.28                | 4.22      | 4.02      | 11.87                    | 11.89     | 14.21     | 2.08      | 1.53      | 4.21      |
| <b>EA</b>                | 9.25                     | 13.59     | 0.18      | 3.99                | 4.43      | 4.22      | 11.53                    | 11.58     | 12.96     | 2.96      | 2.65      | 4.19      |
| <b>Non-Vulnerable EA</b> | 8.56                     | 13.45     | -1.38     | 3.56                | 3.81      | 3.57      | 11.65                    | 11.80     | 13.29     | 3.46      | 2.58      | 3.65      |
| <b>Vulnerable EA</b>     | 11.94                    | 14.00     | 4.37      | 5.66                | 6.23      | 5.97      | 11.14                    | 11.01     | 12.10     | 1.92      | 2.83      | 5.48      |

Source: Bankscope and authors' calculations

lending may raise potential issues of credit misallocation or loosening in lending standards. While the weighted average share at the EU level remained broadly constant (between 46% and 48%) over the three above periods, relevant differences can be observed across countries. In the Euro Area, while in vulnerable countries the loans to assets ratio was already at 58.4% in 2000-2004 and increased up to 63.2% in 2005-2007, in non-vulnerable countries the same ratio decreased from 42.5% in 2000-2004 to 37.6% in 2005-2007, showing two completely opposite trends. More precisely, some vulnerable countries<sup>214</sup> displayed significant increase in the lending share or kept high values of this ratio from 2000-2004 to 2005-2007: Spain, from 58% to 66.5%; Ireland, from 53% to 59.6%; Greece, from 51% to 62%; Portugal from 65% to 67%. On the other hand, banks in various non-vulnerable countries observed a decline in the loans to assets ratio over the same periods: France, from 38.1% to 34.7%; Germany, from 42.9% to 35%.

Until the sovereign debt crisis, the investment in government securities used to be considered as a low-risk type of bank exposure. Therefore, the developments in banks' sovereign bond exposures reflected also the risk appetite of credit institutions in relation to various exposure types and to the returns from different asset types. Indeed, the ratio of sovereign bond exposures decreased for EU banks from 7.4% in 2000-2004 to 5.4% in 2005-2007, reflecting the preference for other asset types deemed as more profitable (including also lending<sup>215</sup>). In the Euro Area, this decline concerned both vulnerable countries (from 8.2% to 5.2%) and non-vulnerable countries (from 8.3% to 6%). Significant declines were observed particularly in some Euro Area vulnerable countries, like Spain (from 14.5% to 4.8%), Ireland (from 9.5 to 6.4%) and Greece (from 20.5% to 10.8%), largely matching the simultaneous expansion in bank lending in these countries.

The search for more profitable revenue sources in the years before the global financial crisis was conducted by banks also by increasing their reliance on other activities different than lending provision and deposit taking. The share of non-interest income to total revenues increased just slightly at the EU level, from 20.5% in 2000-2004 to 21.6% in 2005-2007, but it was concentrated in some non-Euro Area countries, like United Kingdom and Sweden, and in some non-vulnerable Euro Area countries, like Germany, Finland and France. In the same period, the share of non-interest income decreased for banks in vulnerable countries, possibly due to larger revenues from lending.

---

<sup>214</sup> The banking systems of some of these countries, like Spain and Ireland, were severely hit by the bust of the housing bubble during the global financial crisis, which ultimately led to the need of public support.

<sup>215</sup> For instance, in the Euro Area, lending rates increased significantly from end-2005 to end-2007 - following the gradual increase in the monetary policy rates - while banks could still benefit from an increase in loan demand. For instance, from December 2005 to December 2007, lending rates increased from 4.2% to 5.3% for loans to corporations, in a context of still increasing demand as reported by banks in the Bank Lending Survey. In the same period, the weighted average yield on 10-year euro area government bond rose from 3.4% to 4.4%. This suggests that, even taking into account additional capital costs for lending due to solvency requirements, banks could have some incentives to shift their asset composition towards lending or other asset types offering higher returns.

The various strategies for balance sheet composition implemented by EU banks in the run-up to the crisis contributed to significant improvements in bank profitability, as the return on average equity increased from 10.2% in 2000-2004 to 14.1% in 2005-2007. Within the Euro Area, banks in non-vulnerable countries raised their RoE more than their peers in vulnerable countries (respectively, from 8.6% to 13.4% and from 12% to 14%). Among non-vulnerable countries, German banks observed a RoE increase from 3.4% to 10.3%, although sometimes implementing risk-taking strategies detrimental to their stability during the global financial crisis<sup>216</sup>. Among vulnerable countries, Spanish banks increased their RoE from 13% to 16%, Irish banks from 16% to 19.3% and Greek banks from 12.2% to 17.2%, mostly based on their credit expansion.

The global financial crisis showed the inadequacy of the liquidity buffers of several banks, which were not able to cope with the distress in their wholesale funding markets and then needed various forms of public support. In fact, EU banks had already observed some relevant improvement in their liquidity position from 2000-2004 to 2005-2007, as the ratio of liquid assets to deposits and short-term borrowing had increased from 39.5% to 55%, also in absence of a specific liquidity regulation. However, significant country heterogeneity can be observed across countries. In the Euro Area, banks in vulnerable countries improved their liquid assets ratio only from 26% to 32.3%, while their peers in non-vulnerable countries registered an increase from 46.4% to 64.8%. In the period 2005-2007, banks in Spain, Greece and Portugal displayed liquid assets ratios close to 25%, while German banks showed a ratio slightly below 69% and French banks a ratio just above 83%.

Without precluding further heterogeneity across banks within countries, these differences already signal the existence of some structural vulnerabilities in some national banking systems which may have contributed to explain the resilience to crisis shocks. Given the significant changes from 2000-2004 to 2005-2007, the analysis presented below investigates also the role of national differences in prudential regulation (i.e. the CRD implementation) in shaping the balance sheet management of banks and then the implications on crisis vulnerability.

---

<sup>216</sup> See for example the defaults and the bailouts concerning some Landesbanks which had invested in structured products.

## 3.7 Results

### 3.7.1 Empirical Results: Baseline Specification

Table 3.3 presents the results for the baseline specification in equation (1), based on the sample of EU banks included in our analysis<sup>217</sup>. It reports the marginal effects of the probit estimation for the determinants of the probability of public support to EU banks: in each regression, we use one of the prudential regulation indicators as main explanatory variable and we control for bank characteristics and macroeconomic factors. Col.1-4 show the results for the overall indicator, while Col.5-8 and Col.9-12 report the estimates for the indicators of respectively supervisory discretion and regulatory flexibility.

In general, banks established in countries with a less stringent prudential framework display higher probability of being in distress during the crisis, as evidenced by the provision of some form of government support: for example (see Col. 1), a 1-point increase in the overall indicator (implying a more lenient prudential environment) is associated with a 1.23 percentage point increase in the probability of crisis support (the average probability of support is equal to 16% for the estimation sample<sup>218</sup>). To put things in perspective, if we consider the cross-country distribution of the indicator, we find that the variation in the indicator value from the minimum to the maximum (22 points) would correspond to an increase in the probability of support of around 27 percentage points.

This result is broadly confirmed when we consider the distinct categories of support measures, like recapitalisations, credit guarantees and liquidity facilities, while the magnitude of the estimated effects may be different across measures. The marginal effect is of similar magnitude (1.13 percentage points) for recapitalisations, which are the most common type of public intervention in the considered period. The corresponding effect is smaller for credit guarantees (0.55 percentage points), although this estimate may be somehow downward biased: due to data availability, our measure of guarantees on bank liabilities captures mainly the ad-hoc measures for individual institutions, while – depending on the disclosure by national authorities - it may not include the information on the participation of individual institutions into national schemes.

---

<sup>217</sup> The results discussed in this section come from the estimation of a probit model, which excludes observations for Luxembourg, Netherlands and Denmark, as discussed in Section 3.6.2. The full set of estimated point coefficients and marginal effects are presented in the Annex 3.B.

<sup>218</sup> In this case we report the average values of the probability of public support or of specific crisis measures for the estimation sample, and exclude Luxembourg, Netherlands and Denmark.

**Table 3.3 Probit Baseline Specification: Average Marginal Effects**

| VARIABLES                  | (1)<br>SUPP             | (2)<br>RECAP            | (3)<br>GUAR              | (4)<br>LIQSUPP          | (5)<br>SUPP             | (6)<br>RECAP             | (7)<br>GUAR              | (8)<br>LIQSUPP          | (9)<br>SUPP             | (10)<br>RECAP           | (11)<br>GUAR             | (12)<br>LIQSUPP         |
|----------------------------|-------------------------|-------------------------|--------------------------|-------------------------|-------------------------|--------------------------|--------------------------|-------------------------|-------------------------|-------------------------|--------------------------|-------------------------|
| <i>PRUDENTIAL REGUL.</i>   |                         |                         |                          |                         |                         |                          |                          |                         |                         |                         |                          |                         |
| Overall Indicator          | 0.0123***<br>(0.00266)  | 0.0113***<br>(0.00257)  | 0.00550***<br>(0.00188)  | 0.0144***<br>(0.00491)  |                         |                          |                          |                         |                         |                         |                          |                         |
| Supervisory Discretion     |                         |                         |                          |                         | 0.0158***<br>(0.00348)  | 0.0126***<br>(0.00344)   | 0.00813***<br>(0.00249)  | 0.00667**<br>(0.00332)  |                         |                         |                          |                         |
| Regulatory Flexibility     |                         |                         |                          |                         |                         |                          |                          |                         | 0.0166**<br>(0.00655)   | 0.0213***<br>(0.00622)  | 0.00611<br>(0.00474)     | 1.677***<br>(0.464)     |
| <i>BANK CHARACT.</i>       |                         |                         |                          |                         |                         |                          |                          |                         |                         |                         |                          |                         |
| Size                       | 0.0976***<br>(0.0103)   | 0.0903***<br>(0.0103)   | 0.0478***<br>(0.00989)   | 0.00213<br>(0.00650)    | 0.0956***<br>(0.0103)   | 0.0889***<br>(0.0103)    | 0.0460***<br>(0.00976)   | 0.00511<br>(0.00808)    | 0.0994***<br>(0.0104)   | 0.0911***<br>(0.0106)   | 0.0490***<br>(0.0101)    | 0.00254<br>(0.00582)    |
| RoAE                       | -0.00249<br>(0.00158)   | -0.000300<br>(0.00162)  | -0.000627<br>(0.000799)  | 0.00181<br>(0.00140)    | -0.00291*<br>(0.00172)  | -0.000557<br>(0.00156)   | -0.000754<br>(0.000805)  | 0.000713<br>(0.00139)   | -0.00193<br>(0.00151)   | 0.000681<br>(0.00209)   | -0.000471<br>(0.000817)  | 0.00110<br>(0.00124)    |
| <i>BALANCE SHEET COMP.</i> |                         |                         |                          |                         |                         |                          |                          |                         |                         |                         |                          |                         |
| Liquid Assets Ratio        | -0.000776<br>(0.000789) | -0.00169*<br>(0.000901) | 3.96e-05<br>(0.000509)   | -0.00131<br>(0.00113)   | -0.000936<br>(0.000787) | -0.00178**<br>(0.000897) | 9.31e-06<br>(0.000500)   | -0.000584<br>(0.000888) | -0.000887<br>(0.000817) | -0.00169*<br>(0.000911) | -6.57e-05<br>(0.000534)  | -0.00198<br>(0.00132)   |
| Govern. Secur. Ratio       | -0.00280<br>(0.00365)   | -0.00326<br>(0.00354)   | 0.00121<br>(0.00245)     | 0.000612<br>(0.00198)   | -0.00189<br>(0.00363)   | -0.00233<br>(0.00355)    | 0.00171<br>(0.00241)     | 0.00402**<br>(0.00201)  | -0.00307<br>(0.00383)   | -0.00375<br>(0.00363)   | 0.00133<br>(0.00259)     | 0.000282<br>(0.00194)   |
| Non-Inter. Income Ratio    | -0.00498**<br>(0.00198) | -0.00372*<br>(0.00190)  | -0.00648***<br>(0.00175) | -0.000317<br>(0.000829) | -0.00387**<br>(0.00192) | -0.00281<br>(0.00185)    | -0.00580***<br>(0.00167) | 0.000452<br>(0.000964)  | -0.00534**<br>(0.00213) | -0.00444**<br>(0.00204) | -0.00667***<br>(0.00191) | -0.000581<br>(0.000888) |
| Loans Assets Ratio         | -0.000239<br>(0.00140)  | -0.000903<br>(0.00144)  | 0.000898<br>(0.000994)   | 3.29e-06<br>(0.00105)   | 0.000171<br>(0.00143)   | -0.000576<br>(0.00146)   | 0.00117<br>(0.00101)     | 0.00172<br>(0.00115)    | -0.00124<br>(0.00142)   | -0.00184<br>(0.00145)   | 0.000460<br>(0.00101)    | -0.00109<br>(0.00136)   |
| <i>MACRO CONTROLS</i>      |                         |                         |                          |                         |                         |                          |                          |                         |                         |                         |                          |                         |
| GDP Growth Rate            | 0.0425***<br>(0.00994)  | 0.0331***<br>(0.00989)  | 0.00309<br>(0.00823)     | 0.0337***<br>(0.0129)   | 0.0460***<br>(0.00968)  | 0.0379***<br>(0.00960)   | 0.00228<br>(0.00825)     | 0.0115<br>(0.00918)     | 0.0480***<br>(0.0102)   | 0.0325***<br>(0.0105)   | 0.00718<br>(0.00817)     | -0.779***<br>(0.216)    |
| Long-Term Rate             | 0.582***<br>(0.141)     | 0.165<br>(0.155)        | 0.566***<br>(0.105)      | -0.0476<br>(0.0986)     | 0.559***<br>(0.141)     | 0.166<br>(0.150)         | 0.546***<br>(0.103)      | 0.111*<br>(0.0666)      | 0.598***<br>(0.151)     | 0.169<br>(0.163)        | 0.584***<br>(0.110)      | -23.49***<br>(6.549)    |
| Short-Term Rate            | -0.276***<br>(0.0608)   | -0.121*<br>(0.0641)     | -0.230***<br>(0.0491)    | 0.0760<br>(0.0524)      | -0.265***<br>(0.0605)   | -0.122*<br>(0.0630)      | -0.219***<br>(0.0482)    | -0.0235<br>(0.0326)     | -0.290***<br>(0.0643)   | -0.130*<br>(0.0667)     | -0.241***<br>(0.0515)    | 9.966***<br>(2.775)     |
| Observations               | 394                     | 394                     | 394                      | 394                     | 394                     | 394                      | 394                      | 394                     | 394                     | 394                     | 394                      | 394                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Bank size plays an important role in explaining the probability of public support for most types of measures, and in particular for recapitalisations. For example, a 10-percent increase in the amount of total assets – across banks - is associated with a 0.98 p.p. rise in the probability of any public intervention and to a 0.9 p.p. increase in the probability of recapitalisation. Therefore, in terms of economic significance, this effect is comparable to the one of a 1-point increase in the overall indicator. This suggests that, independently from the prudential framework, larger banks are more likely to receive some form of public support<sup>219</sup>.

We consider also some bank characteristics for balance sheet composition, which are potentially related to bank risk-taking. A higher non-interest income ratio is generally associated with a lower probability of public support, suggesting some potential benefits from revenue diversification for bank performance. Also, a higher liquid assets ratio is related to a lower support probability, due to the importance of bank liquidity for stress resilience; this result holds in particular for recapitalisations, suggesting that some of these capital injections were addressed to banks in weaker liquidity position and that the availability of larger liquidity buffers could have contributed to reduce the need for recapitalizing banks otherwise solvent. Other balance sheet variables do not show significant marginal effects on the probability of bank distress. However, this specification may mask the incentives that prudential regulation may raise for the management of bank balance sheets and so the effects of this potential risk-taking on the probability of bank distress. For this purpose, in Sections 3.7.3 and 3.7.4, we investigate the balance sheet channels through which a more lenient prudential framework may have led to greater financial vulnerability.

Macroeconomic controls provide some evidence on country-level drivers of bank distress. Banks established in countries with higher GDP growth rate in the pre-crisis period experienced higher increase in bank distress during the crisis. Given that the global financial crisis was preceded by a period of broad-based economic growth, this finding would be consistent with the idea that higher pre-crisis economic expansion was associated with a larger increase in bank balance sheets, which ultimately proved to be unsustainable during the crisis<sup>220</sup>. Also, banks in countries with higher long-term rates (i.e. higher yields on 10-year sovereign bonds) in the pre-crisis time showed higher likelihood to require public support during the crisis, particularly for guarantees on bank liabilities. Higher sovereign bond yields by 100 basis points are associated with a 0.57 p.p. increase in the probability to require guarantees on bank liabilities. This can be explained based on the strong correlation between bank bond yields and sovereign bond yields, as due to the sovereign-bank nexus: banks whose sovereigns pay higher risk premia also get funding at more expensive rates and therefore could be subject to higher

---

<sup>219</sup> Section 3.7.2 further develops this point by presenting an analysis on two subsamples of banks classified by size and a study on the interaction between prudential regulation and bank size.

<sup>220</sup> This argument is supported also when we use as a control variable the annual growth rate of total assets for the national banking systems (averaged for the years 2005-2007).

funding distress in crisis times. Moreover, lower short-term rates (i.e. 3-month interbank rates) before the crisis are associated with higher probability of bank distress during the crisis<sup>221</sup>. Provided that short-term interbank rates closely follow monetary policy rates, the estimated effect would be in line with the literature on the risk-taking channel of monetary policy, i.e. the argument that low monetary policy rates before the crisis could have contributed to bank risk-taking which then realised during the crisis (see for example Maddaloni and Peydró, 2011, as well as Jiménez, Ongena, Peydró and Saurina, 2014).

The results obtained for the overall indicator are confirmed when estimating the model with the two sub-indicators of regulatory flexibility and supervisory discretion, in order to investigate the implications of different approaches to prudential regulation for the stability of financial intermediaries. A 1-point increase in regulatory flexibility is related to a 1.66 p.p. increase in the probability to require support (Col.5), while a corresponding rise in supervisory discretion is related to a 1.58 p.p. rise in the bailout probability (Col.9). In particular, for recapitalisations, the marginal effect of the regulatory flexibility indicator is generally greater than the one of supervisory discretion (2.13 p.p., from Col.10, versus 1.26 p.p. from Col.6). These results suggest that both dimensions of regulatory flexibility and supervisory discretion are relevant for the financial stability of banks. However, the different incentive structure embedded in regulatory options and supervisory discretions suggests that regulatory flexibility may have more pervasive effect on the stress resilience of banks.

What are the insights from these first results? And, in particular, what are the channels through which the existing prudential framework may have influenced the ex-post probability of receiving public support? In the following sections we will try to shed some light on these effects, first for banks of different size, and then to identify the channels of transmission that are possibly conducive to more risk-taking.

### **3.7.2 Empirical Results: Large versus Medium-Small Banks**

Given the importance of bank size for our analysis, we exploit this element of heterogeneity across banks to explore two issues: first, whether large and small banks may differ in their ability or interest to take advantage of regulatory flexibility and supervisory discretion; second, whether large and small banks may display differences in their risk-taking in response to a more lenient prudential framework.

---

<sup>221</sup> Short-term rates present limited heterogeneity in our sample, as all the euro area countries have the 3-month Euribor.

### 3.7.2.1 Estimation for Different Subsamples

In order to explore the implications of regulatory flexibility and supervisory discretion for banks of different size, we first estimate the baseline specification for two different subsamples, corresponding to large and medium-small banks. We investigate whether the prudential regulation incentives may affect differently the resilience of banks of different size. Table 3.4 presents the results of the baseline probit specification for the two subsamples: it reports the marginal effects of the prudential regulation indicators and of the bank balance sheet variables on the probability of any support, of recapitalization and credit guarantees<sup>222</sup>.

The estimates for the two subsamples display significant differences in the marginal effects of the prudential regulation indicators. A 1-point increase in the overall indicator is associated with a 2.18 p.p. rise in the support probability for large banks (Panel A Col.1), while with a 0.9 p.p. increase in the bailout probability for medium and small banks (Panel A Col. 4). Also, larger bank size predicts higher probability of public support, but the magnitude of this effect is different for the two subsamples. A 10-percent increase in banks' total assets is related to a 1.79 p.p. increase in the support probability for large banks (Panel A Col.1), and to a 0.53 p.p. rise in the bailout probability for medium and small banks (Panel A Col. 4).

The results on bank size as a determinant of public intervention support the too-big-to-fail argument in explaining the bailout of EU banks in the crisis aftermath, i.e. larger banks had higher probability of being granted public support due to their systemic status. Given that bank size already captures the too-big-to-fail component, the differences in the marginal effects of the prudential regulation indicators across the two subsamples of banks might then require a separate explanation. We explore whether the interplay between prudential framework, bank risk-taking and crisis distress may work differently for large and medium-small banks.

The distinction between supervisory discretion and regulatory flexibility provides useful indications to disentangle the differences across the two groups of banks. The marginal effect of supervisory discretion on the support probability is considerably wider for large banks than for medium and small banks: for instance, an additional point in supervisory discretion is associated with a higher probability of crisis support by 3.16 p.p. for large banks and by 1.07 p.p. for medium and small banks. On the contrary, the marginal effect of regulatory flexibility is never significant for large banks, while it is sizeable for medium and small banks (an additional point in regulatory flexibility is related to an increase in the support probability by 1.45 p.p.).

---

<sup>222</sup> For this part of the analysis, we do not include the measures of liquidity support due to their small number, also further reduced due to the sample breakdown. The small number of observations for which we observe the liquidity provision may indeed raise some potential issues for the convergence of the maximum likelihood function.



**Table 3.4 Baseline Probit Specification: Average Marginal Effects (by Bank Size)**

| VARIABLES                   | LARGE BANKS             |                         |                         | MEDIUM AND SMALL BANKS  |                         |                         |
|-----------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                             | (1)<br>SUPP             | (2)<br>RECAP            | (3)<br>GUAR             | (4)<br>SUPP             | (5)<br>RECAP            | (6)<br>GUAR             |
| <b>Panel A</b>              |                         |                         |                         |                         |                         |                         |
| <i>PRUDENTIAL REGUL.</i>    |                         |                         |                         |                         |                         |                         |
| Overall Indicator           | 0.0218***<br>(0.00609)  | 0.0159**<br>(0.00623)   | 0.0127**<br>(0.00499)   | 0.00896***<br>(0.00272) | 0.00836***<br>(0.00252) | 0.00332**<br>(0.00157)  |
| <i>BANK CHARACTERISTICS</i> |                         |                         |                         |                         |                         |                         |
| Size                        | 0.179***<br>(0.0417)    | 0.152***<br>(0.0444)    | 0.0837**<br>(0.0417)    | 0.0530**<br>(0.0265)    | 0.0320<br>(0.0243)      | 0.0167<br>(0.0151)      |
| RoAE                        | -0.00329<br>(0.00276)   | 0.00641<br>(0.00744)    | -0.000970<br>(0.00173)  | -0.00146<br>(0.00290)   | -0.00281<br>(0.00270)   | 0.000467<br>(0.00141)   |
| <i>BALANCE SHEET COMP.</i>  |                         |                         |                         |                         |                         |                         |
| Liquid Assets Ratio         | -0.00362*<br>(0.00200)  | -0.00365*<br>(0.00200)  | -0.00282<br>(0.00174)   | 0.000550<br>(0.000844)  | -0.00190<br>(0.00137)   | 0.000902*<br>(0.000460) |
| Government Securities Ratio | -0.00943<br>(0.00875)   | -0.00866<br>(0.00849)   | 0.00492<br>(0.00658)    | 0.00163<br>(0.00380)    | -0.00307<br>(0.00372)   | 0.00177<br>(0.00216)    |
| Non-interest Income Ratio   | -0.0140***<br>(0.00525) | -0.0167***<br>(0.00517) | -0.0158***<br>(0.00474) | -0.00115<br>(0.00175)   | 2.32e-05<br>(0.00153)   | -0.000784<br>(0.00105)  |
| Loans Assets Ratio          | -0.00248<br>(0.00445)   | -0.00534<br>(0.00438)   | 0.00225<br>(0.00378)    | 0.00142<br>(0.00148)    | -0.000997<br>(0.00154)  | 0.00109<br>(0.000837)   |
| <b>Panel B</b>              |                         |                         |                         |                         |                         |                         |
| <i>PRUDENTIAL REGUL.</i>    |                         |                         |                         |                         |                         |                         |
| Supervisory Discretion      | 0.0316***<br>(0.00778)  | 0.0214**<br>(0.00839)   | 0.0185***<br>(0.00649)  | 0.0107***<br>(0.00351)  | 0.00997***<br>(0.00330) | 0.00414**<br>(0.00204)  |
| <i>BANK CHARACTERISTICS</i> |                         |                         |                         |                         |                         |                         |
| Size                        | 0.170***<br>(0.0409)    | 0.149***<br>(0.0435)    | 0.0755*<br>(0.0407)     | 0.0520*<br>(0.0267)     | 0.0314<br>(0.0244)      | 0.0158<br>(0.0151)      |
| RoAE                        | -0.00385<br>(0.00291)   | 0.00413<br>(0.00720)    | -0.00115<br>(0.00173)   | -0.00180<br>(0.00294)   | -0.00304<br>(0.00269)   | 0.000295<br>(0.00143)   |
| <i>BALANCE SHEET COMP.</i>  |                         |                         |                         |                         |                         |                         |
| Liquid Assets Ratio         | -0.00352*<br>(0.00199)  | -0.00358*<br>(0.00200)  | -0.00265<br>(0.00172)   | 0.000197<br>(0.000819)  | -0.00211*<br>(0.00128)  | 0.000739*<br>(0.000417) |
| Government Securities Ratio | -0.00864<br>(0.00862)   | -0.00788<br>(0.00847)   | 0.00564<br>(0.00648)    | 0.00234<br>(0.00383)    | -0.00276<br>(0.00378)   | 0.00191<br>(0.00215)    |
| Non-interest Income Ratio   | -0.0130**<br>(0.00510)  | -0.0156***<br>(0.00511) | -0.0148***<br>(0.00459) | -0.000351<br>(0.00170)  | 0.000594<br>(0.00150)   | -0.000496<br>(0.00100)  |
| Loans Assets Ratio          | -0.00179<br>(0.00443)   | -0.00475<br>(0.00441)   | 0.00256<br>(0.00375)    | 0.00147<br>(0.00151)    | -0.000877<br>(0.00153)  | 0.00105<br>(0.000827)   |
| <b>Panel C</b>              |                         |                         |                         |                         |                         |                         |
| <i>PRUDENTIAL REGUL.</i>    |                         |                         |                         |                         |                         |                         |
| Regulatory Flexibility      | 0.0209<br>(0.0155)      | 0.0224<br>(0.0150)      | 0.0138<br>(0.0127)      | 0.0145**<br>(0.00696)   | 0.0146**<br>(0.00638)   | 0.00795<br>(0.00496)    |
| <i>BANK CHARACTERISTICS</i> |                         |                         |                         |                         |                         |                         |
| Size                        | 0.174***<br>(0.0432)    | 0.145***<br>(0.0451)    | 0.0797*<br>(0.0437)     | 0.0535**<br>(0.0264)    | 0.0349<br>(0.0236)      | 0.0163<br>(0.0154)      |
| RoAE                        | -0.00277<br>(0.00281)   | 0.0100<br>(0.00762)     | -0.000725<br>(0.00178)  | -0.000428<br>(0.00282)  | -0.00212<br>(0.00258)   | 0.00105<br>(0.00138)    |
| <i>BALANCE SHEET COMP.</i>  |                         |                         |                         |                         |                         |                         |
| Liquid Assets Ratio         | -0.00369*<br>(0.00210)  | -0.00369*<br>(0.00205)  | -0.00323*<br>(0.00187)  | 0.000378<br>(0.000877)  | -0.00176<br>(0.00124)   | 0.00104*<br>(0.000576)  |
| Government Securities Ratio | -0.00862<br>(0.00913)   | -0.00880<br>(0.00866)   | 0.00509<br>(0.00686)    | 0.000438<br>(0.00397)   | -0.00336<br>(0.00378)   | 0.00151<br>(0.00233)    |
| Non-interest Income Ratio   | -0.0134**<br>(0.00559)  | -0.0171***<br>(0.00539) | -0.0163***<br>(0.00510) | -0.00201<br>(0.00195)   | -0.000377<br>(0.00164)  | -0.00147<br>(0.00123)   |
| Loans Assets Ratio          | -0.00423<br>(0.00453)   | -0.00691<br>(0.00436)   | 0.000831<br>(0.00384)   | 0.000561<br>(0.00146)   | -0.00159<br>(0.00154)   | 0.00105<br>(0.000913)   |
| Macro Controls              | YES                     | YES                     | YES                     | YES                     | YES                     | YES                     |
| Observations                | 121                     | 121                     | 121                     | 273                     | 273                     | 273                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

These differences suggest that supervisory discretion may have negative repercussions on financial stability particularly for large banks. We may suppose that large banks would be able to exert a stronger influence on the assessment of supervisory authorities, in order to obtain the application of a more favourable treatment. If this influence is sufficiently effective, this could result also in higher risk-taking beyond the risk-bearing capacity of individual institutions and potentially in higher distress probability. At the same time, regulatory flexibility does not have any significant effect on the probability of crisis support for large banks<sup>223</sup>.

While the more favourable treatment allowed by general options is available to all institutions in a given country, the more lenient regime due to case-by-case discretions is applicable only to the institutions authorized by the supervisory authorities. In principle, the ex-ante supervisory assessment should ensure that a less stringent rule is applied only to sound banks. However, the results show that - for large banks - a more permissive prudential framework is conducive to bank distress particularly when implemented via supervisory decisions and not when enacted via general options. Although we do not have data on the bank-specific supervisory decisions for case-by-case discretions<sup>224</sup>, these results suggest that some issues of inappropriate risk assessment may arise in the interaction between supervisory authorities and large banks, due to a potential regulatory capture particularly by large banks<sup>225</sup>. This would grant support to the policy design of banking supervision in the Single Supervisory Mechanism, where the direct supervision for significant banks is directly assigned to the centralized authority, i.e. the ECB (rather than to national authorities), as this was deemed as the most appropriate solution to ensure a supervisory level playing-field for large banks<sup>226</sup>.

The results for medium and small banks show a significantly different picture. For these banks, regulatory flexibility seems to have more negative financial stability implications than supervisory discretion: the marginal effect of regulatory flexibility, particularly for the probability of any support and of recapitalisations, is almost 50% larger than the corresponding effect of supervisory discretion (see Panels B and C, Col. 4-5). This would be consistent with the different structure of incentives embedded in the regulatory flexibility and the supervisory discretion. Regulatory flexibility may lead to higher probability of distress as banks can take advantage from the more permissive treatment without any ex-ante evaluation by the

---

<sup>223</sup> Large banks still display higher probability to receive public intervention, but this is due to their size. The marginal effect of bank size, around 1.74 p.p. for a 10-percent increase in bank total assets (Panel C Col. 1), is of comparable magnitude as in the other specifications in Panel A and B.

<sup>224</sup> For the period of the CRD implementation (2006-2007), the available data indicate the supervisory discretions exerted by the national authorities, but do not include information about the application of these discretions to specific credit institutions. Then we may not be able to analyse how large banks benefited from the approval of bank-specific supervisory discretions, vis-à-vis medium and small banks.

<sup>225</sup> This would be in line with the argument of regulatory capture presented by Goodhart (2011). This argument, presented in his history of the Basel Committee, applies also here in explaining the interaction between large banks and supervisory authorities.

<sup>226</sup> Note also that the quantitative threshold used in our analysis (EUR 30 billion) is one of the main criteria for the classification of significant institutions for the Single Supervisory Mechanism

supervisory authority. In addition, given that medium and small banks are usually subject to less frequent scrutiny by supervisory authorities, the effects of the risk accumulation may be identified with some delay, when prompt corrective actions may not be sufficient and public support measures may be required. On the other hand, supervisory discretion – if properly exercised by national authorities – may somehow attenuate the potential risk-taking implications of a more permissive regime, as the latter would be applied to specific banks only following a case-by-case assessment. Also, we can suppose that medium and small banks would be less able to exert any influence on the decisions by supervisory authorities as they would not have the resources for that.

### 3.7.2.2 Interaction with Bank Size

In order to investigate the role of bank size for the risk-taking incentives of the prudential framework, we introduce an interaction term between the prudential regulation indicator and bank size. By estimating the regression in equation (2), we analyse whether and to what extent the relation between a more permissive prudential framework and the probability of bank distress may vary for banks of different size.

The plots in Figure 3.2 show the marginal effect of an increase in the value of the prudential indicators on the probability of crisis support for banks of different size<sup>227</sup>, including also the interaction effects. The dashed line indicates the value of bank size corresponding to the threshold of EUR 30 billion, used to classify large banks and medium-small banks, in line with the main size indicator applied in the definition of significant banks for the SSM.

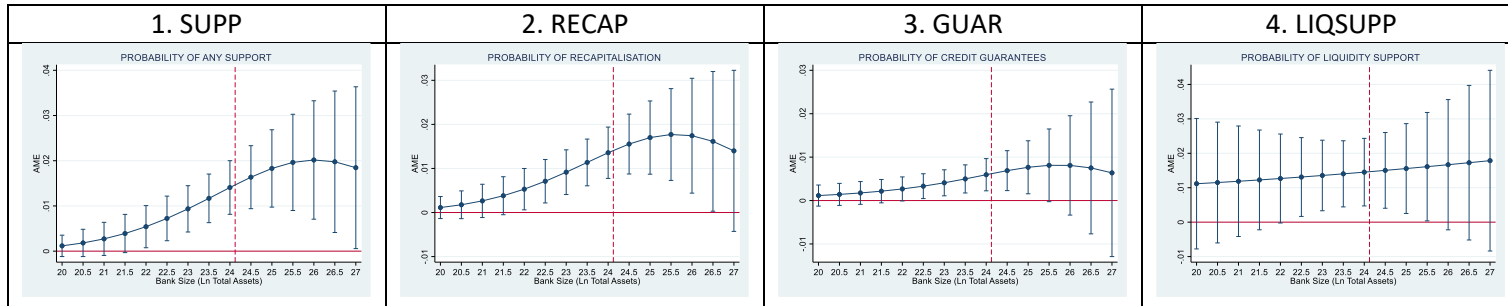
Figure 3.2 shows that a less stringent prudential framework is associated with higher support probability and that this marginal effect increases as a function of bank size. The plots 1 and 2 in Panel A display that, for a 1-point increase in the overall indicator, the marginal increase in the distress probability takes the shape first of a convex function for lower values of bank size, and then of a concave function for increasing values of bank size. The marginal increase in the probability of any support is around 0.5 p.p. for banks at the 10<sup>th</sup> percentile of the size distribution and around 0.9 p.p. for the median bank, while it increases up to 2 p.p. for banks at the 90<sup>th</sup> percentile, before slightly decreasing in the last decile of the distribution. A similar development is observed also for the probability of recapitalisations (up to 1.75 p.p. for banks at the 90<sup>th</sup> percentile and then decreasing). Both plots suggest that a laxer prudential framework has no or limited implications for small banks, while it may have sizeable repercussions on the riskiness and resilience of medium and large banks. These results are based on the overall indicator, which may indeed mask different effects. Therefore, we focus our following discussion on the results and plots for supervisory discretion and regulatory flexibility.

---

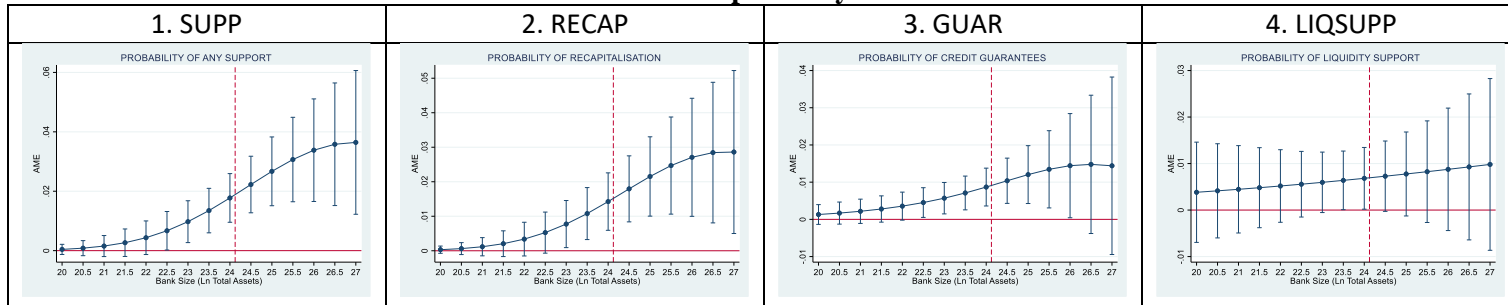
<sup>227</sup> As in the rest of the analysis, the variable used for bank size is the log of total assets.

**Figure 3.2 Interaction with Size (All Banks)**

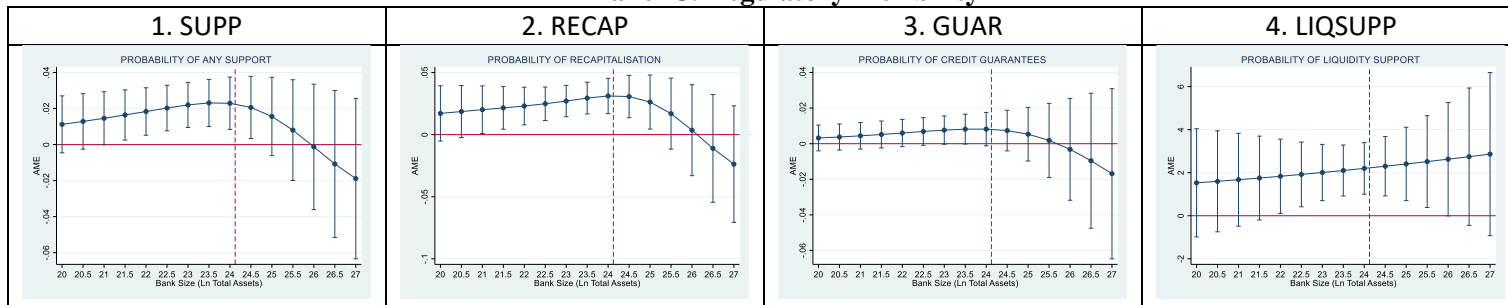
**Panel A. Overall Indicator**



**Panel B. Supervisory Discretion**



**Panel C. Regulatory Flexibility**



**Figure 3.2**

The plots display the average marginal effects (AMEs) of the Prudential Regulation Indicator and of its two sub-components of Supervisory Discretion and Regulatory Flexibility on the probability of any form of support (SUPP) and of specific crisis interventions (RECAP, GUAR, LIQSUPP) for different values of banks size (computed as the logarithm of total assets). The AMEs are computed based on the estimation of a probit regression, including an interaction term between the prudential regulation indicator and bank size. The dashed line indicates the value of bank size corresponding to the threshold of EUR 30 billion, used to classify large banks and medium-small banks. Confidence intervals are drawn for the 5% level.

The rising trend in the marginal increase of support probability, as a function of bank size, is particularly evident in Panel B for supervisory discretion. The marginal increase in the probability of any support is not significant for banks until the 1<sup>st</sup> quartile of the distribution, then it is around 1 p.p. for the median bank and increases up to 2 p.p. for banks at the 3<sup>rd</sup> quartile and up to 3.6 p.p. for banks at the top end of the distribution. Similar effects are observed for the probability of recapitalization (0.8 p.p. for the median bank, 1.6 p.p. for banks at the 3<sup>rd</sup> quartile and 2.9 p.p. at the top end). The marginal variation in the probability of credit guarantees is also increasing with bank size, but follows a smoother path and it is significant for banks from the 25<sup>th</sup> to the 90<sup>th</sup> percentile of the distribution.

A more permissive treatment, as available via supervisory discretion, does not have any significant effect on the probability of distress for smaller banks (in the first quartile of the size distribution), while it increases considerably the probability of bank distress the larger is the size of the bank. In principle, all banks may be considered for the application of a more favourable treatment, subject to the decisions of the supervisory authorities. In fact, banks of larger size could devote more resources to obtain the approval of a more lenient treatment via supervisory discretion. This may not affect per se the probability of bank distress, unless the institutions authorized to use this more favourable treatment undertake some additional risk-taking which may not be sustainable. The considerably higher marginal increase in the distress probability for larger banks, as explained by the interaction between regulatory incentives and banks' size<sup>228</sup>, suggests that the risk-taking incentives coming from supervisory discretion may be significantly stronger for larger banks. Banks' size, and so the implicit subsidy related to that, may contribute to explain this higher risk propensity, as larger banks may be in the position not to fully internalize the implications of their risk-taking behaviour.

The plots for regulatory flexibility in Panel C display significantly different developments. They show a non-linear pattern in the marginal increase in probability depending on bank size: for a 1-point increase in regulatory flexibility, the marginal increase in the probability of any support displays first a gradually increasing trend for small and medium banks, before decreasing quite sharply even into negative values for large banks (although being not significant). This marginal probability increase is already significant at 1.6 p.p. for banks at the 5<sup>th</sup> distribution percentile and then rises smoothly up to 2.3 p.p. for banks at the 75<sup>th</sup> percentile<sup>229</sup>. Similar developments are observed for the probability of recapitalization, with an increase until the third distribution quartile (up to 3.1 p.p.) and then a sudden decrease and loss of significance.

---

<sup>228</sup> See also the results for the interaction between supervisory discretion and bank size based on the linear probability analysis, showing a positive coefficient for the interaction term.

<sup>229</sup> So bank size may still play some role in explaining this increase in support probability, but only for medium and small banks.

These developments suggest that a more lenient prudential treatment, established via regulatory flexibility, increases significantly the probability of bank distress particularly for small and medium banks, while it has no significant impact for large banks. The opportunity to use this more favourable regime is available to all banks, also without the need of a supervisory approval. However, this seems to lead to higher risk-taking and bank distress only for small and medium banks. At the same time, the risk-taking related to regulatory flexibility appear to be very limited for larger banks, perhaps because they take more advantage of the more permissive treatment available via supervisory discretion.

### **3.7.3 Empirical Results: Prudential Regulation and Banks' Balance Sheet Management**

In this section we examine more in detail the relation between national prudential frameworks and banks' balance sheet management. We focus on some bank balance sheet characteristics, which are potentially related to bank risk-taking and are monitored for the stability of financial intermediaries: the amount of lending with respect to total assets; the share of bank exposures to sovereign bonds; the reliance on non-interest income sources for banks; the size of liquidity buffers with respect to deposits and short-term liabilities.

We present first a descriptive analysis at the country-level to explore the potential relation of these balance sheet variables with the national prudential frameworks. Then we conduct a regression analysis at the bank-year level to estimate how the prudential regulation indicators may explain banks' balance sheet composition.

#### **3.7.3.1 Country-level Analysis: Changes in Balance Sheets after the CRD Adoption**

We explore how banks' business models in different countries evolved following the adoption of the Capital Requirements Directive by Member States. In particular, we investigate whether and to what extent the banking sectors in different countries undertook more risk in their balance sheet management. For this purpose, we monitor the changes in banks' balance sheet composition at the country-level after the CRD adoption and we study the correlation between the prudential regulation indicators and the ex-post changes in the balance sheet variables.

Using the descriptive statistics presented in Section 3.6.2, we consider the variations in the country weighted average balance sheet variables from the period 2000-2004 (before the design of the directive) to the period 2005-2007 (following the adoption of the directive)<sup>230</sup>. We

---

<sup>230</sup> We refer to 2005 as the starting year to analyse the changes in banks' balance sheets induced by the new prudential regime because the directive was based on the Basel II accord adopted in 2004 and given that the directive proposal was presented by the EU Commission already in 2004 and then discussed and broadly agreed by the EU Council and the Parliament in 2005. The publication of the directive in 2006

document how these country-level changes in banks' balance sheet composition were related to the national implementation of the CRD. Figure 3.3 presents scatter plots with the indicators of supervisory discretion and regulatory flexibility and the changes in banks' balance sheet composition (from the period 2000-2004 to the period 2005-2007)<sup>231</sup>. The discussion of this descriptive evidence is useful also to formulate some hypotheses which will then be investigated in the following empirical analysis.

Panel A reports the plots for the changes in the ratio of net loans to total assets. The modest variation at the sample level (a decline of around 2 p.p., see Table 3.2) masks significant heterogeneity across countries: in fact, in the period after the CRD adoption, the share of lending increased particularly in countries with more lenient prudential regulation, while it decreased mostly in countries with more stringent prudential regime. This holds for both indicators of prudential regulation, although the correlation displays a larger coefficient for regulatory flexibility than for supervisory discretion. To give some country examples, the share of lending increased respectively by 8.5 p.p. and 11 p.p. in Spain and Greece, which displayed some of the highest values in regulatory flexibility. Therefore, in countries with a laxer implementation of capital requirements, banks expanded their credit provision more than in countries with a stricter adoption of prudential rules.

Panel B shows the plots for the changes in the ratio of non-interest income to total revenues. Although this variable remains broadly constant at the EU level after the CRD adoption (only 1 p.p. increase, see Table 3.2), relevant differences emerge across countries. While these changes seem to be unrelated to supervisory discretion, they display a positive correlation with regulatory flexibility. After the CRD adoption, banks in countries with a more flexible regulation increased relatively more their share of income from non-interest activities. While, in the same period, the banks in some countries with less regulatory flexibility even decreased their non-interest income ratio. This may suggest that more regulatory flexibility in the CRD implementation could have favoured more reliance of banks on non-interest income sources in the pre-crisis period.

Panel C presents the plots for the changes in the ratio of liquid assets to deposits and short-term liabilities. This ratio indicates how large is the buffer of liquid assets of a bank with respect to its short-term liabilities: a higher value indicates a stronger liquidity position of the institution. This ratio increased for most countries from the period 2000-2004 to the period 2005-2007 (on average, by more than 10 p.p.), but considerable heterogeneity can be observed across countries. In fact, the size of this increase in liquidity is correlated negatively with

---

was then largely anticipated by the industry which had started the transition to the new framework in advance.

<sup>231</sup> For consistency with the empirical analysis presented in the previous and the following sections, the scatter plots show the observations for the 14 EU countries included in our regression sample, therefore they exclude Denmark, Luxembourg and the Netherlands.

**Figure 3.3 Prudential Regulation and Balance Sheet Changes (2005-2007, vs. 2000-2004)**



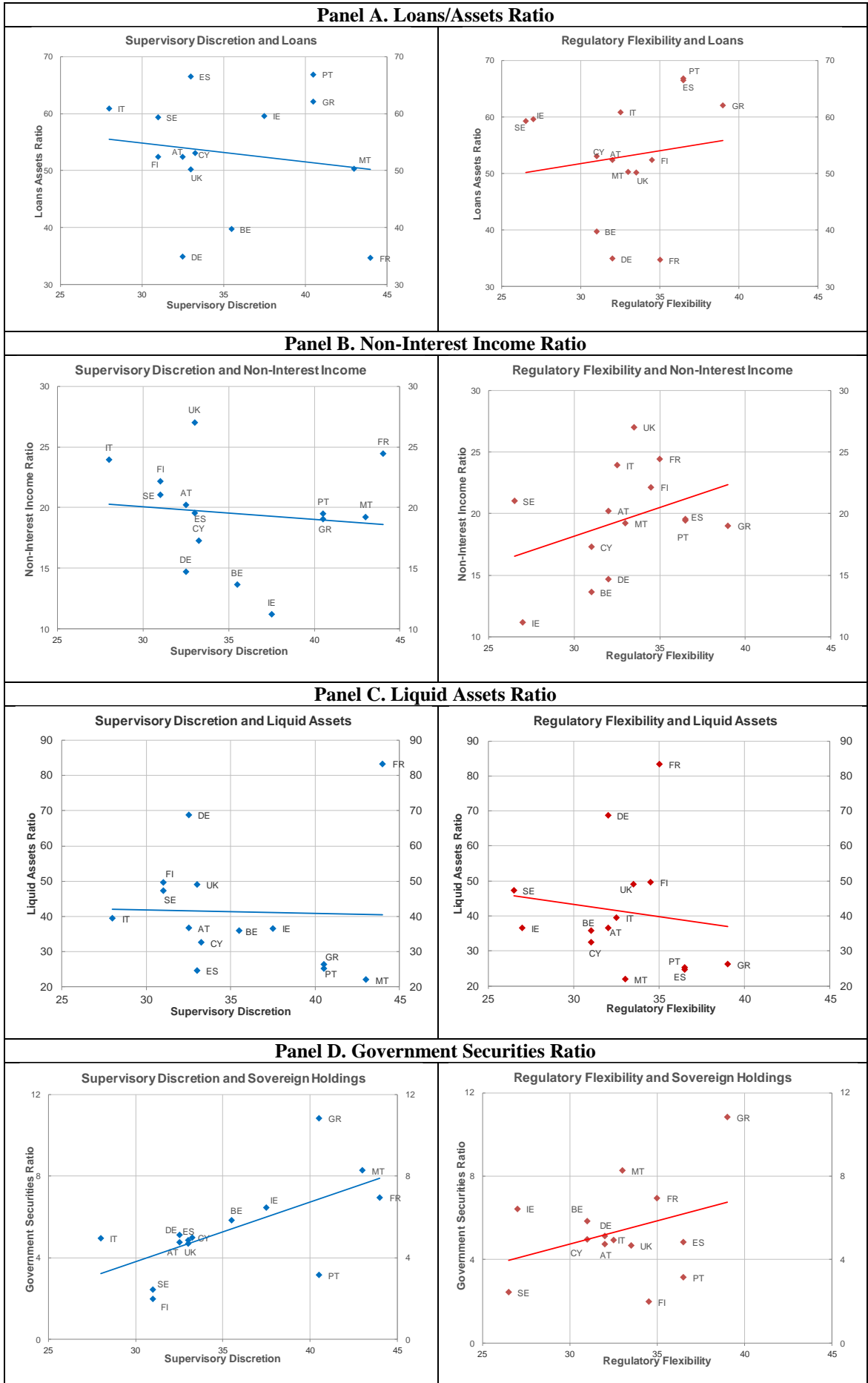


regulatory flexibility and positively with supervisory discretion. Banks in countries with more regulatory flexibility registered smaller increases in their liquid assets ratio: as the CRD did not contain any liquidity requirement, this raises the question whether some regulatory spillovers may occur from capital requirements to the liquidity position of banks. While, in the same period, banks in countries with more supervisory discretion observed larger increases in their share of liquid assets: this suggests the hypothesis that the case-by-case assessment in supervisory discretion may raise some positive incentives also for the management of bank liquidity.

Panel D displays the plots for the changes in the ratio of government securities to total assets. The share of sovereign exposures decreased for most countries from the period 2000-2004 to the period 2005-2007 (by around 2 p.p. on average), but significant differences can be gauged across countries and can be related to prudential regulation. After the CRD adoption, banks reduced their sovereign bond exposures relatively more in those countries implementing the directive with more lenient capital requirements. The developments in bank lending and sovereign exposures point to some substitution in the asset composition of banks. For instance, the share of sovereign bond holdings decreased by around 10 p.p. in Spain and Greece, both countries with high values of regulatory flexibility, which displayed at the same time a significant increase in the share of lending, close to 10 p.p. This suggests that banks could have benefited from a more flexible regulation to expand lending at the expense of sovereign bond exposures. On the contrary, in countries with a more stringent prudential framework, banks might have increased their exposures to sovereign bonds, while reducing other asset classes subject to higher risk weights.

The above analysis on the changes at the country-level after the CRD adoption suggests the existence of a relationship between the national implementation of capital requirements and the changes in banks' balance sheet composition after the CRD adoption. The hypotheses presented above are explored more formally in the following section with a regression analysis at the bank-year level on the potential drivers of balance sheet composition during the implementation period of the new prudential regime (2005-2007). To introduce this analysis, in Figure 3.4 we display the plots with the indicators of prudential regulation and the average balance sheet characteristics of national banking systems in the same period. We refer to these plots in the discussion of the regression analysis.

**Figure 3.4 Prudential Regulation and Balance Sheet Composition (2005-2007)**



### 3.7.3.2 Bank-level Regressions: Prudential Regulation and Balance Sheet Incentives

To investigate the role of prudential regulation in shaping banks' balance sheet management, we develop a regression analysis at the bank-year level for the years 2005-2007, i.e. the period of the CRD implementation, by controlling for other relevant bank-specific and country-level factors. We may suppose that the balance sheet composition in a given period can be determined by banks based on some bank characteristics and the macroeconomic conditions in the previous period. Therefore, we estimate the regression in equation (3) using one-year lagged variables for the years from 2005 to 2007. Table 3.5 presents the results for this regression using bank-year observations: Panel A refers to the overall sample of banks, while Panel B and C concern respectively large banks and medium-small banks.

Col. 1-3 show the results for the loans to assets ratio. The two indicators of regulatory flexibility and supervisory discretion display different relationships with the share of lending. The loans-to-assets ratio is negatively related to the indicator of supervisory discretion. In countries where supervisors were entitled to exercise discretionary powers to set the regulatory treatment for individual institutions, banks had on average a smaller lending portfolio as a fraction of their balance sheets (see also Figure 3.4 Panel A LHS Chart). On the other hand, banks in countries with higher regulatory flexibility showed higher loans to assets ratio, suggesting a possible role of regulation in fostering credit provision (see also Figure 3.4 Panel A RHS Chart).

Col. 4-6 present the results for the non-interest income ratio. Banks benefiting from more regulatory flexibility in the implementation of capital requirements presented a higher share of income from non-interest sources in the years before the crisis: a 1-point increase in regulatory flexibility is associated with 0.7 p.p. increase in the non-interest income ratio<sup>232</sup>. The magnitude of this marginal effect is broadly confirmed when we consider the two subsamples of large and medium-small banks. This result is consistent with the descriptive evidence at the country-level in Figure 3.4 Panel B (regulatory flexibility is positively related to an increase in the non-interest income ratio after the CRD adoption).

Col. 7-9 refer to the ratio of liquid assets to total deposits and short-term liabilities. In this case we observe different results for the indicators of regulatory flexibility and supervisory discretion. Higher regulatory flexibility is associated with lower liquid assets ratios (Col.9): i.e., banks subject to more lenient capital regulation displayed smaller liquidity buffers (see also Figure 3.4 Panel C RHS Chart). This result is mainly driven by medium and small banks, which indeed rely more on regulatory flexibility. Since the CRD did not contain any provision on liquidity, this result supports the argument that some spillovers may exist between capital regulation and bank liquidity behaviour, as envisaged in some theoretical studies (e.g. Admati,

---

<sup>232</sup> The weighted average non-interest income ratio for the banks included in the sample for the period 2005-2007 is 21.6%

DeMarzo, Hellwig and Pfleiderer, 2013; Rochet and Vives, 2004). If capital regulation may act as a substitute for liquidity requirements, then the stringency of capital requirements may have unintended (positive) implications also for banks' liquidity position<sup>233</sup>. On the other hand, larger supervisory discretion is related to higher liquid assets ratios (Col.8): banks which are more subject to the supervisory assessment (to obtain more favourable treatment) may be incentivized to keep larger liquidity buffers (see also Figure 3.4 Panel C LHS Chart). This result holds for large banks, which indeed benefit more from supervisory discretion, and is strictly related to the result discussed below for the exposures to sovereign debt.

Col. 10-12 display the results for the ratio of government securities to total assets. Banks subject to a less stringent prudential framework presented larger exposures to sovereign bonds. This result is driven by supervisory discretion: when banks have to rely on the assessment by national supervisory authorities to obtain a more favourable regulatory treatment, they may be incentivized to invest a larger share of their assets in government bonds (see also Figure 3.4 Panel D LHS Chart). This is consistent with a narrative of moral suasion on the side of national authorities (including potentially national supervisors), which may have encouraged domestic banks to invest in sovereign domestic bonds (see for example: Ongena, Popov and Van Horen, 2019; Altavilla, Pagano and Simonelli, 2017).

To sum up, all four measures of balance sheet risk-taking are significantly related to at least one of the prudential indicators, supporting the argument that the micro-prudential framework raised important incentives for the management of bank balance sheets. In fact, regulatory flexibility and supervisory discretion capture different types of incentives. In countries with a more regulatory flexible environment, banks had higher non-interest income ratios, lower liquid assets ratios and larger credit provision (suggesting a potential risk-taking channel induced by a more lenient regulation). In countries with more supervisory discretion, banks subject to this case-by-case assessment by supervisory authorities were encouraged to keep their lending provision under control and to have wider buffers of liquid assets, which were however based on larger exposures to government bonds.

---

<sup>233</sup> From a regulatory point of view, this may occur if the credit risk of bank assets (as captured in the regulatory risk weights) is correlated with the degree of liquidity of bank assets. In that case, risk-based capital requirements – by favouring the exposures to low-risk assets – may also incentivize the exposures to more liquid assets.

**Table 3.5 Prudential Framework and Banks' Balance Sheet Management**

| VARIABLES                          | (1)<br>LoansAssets | (2)<br>LoansAssets   | (3)<br>LoansAssets  | (4)<br>NonIntInc  | (5)<br>NonIntInc   | (6)<br>NonIntInc    | (7)<br>LiqAssets    | (8)<br>LiqAssets  | (9)<br>LiqAssets     | (10)<br>GovSec      | (11)<br>GovSec      | (12)<br>GovSec   |
|------------------------------------|--------------------|----------------------|---------------------|-------------------|--------------------|---------------------|---------------------|-------------------|----------------------|---------------------|---------------------|------------------|
| <i>Panel A: All Banks</i>          |                    |                      |                     |                   |                    |                     |                     |                   |                      |                     |                     |                  |
| Overall_Indicator                  | -0.264<br>(0.192)  |                      |                     | 0.129<br>(0.119)  |                    |                     | 0.000247<br>(0.280) |                   |                      | 0.132**<br>(0.0556) |                     |                  |
| Superv_Discret                     |                    | -0.900***<br>(0.250) |                     |                   | -0.0157<br>(0.155) |                     |                     | 0.670*<br>(0.346) |                      |                     | 0.167**<br>(0.0734) |                  |
| Regul_Flexib                       |                    |                      | 1.349***<br>(0.457) |                   |                    | 0.699***<br>(0.259) |                     |                   | -2.015***<br>(0.708) |                     |                     | 0.170<br>(0.110) |
| Bank Controls                      | YES                | YES                  | YES                 | YES               | YES                | YES                 | YES                 | YES               | YES                  | YES                 | YES                 | YES              |
| Macro Controls                     | YES                | YES                  | YES                 | YES               | YES                | YES                 | YES                 | YES               | YES                  | YES                 | YES                 | YES              |
| Observations                       | 1,323              | 1,323                | 1,323               | 1,328             | 1,328              | 1,328               | 1,313               | 1,313             | 1,313                | 981                 | 981                 | 981              |
| R-squared                          | 0.056              | 0.079                | 0.073               | 0.060             | 0.057              | 0.071               | 0.042               | 0.049             | 0.063                | 0.073               | 0.072               | 0.062            |
| <i>Panel B: Large Banks</i>        |                    |                      |                     |                   |                    |                     |                     |                   |                      |                     |                     |                  |
| Overall_Indicator                  | -0.437*<br>(0.228) |                      |                     | 0.256*<br>(0.133) |                    |                     | 0.624<br>(0.444)    |                   |                      | 0.0802<br>(0.0917)  |                     |                  |
| Superv_Discret                     |                    | -0.861***<br>(0.310) |                     |                   | 0.190<br>(0.187)   |                     |                     | 1.181*<br>(0.604) |                      |                     | 0.101<br>(0.126)    |                  |
| Regul_Flexib                       |                    |                      | 0.262<br>(0.409)    |                   |                    | 0.752***<br>(0.264) |                     |                   | -0.239<br>(0.850)    |                     |                     | 0.122<br>(0.173) |
| Bank Controls                      | YES                | YES                  | YES                 | YES               | YES                | YES                 | YES                 | YES               | YES                  | YES                 | YES                 | YES              |
| Macro Controls                     | YES                | YES                  | YES                 | YES               | YES                | YES                 | YES                 | YES               | YES                  | YES                 | YES                 | YES              |
| Observations                       | 366                | 366                  | 366                 | 364               | 364                | 364                 | 367                 | 367               | 367                  | 302                 | 302                 | 302              |
| R-squared                          | 0.370              | 0.394                | 0.351               | 0.149             | 0.136              | 0.162               | 0.174               | 0.187             | 0.161                | 0.050               | 0.049               | 0.046            |
| <i>Panel C: Medium-Small Banks</i> |                    |                      |                     |                   |                    |                     |                     |                   |                      |                     |                     |                  |
| Overall_Indicator                  | -0.103<br>(0.264)  |                      |                     | 0.0519<br>(0.159) |                    |                     | -0.449<br>(0.327)   |                   |                      | 0.153**<br>(0.0717) |                     |                  |
| Superv_Discret                     |                    | -0.784**<br>(0.341)  |                     |                   | -0.169<br>(0.206)  |                     |                     | 0.197<br>(0.372)  |                      |                     | 0.199**<br>(0.0912) |                  |
| Regul_Flexib                       |                    |                      | 1.836***<br>(0.643) |                   |                    | 0.794**<br>(0.333)  |                     |                   | -2.873***<br>(0.966) |                     |                     | 0.167<br>(0.151) |
| Bank Controls                      | YES                | YES                  | YES                 | YES               | YES                | YES                 | YES                 | YES               | YES                  | YES                 | YES                 | YES              |
| Macro Controls                     | YES                | YES                  | YES                 | YES               | YES                | YES                 | YES                 | YES               | YES                  | YES                 | YES                 | YES              |
| Observations                       | 957                | 957                  | 957                 | 964               | 964                | 964                 | 946                 | 946               | 946                  | 679                 | 679                 | 679              |
| R-squared                          | 0.032              | 0.048                | 0.062               | 0.120             | 0.122              | 0.135               | 0.042               | 0.038             | 0.080                | 0.052               | 0.053               | 0.036            |

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### **3.7.4 Empirical Results: Prudential Regulation, Banks' Balance Sheets and Realised Risks**

To formally investigate the relationship between the balance sheet variables linked to risk-taking and the prudential environment we estimate a probit model with an IV specification as in (4). The marginal effects related to each measure of risk-taking are reported in Table 3.6. Panel A shows the results for the overall sample of banks, while Panel B reports the estimates for the two subsamples of large and medium-small banks<sup>234</sup>. In the following sections we assess the results of each balance sheet channel individually, also highlighting potential differences in the behaviour of large banks versus medium and small banks, along the same distinction used above. We focus our discussion on the results for supervisory discretion and regulatory flexibility, to better disentangle the different types of incentives related to the two different approaches of the prudential framework.

#### **3.7.4.1 Bank Lending**

When analysing credit provision, we find limited evidence that a more lenient prudential framework is correlated with a lending behaviour hindering the stability of banks. In fact, the effects depend significantly on the design of the prudential framework, as the estimated marginal effects for the two indicators go in different directions.

The lending provision explained by the supervisory discretion indicator is associated with lower likelihood to require support during the crisis. The marginal effects are statistically significant for all types of crisis support except for liquidity facilities. A 1-percentage point increase in the loans to assets ratio, as explained by supervisory discretion, is associated with a reduction in the probability of distress by 0.78 p.p.. These results suggest that in countries where supervisors had more discretionary powers banks may have been prevented somewhat from engaging in excessive lending, as supervisory discretion may have exerted some positive incentives in avoiding unsustainable credit expansion.

This result holds for both subsamples of banks based on their size. However, the economic magnitude of this effect is more relevant for large banks (the marginal effect is equal to -1.8 p.p. for large banks and to -0.67 p.p. for medium and small banks). This is consistent with the idea that large banks are – due to their size - subject to a more frequent and accurate scrutiny by supervisory authorities. In order to take advantage of the more favourable regime set by supervisory decisions, large banks in countries with more supervisory discretion could have been incentivized to undertake a more prudent lending behaviour such to reduce their probability of distress.

---

<sup>234</sup> The complete set of results, including the coefficients of the reduced form equation, is reported in Annex 3.C, Tables from 3.20 to 3.34.

**Table 3.6 MLE IV Probit Specification: Average Marginal Effects**

**Panel I. Overall Sample**

| VARIABLES                                 | (1)<br>SUPP               | (2)<br>RECAP              | (3)<br>GUAR               | (4)<br>LIQSUPP            |
|---|---------------------------|---------------------------|---------------------------|---------------------------|
| <b>Panel I.A Loans/Assets</b>             |                           |                           |                           |                           |
| Loans/Assets Indicator                    | -0.0136***<br>(0.000160)  | -0.0113***<br>(0.00184)   | -0.00748<br>(0.00514)     | -0.0132***<br>(0.000660)  |
| Loans/Assets SupDiscr                     | -0.00775***<br>(0.00220)  | -0.00625**<br>(0.00274)   | -0.00593**<br>(0.00278)   | -0.00787***<br>(0.00249)  |
| Loans/Assets FlexReg                      | 0.0110***<br>(0.00287)    | 0.0122***<br>(0.00204)    | 0.00300<br>(0.00450)      | 0.0142***<br>(0.000342)   |
| Observations                              | 493                       | 493                       | 493                       | 493                       |
| <b>Panel I.B Non-Inter. Income Ratio</b>  |                           |                           |                           |                           |
| Non_Int_Inc Indicator                     | 0.0190***<br>(0.00366)    | 0.0184***<br>(0.00359)    | 0.00915<br>(0.00889)      | 0.0228***<br>(0.00119)    |
| Non_Int_Inc  SupDisc                      | 0.0238***<br>(0.000166)   | 0.0152*<br>(0.00798)      | 0.0152<br>(0.0108)        | 0.0219***<br>(0.00309)    |
| Non_Int_Inc  FlexReg                      | 0.0135***<br>(0.00491)    | 0.0162***<br>(0.00365)    | -0.000689<br>(0.00541)    | 0.0235***<br>(5.64e-05)   |
| Observations                              | 499                       | 499                       | 499                       | 499                       |
| <b>Panel I.C Liquid Assets Ratio</b>      |                           |                           |                           |                           |
| Liquid_Assets Indicator                   | -0.00960***<br>(0.000317) | -0.00978***<br>(0.000414) | -0.00944***<br>(0.000269) | -0.00951***<br>(0.000375) |
| Liquid_Assets Sup_Disc                    | 0.00670***<br>(0.00161)   | 0.00553***<br>(0.00201)   | 0.00595***<br>(0.00230)   | 0.00627***<br>(0.00184)   |
| Liquid_Assets Flex_Reg                    | -0.00594***<br>(0.00201)  | -0.00761***<br>(0.00169)  | -0.00118<br>(0.00185)     | -0.0101***<br>(0.000659)  |
| Observations                              | 490                       | 490                       | 490                       | 490                       |
| <b>Panel I.D Govern. Securities Ratio</b> |                           |                           |                           |                           |
| SovSecurities Indicator                   | 0.0509***<br>(0.00760)    | 0.0471***<br>(0.00812)    | 0.0619***<br>(0.00237)    | 0.0543***<br>(0.00461)    |
| SovSecurities Sup_Disc                    | 0.0498***<br>(0.00762)    | 0.0439***<br>(0.00953)    | 0.0615***<br>(0.00267)    | 0.0478***<br>(0.00926)    |
| SovSecurities Flex_Reg                    | 0.0589***<br>(0.00597)    | 0.0544***<br>(0.00864)    | 0.0624***<br>(0.00214)    | 0.0600***<br>(0.00350)    |
| Observations                              | 395                       | 395                       | 395                       | 395                       |
| BANK CONTROLS                             | YES                       | YES                       | YES                       | YES                       |
| MACRO CONTROLS                            | YES                       | YES                       | YES                       | YES                       |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Panel II. Banks Classified by Size (below or above EUR 30 bn)**

| VARIABLES                                  | LARGE BANKS             |                         |                         | MEDIUM AND SMALL BANKS   |                          |                          |
|--|-------------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|
|  | (1)<br>SUPP             | (2)<br>RECAP            | (3)<br>GUAR             | (4)<br>SUPP              | (5)<br>RECAP             | (6)<br>GUAR              |
| <b>Panel II.A Loans/Assets</b>             |                         |                         |                         |                          |                          |                          |
| Loans/Assets Indicator                     | -0.0181***<br>(0.00283) | -0.0167***<br>(0.00379) | -0.0182***<br>(0.00298) | -0.0129***<br>(0.000280) | -0.0125***<br>(0.00147)  | -0.0129***<br>(3.80e-05) |
| Loans/Assets SupDiscr                      | -0.0180***<br>(0.00280) | -0.0164***<br>(0.00389) | -0.0179***<br>(0.00310) | -0.00674**<br>(0.00307)  | -0.00699***<br>(0.00253) | -0.00569<br>(0.00369)    |
| Loans/Assets FlexReg                       | -0.0188***<br>(0.00327) | -0.0180***<br>(0.00396) | -0.0197***<br>(0.00240) | 0.00680**<br>(0.00310)   | 0.00830***<br>(0.00249)  | 0.000409<br>(0.00167)    |
| Observations                               | 135                     | 135                     | 135                     | 358                      | 358                      | 358                      |
| <b>Panel II.B Non-Inter. Income Ratio</b>  |                         |                         |                         |                          |                          |                          |
| Non_Int_Inc Indicator                      | 0.0267***<br>(0.00844)  | 0.0140<br>(0.0171)      | 0.00314<br>(0.0311)     | 0.0195***<br>(0.00468)   | 0.0199***<br>(0.00312)   | 0.00910<br>(0.0135)      |
| Non_Int_Inc  SupDisc                       | 0.0283***<br>(0.00675)  | 0.0139<br>(0.0187)      | 0.00914<br>(0.0372)     | -0.0224***<br>(0.000931) | 0.0223***<br>(0.000279)  | -0.0226***<br>(0.000597) |
| Non_Int_Inc  FlexReg                       | -0.0313***<br>(0.00898) | -0.0116<br>(0.0304)     | -0.0339***<br>(0.00262) | 0.0132**<br>(0.00542)    | 0.0153***<br>(0.00449)   | -0.000145<br>(0.00388)   |
| Observations                               | 135                     | 135                     | 135                     | 364                      | 364                      | 364                      |
| <b>Panel I.C Liquid Assets Ratio</b>       |                         |                         |                         |                          |                          |                          |
| Liquid_Assets Indicator                    | 0.00654***<br>(0.00169) | 0.00576***<br>(0.00205) | 0.00658***<br>(0.00163) | -0.00945***<br>(0.00120) | -0.00956***<br>(0.00108) | -0.00952***<br>(0.00144) |
| Liquid_Assets Sup_Disc                     | 0.00662***<br>(0.00167) | 0.00575***<br>(0.00208) | 0.00662***<br>(0.00162) | 0.00658**<br>(0.00292)   | 0.00650***<br>(0.00224)  | 0.00648*<br>(0.00339)    |
| Liquid_Assets Flex_Reg                     | 0.00597***<br>(0.00205) | 0.00546**<br>(0.00230)  | 0.00659***<br>(0.00167) | -0.00326**<br>(0.00155)  | -0.00454**<br>(0.00178)  | -0.000700<br>(0.00123)   |
| Observations                               | 136                     | 136                     | 136                     | 354                      | 354                      | 354                      |
| <b>Panel II.D Govern. Securities Ratio</b> |                         |                         |                         |                          |                          |                          |
| SovSecurities Indicator                    | 0.0483***<br>(0.00534)  | 0.0452***<br>(0.00777)  | 0.0480***<br>(0.00567)  | 0.0488***<br>(0.0139)    | 0.0471***<br>(0.0118)    | 0.0320<br>(0.0255)       |
| SovSecurities Sup_Disc                     | 0.0493***<br>(0.00497)  | 0.0461***<br>(0.00750)  | 0.0486***<br>(0.00537)  | 0.0465***<br>(0.0145)    | 0.0430***<br>(0.0131)    | 0.0402*<br>(0.0234)      |
| SovSecurities Flex_Reg                     | 0.0454***<br>(0.00828)  | 0.0422***<br>(0.0110)   | 0.0480***<br>(0.00611)  | 0.0617***<br>(0.0138)    | 0.0582***<br>(0.0132)    | 0.0680***<br>(0.00285)   |
| Observations                               | 121                     | 121                     | 121                     | 274                      | 274                      | 274                      |
| Bank Controls                              | YES                     | YES                     | YES                     | YES                      | YES                      | YES                      |
| Macro Controls                             | YES                     | YES                     | YES                     | YES                      | YES                      | YES                      |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



At the same time, the lending activity explained by a more flexible regulatory environment increases the probability to require support during the crisis for all types of measures. The economic significance of the marginal effects suggests that regulatory flexibility may have fostered risky lending more than the positive impact related to supervisory discretion. A one-percentage point increase in the loans-to-assets ratio, as explained by regulatory flexibility, is related to a 1.1 p.p. increase in the support probability. As mentioned, in our setting we cannot exclude that the prudential framework is a result of pre-existing conditions. However, when looking at the changes in balance sheet composition, we note that in countries with more regulatory flexibility bank lending increased relatively more than in other countries (see Section 3.7.3). Also, the rise in distress probability suggests that this lending expansion may have led to an increase in risk-taking, given that regulatory flexibility allows for the application of a more favourable regime without requiring any ex-ante supervisory assessment.

When dividing the sample based on banks' size, we find that this result for regulatory flexibility is mainly driven by the risk-taking behaviour of medium and small banks. In fact, these banks display a positive marginal effect of the lending explained by regulatory flexibility, while large banks show a negative effect of the same variable. This is consistent with the idea that medium and small banks exploited relatively more the risk-taking opportunities allowed by regulatory flexibility.

#### **3.7.4.2 Bank Non-Interest Income**

The holdings of complex structured products and the excessive reliance on non-interest income have been blamed as powerful sources of risk taken by banks that eventually unraveled during the financial crisis. One could argue, however, that more diversified portfolios of activities can help in reducing banks' risk. On the one hand, banks with a more diversified income structure may be able to better respond to financial shocks, especially if these are focused on some specific types of assets, such as non-performing loans with high expected losses. On the other hand, if a large fraction of the bank income results from riskier activities, or if a bank expands excessively its trading book, higher non-interest income may reflect an increase in bank risk overall<sup>235</sup>.

The results of the estimation of the IV probit model as reported in Table 3.6 support the argument that the reliance on non-interest income explained by a less stringent prudential framework points to overall higher bank risk. Banks with a larger share of non-interest income associated to the prudential framework have higher probability of having received public support, in particular recapitalization measures. Marginal effects are statistically and

---

<sup>235</sup> We cannot exclude that these two effects may play a different role depending on the level of the non-interest income ratio. In such case, their compositional outcome would then display some potential non-linearity.

economically significant, with a higher marginal effect of non-interest income associated to supervisory discretion. A 1-percentage point increase in the non-interest income ratio, as explained by supervisory discretion, is associated with higher support probability by 2.38 p.p.; while the corresponding increase in the same ratio, as explained by regulatory flexibility, is related to a 1.35 p.p. rise in the support probability.

### **3.7.4.3 Bank Liquidity**

Next, we explore the liquidity position of banks, measured by the ratio of liquid assets to deposits and short-term liabilities. We investigate whether the pre-crisis liquidity position of banks, as related to the prudential framework incentives, could explain the cross-bank variation in the probability to require support during the crisis. It is important to point out that the prudential regulation that we are considering – the implementation of CRD – imposed only solvency requirements (i.e. capital) and did not explicitly include liquidity regulations. Some (mainly theoretical) studies have highlighted that capital regulation may have some implications on bank liquidity, i.e. capital requirements may act as a substitute for liquidity requirements (Rochet and Vives, 2004; Admati et al., 2013).

In line with the analysis on prudential regulation and banks' liquidity management in Section 3.7.3.2, the results from the IV probit estimation on bank liquidity reflect the different incentives that regulatory flexibility and supervisory discretion may raise for the liquidity position of banks.

Greater liquidity buffers explained by regulatory flexibility are associated with lower probability of requiring crisis support (see negative marginal effect for `Liquid_Assets/Flex_Reg`). For instance, a 1-percentage point increase in the liquid assets ratio, as explained by lower regulatory flexibility, is related to a lower probability of recapitalization by 0.76 p.p. and to a lower probability of liquidity support by 1 p.p.. This result is consistent with the argument of regulatory spillovers between solvency requirements and bank liquidity. More flexible regulation for capital requirements might have spurred lower liquidity buffers<sup>236</sup> and this might have increased liquidity risk, even if liquidity requirements were not disciplined in the prudential framework. When considering banks of different size, this result is driven by medium and small banks, which tend to exploit more the favourable treatment allowed by regulatory flexibility.

On the other hand, the liquidity buffers explained by supervisory discretion display a positive and significant marginal effect on the probability of requiring public support. This somewhat counterintuitive result may indeed be related to the composition of the liquid assets

---

<sup>236</sup> See also the results for the reduced-equation in Table C.7, in Col. 2, 5, 8 and 11: a one-point increase in regulatory flexibility is related to a decrease in the liquid assets ratio in a range between 2.7 and 2.8 p.p. across the four specifications.

and in particular to the holdings of sovereign bonds with their associated risk. In fact, from the reduced form equation (Appendix Table 3.26), we observe that higher supervisory discretion is related to larger liquidity buffers, which could include sovereign bonds. We address this issue in the following step of our analysis.

#### **3.7.4.4 Bank Holdings of Sovereign Bonds**

Finally, we consider the role of banks' exposures to government securities. The Euro Area sovereign debt crisis has shown that sovereign bond exposures may result – in some cases – in risky investments for banks. Nevertheless, in line with the Basel framework, the EU capital requirements assign a 0% risk weight – under the Standardised Approach for credit risk - to the exposures to government securities issued by EU Member States, independently from the issuer credit ratings and from the bond credit risk. This may incentivise banks to purchase and hold sovereign bonds.

In our empirical analysis, we study the implications of the pre-crisis sovereign debt exposures (2005-2007) on the crisis distress of banks, as evidenced by the public intervention measures from 2008 to 2010. So we focus on the period of the global financial crisis, before the peak of the Euro Area sovereign debt crisis in the summer of 2011<sup>237</sup>. The results reported in Table 3.6 show that sovereign bond holdings<sup>238</sup>, as explained by a laxer prudential environment, increased the probability of requiring public support during the crisis across most specifications. The marginal effects are comparable for supervisory discretion and regulatory flexibility. For instance, an additional percentage point in the share of government bond exposures, as related to larger supervisory discretion, is associated with a higher probability of recapitalization by 4.4 p.p. in crisis time. These results hold for both large and medium-small banks and point to a strong detrimental effect of the sovereign-bank nexus on the stability of banks even before the Euro Area sovereign crisis erupted in full force.

Since capital requirements do not differentiate across sovereign issuers from different countries, theoretical and empirical studies have examined the determinants for the exposures of EU banks to sovereign bonds, and particularly to the domestic ones. The evidence presented in some recent papers (Ongena, Popov and Van Horen, 2019; Altavilla, Pagano and Simonelli, 2017; De Marco and Macchiavelli, 2016) suggests that national authorities in the EU (including potentially supervisory authorities) could have exerted some indirect or direct influence on domestic banks, to encourage the purchase and the holding of national sovereign bonds (i.e. the moral suasion argument). Also, the theoretical findings in some papers (Crosignani, 2017)

---

<sup>237</sup> For a robustness analysis focused on Euro Area banks and considering only the public intervention in 2008 and 2009, see the discussion in Section 3.7.5.1

<sup>238</sup> We are using the ratio of sovereign bonds to total assets; therefore this variable is correlated with the liquid assets ratio in the previous estimation, which is calculated as the ratio of liquid assets to the sum of deposits and short-term liabilities.

support the argument that banks with low capital increase their exposures to sovereign bonds, particularly domestic.

The results of the reduced form equation (Appendix Table 3.29) show that more lenient capital requirements, particularly in countries with larger supervisory discretion, are associated with higher shares of sovereign bond exposures. Provided that recapitalisation measures are implemented by governments, but the assessment to verify the potential undercapitalisation of banks is usually conducted by supervisory authorities, our evidence related to supervisory discretion supports the argument that supervisory authorities with high discretionary power may have been instrumental in fostering public support for banks with large holdings of sovereign bonds.

This would strengthen the case for a Banking Union with a Single Supervision, in order to break the vicious loop between banks and sovereigns. Further research to validate this argument could be developed by looking at the composition – by country of issuer – of banks' exposures to sovereign debt, in order to distinguish between domestic and foreign public debt. Unfortunately, these data are not available for the time period and the banks in our sample.

### **3.7.5 Robustness Analysis**

We conduct some robustness analysis to investigate whether the results obtained in the above analysis are confirmed also when we consider smaller subsamples either in terms of countries or in terms of years (particularly for the timing of public support measures). Also, given the role of the pre-crisis credit boom as a potential source of crisis vulnerability, we develop further analysis to investigate more in depth some questions on the lending behavior of banks, using some more granular data although available for a subsample of banks.

#### **3.7.5.1 Euro Area: Country Heterogeneity and Timing of Public Support**

The global financial crisis occurred in 2008-2009 was followed right afterwards by the Euro Area sovereign debt crisis. In general, the adverse macroeconomic developments of the global financial crisis had affected the public finances of many countries. However, the budgetary and debt position of some countries in particular (indicated as vulnerable countries) raised stronger concerns among investors, pushing upwards the yields on the sovereign bonds and making more difficult the market access for the sovereigns and the banks in those countries<sup>239</sup>.

---

<sup>239</sup> This was exacerbated due to a strong sovereign-bank nexus, working as a two-way feedback loop. In some countries, like Ireland and Spain, the large expenses for the public support of the banking sectors led to a significant worsening of the public finance position of the sovereigns. In other countries, like

These developments had relevant implications on the distress of credit institutions and were accompanied by further measures of public support to banks. Since our analysis is focused on the banking distress during the global financial crisis – as potentially induced by pre-crisis risk taking - we want to make sure that the results of our analysis are not affected by the developments of the sovereign debt crisis. From a timing viewpoint, Greece started to experience financial distress on its sovereign debt at the end of 2009 and received the first IMF-EU bailout in 2010. Then the sovereign debt crisis affected Ireland and Portugal between the end of 2010 and the beginning of 2011. Finally, the most acute phase of the crisis developed starting from the summer of 2011 with the contagion to Spain and Italy.

This timeline would suggest to conduct this robustness analysis focused on the Euro Area by excluding the measures of public support implemented in 2010, in case they may reflect some initial developments of the sovereign debt crisis, while the measures enacted in 2008 and 2009 would be directly related to the global financial crisis. Therefore, we first conduct the baseline analysis as in equation (1) using the measures of public support from 2008 to 2010 (see Table 3.7 Panel I Col.1-3) and then we estimate the same regression only based on the public intervention in 2008 and 2009 (see Table 3.7 Panel I Col.4-6).

The results for the Euro Area with the measures in 2008-2010 are broadly in line with the results obtained for the EU in the baseline specification of Table 3.3. Then, when we focus on the public support in 2008 and 2009, we see that the results are all confirmed, with some minor differences only in the magnitude for few specifications. This difference is quite modest for the overall indicator and the supervisory discretion, while it is more visible in the regressions for regulatory flexibility: a 1-point increase in this indicator is associated with a 1.7 p.p. increase in the probability of any support in 2008-2009 (vs. 2.37 p.p. rise in the probability of any support in 2008-2010). This can be explained mostly by the recapitalizations implemented in 2010 in Greece and Spain, which were however due to different reason. In Greece, these measures were implemented in the context of the First Economic Adjustment Programme to address the consequences of the sovereign debt crisis. In Spain, the capital injections of 2010 were aimed at recapitalizing the savings banks to deal with the losses from the bust of the housing bubble and to support the aggregation process of the sector for resilience purposes, after the unsustainable credit growth in the pre-crisis years. Therefore, also this banking distress for Spain can be fully considered in the analysis on the crisis consequences of ex-ante risk-taking.

---

Greece and Italy, already characterized by very high public debts, the exposures to underpriced sovereign debt affected negatively the capital and funding positions of banks also due to the strong home bias in sovereign bond exposures.

**Table 3.7 Euro Area and Timing of Support: Baseline Probit - Average Marginal Effects**

**Panel I. All Euro Area Countries**

| VARIABLES              | MEASURES 2008-2010     |                        |                         | MEASURES 2008-2009     |                        |                        |
|------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|------------------------|
|                        | (1)<br>SUPP            | (2)<br>RECAP           | (3)<br>GUAR             | (4)<br>SUPP            | (5)<br>RECAP           | (6)<br>GUAR            |
| <i>Panel I.A</i>       |                        |                        |                         |                        |                        |                        |
| Overall Indicator      | 0.0137***<br>(0.00277) | 0.0116***<br>(0.00278) | 0.00661***<br>(0.00194) | 0.0125***<br>(0.00217) | 0.0104***<br>(0.00209) | 0.00455**<br>(0.00195) |
| Size                   | 0.0949***<br>(0.0112)  | 0.0882***<br>(0.0112)  | 0.0470***<br>(0.0103)   | 0.0815***<br>(0.00982) | 0.0708***<br>(0.0101)  | 0.0477***<br>(0.0103)  |
| Long-Term Rate         | 0.408***<br>(0.110)    | 0.0452<br>(0.128)      | 0.400***<br>(0.0753)    | 0.502***<br>(0.0839)   | 0.217**<br>(0.0968)    | 0.366***<br>(0.0749)   |
| <i>Panel I.B</i>       |                        |                        |                         |                        |                        |                        |
| Supervisory Discretion | 0.0159***<br>(0.00357) | 0.0125***<br>(0.00361) | 0.00828***<br>(0.00252) | 0.0167***<br>(0.00273) | 0.0136***<br>(0.00269) | 0.00628**<br>(0.00249) |
| Size                   | 0.0937***<br>(0.0113)  | 0.0874***<br>(0.0113)  | 0.0454***<br>(0.0103)   | 0.0792***<br>(0.00989) | 0.0700***<br>(0.0101)  | 0.0464***<br>(0.0103)  |
| Long-Term Rate         | 0.386***<br>(0.112)    | 0.0358<br>(0.123)      | 0.383***<br>(0.0750)    | 0.481***<br>(0.0836)   | 0.217**<br>(0.0922)    | 0.353***<br>(0.0736)   |
| <i>Panel I.C</i>       |                        |                        |                         |                        |                        |                        |
| Regulatory Flexibility | 0.0237***<br>(0.00734) | 0.0226***<br>(0.00696) | 0.0129**<br>(0.00589)   | 0.0170**<br>(0.00679)  | 0.0162***<br>(0.00616) | 0.00558<br>(0.00543)   |
| Size                   | 0.0971***<br>(0.0112)  | 0.0892***<br>(0.0114)  | 0.0495***<br>(0.0106)   | 0.0851***<br>(0.00992) | 0.0711***<br>(0.00998) | 0.0488***<br>(0.0105)  |
| Long-Term Rate         | 0.437***<br>(0.119)    | 0.0529<br>(0.135)      | 0.431***<br>(0.0825)    | 0.533***<br>(0.0974)   | 0.215**<br>(0.105)     | 0.371***<br>(0.0797)   |
| Bank Controls          | YES                    | YES                    | YES                     | YES                    | YES                    | YES                    |
| Macro Controls         | YES                    | YES                    | YES                     | YES                    | YES                    | YES                    |
| Observations           | 355                    | 355                    | 355                     | 355                    | 355                    | 355                    |

**Panel II. Vulnerable Euro Area Countries**

| VARIABLES              | MEASURES 2008-2010     |                       |                        | MEASURES 2008-2009     |                         |                         |
|------------------------|------------------------|-----------------------|------------------------|------------------------|-------------------------|-------------------------|
|                        | (1)<br>SUPP            | (2)<br>RECAP          | (3)<br>GUAR            | (4)<br>SUPP            | (5)<br>RECAP            | (6)<br>GUAR             |
| <i>Panel II.A</i>      |                        |                       |                        |                        |                         |                         |
| Overall Indicator      | 0.0156***<br>(0.00479) | 0.00952*<br>(0.00513) | 0.0119***<br>(0.00297) | 0.0125***<br>(0.00295) | 0.00807***<br>(0.00310) | 0.00880***<br>(0.00258) |
| Size                   | 0.0601**<br>(0.0243)   | 0.0505**<br>(0.0258)  | 0.0282**<br>(0.0141)   | 0.0479***<br>(0.0167)  | 0.0373**<br>(0.0175)    | 0.0289**<br>(0.0141)    |
| Long-Term Rate         | 0.730***<br>(0.226)    | 0.00788<br>(0.230)    | 0.413***<br>(0.0687)   | 0.649***<br>(0.133)    | 0.222<br>(0.137)        | 0.373***<br>(0.0757)    |
| <i>Panel II.B</i>      |                        |                       |                        |                        |                         |                         |
| Supervisory Discretion | 0.0229***<br>(0.00696) | 0.0110<br>(0.00777)   | 0.0265**<br>(0.0129)   | 0.0203***<br>(0.00399) | 0.0134***<br>(0.00454)  | 0.0178***<br>(0.00577)  |
| Size                   | 0.0593**<br>(0.0247)   | 0.0475*<br>(0.0259)   | 0.0328**<br>(0.0145)   | 0.0465***<br>(0.0163)  | 0.0356**<br>(0.0171)    | 0.0354**<br>(0.0145)    |
| Long-Term Rate         | 0.701***<br>(0.236)    | -0.0216<br>(0.228)    | 0.421***<br>(0.0720)   | 0.600***<br>(0.127)    | 0.204<br>(0.134)        | 0.377***<br>(0.0574)    |
| <i>Panel II.C</i>      |                        |                       |                        |                        |                         |                         |
| Regulatory Flexibility | 0.0203*<br>(0.0106)    | 0.0172*<br>(0.0100)   | 0.0223***<br>(0.00732) | 0.0151*<br>(0.00795)   | 0.0102<br>(0.00717)     | 0.0118*<br>(0.00636)    |
| Size                   | 0.0545**<br>(0.0245)   | 0.0493*<br>(0.0255)   | 0.0217<br>(0.0149)     | 0.0428**<br>(0.0178)   | 0.0344*<br>(0.0181)     | 0.0232<br>(0.0143)      |
| Long-Term Rate         | 0.755***<br>(0.241)    | 0.0357<br>(0.228)     | 0.512***<br>(0.113)    | 0.715***<br>(0.159)    | 0.228<br>(0.143)        | 0.401***<br>(0.103)     |
| Bank Controls          | YES                    | YES                   | YES                    | YES                    | YES                     | YES                     |
| Macro Controls         | YES                    | YES                   | YES                    | YES                    | YES                     | YES                     |
| Observations           | 164                    | 164                   | 164                    | 164                    | 164                     | 164                     |

**Panel III. Non-Vulnerable Euro Area Countries**

| VARIABLES                 | MEASURES 2008-2010      |                         |                       | MEASURES 2008-2009      |                         |                       |
|---------------------------|-------------------------|-------------------------|-----------------------|-------------------------|-------------------------|-----------------------|
|                           | (1)<br>SUPP             | (2)<br>RECAP            | (3)<br>GUAR           | (4)<br>SUPP             | (5)<br>RECAP            | (6)<br>GUAR           |
| <i><b>Panel III.A</b></i> |                         |                         |                       |                         |                         |                       |
| Overall Indicator         | 0.00837***<br>(0.00321) | 0.00814***<br>(0.00297) | -0.00678<br>(0.00458) | 0.00837***<br>(0.00321) | 0.00820***<br>(0.00285) | -0.00678<br>(0.00458) |
| Size                      | 0.0863***<br>(0.0114)   | 0.0838***<br>(0.0112)   | 0.0734***<br>(0.0156) | 0.0863***<br>(0.0114)   | 0.0795***<br>(0.0110)   | 0.0734***<br>(0.0156) |
| Long-Term Rate            | -0.0812<br>(0.448)      | -0.0925<br>(0.404)      | -0.567<br>(1.171)     | -0.0812<br>(0.448)      | -0.0855<br>(0.363)      | -0.567<br>(1.171)     |
| <i><b>Panel III.B</b></i> |                         |                         |                       |                         |                         |                       |
| Supervisory Discretion    | 0.0109**<br>(0.00425)   | 0.0106***<br>(0.00394)  | -0.00923<br>(0.00667) | 0.0109**<br>(0.00425)   | 0.0107***<br>(0.00369)  | -0.00923<br>(0.00667) |
| Size                      | 0.0856***<br>(0.0115)   | 0.0828***<br>(0.0112)   | 0.0732***<br>(0.0156) | 0.0856***<br>(0.0115)   | 0.0785***<br>(0.0110)   | 0.0732***<br>(0.0156) |
| Long-Term Rate            | -0.173<br>(0.654)       | -0.183<br>(0.608)       | -0.150<br>(1.378)     | -0.173<br>(0.654)       | -0.166<br>(0.506)       | -0.150<br>(1.378)     |
| <i><b>Panel III.C</b></i> |                         |                         |                       |                         |                         |                       |
| Regulatory Flexibility    | 0.0274*<br>(0.0147)     | 0.0271*<br>(0.0138)     | -0.0240*<br>(0.0144)  | 0.0274*<br>(0.0147)     | 0.0269**<br>(0.0134)    | -0.0240*<br>(0.0144)  |
| Size                      | 0.0895***<br>(0.0115)   | 0.0875***<br>(0.0115)   | 0.0739***<br>(0.0156) | 0.0895***<br>(0.0115)   | 0.0834***<br>(0.0113)   | 0.0739***<br>(0.0156) |
| Long-Term Rate            | 0.126<br>(0.277)        | 0.110<br>(0.247)        | -1.699<br>(1.047)     | 0.126<br>(0.277)        | 0.111<br>(0.234)        | -1.699<br>(1.047)     |
| Bank Controls             | YES                     | YES                     | YES                   | YES                     | YES                     | YES                   |
| Macro Controls            | YES                     | YES                     | YES                   | YES                     | YES                     | YES                   |
| Observations              | 191                     | 191                     | 191                   | 191                     | 191                     | 191                   |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Given the significant cross-country heterogeneity in various bank balance sheet characteristics<sup>240</sup>, including the exposure to the sovereign debt crisis, we conduct the same analysis separately for the banks in vulnerable and non-vulnerable countries. The group of vulnerable countries include Cyprus, Greece, Ireland, Italy, Spain and Portugal. Panel II and III show the results respectively for vulnerable and non-vulnerable countries. In this context, it is important to consider that the distribution of the prudential indicators across countries does not match the distinction between vulnerable and non-vulnerable countries: in fact, there are non-vulnerable countries with high values of regulatory flexibility or supervisory discretion, as well as vulnerable countries with low values of these indicators.

For non-vulnerable countries, as expected there is no difference in the results of the analysis depending on whether we consider only the support measures in 2008 and 2009 (Col. 4-6) or we include also the ones in 2010 (Col. 1-3). This is because the banks in these countries received almost all the public intervention in 2008 and 2009, as their distress episodes were related to the risk-taking taking place before the global financial crisis. Indeed, for these countries we find evidence that a more lenient prudential framework in the pre-crisis time was related to higher crisis distress and larger need of public bailout: for instance, a 1-point increase in the overall indicator is associated with a 0.84 p.p. rise in the probability of any support.

For vulnerable countries, we can observe some difference in the results across the two sample periods: for example, a 1-point increase in the overall indicator is related to a 1.25 p.p. rise in the probability of any support in 2008-2009 (vs. 1.56 p.p. increase in the corresponding probability for the years 2008-2010). This is mainly due to the differences in the timing of support for countries like Greece and Spain as discussed above.

Interesting differences across the two groups of countries can be observed particularly for the relationship between supervisory discretion and probability of crisis distress. In fact, the marginal effect of supervisory discretion on the probability of any support is equal to 1.09 p.p. for banks in non-vulnerable countries and to 2.03 p.p. for banks in vulnerable countries. Since we are controlling for bank size and other balance sheet characteristics, as well as country-level macroeconomic conditions, this result suggests that supervisory discretion may have encouraged risk-taking incentives more in vulnerable countries than in other countries. This would point also to different effectiveness – across countries - of the incentive mechanism embedded in supervisory discretion<sup>241</sup>.

---

<sup>240</sup> See the discussion in Section 3.6.2, based on the descriptive statistics in Table 2 for banks in vulnerable and non-vulnerable countries

<sup>241</sup> Further research on differences in supervisory effectiveness would however require more detailed data at the national level on the modalities of the supervisory assessment and on the content of supervisory decisions.



### 3.7.5.2 Country Heterogeneity: Robustness to Sample Composition

The country heterogeneity in the business models of the banking sector or in the implementation of public support measures provides the rationale to analyse the robustness of the empirical results to the inclusion of individual countries in the sample composition.

We estimate the probit baseline specification as in equation (1), by excluding each time one country from the sample. Given that our sample for the empirical analysis includes 14 EU countries, we drop once per time: a) the two non-Euro Area countries (UK, SE); b) the five main countries classified as vulnerable (ES, GR, IE, IT, PT); c) the two most important countries defined as non-vulnerable (DE, FR).

The results of this robustness analysis (in terms of marginal effects) are presented in Table 3.8. For each subsample (after dropping one country per time), we estimate separately the regressions for the four categories of public support and for the three indicators of prudential regulation (overall indicator, supervisory discretion and regulatory flexibility).

We find that the results are confirmed also when we drop individual countries, including large countries with a significant number of banks. This holds for the various dependent variables: in particular, any type of support, as well as the two most common measures, recapitalisations and guarantees on bank liabilities. While the sign of the marginal effect is confirmed, some minor differences can emerge in the magnitude of the effects. For liquidity support, given that these measures were concentrated in few countries, the exclusion of countries like Greece and Portugal explains why the marginal effect can become non-significant.

**Table 3.8 Robustness to Sample Composition: Baseline Probit - Average Marginal Effects**

| DROPPED COUNTRY | VARIABLES              | (1)<br>SUPP             | (2)<br>RECAP            | (3)<br>GUAR             | (4)<br>LIQSUPP            |
|-----------------|------------------------|-------------------------|-------------------------|-------------------------|---------------------------|
| DE              | Overall Indicator      | 0.0150***<br>(0.00331)  | 0.0133***<br>(0.00327)  | 0.00617***<br>(0.00202) | 0.0211***<br>(0.00723)    |
|                 | Supervisory Discretion | 0.0203***<br>(0.00445)  | 0.0159***<br>(0.00452)  | 0.00884***<br>(0.00288) | 0.00945*<br>(0.00492)     |
|                 | Regulatory Flexibility | 0.0205**<br>(0.00830)   | 0.0245***<br>(0.00775)  | 0.0106**<br>(0.00512)   | 2.519***<br>(0.697)       |
|                 | Observations           | 268                     | 268                     | 268                     | 268                       |
| ES              | Overall Indicator      | 0.0106***<br>(0.00222)  | 0.00949***<br>(0.00204) | 0.00512***<br>(0.00198) | 0.00765**<br>(0.00313)    |
|                 | Supervisory Discretion | 0.0143***<br>(0.00325)  | 0.0121***<br>(0.00308)  | 0.00578*<br>(0.00302)   | 0.00527**<br>(0.00262)    |
|                 | Regulatory Flexibility | 0.0256***<br>(0.00594)  | 0.0252***<br>(0.00526)  | 0.0150***<br>(0.00477)  | 1.522e+06***<br>(512,107) |
|                 | Observations           | 338                     | 338                     | 338                     | 338                       |
| FR              | Overall Indicator      | 0.0113***<br>(0.00357)  | 0.00881**<br>(0.00351)  | 0.00949***<br>(0.00222) | 0.0291***<br>(0.00708)    |
|                 | Supervisory Discretion | 0.0157***<br>(0.00519)  | 0.00728<br>(0.00537)    | 0.0164***<br>(0.00318)  | 0.0105**<br>(0.00436)     |
|                 | Regulatory Flexibility | 0.0119*<br>(0.00653)    | 0.0162***<br>(0.00612)  | 0.00772<br>(0.00503)    | 0.118<br>(3.069)          |
|                 | Observations           | 367                     | 367                     | 367                     | 367                       |
| GR              | Overall Indicator      | 0.0109***<br>(0.00296)  | 0.00745***<br>(0.00289) | 0.00356*<br>(0.00204)   | 0.00327<br>(0.00370)      |
|                 | Supervisory Discretion | 0.0139***<br>(0.00368)  | 0.00810**<br>(0.00366)  | 0.00601**<br>(0.00252)  | 0.00188<br>(0.00181)      |
|                 | Regulatory Flexibility | 0.0102<br>(0.00708)     | 0.0112*<br>(0.00658)    | -0.000829<br>(0.00496)  | 5.619***<br>(2,175)       |
|                 | Observations           | 383                     | 383                     | 383                     | 383                       |
| IE              | Overall Indicator      | 0.0119***<br>(0.00267)  | 0.0109***<br>(0.00258)  | 0.00540***<br>(0.00190) | 0.0148***<br>(0.00507)    |
|                 | Supervisory Discretion | 0.0162***<br>(0.00344)  | 0.0130***<br>(0.00344)  | 0.00813***<br>(0.00246) | 0.0147<br>(0.00897)       |
|                 | Regulatory Flexibility | 0.0195**<br>(0.00852)   | 0.0321***<br>(0.00878)  | 0.00609<br>(0.00566)    | 1.742***<br>(0.482)       |
|                 | Observations           | 382                     | 382                     | 382                     | 382                       |
| IT              | Overall Indicator      | 0.00989***<br>(0.00353) | 0.0145***<br>(0.00336)  | -0.000141<br>(0.00235)  | 0.0173***<br>(0.00592)    |
|                 | Supervisory Discretion | 0.0122**<br>(0.00493)   | 0.0161***<br>(0.00455)  | -0.00126<br>(0.00362)   | 0.00769*<br>(0.00451)     |
|                 | Regulatory Flexibility | 0.0138*<br>(0.00707)    | 0.0224***<br>(0.00685)  | 0.00165<br>(0.00483)    | 2.190***<br>(0.605)       |
|                 | Observations           | 327                     | 327                     | 327                     | 327                       |
| PT              | Overall Indicator      | 0.0119***<br>(0.00286)  | 0.0143***<br>(0.00264)  | 0.00253<br>(0.00195)    | 0.0307<br>(0.722)         |
|                 | Supervisory Discretion | 0.0146***<br>(0.00367)  | 0.0157***<br>(0.00351)  | 0.00401<br>(0.00265)    | 0.00594*<br>(0.00323)     |
|                 | Regulatory Flexibility | 0.0147**<br>(0.00662)   | 0.0258***<br>(0.00653)  | 0.00203<br>(0.00412)    | 0.0356<br>(1.070)         |
|                 | Observations           | 381                     | 381                     | 381                     | 381                       |
| SE              | Overall Indicator      | 0.0131***<br>(0.00271)  | 0.0111***<br>(0.00269)  | 0.00601***<br>(0.00189) | 0.0147***<br>(0.00502)    |
|                 | Supervisory Discretion | 0.0155***<br>(0.00346)  | 0.0121***<br>(0.00348)  | 0.00796***<br>(0.00244) | 0.00677**<br>(0.00340)    |
|                 | Regulatory Flexibility | 0.0210***<br>(0.00715)  | 0.0213***<br>(0.00680)  | 0.00963*<br>(0.00538)   | 1.724***<br>(0.477)       |
|                 | Observations           | 386                     | 386                     | 386                     | 386                       |
| UK              | Overall Indicator      | 0.0126***<br>(0.00272)  | 0.0115***<br>(0.00260)  | 0.00561***<br>(0.00197) | 0.00659**<br>(0.00285)    |
|                 | Supervisory Discretion | 0.0161***<br>(0.00357)  | 0.0128***<br>(0.00348)  | 0.00829***<br>(0.00259) | 0.00818**<br>(0.00339)    |
|                 | Regulatory Flexibility | 0.0169**<br>(0.00673)   | 0.0217***<br>(0.00632)  | 0.00603<br>(0.00497)    | 698,239***<br>(194,036)   |
|                 | Observations           | 363                     | 363                     | 363                     | 363                       |

Standard errors in parentheses. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

### 3.7.5.3 Bank Lending: Loan Type and Credit Quality

An important component of the risk-taking behaviour by banks in the pre-crisis period concerned the expansion of credit provision and the loosening in lending standards. The analyses on the balance sheet management by banks (Section 3.7.3) and on the risk-taking channels of prudential regulation incentives (Section 3.7.4) suggest that the two indicators of supervisory discretion and regulatory flexibility may capture different incentives with respect to bank lending. While higher supervisory discretion may have contributed to limit the amount of credit provision, higher regulatory flexibility may have encouraged an increase in bank lending.

We investigate the dynamics in bank lending behaviour more in detail, by using more granular data which are however available only for smaller subsample of banks. We consider the credit volumes for different categories of loans, in particular residential mortgages and corporate loans, to explore how they are related to the probability of crisis distress. Also, we focus on the ratio of non-performing loans to study how this can explain the probability that a bank may need to require public support in the crisis.

We extend the IV probit analysis on bank loans by estimating the equations (4) and (5) for the following balance sheet risk-taking variables: for credit quality, the ratio of non-performing loans to gross loans; for loan categories, the ratios of residential mortgages and corporate loans to total assets (so that the results are comparable to the ones discussed above for the loans to assets ratio). The results are reported in Table 3.9, which presents the same structure as in Table 3.6<sup>242</sup>.

The results in Panel A show that higher NPL ratios due to laxer prudential frameworks contributed to increase the probability of crisis distress. For instance, a 1-percentage point increase in the NPL ratio<sup>243</sup> – as explained by the overall indicator – is related to an increase in the probability of requiring recapitalization by 13.5 p.p, therefore it is equivalent to doubling this probability. In fact, this sizeable effect on crisis distress is the result of a risk-taking behavior in bank lending, due to a more lenient assessment of credit risk, which was incentivized by some national prudential frameworks, as set after the CRD adoption. Indeed, as discussed in Annex 3.1, some national options and discretions in the CRD allowed for a more favourable treatment to be applied to certain past due exposures, by reducing the risk weight on past due residential mortgages or by leaving the definition of a loan default to the choice of national competent authorities. In line with these incentives, the results from the reduced form equation (Appendix Table 3.32) suggest that higher values of the overall indicator and of

---

<sup>242</sup> We estimate the IV probit regressions for all the banks included in our sample which have non-missing observations for these variables, without making further distinctions with regard to the size of the banks, as this would further restrict the estimation sample.

<sup>243</sup> In the observed sample of 272 banks, the average NPL ratio is equal to 2.68% with a standard deviation of 2.44 percentage points.

supervisory discretion were associated with higher NPL ratios. This risk-taking behavior increased the probability – for the banks subject to a laxer prudential regime – to require measures of recapitalization and liquidity support during the crisis.

Panel B reports the results for the ratio of residential mortgages to total assets. Banks with a larger share of residential mortgages displayed higher probability to require crisis support: for example, a 1-percentage point increase in the ratio of residential mortgages – as explained by supervisory discretion - is related to an increase in the probability of crisis distress by 1.5 p.p. Also in this case, various national options and discretions set in the CRD allowed national authorities to apply a more lenient regulatory treatment to residential mortgages, both in the assessment of credit risk under the standardized approach and for the recognition of real estate property as a form of funded credit protection. Looking at the reduced form equation (Appendix Table 3.33), the positive relationship between prudential regulation leniency and support probability is significant in one specification for supervisory discretion and liquidity support. Despite the small number of observations for residential mortgages, the results of the IV probit estimation provide support to the argument that the credit expansion in residential real estate - fueled by favourable prudential regimes - increased the vulnerability of banks up to triggering their crisis distress. This occurred also because the bust of the housing bubble affected negatively the balance sheets and then the creditworthiness of the banks more exposed to the real estate, also by increasing their funding costs.

The significant role of mortgage lending in banks' pre-crisis risk-taking emerges also in the comparison across different categories of loans. Panel C shows the results for the ratio of corporate loans to total assets. Banks with a larger share of corporate loans displayed lower probability of crisis distress: i.e. a 1-percentage point increase in the ratio of corporate loans is associated with a lower probability of crisis distress by 1.3 p.p.. In fact, under the Basel II framework, corporate loans were subject to more stringent capital requirements than other loan types and this may have induced banks to apply a more prudent behaviour in corporate lending.

**Table 3.9 Bank Lending: MLE IV Probit – Average Marginal Effects**

| VARIABLES                                     | (1)<br>SUPP              | (2)<br>RECAP             | (3)<br>GUAR              | (4)<br>LIQSUPP           |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| <b>Panel A. NPLs/Gross Loans</b>              |                          |                          |                          |                          |
| NPL Ratio  Indicator                          | 0.148***<br>(0.0207)     | 0.135***<br>(0.0223)     | 0.161***<br>(0.00922)    | 0.153***<br>(0.00769)    |
| NPL Ratio  SupDiscr                           | 0.147***<br>(0.0161)     | 0.133***<br>(0.0238)     | 0.161***<br>(0.0149)     | 0.142***<br>(0.0187)     |
| NPL Ratio  FlexReg                            | 0.161***<br>(0.00708)    | 0.160***<br>(0.0122)     | -0.162***<br>(0.00491)   | 0.159***<br>(0.00114)    |
| Observations                                  | 272                      | 272                      | 272                      | 272                      |
| <b>Panel B. Resid. Mortgages/Total Assets</b> |                          |                          |                          |                          |
| ResidMort/Assets  Indicator                   | 0.0141***<br>(0.00351)   | 0.0133***<br>(0.00513)   | 0.0153***<br>(0.000938)  | 0.0150***<br>(0.000643)  |
| ResidMort/Assets  SupDisc                     | 0.0150***<br>(0.00228)   | 0.0144***<br>(0.00417)   | 0.0153***<br>(0.000936)  | 0.0149***<br>(0.000892)  |
| ResidMort/Assets  FlexReg                     | 0.00998<br>(0.00721)     | 0.00831<br>(0.00854)     | 0.0154***<br>(0.000902)  | 0.0150***<br>(0.000666)  |
| Observations                                  | 107                      | 107                      | 107                      | 107                      |
| <b>Panel C. Corporate Loans/Total Assets</b>  |                          |                          |                          |                          |
| CorpLoans/Assets  Indicator                   | -0.0132***<br>(0.000406) | -0.0132***<br>(0.000413) | -0.0133***<br>(0.000404) | -0.0132***<br>(0.000403) |
| CorpLoans/Assets  Sup_Disc                    | -0.0132***<br>(0.000406) | -0.0132***<br>(0.000414) | -0.0133***<br>(0.000404) | -0.0132***<br>(0.000413) |
| CorpLoans/Assets  Flex_Reg                    | -0.0132***<br>(0.000406) | -0.0132***<br>(0.000412) | -0.0133***<br>(0.000405) | -0.0132***<br>(0.000407) |
| Observations                                  | 164                      | 164                      | 164                      | 164                      |
| BANK CONTROLS                                 | YES                      | YES                      | YES                      | YES                      |
| MACRO CONTROLS                                | YES                      | YES                      | YES                      | YES                      |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### 3.8 Conclusions

This paper analyses the implications of national differences in the prudential framework across EU countries before the global financial crisis on the stability of credit institutions during the crisis period. We construct quantitative indicators of regulatory flexibility and supervisory discretion, based on the exercise of national options and discretions in the implementation of the Capital Requirements Directive. We collect the measures of public support implemented by EU Governments during the period 2008-2010 and classify the various forms of financial assistance (recapitalisations, credit guarantees, and liquidity provision).

Overall, the analysis suggests that banks established in countries with less stringent prudential regulation before the crisis were more likely to require public support during the crisis. The results hold for both indicators of supervisory discretion and regulatory flexibility, suggesting that the *micro-prudential stance* of national authorities had relevant implications for the management of bank balance sheets and for the risk-taking incentives of credit institutions.

We investigate the channels through which a more lenient prudential regulation may have led to greater financial vulnerability of banks. Using an instrumental variable approach, we focus on the component of balance sheet risk-taking explained by the incentives of the prudential framework and analyse how this affects bank resilience.

The share of bank income from non-interest business – as explained by a less stringent prudential regime - is associated with higher probability to require public support during the crisis. This result provides some evidence that prudential regulation might have incentivised banks to venture away from their core business into risky activities.

We find some evidence that a more lenient prudential framework might have spurred larger amount of credit provision, particularly for medium and small banks and for the provision of residential mortgages. In fact, bank lending in countries with more regulatory flexibility is associated with higher likelihood of requiring all types of bailout during the crisis. At the same time, we observe that higher supervisory discretion may have induced some incentives for banks to limit their credit provision, therefore partially reducing this risk-taking behaviour.

The Basel 2 framework did not include liquidity requirements. Our study documents the existence of some regulatory spillovers, since lower liquidity buffers explained by more flexible regulatory frameworks – which established only capital requirements - increase the probability of banks to have been in financial distress. At the same time, our study suggests that the composition of liquid assets is important. When more liquid assets take the form of sovereign debt, the related increase in the sovereign-bank nexus seems overall to have a detrimental impact on banks' resilience.

Overall, our results show that a prudential environment in which important options and discretions are maintained at the national level is at best not conducive to a better allocation of

risk – which was the main rationale for maintaining these options – and may actually foster risk-taking. This supports the ongoing efforts aimed at establishing a level-playing field in banking regulation and supervision across EU countries. The introduction of a Single Rule-Book, intended to minimize the differences in prudential regulation across EU countries, provides a relevant contribution to reduce the heterogeneities in the risk-taking of credit institutions, by realigning the regulatory incentives on the basis of a common prudential framework.

## **3.9 ANNEXES**

### **Annex 3.A: The Indicators of Prudential Regulation**

#### **3.A.1 The Construction of the Indicators**

This data appendix describes the steps followed for the construction of the indicators of prudential regulation used in the empirical analysis: the overall indicator and its subcomponents of supervisory discretion and regulatory flexibility.

We base the construction of our indicators on the national options and discretions available to national authorities in the regulatory framework of the Capital Requirements Directives: namely the Directive 2006/48 (Taking up and pursuit of the business of credit institutions), and the Directive 2006/49 (Capital adequacy of investment firms and credit institutions), which implemented the Basel II agreement in the European Union.

We identify the national options and discretions and their impact on the regulatory burden of the concerned banks based on the technical assessment provided in May 2008 by the Committee of European Banking Supervisors (CEBS), now succeeded by the European Banking Authority (EBA). The legal provisions covered in the technical advice were 152, including also the transitional provisions established to regulate the smooth shift to the Basel II prudential framework and then subject to expiration after a pre-defined period of time. Since we are interested in the regulatory provisions that can potentially affect the risk-taking incentives of banks in a structural way, we have excluded the transitional provisions from our consideration and focused only on the permanent provisions which characterise the new regime.

Therefore, we focus on 87 provisions for which we have accurate information about the way national authorities exercised the options. The relevant provisions are organised in nine categories in relation to the regulated field: definition of own funds; scope of application; counterparty risk; standardised approach; IRB approach; credit risk mitigation; operational risk; qualifying holdings; trading book. We present a table (Appendix Tables 3.1 to 3.10) for each of these regulated fields and compute the indicators in each table before aggregating the results across fields.

The options and discretions are also classified in two categories, depending on whether they enable national regulators to establish a more favourable treatment for all banks (regulatory flexibility, indicated as REG in the tables), or whether they assign to national supervisors the prerogative to waive some regulatory requirements for specific banks based on a case-by-case assessment (supervisory discretion, reported as SUP in the tables). The overall indicator is computed as the sum of the two sub-indicators of supervisory discretion and regulatory flexibility.



The national options and discretions may have different effects on the regulatory burden of the concerned banks: in general, the exercise of an option implies a more favourable regulatory treatment, although in very few cases it may also determine a more restrictive treatment. Therefore, the indicators are constructed in a way such that a higher (positive) value indicates a more lenient treatment. In few cases we assign different weights to the options, following the assessment provided by the CEBS (now EBA).

The CEBS technical advice evaluated to what extent each option could affect the level-playing field across jurisdictions and therefore whether the divergences in the option exercise could have any business impact. This qualitative assessment was conducted based on the results of a survey conducted across supervisory authorities and industry participants about the regulatory importance of these options and the change in capital burden or disclosure requirements implied by their exercise. The CEBS summarised the results of this survey in its assessment about the options. Based on that, we assign a weight equal to: 0.5 if the option was reported to have no or limited regulatory importance and no or minor business impact; 1 if the option was considered to be important for the regulatory treatment and to have business impact. In very limited cases, we attribute a weight equal to 1.5 if the option was assessed as very important for the regulatory treatment, as it could endanger the level-playing field across jurisdictions, and was evaluated as having significant business impact. On the other hand, in the limited cases where the national option provided the possibility to apply a more stringent treatment, we assign a (negative) weight equal to -0.5.

The CEBS technical advice provided also information on which national authorities exercised the national options and discretions and how they implemented them in case of multiple choices. We use such information for 15 countries: Austria (AT), Belgium (BE), Cyprus (CY), Germany (DE), Spain (ES), Finland (FI), France (FR), Greece (GR), Ireland (IE), Italy (IT), Luxembourg (LU), Malta (MT), Portugal (PT), Sweden (SE), and United Kingdom (UK). No responses were available for Denmark and Netherlands. In order to ensure some degree of homogeneity across national banking systems, also due to the previous process of harmonisation across EU countries for Single Market purposes, we don't include the Eastern European countries which joined the EU in 2004 and 2007.

Based on the indications about the option exercise by national authorities, and on the weights for the options as described above, we compute the value of the indicator for each field of banking regulation. The results of this computation per each field are presented in the tables A.1 to A.9.

In each table, we report the relevant legislative provision, a short indication of the content of the national option, the type of option (REG or SUP), as well as the weight assigned depending on the impact on the regulatory burden of banks. Then we sum the points obtained

for the sub-indicators (supervisory discretion and regulatory flexibility) and for the overall indicator.

Finally, we aggregate the results obtained for all the regulatory fields in order to obtain the final indicators. In doing so, we also take into account the relative importance of the various fields of regulation when computing the aggregate (weighted) indicators. Given that we are interested in the options and discretions that have important effects on the capital requirements for banks established in different countries, we attach particular importance to the Pillar 1 provisions in the following fields: the definition of own funds; the standardised and the IRB approaches for credit risk; the counterparty risk in derivatives; the market risk for the trading book. Therefore, when aggregating the results across fields, we assign a weight equal to 2 to the indicator values for these regulatory fields and a weight equal to 1 for the remaining regulatory fields.

Appendix Table 3.10 presents the aggregate (weighted) results for the sub-components of supervisory discretion and regulatory flexibility and for the overall indicator. In the empirical analysis, we use the aggregate (weighted) values for the indicators of prudential regulation.

### **3.A.2 Main Examples of National Options and Discretions**

National options and discretions address some important issues in bank regulation, which are widely considered in the policy debate as the regulatory treatment may contribute to shape banks' incentives for their balance sheet management. A review of some of these options is then useful to highlight the importance of the regulatory differences which could be determined by the potentially heterogeneous exercise of these provisions.

Importantly, while some of these options have been either removed or transformed in the design of the Single Rulebook, some of them are still present in the current regulatory framework. In fact, the initiative undertaken by the ECB as the competent authority for euro area significant banks – for some options in the current CRR – highlights the need to reduce the regulatory differences which may hamper the level-playing field for euro area banks.

The CRD framework considered in this paper contains some national options and discretions related to various relevant areas: the capital treatment of participations in insurance companies; the counterparty credit risk for derivatives contracts cleared with central counterparties; the credit risk for the exposures to other banks in the interbank market or for the lending exposures secured by residential or commercial real estate; the definition of past due exposures in the loan portfolio for the purpose of the IRB approach; the list of the entities eligible for the provision of unfunded credit protection; the capital treatment of the exposures to public sector entities; the specific risk requirements for trading book items; the trading book

treatment of the underwriting of debt and equity instruments. Most of the national options and discretions discussed below allow for a more favourable regulatory treatment.

A key area of capital regulation concerns **the definition and the computation of banks' own funds**, as the CRD disciplines both the eligible components and the items to be deducted. In general, the CRD requires the deduction of the participations in insurance companies; however, it also contains two NODs allowing Member States – respectively - to permit the use of alternative methodologies for determining the capital adequacy at the conglomerate level (Art. 59, Dir.48/2006; see Appendix Table 3.1), and to decide not to deduct certain participations from solo-level own funds (Art. 59, Dir.48/2006; see Appendix Table 3.1). The exercise of these national discretions avoids a reduction in the amount of own funds which otherwise would concern the banking groups with these participations. Therefore, EU countries with a significant diffusion of the bancassurance model, i.e. financial conglomerates providing both banking and insurance services, are particularly interested in exploiting this source of regulatory flexibility, to minimise the capital burden for their domestic banking groups with this business model.

Another key area of capital regulation regards the **determination of the risk-weighted amount of bank exposures**, in relation to the various types of risk. Consistently with the Basel II approach, aimed at increasing the risk sensitiveness of capital regulation, the CRD contains a detailed **treatment of credit risk** for different exposure types, like interbank loans, residential and commercial mortgages, exposures to public sector entities.

Given the significant reliance of credit institutions on interbank lending before the crisis, some options set in the standardized approach may explain potential regulatory incentives regarding the supply of **interbank loans**. The CRD assigns to Member States the option to choose which method (rating of the institution or of the central government) should be applied to compute the risk-weighted amount for exposures to institutions (for maturities above 3 months) (Article 80.3 and Annex VI, Part 1, Point 24, Dir.48/2006; see Appendix Table 3.4). Given that in general bank credit ratings have as an upper floor the sovereign credit rating, the choice of the central government method (as selected by most Member States) implies a reduction of the risk weight for the exposures to banks having a lower credit rating than the sovereign. Most importantly, this choice means that the exposures to all banks in a given country are subject to the same risk weight, without differentiation across them in terms of creditworthiness. In addition, the CRD allows Member States to apply a more permissive treatment, in the form of a 20% risk weight, to all short-term interbank exposures with a residual maturity of 3 months or less and funded in the national currency (Annex VI, Part 1, Point 37, Dir.48/2006; see Appendix Table 3.4). The more favourable treatment allowed by these national discretions could have encouraged the provision of interbank lending to all banks in the countries where national authorities had decided to exploit this regulatory opportunity.

The lending boom observed in some countries before the crisis raises also the question whether the regulatory framework set the proper incentives for an adequate risk assessment for **loans to the private sector (households and corporates)**. Some national options and discretions allow for a more favourable treatment to be applied to certain **past due exposures or items with higher risk**. Under the standardized approach, subject to the exercise of a national discretion, banks can assign a lower risk weight (50% instead of 100%) to past due residential mortgages provided that the value adjustments are at least 20% of the gross exposure (Annex VI, Part 1, Point 64, Dir.48/2006; see Appendix Table 3.4). Also, under the IRB approach, **the definition of loan default with regard to the number of days past due** is left to a decision of national competent authorities, which can determine this time threshold in a range between 90 and 180 days (Annex VII, Part 4, Point 48, first and second sentence, Dir.48/2006; see Appendix Table 3.5): since the characterization of a loan default is relevant for the computation of the expected loss and then of the risk weight under the IRB approach, the exercise of this national discretion may lead to lower capital requirements on past due exposures. In the above two cases, the provision of a more lenient treatment for past due exposures could have encouraged some forbearance behaviour by banks, with potential implications on their risk-taking. Also, independently from the past due status of a loan, for the items belonging to regulatory high-risk categories (like investments in venture capital and private equity), Member States may allow for the assignment of lower risk weights, 100% or 50% (instead of 150%), provided that value adjustments are respectively at least 20% or 50% of the gross exposure (Annex VI, Part 1, Point 67, Dir.48/2006; see Appendix Table 3.4). In these cases, the national discretions of the CRD framework – by reducing the capital burden - may have contributed to the risk taken by banks in their lending activity.

The regulatory framework, while setting the risk weights for the credit risk of bank exposures, disciplines the use of some techniques for **credit risk mitigation, via funded or unfunded protection**. Some national discretions allow Member States to broaden the scope for this credit risk mitigation. In general, **residential and commercial real estate may be eligible for funded credit protection** if the risk of the borrower does not depend upon the performance of the underlying property. However, the CRD allows national authorities to waive this requirement, if they have evidence that the relevant market is well developed and long established with sufficiently low loss rates (Annex VIII, Part 1, Point 16, first sentence, and Point 17, Dir.48/2006; see Appendix Table 3.6). The wider possibility to use real estate collateral as funded credit protection, by reducing the corresponding capital requirements for these exposures, could have encouraged the provision of residential and commercial mortgages. Moreover, national discretions may also allow Member States to expand the **set of financial institutions which are eligible providers of unfunded credit protection**, in addition to the ones defined by the CRD framework (Annex VIII, Part 1, Point 28 (Dir.48/2006; see Appendix Table 3.6).

The CRD framework provides also some national options and discretions on credit risk which may be relevant for the sovereign-bank nexus from various points of view, like **the provision of sovereign guarantees, the use of sovereign bonds as repo collateral or the exposures to public sector entities**. As a general rule, under the standardized approach, all exposures to sovereign bonds issued by EU governments and denominated in the domestic currency are subject to a zero risk weight. Supervisory authorities, subject to a case-by-case assessment, may extend this regulatory treatment to exposures guaranteed by the central government where the guarantee is denominated in the domestic currency of the borrower (Annex VIII, Part 3, Point 89, Dir.48/2006; see Appendix Table 3.6). This may incentivize banks to increase those exposures which can benefit from sovereign guarantees. Moreover, the use of sovereign bonds as underlying assets in repo operations may justify a more favourable treatment for the purpose of funded credit protection. While in general, under the financial collateral comprehensive method, the value of the collateral has to be adjusted in relation to the asset volatility, competent authorities may allow credit institutions to apply a 0% volatility adjustment if sovereign bonds are used as collateral and this allows also for a mutual recognition clause from other competent authorities (Annex VIII, Part 3, Point 59, Dir.48/2006).

The exercise of supervisory discretion may also explain the provision of a more favourable treatment for the exposures to public sector entities. In general, these exposures would be assigned a 100% risk weight: however, competent authorities may decide – on a case-by-case basis - to treat them as exposures to credit institutions, with a consequent reduction of the applied risk weight (Annex VI, Part 1, Point 14, Dir.48/2006; see Appendix Table 3.4). In addition, if the public sector entity benefits from a guarantee of the central government, competent authorities may decide – always on a case-by-case basis – to treat these exposures as exposures to central government, i.e. with a zero risk weight (Annex VI, Part 1, Point 15, Dir.48/2006; see Appendix Table 3.4). These discretions may raise incentives in favour of the provision of bank lending to public sector entities, particularly if guaranteed by the government.

A field subject to significant discussion after the crisis was also the **treatment of the counterparty credit risk and the market risk for derivatives instruments**. Before the crisis, only some derivatives contracts were cleared with central counterparties: in that context, the CRD allowed for the provision of different regulatory treatments, also potentially to incentivize central clearing given the lower risk of cleared transactions. Competent authorities were allowed to identify the credit risk exposures to central counterparties, as resulting from derivatives, repos or securities lending transactions, to which a 0% risk weight could be attributed (Annex III, Part 2, Point 6, Dir. 48/2006; see Appendix Table 3.3). Also, based on the regulation of the position risk in the trading book, competent authorities could allow the capital requirement for an OTC derivative cleared by a central counterparty to be equal to the margin required by the clearing

house (Annex I, Point 4, second subparagraph, second sentence, Dir. 49/2006; see Appendix Table 3.9).

Finally, various national options and discretions concerned the **treatment of the market risk in the trading book**, with potential related incentives for the holdings and the trading of debt and equity instruments as well as for the underwriting of these securities. The discipline of the position risk includes both a specific-risk component (which is issuer-specific) and a general-risk component (which relates to broad market conditions), both for debt and for equity. For the calculation of capital requirements on debt securities against specific risk, a 0% weighting may, subject to the discretion of the national authorities, be assigned to debt securities issued by certain entities, including governments and credit institutions, where these securities are denominated and funded in domestic currency (Article 19.1, Dir. 49/2006; see Appendix Table 3.9). Moreover, for covered bonds included in the trading book, Member States may set a reduced specific risk requirement, with reductions similar to those applied in the banking book under the standardized approach (Article 19.2, Dir. 2006/49; see Appendix Table 3.9). For equity instruments, the competent authorities may allow the capital requirement against specific risk to be 2% rather than 4% for the portfolios of highly liquid equity instruments held by a credit institution, subject to some concentration limits. The discipline of the position risk in the trading book includes also a national discretion regarding the underwriting of debt or equity securities, which may contribute to reduce the net positions particularly for those banks acting as bookrunners. The competent authorities may allow an institution to calculate the net positions by deducting the underwriting positions, which are subscribed or sub-underwritten by third parties on the basis of formal agreements (Annex I, Point 41 Dir. 49/2006; see Appendix Table 3.9). This provision, by reducing the net positions, implies also a decrease in the capital requirements for the market risk, therefore potentially encouraging the underwriting activity of investment banks.

**Appendix Table 3.1 OWN FUNDS – PILLAR 1**

| ARTICLE                                  | DENOMINATION  | TYPE | WEIGHT | AT         | BE         | CY         | DE         | ES         | FI         | FR         | GR         | IE         | IT         | LU         | MT         | PT         | SE         | UK         |
|--|---|------|--------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Article 27.2<br>Dir. 2006/49             | Consolidated own funds<br>of institutions   | SUP  | 1      | 0          | 1          | 1          | 0          | 1          | 0          | 0          |            | 1          | 1          | 1          | 1          | 1          | 1          | 0          |
| Article 57<br>(second last<br>paragraph) | Inclusion of interim<br>profits   | REG  | 1      | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| Article 58                               | Waiver on certain<br>deductions   | SUP  | 0.5    | 0          | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0          | 0.5        | 0.5        |
| Article 59                               | Alternatives to deductions  | REG  | 1      | 1          | 1          | 1          | 1          | 1          | 0          | 1          | 1          | 1          | 0          | 1          | 1          | 1          | 1          | 1          |
| Article 60                               | Deductions for stand-<br>alone requirements<br>purposes   | REG  | 1      | 1          | 1          | 0          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 0          | 1          | 1          | 0          |
| Articles 61,<br>63.1                     | Composition of own funds<br>of credit institutions  | REG  | 1      | 0          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| Article 63.2                             | Securities of<br>indefinite duration as<br>own funds items  | REG  | 1      | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| Article 63.3                             | Excess value adjustments<br>and provisions as own<br>funds items                                    | REG  | 0.5    | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        |
| Article 64.3                             | Fixed-term cumulative<br>preferential shares and<br>subordinated loan capital<br>as own funds items | REG  | 1      | 1          | 1          | 1          | 0.5        | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| Article 14<br>Dir. 2006/49               | Excess of subordinated<br>capital   | SUP  | 1      | 0          | 1          |            | 0          | 1          | 0          | 0          |            | 1          | 1          | 1          | 1          | 1          | 1          | 0          |
| <b>Supervisory Discretion</b>            |   |      |        | <b>0</b>   | <b>2.5</b> | <b>1.5</b> | <b>1.5</b> | <b>1.5</b> | <b>0.5</b> | <b>1.5</b> | <b>0.5</b> | <b>2.5</b> | <b>2.5</b> | <b>2.5</b> | <b>1.5</b> | <b>2</b>   | <b>2.5</b> | <b>1.5</b> |
| <b>Regulatory Flexibility</b>            |   |      |        | <b>5.5</b> | <b>6.5</b> | <b>5.5</b> | <b>6</b>   | <b>6.5</b> | <b>5.5</b> | <b>6.5</b> | <b>6.5</b> | <b>6.5</b> | <b>5.5</b> | <b>6.5</b> | <b>5.5</b> | <b>6.5</b> | <b>6.5</b> | <b>5.5</b> |
| Overall Indicator                        |   |      |        | 5.5        | 9          | 7          | 7.5        | 8          | 6          | 8          | 7          | 9          | 8          | 9          | 7          | 8.5        | 9          | 7          |
| <b>Overall Weighted Indicator</b>        |   |      |        | <b>11</b>  | <b>18</b>  | <b>14</b>  | <b>15</b>  | <b>16</b>  | <b>12</b>  | <b>16</b>  | <b>14</b>  | <b>18</b>  | <b>16</b>  | <b>18</b>  | <b>14</b>  | <b>17</b>  | <b>18</b>  | <b>14</b>  |

Note. The definition of own funds (i.e. the instruments which can be considered for the computation of regulatory capital) assumes a crucial importance for capital regulation, as it determines the numerator of the risk-weighted capital ratio. For this reason, we assign to the national options and discretions included in this category a double weight in defining their contribution to the overall weighted indicator.

**Appendix Table 3.2 SCOPE OF APPLICATION**

| ARTICLE                           | DENOMINATION                                     | TYPE | WEIGHT | AT         | BE       | CY         | DE       | ES       | FI       | FR       | GR       | IE         | IT       | LU       | MT         | PT         | SE       | UK       |
|-----------------------------------|--|------|--------|------------|----------|------------|----------|----------|----------|----------|----------|------------|----------|----------|------------|------------|----------|----------|
| Article 69.1                      | Individual waiver for subsidiaries               | REG  | 0.5    | 0          | 0.5      | 0.5        | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0          | 0        | 0.5      | 0          | 0.5        | 0.5      | 0.5      |
| Article 69.3                      | Individual waiver for parent credit institutions | REG  | 1      | 0          | 0        | 0          | 1        | 1        | 0        | 1        | 1        | 0          | 0        | 1        | 0          | 0          | 1        | 0        |
| Article 70                        | Solo consolidation                               | SUP  | 1      | 0          | 1        | 1          | 1        | 1        | 0        | 0        | 1        | 1          | 0        | 1        | 0          | 0          | 1        | 1        |
| Article 72.3                      | Exemption from Pillar III                        | SUP  | 0.5    | 0          | 0.5      | 0          | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5        | 0        | 0.5      | 0.5        | 0          | 0.5      | 0.5      |
| Article 73.1                      | Exemption from consolidation                     | SUP  | 1      | 0.5        | 1        | 1          | 1        | 1        | 1        | 1        | 1        | 1          | 1        | 1        | 1          | 1          | 1        | 1        |
| <b>Supervisory Discretion</b>     |  |      |        | 0          | 0.5      | 0.5        | 1.5      | 1.5      | 0.5      | 1.5      | 1.5      | 0          | 0        | 1.5      | 0          | 0.5        | 1.5      | 0.5      |
| <b>Regulatory Flexibility</b>     |  |      |        | 0.5        | 2.5      | 2          | 2.5      | 2.5      | 1.5      | 1.5      | 2.5      | 2.5        | 1        | 2.5      | 1.5        | 1          | 2.5      | 2.5      |
| Overall Indicator                 |  |      |        | 0.5        | 3        | 2.5        | 4        | 4        | 2        | 3        | 4        | 2.5        | 1        | 4        | 1.5        | 1.5        | 4        | 3        |
| <b>Overall Weighted Indicator</b> |  |      |        | <b>0.5</b> | <b>3</b> | <b>2.5</b> | <b>4</b> | <b>4</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>2.5</b> | <b>1</b> | <b>4</b> | <b>1.5</b> | <b>1.5</b> | <b>4</b> | <b>3</b> |



**Appendix Table 3.3 COUNTERPARTY RISK IN DERIVATIVES AND OTHER EXPOSURES – PILLAR 1**

| ARTICLE                           | DENOMINATION   | TYPE | WEIGHT | AT         | BE       | CY         | DE       | ES         | FI         | FR         | GR       | IE       | IT         | LU         | MT         | PT         | SE       | UK       |
|-----------------------------------|--|------|--------|------------|----------|------------|----------|------------|------------|------------|----------|----------|------------|------------|------------|------------|----------|----------|
| Annex III, Part 2, Point 6        | 0% risk weight for other credit risk exposures determined by the competent authorities outstanding with a central counterparty | SUP  | 1      | 0          | 0        | 1          | 0        | 1          | 1          | 1          | 0        | 0        | 1          | 1          | 1          | 1          | 0        | 1        |
| Annex III, Part 3                 | Alternative template for the calculation of potential future value in certain cases  | SUP  | 0.5    | 0          | 0        | 0          | 0        | 0.5        | 0.5        | 0.5        | 0        | 0        | 0.5        | 0.5        | 0.5        | 0          | 0.5      | 0.5      |
| Annex III, Part 6, Point 7        | Higher value of coefficient Alpha (multiplier to calculate the exposure value of certain contracts)                            | SUP  | -0.5   | 0          | 0        | -0.5       |          |            | -0.5       |            | 0        | 0        | -0.5       | 0          | 0          | 0          | -0.5     | -0.5     |
| Annex III, Part 6, Point 12       | Internal determination of the value of coefficient Alpha (multiplier to calculate the exposure value of certain contracts)     | SUP  | 1      | 1          | 1        | 0          | 1        | 1          | 1          | 1          | 1        | 1        | 1          | 1          | 1          | 1          | 1        | 1        |
| Annex III, Part 7c (ii)           | Calculation (separate/aggregate) of 'net-to-gross ratio'   | REG  | 0.5    | 0.5        | 0        | 0.5        | 0        |            | 0.5        | 0.5        |          | 0        | 0.5        | 0.5        | 0.5        | 0.5        | 0        | 0        |
| <b>Supervisory Discretion</b>     |  |      |        | <b>1</b>   | <b>1</b> | <b>0.5</b> | <b>1</b> | <b>2.5</b> | <b>2</b>   | <b>2.5</b> | <b>1</b> | <b>1</b> | <b>2</b>   | <b>2.5</b> | <b>2.5</b> | <b>2</b>   | <b>1</b> | <b>2</b> |
| <b>Regulatory Flexibility</b>     |  |      |        | <b>0.5</b> | <b>0</b> | <b>0.5</b> | <b>0</b> | <b>0</b>   | <b>0.5</b> | <b>0.5</b> | <b>0</b> | <b>0</b> | <b>0.5</b> | <b>0.5</b> | <b>0.5</b> | <b>0.5</b> | <b>0</b> | <b>0</b> |
| Overall Indicator                 |  |      |        | 1.5        | 1        | 1          | 1        | 2.5        | 2.5        | 3          | 1        | 1        | 2.5        | 3          | 3          | 2.5        | 1        | 2        |
| <b>Overall Weighted Indicator</b> |  |      |        | <b>3</b>   | <b>2</b> | <b>2</b>   | <b>2</b> | <b>5</b>   | <b>5</b>   | <b>6</b>   | <b>2</b> | <b>2</b> | <b>5</b>   | <b>6</b>   | <b>6</b>   | <b>5</b>   | <b>2</b> | <b>4</b> |

Note. The Pillar 1 provisions for counterparty risk in credit derivatives and other exposures assume a crucial importance for capital regulation. For this reason, we assign to the national options and discretions included in this category a double weight in defining their contribution to the overall weighted indicator.

**Appendix Table 3.4 STANDARDISED APPROACH – PILLAR 1**

| ARTICLE                                   | DENOMINATION   | TYPE | WEIGHT | AT  | BE  | CY  | DE  | ES  | FI  | FR  | GR  | IE  | IT  | LU  | MT  | PT  | SE  | UK  |
|---|--|------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Article 80.3 & Annex VI, Part 1, Point 24 | Risk-weighting exposures to credit institutions  | REG  | 1      | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 0   | 0   | 1   | 1   | 0   | 1   | 1   | 1   |
| Article 80.7                              | Exemption of intra-group exposures from risk-weighted exposures  | SUP  | 0.5    | 0.5 | 0   | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Article 80.8                              | Treatment of exposures to a counter-party which is member of the same institutional protection scheme. | SUP  | 0.5    | 0.5 | 0   | 0   | 0.5 | 0.5 | 0.5 | 0   | 0   | 0   | 0.5 | 0.5 | 0   | 0   | 0.5 | 0   |
| Article 83.2                              | Permission to use unsolicited ratings  | SUP  | 1      | 0.5 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0.5 | 1   | 1   | 1   | 1   | 1   | 1   |
| Annex VI, Part 1, Point 5                 | Recognition of a third country's treatment of central government and central bank exposures            | REG  | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 1   |
| Annex VI, Part 1, Point 11                | Recognition of a third country's treatment of regional governments and local authorities               | REG  | 0.5    | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0   | 0.5 |
| Annex VI, Part 1, Point 14                | Treatment of public sector entities as institutions  | SUP  | 0.5    | 0.5 | 0   | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0   | 0.5 |
| Annex VI, Part 1, Point 15                | Treatment of exposures to public sector entities guaranteed by central governments                     | SUP  | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 1   |
| Annex VI, Part 1, Point 17                | Recognition of a third country's treatment of public sector entities                                   | REG  | 0.5    | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0   | 0.5 |
| Annex VI, Part 1, Point 37                | Treatment of short term exposures to EU institutions in their national currency                        | REG  | 1.5    | 1.5 | 0   | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0   | 1.5 | 1.5 | 1.5 | 0   | 0   | 1.5 |

|                                   |  |     |      |           |            |            |            |             |           |            |            |            |            |            |            |           |            |            |
|-----------------------------------|--|-----|------|-----------|------------|------------|------------|-------------|-----------|------------|------------|------------|------------|------------|------------|-----------|------------|------------|
| Annex VI, Part 1, Point 40        | Treatment of exposures in the form of minimum reserves held by an intermediary credit institution. | REG | 0.5  | 0.5       | 0.5        | 0.5        | 0          | 0.5         | 0.5       | 0.5        | 0.5        | 0          | 0.5        | 0          | 0.5        | 0.5       | 0          | 0.5        |
| Annex VI, Part 1, Point 63        | Risk-weighting past due exposures secured by non eligible collateral                               | SUP | 0.5  | 0.5       | 0          | 0          | 0          | 0           | 0         | 0          | 0.5        | 0          | 0.5        | 0.5        | 0.5        | 0         | 0          | 0          |
| Annex VI, Part 1, Point 64        | Risk-weighting of past due exposures secured by mortgages on residential property                  | SUP | 1.5  | 1.5       | 1.5        | 1.5        | 1.5        | 1.5         | 1.5       | 1.5        | 1.5        | 0          | 1.5        | 1.5        | 1.5        | 0         | 0          | 1.5        |
| Annex VI, Part 1, Point 66        | Risk-weighting items belonging to regulatory high risk categories                                  | REG | -0.5 | -0.5      | -0.5       | -0.5       | 0          | -0.5        | -0.5      | -0.5       | -0.5       | -0.5       | -0.5       | 0          | -0.5       | 0         | 0          | -0.5       |
| Annex VI, Part 1, Point 67        | Regulatory high risk categories - lower risk weight due to value adjustments                       | REG | 1.5  | 1.5       | 1.5        | 1.5        | 0          | 0.75        | 0         | 1.5        | 1.5        | 1.5        | 0          | 0          | 1.5        | 0         | 0          | 1.5        |
| Annex VI, Part 1, Point 68(e)     | Loans secured by commercial real estate as collateral for covered bonds                            | REG | 1    | 0         | 0          | 1          | 0          | 1           | 1         | 0          | 1          | 0          | 1          | 1          | 0          | 0         | 0          | 1          |
| Annex VI, Part 1, Point 85        | Risk-weighting institutions specialising in the inter-bank and public debt market                  | REG | 0.5  | 0         | 0          | 0          | 0          | 0.5         | 1         | 0          | 0          | 0          | 0          | 0.5        | 0          | 0         | 0          | 0          |
| Annex VI, Part 3, Point 17        | Exceptions to the non-use of domestic currency ratings for foreign-currency exposures              | REG | 0.5  | 0         | 0.5        | 0.5        | 0          | 0.5         | 0.5       | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5       | 0.5        | 0.5        |
| <b>Supervisory Discretion</b>     |  |     |      | <b>5</b>  | <b>3.5</b> | <b>4.5</b> | <b>5</b>   | <b>5</b>    | <b>5</b>  | <b>4.5</b> | <b>5</b>   | <b>2.5</b> | <b>5.5</b> | <b>5.5</b> | <b>5</b>   | <b>3</b>  | <b>2</b>   | <b>4.5</b> |
| <b>Regulatory Flexibility</b>     |  |     |      | <b>6</b>  | <b>4</b>   | <b>7.5</b> | <b>4.5</b> | <b>7.25</b> | <b>7</b>  | <b>6.5</b> | <b>6.5</b> | <b>3.5</b> | <b>6</b>   | <b>6.5</b> | <b>5.5</b> | <b>4</b>  | <b>1.5</b> | <b>7.5</b> |
| Overall Indicator                 |  |     |      | 11        | 7.5        | 12         | 9.5        | 12.25       | 12        | 11         | 11.5       | 6          | 11.5       | 12         | 10.5       | 7         | 3.5        | 12         |
| <b>Overall Weighted Indicator</b> |  |     |      | <b>22</b> | <b>15</b>  | <b>24</b>  | <b>19</b>  | <b>24.5</b> | <b>24</b> | <b>22</b>  | <b>23</b>  | <b>12</b>  | <b>23</b>  | <b>24</b>  | <b>21</b>  | <b>14</b> | <b>7</b>   | <b>24</b>  |

Note. The provisions regarding the standardised approach (i.e. the baseline to determine the risk weights for banks' exposures) assumes a crucial importance for capital regulation, as it determines the denominator of the risk-weighted capital ratio. For this reason, we assign to the national options and discretions included in this category a double weight in defining their contribution to the overall weighted indicator.

**Appendix Table 3.5 IRB APPROACH - PILLAR 1**

| ARTICLE   | DENOMINATION  | TYPE | WEIGHT | AT  | BE   | CY   | DE   | ES  | FI   | FR   | GR   | IE   | IT  | LU   | MT   | PT   | SE | UK   |
|---|---|------|--------|-----|------|------|------|-----|------|------|------|------|-----|------|------|------|----|------|
| Article 84.2<br>(second<br>subparagraph)  | Requirements for IRB<br>standards for parent<br>and EU subsidiaries<br>altogether   | SUP  | 1      | 1   | 1    | 1    | 0    | 1   | 1    | 1    | 1    | 1    | 0   | 1    | 1    | 1    | 1  | 1    |
| Annex VII,<br>Part 1, Point 6<br>(second<br>subparagraph)                       | Lower rate for<br>specialized lending   | SUP  | 0.5    | 0.5 | 0.5  | 0.5  | 0    | 0.5 | 0.5  | 0.5  | 0.5  | 0.5  | 0.5 | 0.5  | 0.5  | 0.5  | 1  | 0.5  |
| Annex VII,<br>Part 1, Point<br>18   | Treatment of ancillary<br>banking services  | SUP  | 0.5    | 0.5 | 0.5  | 0.5  | 0.5  | 0.5 | 0.5  | 0    | 0.5  | 0    | 0.5 | 0.5  | 0.5  | 0    | 1  | 0.5  |
| Annex VII,<br>Part 2, Points<br>5 and 7 &<br>Annex VIII,<br>Part 1, Point<br>26 | Possibility to extend<br>the list of unfunded<br>protection providers for<br>the purposes of<br>recognition of<br>unfunded credit<br>protection in PD | REG  | 0.5    | 0   | 0.5  | 0    | 0.5  | 0   | 0.5  | 0    | 0.5  | 0    | 0   | 0.5  | 0.5  | 0.5  | 0  | 0.5  |
| Annex VII,<br>Part 2, Point<br>12   | Alternatives for the<br>calculation of maturity   | REG  | -0.5   | 0   | -0.5 | -0.5 | 0    | 0   | 0    | 0    | -0.5 | -0.5 | 0   | -0.5 | -0.5 | 0    | 0  | 0    |
| Annex VII,<br>Part 2, Point<br>14   | Alternatives for the<br>calculation of maturity   | REG  | -0.5   | 0   | -0.5 | -0.5 | -0.5 | 0   | -0.5 | -0.5 | -0.5 | -0.5 | 0   | -0.5 | -0.5 | -0.5 | 0  | -0.5 |
| Annex VII,<br>Part 2, Point<br>15   | Maturity for EU-firms<br>(< EUR 500 million)  | REG  | 0.5    | 0.5 | 0    | 0    | 0.5  | 0   | 0    | 0    | 0.5  | 0    | 0   | 0    | 0.5  | 0.5  | 0  | 0    |
| Annex VII,<br>Part 2, Point<br>15 (last   | Maturity for EU-firms<br>investing primarily in<br>real estate (< EUR   | REG  | 0.5    | 0.5 | 0    | 0    | 0.5  | 0   | 0    | 0    | 0    | 0    | 0   | 0    | 0.5  | 0.5  | 0  | 0    |

|  |  |     |                        |          |          |           |            |            |            |            |          |            |            |          |          |            |          |            |
|--|--|-----|------------------------|----------|----------|-----------|------------|------------|------------|------------|----------|------------|------------|----------|----------|------------|----------|------------|
| sentence)  | 1,000 million)   |     |                        |          |          |           |            |            |            |            |          |            |            |          |          |            |          |            |
| Annex VII, Part 2, Point 20 & Annex VIII, Part 1, Point 26 | Possibility to extend the list of unfunded protection providers for the purposes of calculation of dilution risk | REG | 0.5                    | 0        | 0.5      | 0         | 0.5        | 0.5        | 0.5        | 0          | 0.5      | 0          | 0          | 0.5      | 0.5      | 0          | 0        | 0.5        |
| Annex VII, Part 4, Point 48 (first and second sentence)    | Definition of default for retail exposures   | REG | 0 if 90 and 1 if 180   | 0        | 0        | 0         | 0          | 0          | 0          | 0          | 0        | 0          | 1          | 0        | 0.5      | 0          | 0.5      | 0.5        |
| Annex VII, Part 4, Point 48 (first and second sentence)    | Definition of default for PSE exposures  | REG | 0 if 90 and 0.5 if 180 | 0        | 0        | 0         | 0          | 0          | 0          | 0.5        | 0.5      | 0          | 0.5        | 0        | 0.5      | 0.5        | 0.5      | 0.5        |
| <b>Supervisory Discretion</b>                              |  |     |                        | <b>2</b> | <b>2</b> | <b>2</b>  | <b>0.5</b> | <b>2</b>   | <b>2</b>   | <b>1.5</b> | <b>2</b> | <b>1.5</b> | <b>1</b>   | <b>2</b> | <b>2</b> | <b>1.5</b> | <b>3</b> | <b>2</b>   |
| <b>Regulatory Flexibility</b>                              |  |     |                        | <b>1</b> | <b>0</b> | <b>-1</b> | <b>1.5</b> | <b>0.5</b> | <b>0.5</b> | <b>0</b>   | <b>1</b> | <b>-1</b>  | <b>1.5</b> | <b>0</b> | <b>2</b> | <b>1.5</b> | <b>1</b> | <b>1.5</b> |
| Overall Indicator  |  |     |                        | 3        | 2        | 1         | 2          | 2.5        | 2.5        | 1.5        | 3        | 0.5        | 2.5        | 2        | 4        | 3          | 4        | 3.5        |
| <b>Overall Weighted Indicator</b>                          |  |     |                        | <b>6</b> | <b>4</b> | <b>2</b>  | <b>4</b>   | <b>5</b>   | <b>5</b>   | <b>3</b>   | <b>6</b> | <b>1</b>   | <b>5</b>   | <b>4</b> | <b>8</b> | <b>6</b>   | <b>8</b> | <b>7</b>   |

Note. The provisions regarding the Internal Rating Based approach (used to determine the risk weights for the exposures of large banks) assumes a crucial importance for capital regulation, as it determines the denominator of the risk-weighted capital ratio. For this reason, we assign to the national options and discretions included in this category a double weight in defining their contribution to the overall weighted indicator.

**Appendix Table 3.6 CREDIT RISK MITIGATION - PILLAR 1**

| ARTICLE                                       | DENOMINATION  | TYPE | WEIGHT | AT         | BE         | CY         | DE         | ES         | FI         | FR         | GR         | IE         | IT         | LU         | MT         | PT         | SE         | UK         |
|---|---|------|--------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Annex VIII, Part 1, Point 16 (first sentence) | Residential real estate property waiver                               | REG  | 0.5    | 0.5        | 0.5        | 0          | 0.5        | 0          | 0.5        | 0.5        | 0.5        | 0          | 0          | 0.5        | 0          | 0          | 0          | 0.5        |
| Annex VIII, Part 1, Point 17                  | Commercial real estate property waiver                                | REG  | 0.5    | 0.5        | 0.5        | 0          | 0.5        | 0          | 0          | 0.5        | 0.5        | 0          | 0          | 0.5        | 0          | 0          | 0          | 0          |
| Annex VIII, Part 1, Point 20                  | Amounts receivable as eligible collateral                             | SUP  | 0.5    | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0          | 0.5        |
| Annex VIII, Part 1, Point 21                  | Other physical collateral   | SUP  | 0.5    | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0          | 0.5        |
| Annex VIII, Part 1, Point 28                  | Eligible protection providers   | REG  | 1      | 1          | 1          | 0          | 0          | 1          | 0          | 1          | 1          | 0          | 1          | 1          | 0          | 1          | 0          | 0          |
| Annex VIII, Part 2, Point 9a (ii)             | Minimum requirements for the recognition of receivables as collateral | REG  | 0.5    | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0          | 0.5        | 0.5        | 0          | 0.5        |
| Annex VIII, Part 3, Point 43                  | Own estimates of volatility adjustments (categories of security)      | SUP  | 0.5    | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        |
| Annex VIII, Part 3, Point 72                  | Reduced LGDs for leasing transactions                                 | SUP  | 0.5    | 0.5        | 0.5        | 0.5        | 0.5        | 0          | 0          | 0.5        | 0          | 0          | 0.5        | 0.5        | 0.5        | 0.5        | 0.5        | 0          |
| Annex VIII, Part 3, Point 73                  | Alternative treatment for real estate collateral (50% risk-weight)    | SUP  | 0.5    | 0.5        | 0.5        | 0          | 0.5        | 0          | 0          | 0.5        | 0          | 0          | 0          | 0.5        | 0          | 0          | 0.5        | 0          |
| Annex VIII, Part 3, Point 89                  | Sovereign guarantees  | SUP  | 1      | 1          | 1          | 1          | 0          | 1          | 1          | 1          | 1          | 1          | 0          | 1          | 1          | 1          | 1          | 1          |
| <b>Supervisory Discretion</b>                 |   |      |        | <b>3.5</b> | <b>3.5</b> | <b>3</b>   | <b>2.5</b> | <b>2.5</b> | <b>2.5</b> | <b>3.5</b> | <b>2.5</b> | <b>2.5</b> | <b>2</b>   | <b>3.5</b> | <b>3</b>   | <b>3</b>   | <b>2.5</b> | <b>2.5</b> |
| <b>Regulatory Flexibility</b>                 |   |      |        | <b>2.5</b> | <b>2.5</b> | <b>0.5</b> | <b>1.5</b> | <b>1.5</b> | <b>1</b>   | <b>2.5</b> | <b>2.5</b> | <b>0.5</b> | <b>1.5</b> | <b>2</b>   | <b>0.5</b> | <b>1.5</b> | <b>0</b>   | <b>1</b>   |
| Overall Indicator                             |   |      |        | 6          | 6          | 3.5        | 4          | 4          | 3.5        | 6          | 5          | 3          | 3.5        | 5.5        | 3.5        | 4.5        | 2.5        | 3.5        |
| <b>Overall Weighted Indicator</b>             |   |      |        | <b>6</b>   | <b>6</b>   | <b>3.5</b> | <b>4</b>   | <b>4</b>   | <b>3.5</b> | <b>6</b>   | <b>5</b>   | <b>3</b>   | <b>3.5</b> | <b>5.5</b> | <b>3.5</b> | <b>4.5</b> | <b>2.5</b> | <b>3.5</b> |

**Appendix Table 3.7 OPERATIONAL RISK**

| ARTICLE   | DENOMINATION                                      | TYPE | WEIGHT | AT       | BE       | CY          | DE       | ES       | FI       | FR       | GR       | IE       | IT       | LU       | MT       | PT       | SE       | UK       |
|---|---|------|--------|----------|----------|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Article 102.4 & Annex X, Part 4, Points 1 and 2 | Combination of approaches                         | SUP  | 0.5    | 0.5      | 0.5      | 0.25        | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      |
| Article 104.3                                   | Alternative Standardised Approach                 | SUP  | 0.5    | 0.5      | 0.5      | 0.5         | 0.5      | 0.5      | 0.5      | 0        | 0.5      | 0        | 0        | 0.5      | 0.5      | 0        | 0.5      | 0.5      |
| Article 105.4                                   | Qualifying criteria for AMA within the same group | SUP  | 0.5    | 0.5      | 0.5      | 0.5         | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      | 0.5      |
| Annex X, Part 2, Points 3 and 5                 | Alternative Standardised Approach                 | SUP  | 0.5    | 0.5      | 0.5      | 0.5         | 0.5      | 0.5      | 0.5      | 0        | 0.5      | 0        | 0        | 0.5      | 0.5      | 0        | 0.5      | 0.5      |
| <b>Supervisory Discretion</b>                   |   |      |        | <b>2</b> | <b>2</b> | <b>1.75</b> | <b>2</b> | <b>2</b> | <b>2</b> | <b>1</b> | <b>2</b> | <b>1</b> | <b>1</b> | <b>2</b> | <b>2</b> | <b>1</b> | <b>2</b> | <b>2</b> |
| <b>Regulatory Flexibility</b>                   |   |      |        | <b>0</b> | <b>0</b> | <b>0</b>    | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> |
| Overall Indicator                               |   |      |        | 2        | 2        | 1.75        | 2        | 2        | 2        | 1        | 2        | 1        | 1        | 2        | 2        | 1        | 2        | 2        |
| <b>Overall Weighted Indicator</b>               |   |      |        | <b>2</b> | <b>2</b> | <b>1.75</b> | <b>2</b> | <b>2</b> | <b>2</b> | <b>1</b> | <b>2</b> | <b>1</b> | <b>1</b> | <b>2</b> | <b>2</b> | <b>1</b> | <b>2</b> | <b>2</b> |

**Appendix Table 3.8 QUALIFYING HOLDINGS OUTSIDE THE FINANCIAL SECTOR**

| ARTICLE                           | DENOMINATION                                 | TYPE | WEIGHT | AT       | BE       | CY         | DE       | ES       | FI       | FR       | GR       | IE       | IT       | LU       | MT       | PT       | SE       | UK       |
|-----------------------------------|--|------|--------|----------|----------|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Article 122.1                     | Special treatment for insurance undertakings | REG  | 1      | 1        | 1        | 0.5        | 1        | 1        | 1        | 1        | 1        | 1        | 1        | 1        | 0        | 1        | 1        | 1        |
| Article 122.2                     | Alternative - deduction                      | REG  | 1      | 1        | 1        | 1          | 1        | 1        | 1        | 1        | 1        | 1        | 0        | 0        | 1        | 1        | 1        | 1        |
| <b>Supervisory Discretion</b>     |  |      |        | 0        | 0        | 0          | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| <b>Regulatory Flexibility</b>     |  |      |        | 2        | 2        | 1.5        | 2        | 2        | 2        | 2        | 2        | 2        | 1        | 1        | 1        | 2        | 2        | 2        |
| Overall Indicator                 |  |      |        | 2        | 2        | 1.5        | 2        | 2        | 2        | 2        | 2        | 2        | 1        | 1        | 1        | 2        | 2        | 2        |
| <b>Overall Weighted Indicator</b> |  |      |        | <b>2</b> | <b>2</b> | <b>1.5</b> | <b>2</b> | <b>2</b> | <b>2</b> | <b>2</b> | <b>2</b> | <b>2</b> | <b>1</b> | <b>1</b> | <b>1</b> | <b>2</b> | <b>2</b> | <b>2</b> |



**Appendix Table 3.9 TRADING BOOK**

| ARTICLE   | DENOMINATION   | TYPE | WEIGHT | AT  | BE   | CY  | DE | ES   | FI   | FR   | GR   | IE   | IT | LU  | MT   | PT  | SE  | UK   |
|---|--|------|--------|-----|------|-----|----|------|------|------|------|------|----|-----|------|-----|-----|------|
| Article 19.1<br>Dir. 2006/49  | 0% weighting of certain<br>debt securities   | REG  | 1      | 0   | 1    | 1   | 0  | 1    | 1    | 1    | 1    | 1    | 0  | 1   | 1    | 1   | 1   | 0    |
| Article 19.2<br>Dir. 2006/49  | Specific risk requirement<br>for covered bonds   | REG  | 1      | 0   | 0    | 0   | 1  | 1    | 1    | 0    | 1    | 1    | 1  | 1   | 1    | 1   | 1   | 0    |
| Article 19.3<br>Dir. 2006/49<br>and Annex I,<br>point 52                            | Third country CIU  | SUP  | 0.5    | 0.5 | 0    | 0.5 | 0  | 0.5  | 0.5  | 0    | 0.25 | 0.5  | 0  | 0.5 | 0.5  | 0.5 | 0.5 | 0    |
| Article 26<br>Dir. 2006/49  | Offsetting trading<br>positions  | SUP  | 1      | 1   | 1    | 1   | 1  | 1    | 0    | 1    | 1    | 1    | 0  | 1   | 1    | 1   | 1   | 0    |
| Annex I, Point<br>2 Dir. 2006/49  | Netting of convertible and<br>offsetting positions in the<br>underlying instrument                         | REG  | 0.5    | 0.5 | 0    | 0.5 | 0  | 0    | 0    | 0.5  | 0.5  | 0.5  | 0  | 0.5 | 0    | 0.5 | 0   | 0.5  |
| Annex I, Point<br>4 (second<br>subparagraph,<br>first sentence)<br>Dir. 2006/49     | Capital requirement for an<br>exchange-traded future   | SUP  | 0.5    | 0   | 0    | 0   | 0  | 0    | 0    | 0.5  | 0.5  | 0.5  | 0  | 0.5 | 0.5  | 0.5 | 0.5 | 0    |
| Annex I, Point<br>4 (second<br>subparagraph,<br>second<br>sentence)<br>Dir. 2006/49 | Capital requirement for<br>OTC derivative cleared by<br>a clearing house                                   | SUP  | 0.5    | 0   | 0    | 0   | 0  | 0    | 0    | 0.5  | 0.5  | 0.5  | 0  | 0.5 | 0.5  | 0.5 | 0.5 | 0    |
| Annex I, Point<br>5 (second<br>subparagraph)<br>Dir. 2006/49                        | Prescription of specific<br>methodologies for the<br>calculation of delta                                  | REG  | -0.5   | 0   | -0.5 | 0   | 0  | -0.5 | -0.5 | -0.5 | 0    | -0.5 | 0  | 0   | -0.5 | 0   | 0   | -0.5 |
| Annex I, Point<br>5 (third<br>subparagraph)<br>Dir. 2006/49                         | Capital requirement for<br>exchange-traded written<br>options and OTC options<br>cleared by clearing house | SUP  | 0.5    | 0   | 0    | 0   | 0  | 0    | 0    | 1    | 0.5  | 1    | 0  | 1   | 0.5  | 1   | 0.5 | 0    |
| Annex I, Point  | Capital requirement for  | SUP  | 0.5    | 0   | 1    | 0.5 | 1  | 0    | 0    | 1    | 0.5  | 1    | 0  | 1   | 0.5  | 1   | 0.5 | 0.5  |

|   |  |     |      |     |     |      |     |      |     |     |      |     |     |     |     |     |     |      |     |
|---|--|-----|------|-----|-----|------|-----|------|-----|-----|------|-----|-----|-----|-----|-----|-----|------|-----|
| 5 (third subparagraph)<br>Dir. 2006/49                    | exchange-traded bought options and OTC bought options cleared by a clearing house  |     |      |     |     |      |     |      |     |     |      |     |     |     |     |     |     |      |     |
| Annex I, Point 14<br>Dir. 2006/49                         | Specific risk charge for a non-qualifying issuer   | REG | -0.5 | 0   | 1   | -0.5 | 0   | -0.5 | 0   | 0   | -0.5 | 0   | 0   | 0   | 0   | 1   | 0   | -0.5 |     |
| Annex I, Point 35 (first sentence)<br>Dir. 2006/49        | Reduced specific risk requirement for certain equity portfolios  | SUP | 1    | 1   | 1   | 1    | 1   | 0    | 1   | 1   | 1    | 1   | 1   | 1   | 1   | 1   | 0   | 1    |     |
| Annex I, Point 35 (last sentence)<br>Dir. 2006/49         | Alternative maximum weight of an individual position in an institution's equity portfolio  | SUP | 0.5  | 0.5 | 0.5 | 0.5  | 0.5 | 0    | 0.5 | 0.5 | 0.5  | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0   | 0.5  |     |
| Annex I, Point 41<br>Dir. 2006/49                         | Special procedure for calculation of capital requirements for underwriting of debt and equity instruments                                    | SUP | 0.5  | 0.5 | 0   | 0.5  | 0.5 | 0.5  | 0.5 | 0.5 | 0.5  | 0.5 | 0.5 | 0   | 0.5 | 0.5 | 0.5 | 0.5  | 0.5 |
| Annex III, Point 2.1 (last sentence)<br>Dir. 2006/49      | Discretionary use of net present value for determining the open position in currencies or gold   | SUP | 0.5  | 0.5 | 0.5 | 0.5  | 0.5 | 0.5  | 0.5 | 0.5 | 0.5  | 0.5 | 0.5 | 0   | 0.5 | 0.5 | 0.5 |      | 0.5 |
| Annex III, Point 3.1<br>Dir. 2006/49                      | Lower capital requirements for closely correlated currencies   | SUP | 0.5  | 0.5 | 0.5 | 0    | 0.5 | 0    | 0   | 0.5 | 0.5  | 0.5 | 0.5 | 0   | 0.5 | 0.5 | 0.5 |      | 0   |
| Annex III, Point 3.2 (first subparagraph)<br>Dir. 2006/49 | Alternative calculation of capital requirements for positions in foreign currencies subject to a legally binding intergovernmental agreement | SUP | 0.5  | 0   | 0.5 | 0    | 0   | 0    | 0.5 | 0.5 | 0.5  | 0.5 | 0   | 0.5 | 0.5 | 0.5 |     |      | 0   |
| Annex III, Point 3.2 (second                              | Capital requirement for matched positions in EMU-currencies  | SUP | 0.5  | 0.5 | 0.5 | 0    | 0   | 0    | 0   | 0.5 | 0.5  | 0.5 | 0   | 0.5 | 0   | 0   |     |      | 0   |

|  |   |     |           |             |           |             |          |           |           |             |           |          |           |           |           |           |          |  |     |
|--|---|-----|-----------|-------------|-----------|-------------|----------|-----------|-----------|-------------|-----------|----------|-----------|-----------|-----------|-----------|----------|--|-----|
| subparagraph)<br>Dir. 2006/49                                    |   |     |           |             |           |             |          |           |           |             |           |          |           |           |           |           |          |  |     |
| Annex IV,<br>Point 7<br>Dir. 2006/49                             | Definition of 'positions in the same commodity'   | SUP | 0.5       | 0.5         | 0.5       | 0.5         | 0.25     | 0.5       | 0.5       | 0.5         | 0.5       | 0.5      | 0         | 0.5       | 0.5       | 0.5       |          |  | 0.5 |
| Annex IV,<br>Point 8<br>Dir. 2006/49                             | Capital requirement for exchange-traded commodities OTC commodity derivatives cleared by a clearing house | SUP | 0.5       | 0           | 0         | 0           | 0        | 0         | 0         | 0           | 0.5       | 0.5      | 0.5       | 0         | 0.5       | 0.5       | 0.5      |  | 0   |
| Annex IV,<br>Point 10 (first subparagraph)<br>Dir. 2006/49       | Prescription of specific methodologies for the calculation of delta for derivatives on commodities        | SUP | -0.5      | 0           | -0.5      | 0           | 0        | -0.5      | -0.5      | -0.5        | 0         | -0.5     | 0         | 0         | -0.5      | 0         |          |  | 0   |
| Annex IV,<br>Point 10 (three last subparagraphs)<br>Dir. 2006/49 | Capital requirement for exchange-traded options and OTC options cleared by a clearing house               | SUP | 0.5       | 0           | 0.25      | 0.5         | 0        | 0         | 0         | 0           | 0.5       | 0.5      | 0.5       | 0         | 0.5       | 0.5       | 0.5      |  | 0.5 |
| <b>Supervisory Discretion</b>                                    |   |     | 5.5       | 5.75        | 5.5       | 5.25        | 2.5      | 3.5       | 9         | 8.75        | 9.5       | 1.5      | 10        | 8         | 9.5       | 4         | 4        |  |     |
| <b>Regulatory Flexibility</b>                                    |   |     | 0.5       | 1.5         | 1         | 1           | 1        | 1.5       | 1         | 2           | 2         | 1        | 2.5       | 1.5       | 3.5       | 2         | -0.5     |  |     |
| Overall Indicator  |   |     | 6         | 7.25        | 6.5       | 6.25        | 3.5      | 5         | 10        | 10.7        | 11.5      | 2.5      | 12.5      | 9.5       | 13        | 6         | 3.5      |  |     |
| <b>Overall Weighted Indicator</b>                                |   |     | <b>12</b> | <b>14.5</b> | <b>13</b> | <b>12.5</b> | <b>7</b> | <b>10</b> | <b>20</b> | <b>21.5</b> | <b>23</b> | <b>5</b> | <b>25</b> | <b>19</b> | <b>26</b> | <b>12</b> | <b>7</b> |  |     |

Note. The provisions regarding the trading book (setting the risk weights for the exposures included in the trading book) assumes a crucial importance for capital regulation, as it determines the denominator of the risk-weighted capital ratio. For this reason, we assign to the national options and discretions included in this category a double weight in defining their contribution to the overall weighted indicator.

**Appendix Table 3.10 AGGREGATE (WEIGHTED) INDICATORS**

| CATEGORY                       | INDICATOR              | AT          | BE          | CY           | DE          | ES          | FI          | FR        | GR          | IE          | IT          | LU          | MT        | PT          | SE          | UK          |
|--------------------------------|------------------------|-------------|-------------|--------------|-------------|-------------|-------------|-----------|-------------|-------------|-------------|-------------|-----------|-------------|-------------|-------------|
| OWN FUNDS                      | Supervisory Discretion | 0           | 5           | 3            | 3           | 3           | 1           | 3         | 1           | 5           | 5           | 5           | 3         | 4           | 5           | 3           |
|                                | Regulatory Flexibility | 11          | 13          | 11           | 12          | 13          | 11          | 13        | 13          | 13          | 11          | 13          | 11        | 13          | 13          | 11          |
|                                | Overall Indicator      | 11          | 18          | 14           | 15          | 16          | 12          | 16        | 14          | 18          | 16          | 18          | 14        | 17          | 18          | 14          |
| SCOPE OF APPLICATION           | Supervisory Discretion | 0           | 0.5         | 0.5          | 1.5         | 1.5         | 0.5         | 1.5       | 1.5         | 0           | 0           | 1.5         | 0         | 0.5         | 1.5         | 0.5         |
|                                | Regulatory Flexibility | 0.5         | 2.5         | 2            | 2.5         | 2.5         | 1.5         | 1.5       | 2.5         | 2.5         | 1           | 2.5         | 1.5       | 1           | 2.5         | 2.5         |
|                                | Overall Indicator      | 0.5         | 3           | 2.5          | 4           | 4           | 2           | 3         | 4           | 2.5         | 1           | 4           | 1.5       | 1.5         | 4           | 3           |
| COUNTERPARTY RISK              | Supervisory Discretion | 2           | 2           | 1            | 2           | 5           | 4           | 5         | 2           | 2           | 4           | 5           | 5         | 4           | 2           | 4           |
|                                | Regulatory Flexibility | 1           | 0           | 1            | 0           | 0           | 1           | 1         | 0           | 0           | 1           | 1           | 1         | 1           | 0           | 0           |
|                                | Overall Indicator      | 3           | 2           | 2            | 2           | 5           | 5           | 6         | 2           | 2           | 5           | 6           | 6         | 5           | 2           | 4           |
| STANDARDISED APPROACH          | Supervisory Discretion | 10          | 7           | 9            | 10          | 10          | 10          | 9         | 10          | 5           | 11          | 11          | 10        | 6           | 4           | 9           |
|                                | Regulatory Flexibility | 12          | 8           | 15           | 9           | 14.5        | 14          | 13        | 13          | 7           | 12          | 13          | 11        | 8           | 3           | 15          |
|                                | Overall Indicator      | 22          | 15          | 24           | 19          | 24.5        | 24          | 22        | 23          | 12          | 23          | 24          | 21        | 14          | 7           | 24          |
| INTERNAL RATING BASED APPROACH | Supervisory Discretion | 4           | 4           | 4            | 1           | 4           | 4           | 3         | 4           | 3           | 2           | 4           | 4         | 3           | 6           | 4           |
|                                | Regulatory Flexibility | 2           | 0           | -2           | 3           | 1           | 1           | 0         | 2           | -2          | 3           | 0           | 4         | 3           | 2           | 3           |
|                                | Overall Indicator      | 6           | 4           | 2            | 4           | 5           | 5           | 3         | 6           | 1           | 5           | 4           | 8         | 6           | 8           | 7           |
| CREDIT RISK MITIGATION         | Supervisory Discretion | 3.5         | 3.5         | 3            | 2.5         | 2.5         | 2.5         | 3.5       | 2.5         | 2.5         | 2           | 3.5         | 3         | 3           | 2.5         | 2.5         |
|                                | Regulatory Flexibility | 2.5         | 2.5         | 0.5          | 1.5         | 1.5         | 1           | 2.5       | 2.5         | 0.5         | 1.5         | 2           | 0.5       | 1.5         | 0           | 1           |
|                                | Overall Indicator      | 6           | 6           | 3.5          | 4           | 4           | 3.5         | 6         | 5           | 3           | 3.5         | 5.5         | 3.5       | 4.5         | 2.5         | 3.5         |
| OPERATIONAL RISK               | Supervisory Discretion | 2           | 2           | 1.75         | 2           | 2           | 2           | 1         | 2           | 1           | 1           | 2           | 2         | 1           | 2           | 2           |
|                                | Regulatory Flexibility | 0           | 0           | 0            | 0           | 0           | 0           | 0         | 0           | 0           | 0           | 0           | 0         | 0           | 0           | 0           |
|                                | Overall Indicator      | 2           | 2           | 1.75         | 2           | 2           | 2           | 1         | 2           | 1           | 1           | 2           | 2         | 1           | 2           | 2           |
| QUALIFYING HOLDINGS            | Supervisory Discretion | 0           | 0           | 0            | 0           | 0           | 0           | 0         | 0           | 0           | 0           | 0           | 0         | 0           | 0           | 0           |
|                                | Regulatory Flexibility | 2           | 2           | 1.5          | 2           | 2           | 2           | 2         | 2           | 2           | 1           | 1           | 1         | 2           | 2           | 2           |
|                                | Overall Indicator      | 2           | 2           | 1.5          | 2           | 2           | 2           | 2         | 2           | 2           | 1           | 1           | 1         | 2           | 2           | 2           |
| TRADING BOOK                   | Supervisory Discretion | 11          | 11.5        | 11           | 10.5        | 5           | 7           | 18        | 17.5        | 19          | 3           | 20          | 16        | 19          | 8           | 8           |
|                                | Regulatory Flexibility | 1           | 3           | 2            | 2           | 2           | 3           | 2         | 4           | 4           | 2           | 5           | 3         | 7           | 4           | -1          |
|                                | Overall Indicator      | 12          | 14.5        | 13           | 12.5        | 7           | 10          | 20        | 21.5        | 23          | 5           | 25          | 19        | 26          | 12          | 7           |
| <b>Supervisory Discretion</b>  |                        | <b>32.5</b> | <b>35.5</b> | <b>33.25</b> | <b>32.5</b> | <b>33</b>   | <b>31</b>   | <b>44</b> | <b>40.5</b> | <b>37.5</b> | <b>28</b>   | <b>52</b>   | <b>43</b> | <b>40.5</b> | <b>31</b>   | <b>33</b>   |
| <b>Regulatory Flexibility</b>  |                        | <b>32</b>   | <b>31</b>   | <b>31</b>    | <b>32</b>   | <b>36.5</b> | <b>34.5</b> | <b>35</b> | <b>39</b>   | <b>27</b>   | <b>32.5</b> | <b>37.5</b> | <b>33</b> | <b>36.5</b> | <b>26.5</b> | <b>33.5</b> |
| <b>Overall Indicator</b>       |                        | <b>64.5</b> | <b>66.5</b> | <b>64.25</b> | <b>64.5</b> | <b>69.5</b> | <b>65.5</b> | <b>79</b> | <b>79.5</b> | <b>64.5</b> | <b>60.5</b> | <b>89.5</b> | <b>76</b> | <b>77</b>   | <b>57.5</b> | <b>66.5</b> |

### Annex 3.B: Cross-Section Baseline Probit Regressions (2005-2007)

Appendix Table 3.11 Probit Baseline Specification with Overall Indicator (Overall Sample)

| VARIABLES                        | (1)                   | (2)                     | (3)                   | (4)                     | (5)                    | (6)                      | (7)                  | (8)                     |
|----------------------------------|-----------------------|-------------------------|-----------------------|-------------------------|------------------------|--------------------------|----------------------|-------------------------|
|                                  | SUPP                  | SUPP                    | RECAP                 | RECAP                   | GUAR                   | GUAR                     | LIQSUPP              | LIQSUPP                 |
|                                  | Coeff                 | AME                     | Coeff                 | AME                     | Coeff                  | AME                      | Coeff                | AME                     |
| <i>PRUDENTIAL FRAMEWORK</i>      |                       |                         |                       |                         |                        |                          |                      |                         |
| Overall Indicator                | 0.0662***<br>(0.0155) | 0.0123***<br>(0.00266)  | 0.0672***<br>(0.0164) | 0.0113***<br>(0.00257)  | 0.0511***<br>(0.0179)  | 0.00550***<br>(0.00188)  | 0.461***<br>(0.154)  | 0.0144***<br>(0.00491)  |
| <i>BANK CHARACTERISTICS</i>      |                       |                         |                       |                         |                        |                          |                      |                         |
| Size                             | 0.524***<br>(0.0709)  | 0.0976***<br>(0.0103)   | 0.539***<br>(0.0768)  | 0.0903***<br>(0.0103)   | 0.444***<br>(0.0932)   | 0.0478***<br>(0.00989)   | 0.0684<br>(0.208)    | 0.00213<br>(0.00650)    |
| RoAE                             | -0.0134<br>(0.00855)  | -0.00249<br>(0.00158)   | -0.00179<br>(0.00964) | -0.000300<br>(0.00162)  | -0.00582<br>(0.00741)  | -0.000627<br>(0.000799)  | 0.0582<br>(0.0446)   | 0.00181<br>(0.00140)    |
| <i>BALANCE SHEET COMPOSITION</i> |                       |                         |                       |                         |                        |                          |                      |                         |
| Liquid Assets Ratio              | -0.00416<br>(0.00425) | -0.000776<br>(0.000789) | -0.0101*<br>(0.00544) | -0.00169*<br>(0.000901) | 0.000367<br>(0.00472)  | 3.96e-05<br>(0.000509)   | -0.0422<br>(0.0357)  | -0.00131<br>(0.00113)   |
| Government Securities Ratio      | -0.0150<br>(0.0196)   | -0.00280<br>(0.00365)   | -0.0194<br>(0.0211)   | -0.00326<br>(0.00354)   | 0.0112<br>(0.0228)     | 0.00121<br>(0.00245)     | 0.0196<br>(0.0635)   | 0.000612<br>(0.00198)   |
| Non-Interest Income Ratio        | -0.0267**<br>(0.0108) | -0.00498**<br>(0.00198) | -0.0222*<br>(0.0114)  | -0.00372*<br>(0.00190)  | -0.0601***<br>(0.0163) | -0.00648***<br>(0.00175) | -0.0102<br>(0.0266)  | -0.000317<br>(0.000829) |
| Loans Assets Ratio               | -0.00129<br>(0.00752) | -0.000239<br>(0.00140)  | -0.00538<br>(0.00857) | -0.000903<br>(0.00144)  | 0.00833<br>(0.00924)   | 0.000898<br>(0.000994)   | 0.000106<br>(0.0336) | 3.29e-06<br>(0.00105)   |
| <i>MACRO CONTROLS</i>            |                       |                         |                       |                         |                        |                          |                      |                         |
| GDP Growth Rate                  | 0.228***<br>(0.0563)  | 0.0425***<br>(0.00994)  | 0.197***<br>(0.0606)  | 0.0331***<br>(0.00989)  | 0.0286<br>(0.0762)     | 0.00309<br>(0.00823)     | 1.080***<br>(0.402)  | 0.0337***<br>(0.0129)   |
| Long-Term Rate                   | 3.125***<br>(0.809)   | 0.582***<br>(0.141)     | 0.981<br>(0.927)      | 0.165<br>(0.155)        | 5.249***<br>(1.012)    | 0.566***<br>(0.105)      | -1.528<br>(3.159)    | -0.0476<br>(0.0986)     |
| Short-Term Rate                  | -1.480***<br>(0.352)  | -0.276***<br>(0.0608)   | -0.721*<br>(0.388)    | -0.121*<br>(0.0641)     | -2.132***<br>(0.469)   | -0.230***<br>(0.0491)    | 2.438<br>(1.666)     | 0.0760<br>(0.0524)      |
| Observations                     | 394                   | 394                     | 394                   | 394                     | 394                    | 394                      | 394                  | 394                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.12 Probit Baseline Specification with Supervisory Discretion (Overall Sample)**

| VARIABLES                        | (1)                   | (2)                     | (3)                   | (4)                      | (5)                    | (6)                      | (7)                  | (8)                     |
|----------------------------------|-----------------------|-------------------------|-----------------------|--------------------------|------------------------|--------------------------|----------------------|-------------------------|
|                                  | SUPP<br>Coeff         | SUPP<br>AME             | RECAP<br>Coeff        | RECAP<br>AME             | GUAR<br>Coeff          | GUAR<br>AME              | LIQSUPP<br>Coeff     | LIQSUPP<br>AME          |
| <i>PRUDENTIAL FRAMEWORK</i>      |                       |                         |                       |                          |                        |                          |                      |                         |
| Supervisory Discretion           | 0.0846***<br>(0.0202) | 0.0158***<br>(0.00348)  | 0.0735***<br>(0.0211) | 0.0126***<br>(0.00344)   | 0.0766***<br>(0.0243)  | 0.00813***<br>(0.00249)  | 0.161**<br>(0.0773)  | 0.00667**<br>(0.00332)  |
| <i>BANK CHARACTERISTICS</i>      |                       |                         |                       |                          |                        |                          |                      |                         |
| Size                             | 0.513***<br>(0.0703)  | 0.0956***<br>(0.0103)   | 0.521***<br>(0.0746)  | 0.0889***<br>(0.0103)    | 0.434***<br>(0.0930)   | 0.0460***<br>(0.00976)   | 0.123<br>(0.194)     | 0.00511<br>(0.00808)    |
| RoAE                             | -0.0156*<br>(0.00931) | -0.00291*<br>(0.00172)  | -0.00326<br>(0.00912) | -0.000557<br>(0.00156)   | -0.00711<br>(0.00759)  | -0.000754<br>(0.000805)  | 0.0172<br>(0.0334)   | 0.000713<br>(0.00139)   |
| <i>BALANCE SHEET COMPOSITION</i> |                       |                         |                       |                          |                        |                          |                      |                         |
| Liquid Assets Ratio              | -0.00502<br>(0.00424) | -0.000936<br>(0.000787) | -0.0104*<br>(0.00533) | -0.00178**<br>(0.000897) | 8.78e-05<br>(0.00471)  | 9.31e-06<br>(0.000500)   | -0.0141<br>(0.0215)  | -0.000584<br>(0.000888) |
| Government Securities Ratio      | -0.0102<br>(0.0195)   | -0.00189<br>(0.00363)   | -0.0136<br>(0.0208)   | -0.00233<br>(0.00355)    | 0.0162<br>(0.0228)     | 0.00171<br>(0.00241)     | 0.0971**<br>(0.0475) | 0.00402**<br>(0.00201)  |
| Non-Interest Income Ratio        | -0.0208**<br>(0.0104) | -0.00387**<br>(0.00192) | -0.0165<br>(0.0109)   | -0.00281<br>(0.00185)    | -0.0547***<br>(0.0157) | -0.00580***<br>(0.00167) | 0.0109<br>(0.0232)   | 0.000452<br>(0.000964)  |
| Loans Assets Ratio               | 0.000916<br>(0.00766) | 0.000171<br>(0.00143)   | -0.00337<br>(0.00854) | -0.000576<br>(0.00146)   | 0.0111<br>(0.00955)    | 0.00117<br>(0.00101)     | 0.0415<br>(0.0272)   | 0.00172<br>(0.00115)    |
| <i>MACRO CONTROLS</i>            |                       |                         |                       |                          |                        |                          |                      |                         |
| GDP Growth Rate                  | 0.247***<br>(0.0557)  | 0.0460***<br>(0.00968)  | 0.222***<br>(0.0587)  | 0.0379***<br>(0.00960)   | 0.0215<br>(0.0777)     | 0.00228<br>(0.00825)     | 0.278<br>(0.217)     | 0.0115<br>(0.00918)     |
| Long-Term Rate                   | 3.000***<br>(0.801)   | 0.559***<br>(0.141)     | 0.974<br>(0.882)      | 0.166<br>(0.150)         | 5.146***<br>(1.008)    | 0.546***<br>(0.103)      | 2.669*<br>(1.614)    | 0.111*<br>(0.0666)      |
| Short-Term Rate                  | -1.421***<br>(0.348)  | -0.265***<br>(0.0605)   | -0.711*<br>(0.374)    | -0.122*<br>(0.0630)      | -2.067***<br>(0.466)   | -0.219***<br>(0.0482)    | -0.567<br>(0.791)    | -0.0235<br>(0.0326)     |
| Observations                     | 394                   | 394                     | 394                   | 394                      | 394                    | 394                      | 394                  | 394                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.13 Probit Baseline Specification with Regulatory Flexibility (Overall Sample)**

| VARIABLES                        | (1)                   | (2)                     | (3)                    | (4)                     | (5)                    | (6)                      | (7)                  | (8)                     |
|----------------------------------|-----------------------|-------------------------|------------------------|-------------------------|------------------------|--------------------------|----------------------|-------------------------|
|                                  | SUPP<br>Coeff         | SUPP<br>AME             | RECAP<br>Coeff         | RECAP<br>AME            | GUAR<br>Coeff          | GUAR<br>AME              | LIQSUPP<br>Coeff     | LIQSUPP<br>AME          |
| <i>PRUDENTIAL FRAMEWORK</i>      |                       |                         |                        |                         |                        |                          |                      |                         |
| Regulatory Flexibility           | 0.0848**<br>(0.0342)  | 0.0166**<br>(0.00655)   | 0.124***<br>(0.0376)   | 0.0213***<br>(0.00622)  | 0.0541<br>(0.0421)     | 0.00611<br>(0.00474)     | 61.34***<br>(0.287)  | 1.677***<br>(0.464)     |
| <i>BANK CHARACTERISTICS</i>      |                       |                         |                        |                         |                        |                          |                      |                         |
| Size                             | 0.507***<br>(0.0673)  | 0.0994***<br>(0.0104)   | 0.529***<br>(0.0750)   | 0.0911***<br>(0.0106)   | 0.434***<br>(0.0903)   | 0.0490***<br>(0.0101)    | 0.0930<br>(0.213)    | 0.00254<br>(0.00582)    |
| RoAE                             | -0.00983<br>(0.00776) | -0.00193<br>(0.00151)   | 0.00396<br>(0.0121)    | 0.000681<br>(0.00209)   | -0.00417<br>(0.00724)  | -0.000471<br>(0.000817)  | 0.0400<br>(0.0450)   | 0.00110<br>(0.00124)    |
| <i>BALANCE SHEET COMPOSITION</i> |                       |                         |                        |                         |                        |                          |                      |                         |
| Liquid Assets Ratio              | -0.00452<br>(0.00418) | -0.000887<br>(0.000817) | -0.00984*<br>(0.00535) | -0.00169*<br>(0.000911) | -0.000582<br>(0.00474) | -6.57e-05<br>(0.000534)  | -0.0722<br>(0.0468)  | -0.00198<br>(0.00132)   |
| Government Securities Ratio      | -0.0157<br>(0.0195)   | -0.00307<br>(0.00383)   | -0.0218<br>(0.0211)    | -0.00375<br>(0.00363)   | 0.0118<br>(0.0229)     | 0.00133<br>(0.00259)     | 0.0103<br>(0.0710)   | 0.000282<br>(0.00194)   |
| Non-Interest Income Ratio        | -0.0272**<br>(0.0111) | -0.00534**<br>(0.00213) | -0.0257**<br>(0.0119)  | -0.00444**<br>(0.00204) | -0.0591***<br>(0.0168) | -0.00667***<br>(0.00191) | -0.0213<br>(0.0324)  | -0.000581<br>(0.000888) |
| Loans Assets Ratio               | -0.00633<br>(0.00727) | -0.00124<br>(0.00142)   | -0.0107<br>(0.00843)   | -0.00184<br>(0.00145)   | 0.00408<br>(0.00893)   | 0.000460<br>(0.00101)    | -0.0398<br>(0.0491)  | -0.00109<br>(0.00136)   |
| <i>MACRO CONTROLS</i>            |                       |                         |                        |                         |                        |                          |                      |                         |
| GDP Growth Rate                  | 0.245***<br>(0.0557)  | 0.0480***<br>(0.0102)   | 0.188***<br>(0.0624)   | 0.0325***<br>(0.0105)   | 0.0636<br>(0.0722)     | 0.00718<br>(0.00817)     | -28.48***<br>(0.232) | -0.779***<br>(0.216)    |
| Long-Term Rate                   | 3.049***<br>(0.810)   | 0.598***<br>(0.151)     | 0.984<br>(0.946)       | 0.169<br>(0.163)        | 5.172***<br>(1.011)    | 0.584***<br>(0.110)      | -858.9<br>(0)        | -23.49***<br>(6.549)    |
| Short-Term Rate                  | -1.477***<br>(0.350)  | -0.290***<br>(0.0643)   | -0.754*<br>(0.392)     | -0.130*<br>(0.0667)     | -2.132***<br>(0.467)   | -0.241***<br>(0.0515)    | 364.5***<br>(0.520)  | 9.966***<br>(2.775)     |
| Observations                     | 394                   | 394                     | 394                    | 394                     | 394                    | 394                      | 394                  | 394                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.14 Probit Baseline Specification with Overall Indicator (Large Banks)**

| VARIABLES                        | (1)                   | (2)                     | (3)                    | (4)                     | (5)                    | (6)                     |
|----------------------------------|-----------------------|-------------------------|------------------------|-------------------------|------------------------|-------------------------|
|                                  | SUPP                  | SUPP                    | RECAP                  | RECAP                   | GUAR                   | GUAR                    |
|                                  | Coeff                 | AME                     | Coeff                  | AME                     | Coeff                  | AME                     |
| <i>PRUDENTIAL FRAMEWORK</i>      |                       |                         |                        |                         |                        |                         |
| Overall Indicator                | 0.0709***<br>(0.0226) | 0.0218***<br>(0.00609)  | 0.0535**<br>(0.0225)   | 0.0159**<br>(0.00623)   | 0.0604**<br>(0.0252)   | 0.0127**<br>(0.00499)   |
| <i>BANK CHARACTERISTICS</i>      |                       |                         |                        |                         |                        |                         |
| Size                             | 0.581***<br>(0.161)   | 0.179***<br>(0.0417)    | 0.511***<br>(0.168)    | 0.152***<br>(0.0444)    | 0.399*<br>(0.206)      | 0.0837**<br>(0.0417)    |
| RoAE                             | -0.0107<br>(0.00910)  | -0.00329<br>(0.00276)   | 0.0216<br>(0.0253)     | 0.00641<br>(0.00744)    | -0.00463<br>(0.00825)  | -0.000970<br>(0.00173)  |
| <i>BALANCE SHEET COMPOSITION</i> |                       |                         |                        |                         |                        |                         |
| Liquid Assets Ratio              | -0.0118*<br>(0.00676) | -0.00362*<br>(0.00200)  | -0.0123*<br>(0.00702)  | -0.00365*<br>(0.00200)  | -0.0135<br>(0.00850)   | -0.00282<br>(0.00174)   |
| Government Securities Ratio      | -0.0307<br>(0.0287)   | -0.00943<br>(0.00875)   | -0.0292<br>(0.0289)    | -0.00866<br>(0.00849)   | 0.0235<br>(0.0317)     | 0.00492<br>(0.00658)    |
| Non-Interest Income Ratio        | -0.0457**<br>(0.0183) | -0.0140***<br>(0.00525) | -0.0564***<br>(0.0194) | -0.0167***<br>(0.00517) | -0.0754***<br>(0.0247) | -0.0158***<br>(0.00474) |
| Loans Assets Ratio               | -0.00807<br>(0.0145)  | -0.00248<br>(0.00445)   | -0.0180<br>(0.0150)    | -0.00534<br>(0.00438)   | 0.0107<br>(0.0181)     | 0.00225<br>(0.00378)    |
| <i>MACRO CONTROLS</i>            |                       |                         |                        |                         |                        |                         |
| GDP Growth Rate                  | 0.0946<br>(0.104)     | 0.0291<br>(0.0318)      | 0.0937<br>(0.113)      | 0.0278<br>(0.0332)      | -0.0723<br>(0.124)     | -0.0152<br>(0.0258)     |
| Long-Term Rate                   | 2.948<br>(1.977)      | 0.907<br>(0.592)        | 2.980<br>(2.038)       | 0.884<br>(0.589)        | 3.204<br>(2.269)       | 0.671<br>(0.469)        |
| Short-Term Rate                  | -1.345*<br>(0.712)    | -0.414**<br>(0.210)     | -1.249*<br>(0.733)     | -0.371*<br>(0.210)      | -1.552*<br>(0.853)     | -0.325*<br>(0.174)      |
| Observations                     | 121                   | 121                     | 121                    | 121                     | 121                    | 121                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Appendix Table 3.15 Probit Baseline Specification with Supervisory Discretion (Large Banks)**

| VARIABLES                        | (1)                   | (2)                    | (3)                    | (4)                     | (5)                    | (6)                     |
|----------------------------------|-----------------------|------------------------|------------------------|-------------------------|------------------------|-------------------------|
|                                  | SUPP<br>Coeff         | SUPP<br>AME            | RECAP<br>Coeff         | RECAP<br>AME            | GUAR<br>Coeff          | GUAR<br>AME             |
| <i>PRUDENTIAL FRAMEWORK</i>      |                       |                        |                        |                         |                        |                         |
| Supervisory Discretion           | 0.105***<br>(0.0304)  | 0.0316***<br>(0.00778) | 0.0722**<br>(0.0304)   | 0.0214**<br>(0.00839)   | 0.0900***<br>(0.0341)  | 0.0185***<br>(0.00649)  |
| <i>BANK CHARACTERISTICS</i>      |                       |                        |                        |                         |                        |                         |
| Size                             | 0.563***<br>(0.160)   | 0.170***<br>(0.0409)   | 0.502***<br>(0.165)    | 0.149***<br>(0.0435)    | 0.367*<br>(0.204)      | 0.0755*<br>(0.0407)     |
| RoAE                             | -0.0128<br>(0.00982)  | -0.00385<br>(0.00291)  | 0.0139<br>(0.0244)     | 0.00413<br>(0.00720)    | -0.00556<br>(0.00843)  | -0.00115<br>(0.00173)   |
| <i>BALANCE SHEET COMPOSITION</i> |                       |                        |                        |                         |                        |                         |
| Liquid Assets Ratio              | -0.0117*<br>(0.00685) | -0.00352*<br>(0.00199) | -0.0121*<br>(0.00702)  | -0.00358*<br>(0.00200)  | -0.0129<br>(0.00851)   | -0.00265<br>(0.00172)   |
| Government Securities Ratio      | -0.0286<br>(0.0288)   | -0.00864<br>(0.00862)  | -0.0266<br>(0.0288)    | -0.00788<br>(0.00847)   | 0.0274<br>(0.0318)     | 0.00564<br>(0.00648)    |
| Non-Interest Income Ratio        | -0.0430**<br>(0.0180) | -0.0130**<br>(0.00510) | -0.0527***<br>(0.0189) | -0.0156***<br>(0.00511) | -0.0718***<br>(0.0241) | -0.0148***<br>(0.00459) |
| Loans Assets Ratio               | -0.00593<br>(0.0147)  | -0.00179<br>(0.00443)  | -0.0160<br>(0.0151)    | -0.00475<br>(0.00441)   | 0.0124<br>(0.0183)     | 0.00256<br>(0.00375)    |
| <i>MACRO CONTROLS</i>            |                       |                        |                        |                         |                        |                         |
| GDP Growth Rate                  | 0.101<br>(0.103)      | 0.0306<br>(0.0308)     | 0.113<br>(0.110)       | 0.0334<br>(0.0323)      | -0.0800<br>(0.125)     | -0.0165<br>(0.0256)     |
| Long-Term Rate                   | 3.524*<br>(1.985)     | 1.064*<br>(0.577)      | 3.345*<br>(2.024)      | 0.992*<br>(0.581)       | 3.732<br>(2.274)       | 0.768*<br>(0.460)       |
| Short-Term Rate                  | -1.495**<br>(0.713)   | -0.451**<br>(0.204)    | -1.346*<br>(0.727)     | -0.399*<br>(0.207)      | -1.668*<br>(0.851)     | -0.343**<br>(0.170)     |
| Observations                     | 121                   | 121                    | 121                    | 121                     | 121                    | 121                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.16 Probit Baseline Specification with Regulatory Flexibility (Large Banks)**

| VARIABLES                        | (1)<br>SUPP<br>Coeff  | (2)<br>SUPP<br>AME     | (3)<br>RECAP<br>Coeff  | (4)<br>RECAP<br>AME     | (5)<br>GUAR<br>Coeff   | (6)<br>GUAR<br>AME      |
|----------------------------------|-----------------------|------------------------|------------------------|-------------------------|------------------------|-------------------------|
| <i>PRUDENTIAL FRAMEWORK</i>      |                       |                        |                        |                         |                        |                         |
| Regulatory Flexibility           | 0.0636<br>(0.0480)    | 0.0209<br>(0.0155)     | 0.0733<br>(0.0504)     | 0.0224<br>(0.0150)      | 0.0626<br>(0.0583)     | 0.0138<br>(0.0127)      |
| <i>BANK CHARACTERISTICS</i>      |                       |                        |                        |                         |                        |                         |
| Size                             | 0.530***<br>(0.154)   | 0.174***<br>(0.0432)   | 0.475***<br>(0.163)    | 0.145***<br>(0.0451)    | 0.362*<br>(0.205)      | 0.0797*<br>(0.0437)     |
| RoAE                             | -0.00842<br>(0.00862) | -0.00277<br>(0.00281)  | 0.0329<br>(0.0255)     | 0.0100<br>(0.00762)     | -0.00329<br>(0.00806)  | -0.000725<br>(0.00178)  |
| <i>BALANCE SHEET COMPOSITION</i> |                       |                        |                        |                         |                        |                         |
| Liquid Assets Ratio              | -0.0112*<br>(0.00661) | -0.00369*<br>(0.00210) | -0.0121*<br>(0.00697)  | -0.00369*<br>(0.00205)  | -0.0147*<br>(0.00875)  | -0.00323*<br>(0.00187)  |
| Government Securities Ratio      | -0.0262<br>(0.0280)   | -0.00862<br>(0.00913)  | -0.0288<br>(0.0286)    | -0.00880<br>(0.00866)   | 0.0231<br>(0.0314)     | 0.00509<br>(0.00686)    |
| Non-Interest Income Ratio        | -0.0406**<br>(0.0181) | -0.0134**<br>(0.00559) | -0.0559***<br>(0.0196) | -0.0171***<br>(0.00539) | -0.0741***<br>(0.0252) | -0.0163***<br>(0.00510) |
| Loans Assets Ratio               | -0.0129<br>(0.0139)   | -0.00423<br>(0.00453)  | -0.0226<br>(0.0147)    | -0.00691<br>(0.00436)   | 0.00377<br>(0.0174)    | 0.000831<br>(0.00384)   |
| <i>MACRO CONTROLS</i>            |                       |                        |                        |                         |                        |                         |
| GDP Growth Rate                  | 0.148<br>(0.102)      | 0.0486<br>(0.0328)     | 0.108<br>(0.114)       | 0.0329<br>(0.0346)      | -0.0169<br>(0.120)     | -0.00372<br>(0.0264)    |
| Long-Term Rate                   | 2.513<br>(1.926)      | 0.827<br>(0.622)       | 2.606<br>(2.028)       | 0.796<br>(0.608)        | 3.197<br>(2.239)       | 0.704<br>(0.485)        |
| Short-Term Rate                  | -1.211*<br>(0.692)    | -0.399*<br>(0.220)     | -1.145<br>(0.726)      | -0.350<br>(0.216)       | -1.550*<br>(0.832)     | -0.341*<br>(0.178)      |
| Observations                     | 121                   | 121                    | 121                    | 121                     | 121                    | 121                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.17 Probit Baseline Specification with Overall Indicator (Medium and Small Banks)**

| VARIABLES                        | (1)                   | (2)                     | (3)                   | (4)                     | (5)                   | (6)                     |
|----------------------------------|-----------------------|-------------------------|-----------------------|-------------------------|-----------------------|-------------------------|
|                                  | SUPP                  | SUPP                    | RECAP                 | RECAP                   | GUAR                  | GUAR                    |
|                                  | Coeff                 | AME                     | Coeff                 | AME                     | Coeff                 | AME                     |
| <i>PRUDENTIAL FRAMEWORK</i>      |                       |                         |                       |                         |                       |                         |
| Overall Indicator                | 0.0722***<br>(0.0231) | 0.00896***<br>(0.00272) | 0.0893***<br>(0.0281) | 0.00836***<br>(0.00252) | 0.0698**<br>(0.0325)  | 0.00332**<br>(0.00157)  |
| <i>BANK CHARACTERISTICS</i>      |                       |                         |                       |                         |                       |                         |
| Size                             | 0.427*<br>(0.220)     | 0.0530**<br>(0.0265)    | 0.342<br>(0.266)      | 0.0320<br>(0.0243)      | 0.352<br>(0.314)      | 0.0167<br>(0.0151)      |
| RoAE                             | -0.0118<br>(0.0234)   | -0.00146<br>(0.00290)   | -0.0300<br>(0.0291)   | -0.00281<br>(0.00270)   | 0.00982<br>(0.0296)   | 0.000467<br>(0.00141)   |
| <i>BALANCE SHEET COMPOSITION</i> |                       |                         |                       |                         |                       |                         |
| Liquid Assets Ratio              | 0.00443<br>(0.00681)  | 0.000550<br>(0.000844)  | -0.0203<br>(0.0148)   | -0.00190<br>(0.00137)   | 0.0190**<br>(0.00943) | 0.000902*<br>(0.000460) |
| Government Securities Ratio      | 0.0131<br>(0.0307)    | 0.00163<br>(0.00380)    | -0.0327<br>(0.0401)   | -0.00307<br>(0.00372)   | 0.0373<br>(0.0455)    | 0.00177<br>(0.00216)    |
| Non-Interest Income Ratio        | -0.00922<br>(0.0142)  | -0.00115<br>(0.00175)   | 0.000248<br>(0.0163)  | 2.32e-05<br>(0.00153)   | -0.0165<br>(0.0220)   | -0.000784<br>(0.00105)  |
| Loans Assets Ratio               | 0.0115<br>(0.0120)    | 0.00142<br>(0.00148)    | -0.0107<br>(0.0165)   | -0.000997<br>(0.00154)  | 0.0230<br>(0.0173)    | 0.00109<br>(0.000837)   |
| <i>MACRO CONTROLS</i>            |                       |                         |                       |                         |                       |                         |
| GDP Growth Rate                  | 0.318***<br>(0.0788)  | 0.0395***<br>(0.00910)  | 0.404***<br>(0.111)   | 0.0378***<br>(0.00965)  | 0.0559<br>(0.130)     | 0.00266<br>(0.00623)    |
| Long-Term Rate                   | 3.077***<br>(1.080)   | 0.382***<br>(0.127)     | 3.178<br>(1.999)      | 0.298<br>(0.182)        | 5.051***<br>(1.324)   | 0.240***<br>(0.0662)    |
| Short-Term Rate                  | -1.683**<br>(0.816)   | -0.209**<br>(0.0994)    | -5.399*<br>(2.903)    | -0.506*<br>(0.264)      | -1.729**<br>(0.736)   | -0.0822**<br>(0.0359)   |
| Observations                     | 273                   | 273                     | 273                   | 273                     | 273                   | 273                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.18 Probit Baseline Specification with Supervisory Discretion (Medium and Small Banks)**

| VARIABLES                        | (1)                   | (2)                    | (3)                  | (4)                     | (5)                  | (6)                     |
|----------------------------------|-----------------------|------------------------|----------------------|-------------------------|----------------------|-------------------------|
|                                  | SUPP<br>Coeff         | SUPP<br>AME            | RECAP<br>Coeff       | RECAP<br>AME            | GUAR<br>Coeff        | GUAR<br>AME             |
| <i>PRUDENTIAL FRAMEWORK</i>      |                       |                        |                      |                         |                      |                         |
| Supervisory Discretion           | 0.0854***<br>(0.0292) | 0.0107***<br>(0.00351) | 0.104***<br>(0.0356) | 0.00997***<br>(0.00330) | 0.0868**<br>(0.0416) | 0.00414**<br>(0.00204)  |
| <i>BANK CHARACTERISTICS</i>      |                       |                        |                      |                         |                      |                         |
| Size                             | 0.414*<br>(0.219)     | 0.0520*<br>(0.0267)    | 0.328<br>(0.261)     | 0.0314<br>(0.0244)      | 0.332<br>(0.312)     | 0.0158<br>(0.0151)      |
| RoAE                             | -0.0143<br>(0.0235)   | -0.00180<br>(0.00294)  | -0.0318<br>(0.0285)  | -0.00304<br>(0.00269)   | 0.00617<br>(0.0300)  | 0.000295<br>(0.00143)   |
| <i>BALANCE SHEET COMPOSITION</i> |                       |                        |                      |                         |                      |                         |
| Liquid Assets Ratio              | 0.00157<br>(0.00652)  | 0.000197<br>(0.000819) | -0.0220<br>(0.0136)  | -0.00211*<br>(0.00128)  | 0.0155*<br>(0.00849) | 0.000739*<br>(0.000417) |
| Government Securities Ratio      | 0.0186<br>(0.0306)    | 0.00234<br>(0.00383)   | -0.0288<br>(0.0399)  | -0.00276<br>(0.00378)   | 0.0399<br>(0.0448)   | 0.00191<br>(0.00215)    |
| Non-Interest Income Ratio        | -0.00279<br>(0.0136)  | -0.000351<br>(0.00170) | 0.00621<br>(0.0157)  | 0.000594<br>(0.00150)   | -0.0104<br>(0.0210)  | -0.000496<br>(0.00100)  |
| Loans Assets Ratio               | 0.0117<br>(0.0121)    | 0.00147<br>(0.00151)   | -0.00916<br>(0.0160) | -0.000877<br>(0.00153)  | 0.0219<br>(0.0170)   | 0.00105<br>(0.000827)   |
| <i>MACRO CONTROLS</i>            |                       |                        |                      |                         |                      |                         |
| GDP Growth Rate                  | 0.352***<br>(0.0791)  | 0.0442***<br>(0.00911) | 0.469***<br>(0.113)  | 0.0448***<br>(0.00975)  | 0.0751<br>(0.127)    | 0.00358<br>(0.00614)    |
| Long-Term Rate                   | 2.959***<br>(1.138)   | 0.372***<br>(0.137)    | 3.638*<br>(1.904)    | 0.348**<br>(0.175)      | 4.691***<br>(1.287)  | 0.224***<br>(0.0659)    |
| Short-Term Rate                  | -1.775*<br>(0.977)    | -0.223*<br>(0.122)     | -5.697**<br>(2.455)  | -0.545**<br>(0.223)     | -1.678**<br>(0.771)  | -0.0801**<br>(0.0381)   |
| Observations                     | 273                   | 273                    | 273                  | 273                     | 273                  | 273                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.19 Probit Baseline Specification with Regulatory Flexibility (Medium and Small Banks)**

| VARIABLES                        | (1)                  | (2)                    | (3)                  | (4)                    | (5)                 | (6)                    |
|----------------------------------|----------------------|------------------------|----------------------|------------------------|---------------------|------------------------|
|                                  | SUPP<br>Coeff        | SUPP<br>AME            | RECAP<br>Coeff       | RECAP<br>AME           | GUAR<br>Coeff       | GUAR<br>AME            |
| <i>PRUDENTIAL FRAMEWORK</i>      |                      |                        |                      |                        |                     |                        |
| Regulatory Flexibility           | 0.112**<br>(0.0551)  | 0.0145**<br>(0.00696)  | 0.150**<br>(0.0670)  | 0.0146**<br>(0.00638)  | 0.157<br>(0.0968)   | 0.00795<br>(0.00496)   |
| <i>BANK CHARACTERISTICS</i>      |                      |                        |                      |                        |                     |                        |
| Size                             | 0.412**<br>(0.209)   | 0.0535**<br>(0.0264)   | 0.357<br>(0.248)     | 0.0349<br>(0.0236)     | 0.321<br>(0.301)    | 0.0163<br>(0.0154)     |
| RoAE                             | -0.00330<br>(0.0217) | -0.000428<br>(0.00282) | -0.0217<br>(0.0265)  | -0.00212<br>(0.00258)  | 0.0206<br>(0.0271)  | 0.00105<br>(0.00138)   |
| <i>BALANCE SHEET COMPOSITION</i> |                      |                        |                      |                        |                     |                        |
| Liquid Assets Ratio              | 0.00291<br>(0.00675) | 0.000378<br>(0.000877) | -0.0180<br>(0.0127)  | -0.00176<br>(0.00124)  | 0.0205*<br>(0.0111) | 0.00104*<br>(0.000576) |
| Government Securities Ratio      | 0.00337<br>(0.0306)  | 0.000438<br>(0.00397)  | -0.0344<br>(0.0390)  | -0.00336<br>(0.00378)  | 0.0298<br>(0.0459)  | 0.00151<br>(0.00233)   |
| Non-Interest Income Ratio        | -0.0155<br>(0.0150)  | -0.00201<br>(0.00195)  | -0.00386<br>(0.0167) | -0.000377<br>(0.00164) | -0.0291<br>(0.0241) | -0.00147<br>(0.00123)  |
| Loans Assets Ratio               | 0.00432<br>(0.0112)  | 0.000561<br>(0.00146)  | -0.0163<br>(0.0158)  | -0.00159<br>(0.00154)  | 0.0207<br>(0.0178)  | 0.00105<br>(0.000913)  |
| <i>MACRO CONTROLS</i>            |                      |                        |                      |                        |                     |                        |
| GDP Growth Rate                  | 0.298***<br>(0.0803) | 0.0387***<br>(0.00987) | 0.337***<br>(0.119)  | 0.0329***<br>(0.0114)  | 0.0461<br>(0.129)   | 0.00234<br>(0.00658)   |
| Long-Term Rate                   | 3.232***<br>(1.073)  | 0.420***<br>(0.135)    | 2.978<br>(1.960)     | 0.291<br>(0.191)       | 5.654***<br>(1.501) | 0.287***<br>(0.0808)   |
| Short-Term Rate                  | -1.753**<br>(0.787)  | -0.228**<br>(0.101)    | -4.764*<br>(2.861)   | -0.465*<br>(0.278)     | -1.942**<br>(0.762) | -0.0985**<br>(0.0400)  |
| Observations                     | 273                  | 273                    | 273                  | 273                    | 273                 | 273                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### Annex 3.C: MLE IV Cross-Section Probit Regressions (2005-2007)

Appendix Table 3.20 MLE IV Probit for Loans Assets Ratio (Overall Sample)

| VARIABLES                              | (1)<br>SUPP<br>Coeff.    | (2)<br>Loans/Assets<br>Red. Form | (3)<br>SUPP<br>AME       | (4)<br>RECAP<br>Coeff.  | (5)<br>Loans/Assets<br>Red. Form | (6)<br>RECAP<br>AME     | (7)<br>GUAR<br>Coeff.   | (8)<br>Loans/Assets<br>Red. Form | (9)<br>GUAR<br>AME      | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Loans/Assets<br>Red. Form | (12)<br>LIQSUPP<br>AME   |
|--|--------------------------|----------------------------------|--------------------------|-------------------------|----------------------------------|-------------------------|-------------------------|----------------------------------|-------------------------|---------------------------|-----------------------------------|--------------------------|
| <b>Panel A: Overall Indicator</b>      |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| <i>BALANCE SHEET MEAS.</i>             |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| Loans Assets Ratio                     | -0.0470***<br>(0.000826) |                                  | -0.0136***<br>(0.000160) | -0.0423***<br>(0.00475) |                                  | -0.0113***<br>(0.00184) | -0.0363***<br>(0.0139)  |                                  | -0.00748<br>(0.00514)   | -0.0467***<br>(0.00160)   |                                   | -0.0132***<br>(0.000660) |
| <i>INSTRUMENTS</i>                     |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| Overall Indicator                      |                          | -0.00613***<br>(0.00159)         |                          |                         | -0.325*<br>(0.192)               |                         |                         | -0.346**<br>(0.161)              |                         |                           | -0.187<br>(0.236)                 |                          |
| Equity Assets Ratio                    |                          | 0.00671*<br>(0.00382)            |                          |                         | -0.0305<br>(0.0738)              |                         |                         | -0.0861<br>(0.116)               |                         |                           | 0.0234<br>(0.0283)                |                          |
| <b>Panel B: Supervisory Discretion</b> |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| <i>BALANCE SHEET MEAS.</i>             |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| Loans Assets Ratio                     | -0.0319***<br>(0.00717)  |                                  | -0.00775***<br>(0.00220) | -0.0274***<br>(0.00919) |                                  | -0.00625**<br>(0.00274) | -0.0315***<br>(0.00896) |                                  | -0.00593**<br>(0.00278) | -0.0364***<br>(0.00660)   |                                   | -0.00787***<br>(0.00249) |
| <i>INSTRUMENTS</i>                     |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| Supervisory Discretion                 |                          | -0.955***<br>(0.227)             |                          |                         | -0.943***<br>(0.226)             |                         |                         | -0.950***<br>(0.226)             |                         |                           | -0.953***<br>(0.226)              |                          |
| Equity Assets Ratio                    |                          | -0.0826<br>(0.0863)              |                          |                         | -0.116<br>(0.0878)               |                         |                         | -0.0998<br>(0.0918)              |                         |                           | -0.0924<br>(0.0775)               |                          |
| <b>Panel C: Regulatory Flexibility</b> |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| <i>BALANCE SHEET MEAS.</i>             |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| Loans Assets Ratio                     | 0.0407***<br>(0.00664)   |                                  | 0.0110***<br>(0.00287)   | 0.0444***<br>(0.00443)  |                                  | 0.0122***<br>(0.00204)  | 0.0211<br>(0.0216)      |                                  | 0.00300<br>(0.00450)    | 0.0484***<br>(0.00180)    |                                   | 0.0142***<br>(0.000342)  |
| <i>INSTRUMENTS</i>                     |                          |                                  |                          |                         |                                  |                         |                         |                                  |                         |                           |                                   |                          |
| Regulatory Flexibility                 |                          | 1.297***<br>(0.441)              |                          |                         | 1.365***<br>(0.415)              |                         |                         | 1.361***<br>(0.430)              |                         |                           | 1.418***<br>(0.406)               |                          |
| Equity Assets Ratio                    |                          | -0.239***<br>(0.0900)            |                          |                         | -0.221**<br>(0.0894)             |                         |                         | -0.222**<br>(0.0949)             |                         |                           | -0.203**<br>(0.0931)              |                          |
| BANK CONTROLS                          | YES                      | YES                              | YES                      | YES                     | YES                              | YES                     | YES                     | YES                              | YES                     | YES                       | YES                               | YES                      |
| MACRO CONTROLS                         | YES                      | YES                              | YES                      | YES                     | YES                              | YES                     | YES                     | YES                              | YES                     | YES                       | YES                               | YES                      |
| Observations                           | 493                      | 493                              | 493                      | 493                     | 493                              | 493                     | 493                     | 493                              | 493                     | 493                       | 493                               | 493                      |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.21MLE IV Probit for Net Loans/Total Assets Ratio (Large Banks)**

| VARIABLES                              | (1)                    | (2)                  | (3)                     | (4)                    | (5)                 | (6)                     | (7)                     | (8)                 | (9)                     | (10)                   | (11)                | (12)                |
|--|------------------------|----------------------|-------------------------|------------------------|---------------------|-------------------------|-------------------------|---------------------|-------------------------|------------------------|---------------------|---------------------|
|  | SUPP                   | Loans/Assets         | SUPP                    | RECAP                  | Loans/Assets        | RECAP                   | GUAR                    | Loans/Assets        | GUAR                    | LIQSUPP                | Loans/Assets        | LIQSUPP             |
|  | Coeff.                 | Red. Form            | AME                     | Coeff.                 | Red. Form           | AME                     | Coeff.                  | Red. Form           | AME                     | Coeff.                 | Red. Form           | AME                 |
| <b>Panel A: Overall Indicator</b>      |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| <i>BALANCE SHEET MEAS.</i>             |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| Loans Assets Ratio                     | -0.0590***<br>(0.0117) |                      | -0.0181***<br>(0.00283) | -0.0550***<br>(0.0152) |                     | -0.0167***<br>(0.00379) | -0.0629***<br>(0.0108)  |                     | -0.0182***<br>(0.00298) | -0.0703***<br>(0.0142) |                     | -0.00944<br>(0.867) |
| <i>INSTRUMENTS</i>                     |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| Overall Indicator                      |                        | -0.421**<br>(0.164)  |                         |                        | -0.418**<br>(0.174) |                         |                         | -0.283*<br>(0.155)  |                         |                        | -0.452**<br>(0.187) |                     |
| Equity Assets Ratio                    |                        | 1.139**<br>(0.451)   |                         |                        | 1.150**<br>(0.478)  |                         |                         | 1.370***<br>(0.472) |                         |                        | 1.038*<br>(0.558)   |                     |
| <b>Panel B: Supervisory Discretion</b> |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| <i>BALANCE SHEET MEAS.</i>             |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| Loans Assets Ratio                     | -0.0584***<br>(0.0115) |                      | -0.0180***<br>(0.00280) | -0.0535***<br>(0.0155) |                     | -0.0164***<br>(0.00389) | -0.0619***<br>(0.0112)  |                     | -0.0179***<br>(0.00310) | -0.0718***<br>(0.0129) |                     | -0.0112<br>(0.976)  |
| <i>INSTRUMENTS</i>                     |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| Supervisory Discretion                 |                        | -0.612***<br>(0.225) |                         |                        | -0.599**<br>(0.238) |                         |                         | -0.423*<br>(0.220)  |                         |                        | -0.644**<br>(0.252) |                     |
| Equity Assets Ratio                    |                        | 0.997**<br>(0.437)   |                         |                        | 1.030**<br>(0.475)  |                         |                         | 1.298***<br>(0.449) |                         |                        | 0.908<br>(0.562)    |                     |
| <b>Panel C: Regulatory Flexibility</b> |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| <i>BALANCE SHEET MEAS.</i>             |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| Loans Assets Ratio                     | -0.0617***<br>(0.0137) |                      | -0.0188***<br>(0.00327) | -0.0604***<br>(0.0162) |                     | -0.0180***<br>(0.00396) | -0.0681***<br>(0.00880) |                     | -0.0197***<br>(0.00240) | -0.0676***<br>(0.0157) |                     | -0.00721<br>(0.350) |
| <i>INSTRUMENTS</i>                     |                        |                      |                         |                        |                     |                         |                         |                     |                         |                        |                     |                     |
| Regulatory Flexibility                 |                        | -0.456<br>(0.316)    |                         |                        | -0.480<br>(0.343)   |                         |                         | -0.292<br>(0.238)   |                         |                        | -0.539<br>(0.437)   |                     |
| Equity Assets Ratio                    |                        | 1.244**<br>(0.542)   |                         |                        | 1.234**<br>(0.543)  |                         |                         | 1.265**<br>(0.560)  |                         |                        | 1.202**<br>(0.569)  |                     |
| BANK CONTROLS                          | YES                    | YES                  | YES                     | YES                    | YES                 | YES                     | YES                     | YES                 | YES                     | YES                    | YES                 | YES                 |
| MACRO CONTROLS                         | YES                    | YES                  | YES                     | YES                    | YES                 | YES                     | YES                     | YES                 | YES                     | YES                    | YES                 | YES                 |
| Observations                           | 135                    | 135                  | 135                     | 135                    | 135                 | 135                     | 135                     | 135                 | 135                     | 135                    | 135                 | 135                 |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.22 MLE IV Probit for Loans Assets Ratio (Medium and Small Banks)**

| VARIABLES                              | (1)                     | (2)                      | (3)                      | (4)                     | (5)                  | (6)                      | (7)                      | (8)                   | (9)                      | (10)                     | (11)                  | (12)                     |
|--|-------------------------|--------------------------|--------------------------|-------------------------|----------------------|--------------------------|--------------------------|-----------------------|--------------------------|--------------------------|-----------------------|--------------------------|
|  | SUPP                    | Loans/Assets             | SUPP                     | RECAP                   | Loans/Assets         | RECAP                    | GUAR                     | Loans/Assets          | GUAR                     | LIQSUPP                  | Loans/Assets          | LIQSUPP                  |
|  | Coeff.                  | Red. Form                | AME                      | Coeff.                  | Red. Form            | AME                      | Coeff.                   | Red. Form             | AME                      | Coeff.                   | Red. Form             | AME                      |
| <b>Panel A: Overall Indicator</b>      |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| <i>BALANCE SHEET MEAS.</i>             |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| Loans Assets Ratio                     | -0.0446***<br>(0.00110) |                          | -0.0129***<br>(0.000280) | -0.0440***<br>(0.00264) |                      | -0.0125***<br>(0.00147)  | -0.0446***<br>(0.000162) |                       | -0.0129***<br>(3.80e-05) | -0.0446***<br>(0.000361) |                       | -0.0128***<br>(8.51e-05) |
| <i>INSTRUMENTS</i>                     |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| Overall Indicator                      |                         | -0.00743***<br>(0.00250) |                          |                         | -0.0894<br>(0.272)   |                          |                          | -0.00169<br>(0.00125) |                          |                          | -0.0117*<br>(0.00600) |                          |
| Equity Assets Ratio                    |                         | 0.00463<br>(0.00412)     |                          |                         | 0.0101<br>(0.0300)   |                          |                          | 0.00844*<br>(0.00440) |                          |                          | 0.00519<br>(0.00677)  |                          |
| <b>Panel B: Supervisory Discretion</b> |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| <i>BALANCE SHEET MEAS.</i>             |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| Loans Assets Ratio                     | -0.0320***<br>(0.00876) |                          | -0.00674**<br>(0.00307)  | -0.0339***<br>(0.00699) |                      | -0.00699***<br>(0.00253) | -0.0376***<br>(0.00916)  |                       | -0.00569<br>(0.00369)    | -0.0417***<br>(0.00428)  |                       | -0.00792***<br>(0.00244) |
| <i>INSTRUMENTS</i>                     |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| Supervisory Discretion                 |                         | -0.886***<br>(0.301)     |                          |                         | -0.886***<br>(0.299) |                          |                          | -0.887***<br>(0.300)  |                          |                          | -0.888***<br>(0.300)  |                          |
| Equity Assets Ratio                    |                         | -0.00467<br>(0.0942)     |                          |                         | -0.0275<br>(0.0899)  |                          |                          | -0.0111<br>(0.0991)   |                          |                          | -0.0149<br>(0.0938)   |                          |
| <b>Panel C: Regulatory Flexibility</b> |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| <i>BALANCE SHEET MEAS.</i>             |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| Loans Assets Ratio                     | 0.0348***<br>(0.00793)  |                          | 0.00680**<br>(0.00310)   | 0.0417***<br>(0.00552)  |                      | 0.00830***<br>(0.00249)  | 0.00710<br>(0.0252)      |                       | 0.000409<br>(0.00167)    | 0.0454***<br>(0.00191)   |                       | 0.0133***<br>(0.000806)  |
| <i>INSTRUMENTS</i>                     |                         |                          |                          |                         |                      |                          |                          |                       |                          |                          |                       |                          |
| Regulatory Flexibility                 |                         | 2.064***<br>(0.530)      |                          |                         | 2.083***<br>(0.525)  |                          |                          | 2.086***<br>(0.525)   |                          |                          | 2.096***<br>(0.523)   |                          |
| Equity Assets Ratio                    |                         | -0.122<br>(0.0993)       |                          |                         | -0.108<br>(0.0982)   |                          |                          | -0.105<br>(0.103)     |                          |                          | -0.0942<br>(0.105)    |                          |
| BANK CONTROLS                          | YES                     | YES                      | YES                      | YES                     | YES                  | YES                      | YES                      | YES                   | YES                      | YES                      | YES                   | YES                      |
| MACRO CONTROLS                         | YES                     | YES                      | YES                      | YES                     | YES                  | YES                      | YES                      | YES                   | YES                      | YES                      | YES                   | YES                      |
| Observations                           | 358                     | 358                      | 358                      | 358                     | 358                  | 358                      | 358                      | 358                   | 358                      | 358                      | 358                   | 358                      |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Appendix Table 3.23 MLE IV Probit for Non-Interest Income Ratio (Overall Sample)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff.   | (2)<br>NonIntInc<br>Red. Form | (3)<br>SUPP<br>AME      | (4)<br>RECAP<br>Coeff. | (5)<br>NonIntInc<br>Red. Form | (6)<br>RECAP<br>AME    | (7)<br>GUAR<br>Coeff. | (8)<br>NonIntInc<br>Red. Form | (9)<br>GUAR<br>AME     | (10)<br>LIQSUPP<br>Coeff. | (11)<br>NonIntInc<br>Red. Form | (12)<br>LIQSUPP<br>AME  |
|--|-------------------------|-------------------------------|-------------------------|------------------------|-------------------------------|------------------------|-----------------------|-------------------------------|------------------------|---------------------------|--------------------------------|-------------------------|
| <b>Panel A: Overall Indicator</b>      |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| Non-Interest Income Ratio              | 0.0684***<br>(0.00884)  |                               | 0.0190***<br>(0.00366)  | 0.0683***<br>(0.00822) |                               | 0.0184***<br>(0.00359) | 0.0419<br>(0.0257)    |                               | 0.00915<br>(0.00889)   | 0.0776***<br>(0.00271)    |                                | 0.0228***<br>(0.00119)  |
| <i>INSTRUMENTS</i>                     |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| Overall Indicator                      |                         | 0.229**<br>(0.114)            |                         |                        | 0.239**<br>(0.104)            |                        |                       | 0.242**<br>(0.0939)           |                        |                           | 0.166<br>(0.127)               |                         |
| Equity Assets Ratio                    |                         | 0.0229<br>(0.0421)            |                         |                        | 0.0360<br>(0.0414)            |                        |                       | 0.0632<br>(0.0548)            |                        |                           | -0.00627<br>(0.0159)           |                         |
| <b>Panel B: Supervisory Discretion</b> |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| Non-Interest Income Ratio              | 0.0784***<br>(0.000715) |                               | 0.0238***<br>(0.000166) | 0.0612***<br>(0.0209)  |                               | 0.0152*<br>(0.00798)   | 0.0579**<br>(0.0260)  |                               | 0.0152<br>(0.0108)     | 0.0762***<br>(0.00447)    |                                | 0.0219***<br>(0.00310)  |
| <i>INSTRUMENTS</i>                     |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| Supervisory Discretion                 |                         | 0.00268***<br>(0.000874)      |                         |                        | 0.226**<br>(0.110)            |                        |                       | 0.219<br>(0.140)              |                        |                           | 0.171<br>(0.170)               |                         |
| Equity Assets Ratio                    |                         | -0.000963<br>(0.00113)        |                         |                        | 0.0625<br>(0.0635)            |                        |                       | 0.0363<br>(0.0706)            |                        |                           | 0.0106<br>(0.0316)             |                         |
| <b>Panel C: Regulatory Flexibility</b> |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| Non-Interest Income Ratio              | 0.0535***<br>(0.0146)   |                               | 0.0135***<br>(0.00491)  | 0.0623***<br>(0.00952) |                               | 0.0162***<br>(0.00365) | -0.00611<br>(0.0504)  |                               | -0.000689<br>(0.00541) | 0.0788***<br>(9.59e-05)   |                                | 0.0235***<br>(5.64e-05) |
| <i>INSTRUMENTS</i>                     |                         |                               |                         |                        |                               |                        |                       |                               |                        |                           |                                |                         |
| Regulatory Flexibility                 |                         | 0.689***<br>(0.223)           |                         |                        | 0.692***<br>(0.227)           |                        |                       | 0.616***<br>(0.239)           |                        |                           | 0.589***<br>(0.166)            |                         |
| Equity Assets Ratio                    |                         | 0.0618<br>(0.0486)            |                         |                        | 0.0533<br>(0.0428)            |                        |                       | 0.100*<br>(0.0523)            |                        |                           | -0.00106<br>(0.00138)          |                         |
| BANK CONTROLS                          | YES                     | YES                           | YES                     | YES                    | YES                           | YES                    | YES                   | YES                           | YES                    | YES                       | YES                            | YES                     |
| MACRO CONTROLS                         | YES                     | YES                           | YES                     | YES                    | YES                           | YES                    | YES                   | YES                           | YES                    | YES                       | YES                            | YES                     |
| Observations                           | 499                     | 499                           | 499                     | 499                    | 499                           | 499                    | 499                   | 499                           | 499                    | 499                       | 499                            | 499                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.24 MLE IV Probit for Non-Interest Income Ratio (Large Banks)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff. | (2)<br>NonIntInc<br>Red. Form | (3)<br>SUPP<br>AME      | (4)<br>RECAP<br>Coeff. | (5)<br>NonIntInc<br>Red. Form | (6)<br>RECAP<br>AME | (7)<br>GUAR<br>Coeff. | (8)<br>NonIntInc<br>Red. Form | (9)<br>GUAR<br>AME      | (10)<br>LIQSUPP<br>Coeff. | (11)<br>NonIntInc<br>Red. Form | (12)<br>LIQSUPP<br>AME |
|--|-----------------------|-------------------------------|-------------------------|------------------------|-------------------------------|---------------------|-----------------------|-------------------------------|-------------------------|---------------------------|--------------------------------|------------------------|
| <b>Panel A: Overall Indicator</b>      |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| Non-Interest Income Ratio              | 0.0846**<br>(0.0332)  |                               | 0.0267***<br>(0.00844)  | 0.0423<br>(0.0534)     |                               | 0.0140<br>(0.0171)  | 0.0114<br>(0.108)     |                               | 0.00314<br>(0.0311)     | -0.0159<br>(366,020)      |                                | -0.00139<br>(25,711)   |
| <i>INSTRUMENTS</i>                     |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| Overall Indicator                      |                       | 0.229<br>(0.187)              |                         |                        | 0.293**<br>(0.122)            |                     |                       | 0.293**<br>(0.121)            |                         |                           | 0.236*<br>(0.132)              |                        |
| Equity Assets Ratio                    |                       | 0.0258<br>(0.343)             |                         |                        | 0.438<br>(0.494)              |                     |                       | 0.476<br>(0.734)              |                         |                           | 0.816**<br>(0.394)             |                        |
| <b>Panel B: Supervisory Discretion</b> |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| Non-Interest Income Ratio              | 0.0909***<br>(0.0277) |                               | 0.0283***<br>(0.00675)  | 0.0418<br>(0.0583)     |                               | 0.0139<br>(0.0187)  | 0.0311<br>(0.117)     |                               | 0.00914<br>(0.0372)     | -0.301<br>(257,846)       |                                | -0.00960<br>(975.1)    |
| <i>INSTRUMENTS</i>                     |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| Supervisory Discretion                 |                       | 0.266<br>(0.258)              |                         |                        | 0.381**<br>(0.163)            |                     |                       | 0.377**<br>(0.184)            |                         |                           | 0.299*<br>(0.179)              |                        |
| Equity Assets Ratio                    |                       | 0.0360<br>(0.297)             |                         |                        | 0.513<br>(0.532)              |                     |                       | 0.420<br>(0.889)              |                         |                           | 0.870**<br>(0.398)             |                        |
| <b>Panel C: Regulatory Flexibility</b> |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| Non-Interest Income Ratio              | -0.103***<br>(0.0383) |                               | -0.0313***<br>(0.00898) | -0.0365<br>(0.0994)    |                               | -0.0116<br>(0.0304) | -0.122***<br>(0.0111) |                               | -0.0339***<br>(0.00262) | 0.00170<br>(13,420)       |                                | 0.000241<br>(1,900)    |
| <i>INSTRUMENTS</i>                     |                       |                               |                         |                        |                               |                     |                       |                               |                         |                           |                                |                        |
| Regulatory Flexibility                 |                       | 0.00727<br>(0.411)            |                         |                        | 0.405<br>(0.402)              |                     |                       | -0.0226<br>(0.233)            |                         |                           | 0.385<br>(0.307)               |                        |
| Equity Assets Ratio                    |                       | 0.777<br>(0.476)              |                         |                        | 0.696<br>(0.498)              |                     |                       | 0.755*<br>(0.444)             |                         |                           | 0.716*<br>(0.398)              |                        |
| BANK CONTROLS                          | YES                   | YES                           | YES                     | YES                    | YES                           | YES                 | YES                   | YES                           | YES                     | YES                       | YES                            | YES                    |
| MACRO CONTROLS                         | YES                   | YES                           | YES                     | YES                    | YES                           | YES                 | YES                   | YES                           | YES                     | YES                       | YES                            | YES                    |
| Observations                           | 135                   | 135                           | 135                     | 135                    | 135                           | 135                 | 135                   | 135                           | 135                     | 135                       | 135                            | 135                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.25 MLE IV Probit for Non-Interest Income Ratio (Medium and Small Banks)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff.   | (2)<br>NonIntInc<br>Red. Form | (3)<br>SUPP<br>AME       | (4)<br>RECAP<br>Coeff. | (5)<br>NonIntInc<br>Red. Form | (6)<br>RECAP<br>AME     | (7)<br>GUAR<br>Coeff.   | (8)<br>NonIntInc<br>Red. Form | (9)<br>GUAR<br>AME       | (10)<br>LIQSUPP<br>Coeff. | (11)<br>NonIntInc<br>Red. Form | (12)<br>LIQSUPP<br>AME  |
|--|-------------------------|-------------------------------|--------------------------|------------------------|-------------------------------|-------------------------|-------------------------|-------------------------------|--------------------------|---------------------------|--------------------------------|-------------------------|
| <b>Panel A: Overall Indicator</b>      |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| Non-Interest Income Ratio              | 0.0706***<br>(0.00662)  |                               | 0.0195***<br>(0.00468)   | 0.0727***<br>(0.00365) |                               | 0.0199***<br>(0.00312)  | 0.0514<br>(0.0325)      |                               | 0.00910<br>(0.0135)      | 0.0729***<br>(0.00461)    |                                | 0.0203***<br>(0.00539)  |
| <i>INSTRUMENTS</i>                     |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| Overall Indicator                      |                         | 0.169<br>(0.191)              |                          |                        | 0.183<br>(0.160)              |                         |                         | 0.210*<br>(0.125)             |                          |                           | 0.170<br>(0.284)               |                         |
| Equity Assets Ratio                    |                         | -0.00145<br>(0.0397)          |                          |                        | 0.00357<br>(0.0310)           |                         |                         | 0.0506<br>(0.0644)            |                          |                           | -0.00112<br>(0.0807)           |                         |
| <b>Panel B: Supervisory Discretion</b> |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| Non-Interest Income Ratio              | -0.0722***<br>(0.00338) |                               | -0.0224***<br>(0.000931) | 0.0735***<br>(0.00114) |                               | 0.0223***<br>(0.000279) | -0.0735***<br>(0.00280) |                               | -0.0226***<br>(0.000597) | 0.0735***<br>(2.71e-05)   |                                | 0.0224***<br>(2.30e-05) |
| <i>INSTRUMENTS</i>                     |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| Supervisory Discretion                 |                         | -0.0875<br>(0.0825)           |                          |                        | 0.00390**<br>(0.00173)        |                         |                         | -0.0266<br>(0.0303)           |                          |                           | 0.00115*<br>(0.000597)         |                         |
| Equity Assets Ratio                    |                         | 0.0685<br>(0.0565)            |                          |                        | -0.000886<br>(0.00149)        |                         |                         | 0.0820<br>(0.0562)            |                          |                           | -0.000591<br>(0.000674)        |                         |
| <b>Panel C: Regulatory Flexibility</b> |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| Non-Interest Income Ratio              | 0.0586***<br>(0.0127)   |                               | 0.0132**<br>(0.00542)    | 0.0674***<br>(0.00723) |                               | 0.0153***<br>(0.00449)  | -0.00281<br>(0.0768)    |                               | -0.000145<br>(0.00388)   | 0.0727***<br>(0.00657)    |                                | 0.0201<br>(0.0350)      |
| <i>INSTRUMENTS</i>                     |                         |                               |                          |                        |                               |                         |                         |                               |                          |                           |                                |                         |
| Regulatory Flexibility                 |                         | 0.754**<br>(0.310)            |                          |                        | 0.753**<br>(0.312)            |                         |                         | 0.685**<br>(0.326)            |                          |                           | 0.717*<br>(0.410)              |                         |
| Equity Assets Ratio                    |                         | 0.0365<br>(0.0516)            |                          |                        | 0.0337<br>(0.0451)            |                         |                         | 0.0767<br>(0.0579)            |                          |                           | 0.00767<br>(0.0937)            |                         |
| BANK CONTROLS                          | YES                     | YES                           | YES                      | YES                    | YES                           | YES                     | YES                     | YES                           | YES                      | YES                       | YES                            | YES                     |
| MACRO CONTROLS                         | YES                     | YES                           | YES                      | YES                    | YES                           | YES                     | YES                     | YES                           | YES                      | YES                       | YES                            | YES                     |
| Observations                           | 364                     | 364                           | 364                      | 364                    | 364                           | 364                     | 364                     | 364                           | 364                      | 364                       | 364                            | 364                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.26 MLE IV Probit for Liquid Assets Ratio (Overall Sample)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff.   | (2)<br>Liq Assets<br>Red. Form | (3)<br>SUPP<br>AME        | (4)<br>RECAP<br>Coeff.  | (5)<br>Liq Assets<br>Red. Form | (6)<br>RECAP<br>AME       | (7)<br>GUAR<br>Coeff.    | (8)<br>Liq Assets<br>Red. Form | (9)<br>GUAR<br>AME        | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Liq Assets<br>Red. Form | (12)<br>LIQSUPP<br>AME    |
|--|-------------------------|--------------------------------|---------------------------|-------------------------|--------------------------------|---------------------------|--------------------------|--------------------------------|---------------------------|---------------------------|---------------------------------|---------------------------|
| <b>Panel A: Overall Indicator</b>      |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| <i>BALANCE SHEET MEAS.</i>             |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| Liquid Assets Ratio                    | -0.0305***<br>(0.00106) |                                | -0.00960***<br>(0.000317) | -0.0311***<br>(0.00136) |                                | -0.00978***<br>(0.000414) | -0.0302***<br>(0.000979) |                                | -0.00944***<br>(0.000269) | -0.0305***<br>(0.00119)   |                                 | -0.00951***<br>(0.000374) |
| <i>INSTRUMENTS</i>                     |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| Overall Indicator                      |                         | -0.177<br>(0.150)              |                           |                         | -0.220<br>(0.191)              |                           |                          | -0.0334<br>(0.0321)            |                           |                           | -0.229<br>(0.243)               |                           |
| Equity Assets Ratio                    |                         | 0.250<br>(0.196)               |                           |                         | 0.205<br>(0.192)               |                           |                          | 0.282<br>(0.207)               |                           |                           | 0.123<br>(0.156)                |                           |
| <b>Panel B: Supervisory Discretion</b> |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| <i>BALANCE SHEET MEAS.</i>             |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| Liquid Assets Ratio                    | 0.0251***<br>(0.00402)  |                                | 0.00670***<br>(0.00161)   | 0.0216***<br>(0.00566)  |                                | 0.00553***<br>(0.00201)   | 0.0262***<br>(0.00441)   |                                | 0.00595***<br>(0.00230)   | 0.0234***<br>(0.00499)    |                                 | 0.00627***<br>(0.00183)   |
| <i>INSTRUMENTS</i>                     |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| Supervisory Discretion                 |                         | 0.824**<br>(0.407)             |                           |                         | 0.875**<br>(0.366)             |                           |                          | 0.823*<br>(0.429)              |                           |                           | 0.876**<br>(0.364)              |                           |
| Equity Assets Ratio                    |                         | -0.0159<br>(0.168)             |                           |                         | 0.0703<br>(0.173)              |                           |                          | -0.0167<br>(0.214)             |                           |                           | 0.0742<br>(0.144)               |                           |
| <b>Panel C: Regulatory Flexibility</b> |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| <i>BALANCE SHEET MEAS.</i>             |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| Liquid Assets Ratio                    | -0.0237***<br>(0.00486) |                                | -0.00594***<br>(0.00201)  | -0.0291***<br>(0.00337) |                                | -0.00761***<br>(0.00169)  | -0.00936<br>(0.0120)     |                                | -0.00118<br>(0.00185)     | -0.0324***<br>(0.00265)   |                                 | -0.0101***<br>(0.000659)  |
| <i>INSTRUMENTS</i>                     |                         |                                |                           |                         |                                |                           |                          |                                |                           |                           |                                 |                           |
| Regulatory Flexibility                 |                         | -2.702***<br>(0.665)           |                           |                         | -2.748***<br>(0.650)           |                           |                          | -2.772***<br>(0.651)           |                           |                           | -2.816***<br>(0.637)            |                           |
| Equity Assets Ratio                    |                         | 0.440**<br>(0.197)             |                           |                         | 0.412**<br>(0.195)             |                           |                          | 0.395*<br>(0.209)              |                           |                           | 0.358*<br>(0.203)               |                           |
| BANK CONTROLS                          | YES                     | YES                            | YES                       | YES                     | YES                            | YES                       | YES                      | YES                            | YES                       | YES                       | YES                             | YES                       |
| MACRO CONTROLS                         | YES                     | YES                            | YES                       | YES                     | YES                            | YES                       | YES                      | YES                            | YES                       | YES                       | YES                             | YES                       |
| Observations                           | 490                     | 490                            | 490                       | 490                     | 490                            | 490                       | 490                      | 490                            | 490                       | 490                       | 490                             | 490                       |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.27 MLE IV Probit for Liquid Assets Ratio (Large Banks)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff.  | (2)<br>Liq Assets<br>Red. Form | (3)<br>SUPP<br>AME      | (4)<br>RECAP<br>Coeff. | (5)<br>Liq Assets<br>Red. Form | (6)<br>RECAP<br>AME     | (7)<br>GUAR<br>Coeff.  | (8)<br>Liq Assets<br>Red. Form | (9)<br>GUAR<br>AME      | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Liq Assets<br>Red. Form | (12)<br>LIQSUPP<br>AME |
|--|------------------------|--------------------------------|-------------------------|------------------------|--------------------------------|-------------------------|------------------------|--------------------------------|-------------------------|---------------------------|---------------------------------|------------------------|
| <b>Panel A: Overall Indicator</b>      |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| <i>BALANCE SHEET MEAS.</i>             |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| Liquid Assets Ratio                    | 0.0201***<br>(0.00584) |                                | 0.00654***<br>(0.00169) | 0.0179**<br>(0.00698)  |                                | 0.00576***<br>(0.00205) | 0.0219***<br>(0.00546) |                                | 0.00658***<br>(0.00163) | 0.0245**<br>(0.0113)      |                                 | 0.00332<br>(0.210)     |
| <i>INSTRUMENTS</i>                     |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| Overall Indicator                      |                        | 0.844***<br>(0.310)            |                         |                        | 0.758**<br>(0.333)             |                         |                        | 0.566**<br>(0.275)             |                         |                           | 0.601<br>(0.428)                |                        |
| Equity Assets Ratio                    |                        | -4.499***<br>(1.219)           |                         |                        | -4.685***<br>(1.238)           |                         |                        | -4.970***<br>(1.206)           |                         |                           | -4.931***<br>(1.268)            |                        |
| <b>Panel B: Supervisory Discretion</b> |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| <i>BALANCE SHEET MEAS.</i>             |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| Liquid Assets Ratio                    | 0.0203***<br>(0.00576) |                                | 0.00662***<br>(0.00167) | 0.0178**<br>(0.00706)  |                                | 0.00575***<br>(0.00208) | 0.0221***<br>(0.00542) |                                | 0.00662***<br>(0.00162) | 0.0247**<br>(0.0110)      |                                 | 0.00315<br>(0.115)     |
| <i>INSTRUMENTS</i>                     |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| Supervisory Discretion                 |                        | 1.117***<br>(0.414)            |                         |                        | 0.954**<br>(0.449)             |                         |                        | 0.739**<br>(0.370)             |                         |                           | 0.700<br>(0.580)                |                        |
| Equity Assets Ratio                    |                        | -4.183***<br>(1.223)           |                         |                        | -4.486***<br>(1.249)           |                         |                        | -4.770***<br>(1.200)           |                         |                           | -4.811***<br>(1.282)            |                        |
| <b>Panel C: Regulatory Flexibility</b> |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| <i>BALANCE SHEET MEAS.</i>             |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| Liquid Assets Ratio                    | 0.0182***<br>(0.00693) |                                | 0.00597***<br>(0.00205) | 0.0169**<br>(0.00775)  |                                | 0.00546**<br>(0.00230)  | 0.0220***<br>(0.00558) |                                | 0.00659***<br>(0.00167) | 0.0239**<br>(0.0119)      |                                 | 0.00273<br>(0.138)     |
| <i>INSTRUMENTS</i>                     |                        |                                |                         |                        |                                |                         |                        |                                |                         |                           |                                 |                        |
| Regulatory Flexibility                 |                        | 1.316*<br>(0.736)              |                         |                        | 1.316*<br>(0.781)              |                         |                        | 0.950<br>(0.614)               |                         |                           | 1.164<br>(0.989)                |                        |
| Equity Assets Ratio                    |                        | -5.166***<br>(1.268)           |                         |                        | -5.166***<br>(1.272)           |                         |                        | -5.245***<br>(1.268)           |                         |                           | -5.210***<br>(1.276)            |                        |
| BANK CONTROLS                          | YES                    | YES                            | YES                     | YES                    | YES                            | YES                     | YES                    | YES                            | YES                     | YES                       | YES                             | YES                    |
| MACRO CONTROLS                         | YES                    | YES                            | YES                     | YES                    | YES                            | YES                     | YES                    | YES                            | YES                     | YES                       | YES                             | YES                    |
| Observations                           | 136                    | 136                            | 136                     | 136                    | 136                            | 136                     | 136                    | 136                            | 136                     | 136                       | 136                             | 136                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.28 MLE IV Probit for Liquid Assets Ratio (Medium and Small Banks)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff.   | (2)<br>Liq Assets<br>Red. Form | (3)<br>SUPP<br>AME       | (4)<br>RECAP<br>Coeff.  | (5)<br>Liq Assets<br>Red. Form | (6)<br>RECAP<br>AME      | (7)<br>GUAR<br>Coeff.   | (8)<br>Liq Assets<br>Red. Form | (9)<br>GUAR<br>AME       | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Liq Assets<br>Red. Form | (12)<br>LIQSUPP<br>AME  |
|--|-------------------------|--------------------------------|--------------------------|-------------------------|--------------------------------|--------------------------|-------------------------|--------------------------------|--------------------------|---------------------------|---------------------------------|-------------------------|
| <b>Panel A: Overall Indicator</b>      |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| Liquid Assets Ratio                    | -0.0307***<br>(0.00172) |                                | -0.00945***<br>(0.00120) | -0.0332***<br>(0.00218) |                                | -0.00956***<br>(0.00108) | -0.0292***<br>(0.00348) |                                | -0.00952***<br>(0.00144) | -0.0335***<br>(0.00418)   |                                 | -0.0100***<br>(0.00113) |
| <i>INSTRUMENTS</i>                     |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| Overall Indicator                      |                         | -0.486<br>(0.305)              |                          |                         | -0.570*<br>(0.307)             |                          |                         | -0.273<br>(0.424)              |                          |                           | -0.486<br>(0.325)               |                         |
| Equity Assets Ratio                    |                         | 0.315*<br>(0.185)              |                          |                         | 0.240<br>(0.187)               |                          |                         | 0.358*<br>(0.196)              |                          |                           | 0.315<br>(0.194)                |                         |
| <b>Panel B: Supervisory Discretion</b> |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| Liquid Assets Ratio                    | 0.0270***<br>(0.00535)  |                                | 0.00658**<br>(0.00292)   | 0.0258***<br>(0.00472)  |                                | 0.00650***<br>(0.00224)  | 0.0314***<br>(0.00221)  |                                | 0.00648*<br>(0.00339)    | 0.0275***<br>(0.00431)    |                                 | 0.00715***<br>(0.00235) |
| <i>INSTRUMENTS</i>                     |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| Supervisory Discretion                 |                         | 0.624<br>(0.463)               |                          |                         | 0.643<br>(0.427)               |                          |                         | 0.641<br>(0.441)               |                          |                           | 0.608<br>(0.472)                |                         |
| Equity Assets Ratio                    |                         | 0.0385<br>(0.187)              |                          |                         | 0.0625<br>(0.142)              |                          |                         | 0.0593<br>(0.207)              |                          |                           | 0.0234<br>(0.156)               |                         |
| <b>Panel C: Regulatory Flexibility</b> |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| <i>BALANCE SHEET MEAS.</i>             |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| Liquid Assets Ratio                    | -0.0195***<br>(0.00549) |                                | -0.00326**<br>(0.00155)  | -0.0285***<br>(0.00559) |                                | -0.00454**<br>(0.00178)  | -0.00943<br>(0.0103)    |                                | -0.000700<br>(0.00123)   | -0.0355***<br>(0.00727)   |                                 | -0.0108<br>(0.0179)     |
| <i>INSTRUMENTS</i>                     |                         |                                |                          |                         |                                |                          |                         |                                |                          |                           |                                 |                         |
| Regulatory Flexibility                 |                         | -4.144***<br>(0.751)           |                          |                         | -4.171***<br>(0.746)           |                          |                         | -4.146***<br>(0.752)           |                          |                           | -4.184***<br>(0.745)            |                         |
| Equity Assets Ratio                    |                         | 0.425**<br>(0.195)             |                          |                         | 0.401**<br>(0.195)             |                          |                         | 0.424**<br>(0.198)             |                          |                           | 0.388*<br>(0.199)               |                         |
| BANK CONTROLS                          | YES                     | YES                            | YES                      | YES                     | YES                            | YES                      | YES                     | YES                            | YES                      | YES                       | YES                             | YES                     |
| MACRO CONTROLS                         | YES                     | YES                            | YES                      | YES                     | YES                            | YES                      | YES                     | YES                            | YES                      | YES                       | YES                             | YES                     |
| Observations                           | 354                     | 354                            | 354                      | 354                     | 354                            | 354                      | 354                     | 354                            | 354                      | 354                       | 354                             | 354                     |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.29 MLE IV Probit for Government Securities Ratio (Overall Sample)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff. | (2)<br>Gov Sec<br>Red. Form | (3)<br>SUPP<br>AME     | (4)<br>RECAP<br>Coeff. | (5)<br>Gov Sec<br>Red. Form | (6)<br>RECAP<br>AME    | (7)<br>GUAR<br>Coeff. | (8)<br>Gov Sec<br>Red. Form | (9)<br>GUAR<br>AME     | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Gov Sec<br>Red. Form | (12)<br>LIQSUPP<br>AME |
|--|-----------------------|-----------------------------|------------------------|------------------------|-----------------------------|------------------------|-----------------------|-----------------------------|------------------------|---------------------------|------------------------------|------------------------|
| <b>Panel A: Overall Indicator</b>      |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.194***<br>(0.0144)  |                             | 0.0509***<br>(0.00760) | 0.190***<br>(0.0163)   |                             | 0.0471***<br>(0.00812) | 0.208***<br>(0.00743) |                             | 0.0619***<br>(0.00237) | 0.210***<br>(0.00778)     |                              | 0.0543***<br>(0.00461) |
| <i>INSTRUMENTS</i>                     |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Overall Indicator                      |                       | 0.106**<br>(0.0502)         |                        |                        | 0.122***<br>(0.0473)        |                        |                       | 0.00800<br>(0.00954)        |                        |                           | 0.125***<br>(0.0464)         |                        |
| Equity Assets Ratio                    |                       | -0.0618*<br>(0.0340)        |                        |                        | -0.0411<br>(0.0359)         |                        |                       | -0.0466<br>(0.0452)         |                        |                           | -0.0330<br>(0.0278)          |                        |
| <b>Panel B: Supervisory Discretion</b> |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.193***<br>(0.0151)  |                             | 0.0498***<br>(0.00762) | 0.184***<br>(0.0212)   |                             | 0.0439***<br>(0.00953) | 0.208***<br>(0.00745) |                             | 0.0615***<br>(0.00267) | 0.213***<br>(0.00980)     |                              | 0.0478***<br>(0.00926) |
| <i>INSTRUMENTS</i>                     |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Supervisory Discretion                 |                       | 0.145**<br>(0.0631)         |                        |                        | 0.158***<br>(0.0612)        |                        |                       | 0.0151<br>(0.0178)          |                        |                           | 0.154**<br>(0.0615)          |                        |
| Equity Assets Ratio                    |                       | -0.0497<br>(0.0344)         |                        |                        | -0.0322<br>(0.0374)         |                        |                       | -0.0509<br>(0.0450)         |                        |                           | -0.0385<br>(0.0354)          |                        |
| <b>Panel C: Regulatory Flexibility</b> |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.204***<br>(0.00941) |                             | 0.0589***<br>(0.00597) | 0.200***<br>(0.0130)   |                             | 0.0544***<br>(0.00864) | 0.208***<br>(0.00740) |                             | 0.0624***<br>(0.00214) | 0.209***<br>(0.00772)     |                              | 0.0600***<br>(0.00350) |
| <i>INSTRUMENTS</i>                     |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Regulatory Flexibility                 |                       | 0.0632<br>(0.0685)          |                        |                        | 0.138<br>(0.102)            |                        |                       | 0.00657<br>(0.0104)         |                        |                           | 0.163<br>(0.104)             |                        |
| Equity Assets Ratio                    |                       | -0.0512<br>(0.0416)         |                        |                        | -0.0441<br>(0.0340)         |                        |                       | -0.0338<br>(0.0450)         |                        |                           | -0.0244<br>(0.0294)          |                        |
| BANK CONTROLS                          | YES                   | YES                         | YES                    | YES                    | YES                         | YES                    | YES                   | YES                         | YES                    | YES                       | YES                          | YES                    |
| MACRO CONTROLS                         | YES                   | YES                         | YES                    | YES                    | YES                         | YES                    | YES                   | YES                         | YES                    | YES                       | YES                          | YES                    |
| Observations                           | 395                   | 395                         | 395                    | 395                    | 395                         | 395                    | 395                   | 395                         | 395                    | 395                       | 395                          | 395                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.30 MLE IV Probit for Government Securities Ratio (Large Banks)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff. | (2)<br>Gov Sec<br>Red. Form | (3)<br>SUPP<br>AME     | (4)<br>RECAP<br>Coeff. | (5)<br>Gov Sec<br>Red. Form | (6)<br>RECAP<br>AME    | (7)<br>GUAR<br>Coeff. | (8)<br>Gov Sec<br>Red. Form | (9)<br>GUAR<br>AME     | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Gov Sec<br>Red. Form | (12)<br>LIQSUPP<br>AME |
|--|-----------------------|-----------------------------|------------------------|------------------------|-----------------------------|------------------------|-----------------------|-----------------------------|------------------------|---------------------------|------------------------------|------------------------|
| <b>Panel A: Overall Indicator</b>      |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.165***<br>(0.0247)  |                             | 0.0483***<br>(0.00534) | 0.157***<br>(0.0341)   |                             | 0.0452***<br>(0.00777) | 0.183***<br>(0.0181)  |                             | 0.0480***<br>(0.00567) | -0.00959<br>(935.7)       |                              | -0.000556<br>(53.52)   |
| <i>INSTRUMENTS</i>                     |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Overall Indicator                      |                       | 0.122**<br>(0.0616)         |                        |                        | 0.118*<br>(0.0640)          |                        |                       | 0.0785<br>(0.0548)          |                        |                           | 0.104<br>(0.0790)            |                        |
| Equity Assets Ratio                    |                       | -0.359*<br>(0.198)          |                        |                        | -0.377*<br>(0.211)          |                        |                       | -0.459**<br>(0.212)         |                        |                           | -0.417*<br>(0.238)           |                        |
| <b>Panel B: Supervisory Discretion</b> |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.169***<br>(0.0229)  |                             | 0.0493***<br>(0.00497) | 0.160***<br>(0.0328)   |                             | 0.0461***<br>(0.00750) | 0.184***<br>(0.0171)  |                             | 0.0486***<br>(0.00537) | -0.00355<br>(2,502)       |                              | -0.000193<br>(137.0)   |
| <i>INSTRUMENTS</i>                     |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Supervisory Discretion                 |                       | 0.156*<br>(0.0822)          |                        |                        | 0.145*<br>(0.0834)          |                        |                       | 0.102<br>(0.0704)           |                        |                           | 0.114<br>(0.107)             |                        |
| Equity Assets Ratio                    |                       | -0.287<br>(0.190)           |                        |                        | -0.327<br>(0.211)           |                        |                       | -0.415**<br>(0.208)         |                        |                           | -0.397*<br>(0.241)           |                        |
| <b>Panel C: Regulatory Flexibility</b> |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.153***<br>(0.0374)  |                             | 0.0454***<br>(0.00828) | 0.144***<br>(0.0478)   |                             | 0.0422***<br>(0.0110)  | 0.183***<br>(0.0188)  |                             | 0.0480***<br>(0.00611) | 0.0670<br>(70,039)        |                              | 0.00269<br>(2,899)     |
| <i>INSTRUMENTS</i>                     |                       |                             |                        |                        |                             |                        |                       |                             |                        |                           |                              |                        |
| Regulatory Flexibility                 |                       | 0.201<br>(0.142)            |                        |                        | 0.218<br>(0.154)            |                        |                       | 0.126<br>(0.119)            |                        |                           | 0.227<br>(0.185)             |                        |
| Equity Assets Ratio                    |                       | -0.483**<br>(0.227)         |                        |                        | -0.474**<br>(0.228)         |                        |                       | -0.497**<br>(0.235)         |                        |                           | -0.469*<br>(0.240)           |                        |
| BANK CONTROLS                          | YES                   | YES                         | YES                    | YES                    | YES                         | YES                    | YES                   | YES                         | YES                    | YES                       | YES                          | YES                    |
| MACRO CONTROLS                         | YES                   | YES                         | YES                    | YES                    | YES                         | YES                    | YES                   | YES                         | YES                    | YES                       | YES                          | YES                    |
| Observations                           | 121                   | 121                         | 121                    | 121                    | 121                         | 121                    | 121                   | 121                         | 121                    | 121                       | 121                          | 121                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Appendix Table 3.31 MLE IV Probit for Government Securities Ratio (Medium and Small Banks)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff. | (2)<br>Gov Sec<br>Red. Form | (3)<br>SUPP<br>AME    | (4)<br>RECAP<br>Coeff. | (5)<br>Gov Sec<br>Red. Form | (6)<br>RECAP<br>AME   | (7)<br>GUAR<br>Coeff. | (8)<br>Gov Sec<br>Red. Form | (9)<br>GUAR<br>AME     | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Gov Sec<br>Red. Form | (12)<br>LIQSUPP<br>AME |
|--|-----------------------|-----------------------------|-----------------------|------------------------|-----------------------------|-----------------------|-----------------------|-----------------------------|------------------------|---------------------------|------------------------------|------------------------|
| <b>Panel A: Overall Indicator</b>      |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.207***<br>(0.0189)  |                             | 0.0488***<br>(0.0139) | 0.208***<br>(0.0159)   |                             | 0.0471***<br>(0.0118) | 0.197***<br>(0.0421)  |                             | 0.0320<br>(0.0255)     | 0.222***<br>(0.0110)      |                              | 0.0499***<br>(0.0121)  |
| <i>INSTRUMENTS</i>                     |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| Overall Indicator                      |                       | 0.114*<br>(0.0626)          |                       |                        | 0.125**<br>(0.0589)         |                       |                       | 0.114<br>(0.0694)           |                        |                           | 0.117*<br>(0.0596)           |                        |
| Equity Assets Ratio                    |                       | -0.0351<br>(0.0328)         |                       |                        | -0.0178<br>(0.0302)         |                       |                       | -0.0353<br>(0.0429)         |                        |                           | -0.0324<br>(0.0278)          |                        |
| <b>Panel B: Supervisory Discretion</b> |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.206***<br>(0.0210)  |                             | 0.0465***<br>(0.0145) | 0.205***<br>(0.0199)   |                             | 0.0430***<br>(0.0131) | 0.207***<br>(0.0268)  |                             | 0.0402*<br>(0.0234)    | 0.222***<br>(0.0121)      |                              | 0.0465***<br>(0.0138)  |
| <i>INSTRUMENTS</i>                     |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| Supervisory Discretion                 |                       | 0.149*<br>(0.0776)          |                       |                        | 0.159**<br>(0.0744)         |                       |                       | 0.138<br>(0.0909)           |                        |                           | 0.148*<br>(0.0762)           |                        |
| Equity Assets Ratio                    |                       | -0.0267<br>(0.0338)         |                       |                        | -0.00913<br>(0.0325)        |                       |                       | -0.0352<br>(0.0413)         |                        |                           | -0.0276<br>(0.0297)          |                        |
| <b>Panel C: Regulatory Flexibility</b> |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| Govern. Securities Ratio               | 0.217***<br>(0.0128)  |                             | 0.0617***<br>(0.0138) | 0.214***<br>(0.0134)   |                             | 0.0582***<br>(0.0132) | 0.220***<br>(0.00836) |                             | 0.0680***<br>(0.00285) | 0.220***<br>(0.00126)     |                              | 0.0671***<br>(0.00456) |
| <i>INSTRUMENTS</i>                     |                       |                             |                       |                        |                             |                       |                       |                             |                        |                           |                              |                        |
| Regulatory Flexibility                 |                       | 0.0765<br>(0.121)           |                       |                        | 0.137<br>(0.132)            |                       |                       | 0.00202<br>(0.0101)         |                        |                           | 0.146<br>(0.173)             |                        |
| Equity Assets Ratio                    |                       | -0.0285<br>(0.0343)         |                       |                        | -0.0159<br>(0.0248)         |                       |                       | -0.00965<br>(0.0458)        |                        |                           | -0.000443<br>(0.000597)      |                        |
| BANK CONTROLS                          | YES                   | YES                         | YES                   | YES                    | YES                         | YES                   | YES                   | YES                         | YES                    | YES                       | YES                          | YES                    |
| MACRO CONTROLS                         | YES                   | YES                         | YES                   | YES                    | YES                         | YES                   | YES                   | YES                         | YES                    | YES                       | YES                          | YES                    |
| Observations                           | 274                   | 274                         | 274                   | 274                    | 274                         | 274                   | 274                   | 274                         | 274                    | 274                       | 274                          | 274                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.32 MLE IV Probit for NPL Ratio (Overall Sample)**

| VARIABLES                              | (1)                  | (2)                       | (3)                   | (4)                  | (5)                  | (6)                  | (7)                   | (8)                       | (9)                    | (10)                  | (11)                    | (12)                  |
|--|----------------------|---------------------------|-----------------------|----------------------|----------------------|----------------------|-----------------------|---------------------------|------------------------|-----------------------|-------------------------|-----------------------|
|  | SUPP                 | NPL Ratio                 | SUPP                  | RECAP                | NPL Ratio            | RECAP                | GUAR                  | NPL Ratio                 | GUAR                   | LIQSUPP               | NPL Ratio               | LIQSUPP               |
|  | Coeff.               | Red. Form                 | AME                   | Coeff.               | Red. Form            | AME                  | Coeff.                | Red. Form                 | AME                    | Coeff.                | Red. Form               | AME                   |
| <b>Panel A: Overall Indicator</b>      |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| <i>BALANCE SHEET MEAS.</i>             |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| NPL Ratio                              | 0.511***<br>(0.0424) |                           | 0.148***<br>(0.0207)  | 0.501***<br>(0.0510) |                      | 0.135***<br>(0.0223) | 0.521***<br>(0.0410)  |                           | 0.161***<br>(0.00922)  | 0.521***<br>(0.0228)  |                         | 0.153***<br>(0.00769) |
| <i>INSTRUMENTS</i>                     |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| Overall Indicator                      |                      | 0.0290<br>(0.0301)        |                       |                      | 0.0409**<br>(0.0203) |                      |                       | 0.000162<br>(0.000105)    |                        |                       | 0.0365*<br>(0.0199)     |                       |
| Equity Assets Ratio                    |                      | -0.0182<br>(0.0153)       |                       |                      | -0.00426<br>(0.0178) |                      |                       | -0.00194***<br>(0.000525) |                        |                       | -0.0124<br>(0.00947)    |                       |
| <b>Panel B: Supervisory Discretion</b> |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| <i>BALANCE SHEET MEAS.</i>             |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| NPL Ratio                              | 0.509***<br>(0.0378) |                           | 0.147***<br>(0.0161)  | 0.497***<br>(0.0563) |                      | 0.133***<br>(0.0238) | 0.521***<br>(0.0685)  |                           | 0.161***<br>(0.0149)   | 0.526***<br>(0.0281)  |                         | 0.142***<br>(0.0187)  |
| <i>INSTRUMENTS</i>                     |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| Supervisory Discretion                 |                      | 0.0444<br>(0.0302)        |                       |                      | 0.0536**<br>(0.0259) |                      |                       | 0.000207<br>(0.000142)    |                        |                       | 0.0499*<br>(0.0271)     |                       |
| Equity Assets Ratio                    |                      | -0.0138<br>(0.0150)       |                       |                      | -0.00124<br>(0.0181) |                      |                       | -0.00176***<br>(0.000534) |                        |                       | -0.00840<br>(0.0144)    |                       |
| <b>Panel C: Regulatory Flexibility</b> |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| <i>BALANCE SHEET MEAS.</i>             |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| NPL Ratio                              | 0.521***<br>(0.0269) |                           | 0.161***<br>(0.00708) | 0.523***<br>(0.0409) |                      | 0.160***<br>(0.0122) | -0.520***<br>(0.0225) |                           | -0.162***<br>(0.00491) | 0.522***<br>(0.00170) |                         | 0.159***<br>(0.00114) |
| <i>INSTRUMENTS</i>                     |                      |                           |                       |                      |                      |                      |                       |                           |                        |                       |                         |                       |
| Regulatory Flexibility                 |                      | 0.000325<br>(0.000252)    |                       |                      | 0.00346<br>(0.0729)  |                      |                       | -0.00202<br>(0.00346)     |                        |                       | 0.0505<br>(0.0316)      |                       |
| Equity Assets Ratio                    |                      | -0.000727**<br>(0.000330) |                       |                      | -0.00244<br>(0.0472) |                      |                       | 0.0158<br>(0.0241)        |                        |                       | -0.000812<br>(0.000526) |                       |
| BANK CONTROLS                          | YES                  | YES                       | YES                   | YES                  | YES                  | YES                  | YES                   | YES                       | YES                    | YES                   | YES                     | YES                   |
| MACRO CONTROLS                         | YES                  | YES                       | YES                   | YES                  | YES                  | YES                  | YES                   | YES                       | YES                    | YES                   | YES                     | YES                   |
| Observations                           | 272                  | 272                       | 272                   | 272                  | 272                  | 272                  | 272                   | 272                       | 272                    | 272                   | 272                     | 272                   |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.33 MLE IV Probit for Residential Mortgages/Total Assets Ratio (Overall Sample)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff. | (2)<br>Mort./Assets<br>Red. Form | (3)<br>SUPP<br>AME  | (4)<br>RECAP<br>Coeff. | (5)<br>Mort./Assets<br>Red. Form | (6)<br>RECAP<br>AME | (7)<br>GUAR<br>Coeff. | (8)<br>Mort./Assets<br>Red. Form | (9)<br>GUAR<br>AME   | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Mort./Assets<br>Red. Form | (12)<br>LIQSUPP<br>AME |
|--|-----------------------|----------------------------------|---------------------|------------------------|----------------------------------|---------------------|-----------------------|----------------------------------|----------------------|---------------------------|-----------------------------------|------------------------|
| <b>Panel A: Overall Indicator</b>      |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| Resid. Mort./Total Assets              | 5.137***<br>(1.020)   |                                  | 1.409***<br>(0.351) | 5.004***<br>(1.466)    |                                  | 1.335***<br>(0.513) | 5.432***<br>(0.477)   |                                  | 1.531***<br>(0.0938) | 5.338***<br>(0.419)       |                                   | 1.505***<br>(0.0643)   |
| <i>INSTRUMENTS</i>                     |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| Overall Indicator                      |                       | 0.00481<br>(0.00308)             |                     |                        | 0.00477<br>(0.00321)             |                     |                       | 0.00210<br>(0.00191)             |                      |                           | 0.00272<br>(0.00460)              |                        |
| Equity Assets Ratio                    |                       | -0.0127<br>(0.0114)              |                     |                        | -0.0130<br>(0.0126)              |                     |                       | -0.0188**<br>(0.00955)           |                      |                           | -0.000574<br>(0.00229)            |                        |
| <b>Panel B: Supervisory Discretion</b> |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| Resid. Mort./Total Assets              | 5.331***<br>(0.716)   |                                  | 1.499***<br>(0.228) | 5.257***<br>(1.115)    |                                  | 1.444***<br>(0.417) | 5.445***<br>(0.478)   |                                  | 1.532***<br>(0.0936) | 5.259<br>(0)              |                                   | 1.492***<br>(0.0129)   |
| <i>INSTRUMENTS</i>                     |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| Supervisory Discretion                 |                       | 0.00673<br>(0.00461)             |                     |                        | 0.00671<br>(0.00449)             |                     |                       | 0.00214<br>(0.00266)             |                      |                           | 0.00414***<br>(0.000928)          |                        |
| Equity Assets Ratio                    |                       | -0.00732<br>(0.0113)             |                     |                        | -0.00816<br>(0.0138)             |                     |                       | -0.0181*<br>(0.00947)            |                      |                           | -3.03e-05<br>(0.000140)           |                        |
| <b>Panel C: Regulatory Flexibility</b> |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| Resid. Mort./Total Assets              | 3.936<br>(2.482)      |                                  | 0.998<br>(0.721)    | 3.380<br>(3.229)       |                                  | 0.831<br>(0.854)    | 5.450***<br>(0.470)   |                                  | 1.537***<br>(0.0902) | 5.258***<br>(0.398)       |                                   | 1.498***<br>(0.0673)   |
| <i>INSTRUMENTS</i>                     |                       |                                  |                     |                        |                                  |                     |                       |                                  |                      |                           |                                   |                        |
| Regulatory Flexibility                 |                       | 0.00493<br>(0.00682)             |                     |                        | 0.00499<br>(0.00734)             |                     |                       | 0.00485<br>(0.00389)             |                      |                           | 0.00122<br>(0.00764)              |                        |
| Equity Assets Ratio                    |                       | -0.0199*<br>(0.0102)             |                     |                        | -0.0199*<br>(0.0103)             |                     |                       | -0.0199**<br>(0.0101)            |                      |                           | -8.04e-05<br>(0.000777)           |                        |
| BANK CONTROLS                          | YES                   | YES                              | YES                 | YES                    | YES                              | YES                 | YES                   | YES                              | YES                  | YES                       | YES                               | YES                    |
| MACRO CONTROLS                         | YES                   | YES                              | YES                 | YES                    | YES                              | YES                 | YES                   | YES                              | YES                  | YES                       | YES                               | YES                    |
| Observations                           | 107                   | 107                              | 107                 | 107                    | 107                              | 107                 | 107                   | 107                              | 107                  | 107                       | 107                               | 107                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Appendix Table 3.34 MLE IV Probit for Corporate Loans/Total Assets Ratio (Overall Sample)**

| VARIABLES                              | (1)<br>SUPP<br>Coeff. | (2)<br>Gov Sec<br>Red. Form | (3)<br>SUPP<br>AME    | (4)<br>RECAP<br>Coeff. | (5)<br>Gov Sec<br>Red. Form | (6)<br>RECAP<br>AME   | (7)<br>GUAR<br>Coeff. | (8)<br>Gov Sec<br>Red. Form | (9)<br>GUAR<br>AME    | (10)<br>LIQSUPP<br>Coeff. | (11)<br>Gov Sec<br>Red. Form | (12)<br>LIQSUPP<br>AME |
|--|-----------------------|-----------------------------|-----------------------|------------------------|-----------------------------|-----------------------|-----------------------|-----------------------------|-----------------------|---------------------------|------------------------------|------------------------|
| <b>Panel A: Overall Indicator</b>      |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| Corp. Loans/Total Assets               | -4.642***<br>(0.262)  |                             | -1.324***<br>(0.0406) | -4.606***<br>(0.268)   |                             | -1.320***<br>(0.0413) | -4.664***<br>(0.260)  |                             | -1.326***<br>(0.0404) | -4.643***<br>(0.259)      |                              | -1.320***<br>(0.0404)  |
| <i>INSTRUMENTS</i>                     |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| Overall Indicator                      |                       | -0.000382<br>(0.000504)     |                       |                        | -0.000255<br>(0.000485)     |                       |                       | -0.000448<br>(0.000465)     |                       |                           | -0.00221<br>(0.00226)        |                        |
| Equity Assets Ratio                    |                       | 0.00300<br>(0.00243)        |                       |                        | 0.00299<br>(0.00242)        |                       |                       | 0.00301<br>(0.00243)        |                       |                           | 0.00185<br>(0.00212)         |                        |
| <b>Panel B: Supervisory Discretion</b> |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| Corp. Loans/Total Assets               | -4.641***<br>(0.262)  |                             | -1.324***<br>(0.0406) | -4.606***<br>(0.269)   |                             | -1.320***<br>(0.0414) | -4.664***<br>(0.260)  |                             | -1.325***<br>(0.0404) | -4.629***<br>(0.266)      |                              | -1.321***<br>(0.0413)  |
| <i>INSTRUMENTS</i>                     |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| Supervisory Discretion                 |                       | -0.000578<br>(0.000760)     |                       |                        | -0.000323<br>(0.000712)     |                       |                       | -0.000536<br>(0.000612)     |                       |                           | -0.00178<br>(0.00188)        |                        |
| Equity Assets Ratio                    |                       | 0.00293<br>(0.00243)        |                       |                        | 0.00295<br>(0.00242)        |                       |                       | 0.00294<br>(0.00243)        |                       |                           | 0.00259<br>(0.00240)         |                        |
| <b>Panel C: Regulatory Flexibility</b> |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| <i>BALANCE SHEET MEAS.</i>             |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| Corp. Loans/Total Assets               | -4.645***<br>(0.262)  |                             | -1.325***<br>(0.0406) | -4.610***<br>(0.268)   |                             | -1.321***<br>(0.0412) | -4.670***<br>(0.260)  |                             | -1.327***<br>(0.0405) | -4.641***<br>(0.262)      |                              | -1.320***<br>(0.0407)  |
| <i>INSTRUMENTS</i>                     |                       |                             |                       |                        |                             |                       |                       |                             |                       |                           |                              |                        |
| Regulatory Flexibility                 |                       | -0.000352<br>(0.000751)     |                       |                        | -0.000319<br>(0.000773)     |                       |                       | -0.000945<br>(0.000964)     |                       |                           | -0.00522<br>(0.00445)        |                        |
| Equity Assets Ratio                    |                       | 0.00301<br>(0.00242)        |                       |                        | 0.00301<br>(0.00242)        |                       |                       | 0.00308<br>(0.00241)        |                       |                           | 0.00242<br>(0.00215)         |                        |
| BANK CONTROLS                          | YES                   | YES                         | YES                   | YES                    | YES                         | YES                   | YES                   | YES                         | YES                   | YES                       | YES                          | YES                    |
| MACRO CONTROLS                         | YES                   | YES                         | YES                   | YES                    | YES                         | YES                   | YES                   | YES                         | YES                   | YES                       | YES                          | YES                    |
| Observations                           | 164                   | 164                         | 164                   | 164                    | 164                         | 164                   | 164                   | 164                         | 164                   | 164                       | 164                          | 164                    |

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 4 Conclusions and Implications for Research and Policy

The thesis analyses some key issues for the current academic and policy debate on the banking system in the European Union and in the Euro Area: the developments and the prospects for the securitisation market; the reliance of credit institutions on central bank liquidity measures for their funding over the crisis; the design of prudential regulation for bank solvency and liquidity; the setting of the prudential framework in the Banking Union. I review the main conclusions from the analysis and discuss the key implications for research and policy.

### 4.1 Securitisation, Bank Funding and Central Bank Liquidity Measures

The first two chapters investigate the securitisation behaviour of banks before and after the crisis from two complementary points of view: Chapter 2 explores – in a funding liquidity perspective - the determinants for the issuance and the retention of securitisation; while Chapter 1 – more focused on solvency issues - analyses how securitising banks managed their capital position after the issuances. The analysis on the determinants of securitisation yields some important results and implications for the developments of the ABS market and for the provision of central bank liquidity to banks in crisis times, particularly in the Euro Area<sup>244</sup>.

First, I study the relative choice across different types of secured debt instruments for bank funding decisions, estimating the relative probability to issue securitisation<sup>245</sup> versus covered bonds in relation to bank-specific characteristics, country-level macroeconomic and financial conditions. Before the crisis, banks with larger funding gap between loans and deposits, lower profitability and lower capital showed higher relative probability to securitise; while, following the crisis, capital-constrained banks with high NPL ratios presented lower relative probability to securitise. In addition, country-specific features – related to national legal systems or capital markets – were significantly relevant for bank funding decisions<sup>246</sup>.

This focus on the relative funding choice provides a novel contribution to the studies on securitisation and more generally on bank funding strategies. Most of the literature has analysed the determinants of securitisation issuances, focusing on that specific instrument type and without modelling the relative choice among different funding solutions and/or different fixed income securities. However, from the viewpoint of a bank treasury department, securitisation is

---

<sup>244</sup> The focus on monetary policy measures as potential determinants of bank funding decisions explains the focus of Chapter 2 on Euro Area banks, in relation to the liquidity provision by the Eurosystem. At the same time, similar measures to expand the access to central bank liquidity were implemented also in other monetary policy jurisdictions in Europe, for instance by the Bank of England.

<sup>245</sup> To ensure the comparability of the underlying assets, for this analysis on the relative choice between securitisation and covered bonds, I focus only on mortgage-backed securitisation.

<sup>246</sup> Though the recent negative trends in securitisation, mortgage-backed securities are still quite diffused in Netherlands, Italy or Spain, while they are almost absent in Austria or Germany as these markets are traditionally dominated by covered bonds.

just one of the possible financing sources a bank can use. Therefore, when comparing these sources from a funding cost perspective, banks may well prefer to issue other debt instruments, like covered bonds, to get wholesale funding at more favourable conditions. Or, when conducting securitisation, banks may find more convenient to retain newly issued ABSs as collateral to get central bank liquidity at low rates, than to distribute them among investors at higher spreads.

Following this perspective, I investigate the decision of securitising banks to distribute or to retain newly issued ABSs, based on bank balance sheet characteristics, monetary policy measures and interbank market developments. Aggregate stylised facts suggest that, while before the crisis Euro Area originator banks distributed most tranches of securitisation<sup>247</sup>, from mid-2007 onwards they started to retain almost all their issuances. To a partial extent, this retention behaviour could be related also to the lack of investors on the demand side. For instance, such explanation could hold for the months right after the subprime crisis in mid-2007, when investors started to have relevant concerns about the credit risk of securitisation products. However, a demand-side argument would not be able to explain why banks - well aware of this investor stigma towards securitisation already in the second half of 2007 - would have continued to issue and retain significant volumes of these products for ten years afterwards.

The persistence of this securitise-to-retain behaviour for several years after the subprime crisis raises the question whether, independently from the developments in market demand, some supply-side factors related to bank funding and balance sheet management could explain these retention decisions of originator banks. Therefore, I investigate the potential incentives coming from the very favourable conditions for central bank liquidity, particularly under stressed market conditions for interbank funding. In this context, the retention behaviour could signal an important change in the use of securitisation by originator banks: instead of getting funding from investors through the market placement of ABSs, banks could obtain central bank funding by pledging retained tranches of newly issued ABSs.

If this incentive were to be relevant for the retention decisions of originator banks, it might plausibly vary across banks in relation to their access to wholesale funding or to their availability of liquid assets. Then, for the identification strategy I exploit the heterogeneity across banks in their ex-ante balance sheet characteristics, to study how originator banks in different financial conditions changed their securitisation behaviour following a variation in the quantity or in the (relative) price of central bank liquidity. In particular, using micro data at the security-bank level, I analyse whether banks under stronger funding constraints were more

---

<sup>247</sup> In practice, before the crisis, originator banks used to retain only the equity tranche in securitisation deals.

interested in retaining newly issued ABSs, after central bank measures or interbank market developments increasing the reliance of credit institutions on monetary policy financing.

I study the introduction of the Eurosystem full allotment policy, expanding the available quantity of central bank funding: under this policy, banks could obtain the entire amount of liquidity they demanded in the refinancing operations, provided that they disposed of adequate collateral. After the full allotment introduction, Euro Area banks in pre-existing weaker funding liquidity conditions had stronger incentives to retain ABSs eligible as collateral, to increase their holdings of collateral assets for central bank liquidity operations. I also explore the price channel of an increase in interbank market spread: by reducing the relative funding costs of central bank liquidity, this may encourage the recourse to monetary policy refinancing. After a rise in interbank market rates<sup>248</sup>, originator banks in weaker liquidity position showed a larger increase in their retention of newly issued ABSs, to increase their availability of liquid assets. In both cases, this identification based on the cross-bank heterogeneity in the ex-ante liquidity conditions captures the role of liquidity constraints in shaping the decisions for securitisation retention by originator banks, to benefit from the provision in central bank funding.

Using this securitise-to-repo strategy, originator banks were able to create new collateral assets from their loan portfolios. However, this could occur to the extent banks could not directly pledge credit claims or they could do that limitedly, subject to higher valuation haircuts than for marketable assets. To further explore this collateral channel, I analyse also the extension of the Eurosystem collateral framework to additional credit claims, exploiting the heterogeneity in loan category and origination country, due to the initiative of national central banks. I show that, after this measure, Euro Area originators reduced the retention of the ABSs backed by loans newly recognised as eligible collateral, as banks could then post directly credit claims; at the same time, no change in retention was observed for the same categories of ABSs, when the national central bank of the origination country did not accept the additional credit claims, as in that case banks still needed to securitise the loans to pledge the ABSs as collateral.

This analysis contributes to our understanding of the bank-based transmission of central bank liquidity provision, particularly via bank liabilities, by analysing the changes in the funding decisions and in the debt issuance plans. Most papers on the transmission of non-standard monetary policy measures have focused their attention on the assets side of banks' balance sheets, exploring the effects on lending provision or on the composition of the securities portfolios. Nonetheless many unconventional measures of the Eurosystem, implemented in the aftermath of the global financial crisis and of the sovereign debt crisis, like the fixed-rate full allotment policy, the 3-year long-term refinancing operations or the additional credit claims

---

<sup>248</sup> Given that the pricing of ABSs as floating-rate notes is linked to a benchmark, usually defined in terms of an interbank market rate, a change in the interbank spread may be associated also with other changes in bank funding costs in case of market placement for ABSs.

framework, were primarily designed to increase the availability of central bank liquidity to banks to deal with their funding distress due to the freeze in wholesale markets.

In the global financial crisis, but also in the sovereign debt crisis<sup>249</sup>, central bank liquidity was indeed decisive in substituting other sources of bank funding, like unsecured interbank loans or the issuance of unsecured bonds. However, this strong reliance on central bank liquidity has also changed significantly the funding strategies of bank treasuries and more generally the management of bank assets and liabilities, though to a different extent across banks. As observed for securitisation, banks in weaker liquidity conditions adapted their funding strategies more than others in response to central bank measures for liquidity provision. This raises also a more general policy issue about the prospects for potential future policy normalisation: given the still significant role of central bank liquidity in bank funding strategies, the potential future phase-out from non-standard measures should avoid sudden adjustments in bank financing, as this could negatively affect also credit intermediation.

Also the future trends in the Euro Area securitisation market are related to these monetary policy developments. The retention of newly issued ABSs by originator banks in the crisis time was crucial to increase the amount of eligible collateral assets, particularly for banks with larger funding needs and less availability of liquid assets. In this perspective, the retention of entire securitisation deals was then useful to facilitate the access of banks to central bank liquidity in the logic of a lender-of-last-resort, while still fulfilling the requirement of using high-quality collateral<sup>250</sup>. However, looking beyond the crisis period, this full retention approach may prevent the realisation of some potential benefits of securitisation for the economy, like the alleviation of potential supply-induced constraints for credit provision or the (partial) redistribution of credit risk across capital markets investors, to the extent that these effects are linked to true-sale securitisations and to the consequent market placement.

More recently, some important initiatives – not explored in this analysis - have been undertaken by EU policy authorities to promote the revitalisation of the ABS market. On the monetary policy side, the ECB has been implementing the ABS Purchase Programme<sup>251</sup>, in the wider context of the Credit Easing Package before and of the Asset Purchase Programme afterwards. Also, on the disclosure requirements, the ECB now requires the issuers to disclose loan-level information on the underlying assets as a further condition for collateral eligibility.

---

<sup>249</sup> Particularly for the banks in the more vulnerable countries.

<sup>250</sup> Also, the stringent collateral eligibility requirements should have contributed to improve the quality of the new issuances for the deal structure and the underlying pool; combined with the valuation haircuts for ABS products, they should have limited the risk taken by central bank balance sheets with the acceptance of this collateral. See the discussion in Bindseil, Corsi, Sahel and Visser (2017), also with respect to the issues on the collateral framework raised by Nyborg (2017a, 2017b).

<sup>251</sup> This is supposed to operate through a price channel - contributing to a spread compression and to a reduction in bank funding costs via securitisation - and a volume channel - incentivising banks to increase the amount of securitisation issuances



On the prudential regulation side, the EU has recently adopted the STS Regulation for simple, transparent and standardised securitisation<sup>252</sup>, which entered into force in January 2019. These recent policy initiatives for the securitisation market raise some questions which could open promising avenues for future research: the availability – for the most recent years from 2014 onwards - of new granular information on loan-level data for securitisation and on securities holdings at the banking group or sector level would provide useful inputs for a more precise identification of both demand and supply factors in the market.

## 4.2 Securitisation, Bank Capital and Prudential Regulation

The possibility to pledge ABSs in central bank liquidity operations has raised incentives for the retention of securitisation by originator banks<sup>253</sup>. However, this retention may have significant implications on banks' capital position: while in case of distributed issuances originator banks can obtain capital relief (with consequent increase in their risk-adjusted capital ratios), in case of retained issuances they have to keep capital for the securitisation positions.

In Chapter 1, I examine how European originator banks managed their capital position after the issuance of different types of securitisation before and after the crisis. In the pre-crisis period (2004 Q1 - 2007 Q2), banks observed an increase in their risk-based capital ratios particularly from the transfer of assets subject to high risk weights<sup>254</sup>, thanks to the consequent reduction in risk-weighted assets. During the crisis (2007 Q3 – 2010Q4), while retaining securitisation, originator banks were still able to improve their risk-weighted capital ratios, but without reducing their leverage.

This could occur to the extent that securitisation products were subject to lower risk weights than the underlying assets<sup>255</sup>. When the originator bank retained the newly issued ABS products, the capital requirements were based on the risk weights for securitisation positions: if these were lower than the risk weights on the underlying loans, the amount of risk-weighted assets could decrease and then, for the same amount of capital, the risk-weighted capital ratio

---

<sup>252</sup> This is intended to provide a more favourable regulatory treatment for the ABSs fulfilling these criteria, and therefore to stimulate the demand from investors

<sup>253</sup> Also some liquidity measures implemented by the Bank of England during the crisis (like the Special Liquidity Scheme) contributed to incentivise the securitisation retention by originator banks. Moreover, since subsidiaries and branches of non-Euro Area banks established in the Euro Area were still monetary policy counterparties of the Eurosystem, the securitisation retention incentives related to the Eurosystem liquidity provision may have significantly affected also non-Euro Area banks. For this reason, the analysis presented in Chapter 1 is conducted for all the securitisation issuances in the EU (plus Switzerland), given the homogeneity of the prudential framework applied to banks.

<sup>254</sup> As discussed in Milne (2008), the transfer of risky assets to the SPV may not necessarily imply a significant transfer of the credit risk, provided that the securitisation deal – for its tranche structure - concentrates the risk mostly within the equity tranche or at most the mezzanine tranche. To the extent that the equity tranche is retained by the originator, even if the senior and mezzanine tranches are distributed among investors, the transfer of credit risk realised through securitisation may then be limited.

<sup>255</sup> See Acharya and Richardson (2009) for a discussion on the regulatory arbitrage incentives related to the holdings of retained securitisation products versus the underlying loans.

could increase. At the same time, the (hypothetical) leverage ratio of the bank would not change, given that it would be computed for all exposures without charging different weights.

Given the role of liquidity constraints in the retention behaviour for collateral purposes, as discussed in Chapter 2, I exploit the heterogeneity across banks in their ex-ante funding liquidity position. In this way, I explore whether originator banks subject to stronger funding constraints increased relatively more their risk-adjusted capital ratios when conducting securitisation during the crisis. I find that originator banks with less liquid assets, when sponsoring securitisation, exploited this regulatory arbitrage opportunity more than other banks.

Also, I classify the securitisation products by type of underlying assets and by credit ratings, in order to distinguish the tranches eligible and non-eligible for the collateral framework. This is to investigate whether this regulatory arbitrage behaviour took place for those securitisation products that originator banks could retain for collateral purposes. The empirical evidence supports this hypothesis: indeed, the marginal increase in the risk-based capital ratio after the issuance of non-eligible securitisation was constant for all banks, independently from their liquidity position; while the marginal increase in the risk-adjusted capital ratio after the issuance of eligible ABSs was increasing for banks in weaker funding liquidity conditions. This suggests that originator banks under stronger funding constraints managed the securitisation process for eligible ABSs in a way to exploit the capital arbitrage opportunities from the prudential framework.

These results may be relevant in a policy perspective for various reasons. First, the study suggests that some measures for monetary policy implementation may have significant spillovers in the domain of prudential policy and supervision. For instance, the determination of central bank eligible collateral - by raising incentives for banks' balance sheet management - could have relevant implications for the risk management of originator banks. Institutions planning to use retained ABSs as eligible collateral for monetary policy operations could be interested also in minimising the capital burden of this retention. In fact, these potential regulatory arbitrage incentives seem to be less concerning now thanks to the regulatory framework for securitisation exposures, as defined in the Single Rulebook and foreseeing a neutrality principle for capital requirements<sup>256</sup>.

Moreover, the study offers insights for the reforms of prudential regulation. In the aftermath of the global financial crisis, the regulatory framework for credit institutions has come under scrutiny for its potential contribution - in the pre-crisis time - to an inadequate risk assessment in securitisation and to an excessive increase in bank leverage, as well as for the lack of liquidity requirements in prudential regulation. The international standard-setter bodies have

---

<sup>256</sup> The neutrality principle for capital requirements, as set in the Capital Requirements Regulation implementing the Basel III accord, implies that the risk weights on the securitisation exposures should be set at least as equal to the risk weights on the underlying assets.

then undertaken some regulatory initiatives to address the incoming risks for financial stability: I briefly discuss those which are directly related to the results of the analysis.

First, to address the potentially negative impact of the originate-to-distribute model on bank monitoring and lending standards, both the US and the EU introduced a 5% retention rule, in order to deal with the problem of incentive misalignment between originator and investors. In fact, the evidence suggests that on average European originator banks retained a significantly larger fraction of their securitisation issuances for potential collateral purposes. So, from this point of view, the 5% retention requirement may not be necessarily binding for most securitisation issuances: however, it is important for setting a minimum required threshold that originator banks should observe.

Also, to deal with the potential regulatory arbitrage incentives induced by the risk-weighted system in Basel II, the new prudential framework defined in Basel III has introduced a leverage ratio in addition to the existing risk-based capital ratio. The empirical analysis shows the strong complementarity between the leverage ratio and the risk-based capital ratio for prudential regulation, given that the evolution of the leverage ratio can either reveal some additional information not observable from risk-based ratios, or even contradict the evidence on bank solvency as based on the evaluation of risk-based capital.

Finally, to ensure the availability of adequate amounts of liquid assets by banks and then to reduce the risk of future liquidity crises, Basel III has introduced two liquidity requirements for banks in the form of the liquidity coverage ratio and the net stable funding ratio<sup>257</sup>. The empirical analysis highlights the strong interaction between the liquidity and the solvency positions of banks: as observed for securitisation under crisis distress, institutions with smaller amount of liquid assets showed also stronger incentives for capital regulatory arbitrage, as they tried to minimise the capital implications of their hoarding of liquid assets. Therefore, the liquidity requirements are crucial to set the appropriate incentives for the management of banks' liquidity position, but also – as observed in Chapter 2 – to reduce the onus on central banks for the provision of liquidity in situations requiring a lender-of-last-resort intervention.

### **4.3 National Differences in Banking Regulation and the Prudential Framework in the Banking Union**

The focus of the thesis on European banking provides also an interesting opportunity to exploit the pre-existing differences in the national prudential frameworks across EU countries for an empirical study on the effectiveness of prudential regulation in the prevention of banking crises. Regulation and supervision for the banking sector are designed to increase the resilience

---

<sup>257</sup> While the liquidity coverage ratio is designed to cover the short-term liquidity needs for net cash outflows in a 30-day period, the net stable funding ratio is intended to ensure the disposal of the stable funding required for a one-year period of extended stress

of banks and overall support the stability of the financial system. But with the occurrence of the financial crisis in 2008, an important academic and policy debate has developed around the question whether the prudential framework – or rather its laxness - was instrumental in spurring the crisis and whether a more stringent prudential framework could have avoided or reduced the intensity of the recent banking crises in advanced economies.

The EU framework in the pre-crisis time offers an interesting setting, as the capital requirements were disciplined via EU directives, but these rules had to be implemented at the country level by national authorities. Chapter 3 (with Angela Maddaloni) investigates the cross-country heterogeneities in capital requirements for EU banks in the run-up to the global financial crisis, based on the national implementation of the Capital Requirements Directives.

A first contribution of this study is to construct country-level indicators of the leniency in the prudential framework for EU banks ahead of the global financial crisis. We provide separate indicators for regulatory flexibility and supervisory discretion, based on two different types of national options and discretions (O&Ds), the general ones and the case-by-case ones<sup>258</sup>. Both regulatory flexibility and supervisory discretion measure the provision of a more favourable regulatory treatment, but with a key difference for prudential incentives: all the banks in a country benefit from the regulatory flexibility established by national legislators, in a context where the supervisory authority can intervene only ex-post to sanction potential excessive risk-taking; while only those banks which have been positively assessed by the supervisor for their risk management can take advantage from the waivers based on supervisory discretion, which then operates ex-ante to prevent further risk-taking by banks.

We use the above indicators of prudential regulation to investigate whether banks established in different EU countries and subject to distinct regulatory frameworks had different probability to be in distress as a consequence of the global financial crisis. We show that banks established in countries with less stringent prudential regulation were more likely to require public support during the crisis. The results suggest that the provision of a more lenient treatment may affect negatively the stability of banks both under regulatory flexibility and under supervisory discretion.

However, when developing our analysis for banks of different size, we observe that the incentive structure of these two dimensions works quite differently for large and medium-small banks. In fact, we find that supervisory discretion has more negative repercussions on the stability of large banks, as they are able to exert more influence on the outcome of the

---

<sup>258</sup> General O&Ds assign to national legislators the power to establish a more favourable regulatory treatment, on well-defined provisions, for all banks in that country (regulatory flexibility); case-by-case O&Ds attribute to national supervisors the prerogative to apply a less stringent prudential treatment, always on specific provisions for individual banks, following an ex-ante assessment of the supervisory authority (supervisory discretion).

supervisory assessment even when undertaking significant risk. On the other hand, regulatory flexibility increases the probability of bank distress particularly for medium and small banks, which in fact are not in the position to benefit from supervisory discretion as large banks also due to lack of resources.

We study the potential transmission channels for the incentives of the prudential framework via the management of bank balance sheets. “Excessive” lending, the reliance on non-interest income sources and the inadequacy of liquidity buffers were all mentioned as sources of risk that may have unraveled through the financial crisis. Using an instrumental variable approach, we focus on the component of balance sheet risk-taking explained by the prudential framework incentives and analyse how this may have affected bank resilience.

More regulatory flexibility is associated with higher share of non-interest income, lower ratios of liquid assets and larger credit provision, leading to higher probability of distress. At the same time, in jurisdictions with more supervisory discretion, banks may have been induced to control the lending amount, with positive implications on crisis resilience.

The Basel II framework did not include explicit liquidity requirement. However, we document that, in countries with more supervisory discretion, banks tended to have larger exposures to government bonds and then wider buffers of liquid assets. Also, we show that sovereign bond holdings associated with higher supervisory discretion were positively related to higher probability of bailout. Therefore, our results suggest that the existence of the sovereign-bank nexus was detrimental to the stability of the banking sector, especially in countries with high supervisory discretion, also ahead of the full unravel of sovereign debt crisis.

This analysis provides relevant policy implications for the design of the prudential framework in the Banking Union in a financial stability perspective. The study shows that in countries with pre-crisis laxer capital regulation banks proved to be less resilient in crisis times. Therefore, a more stringent prudential framework could be desirable to improve the prevention of banking crises. In an institutional setting with different countries, the key issue is how to ensure the establishment of an effective prudential framework: the level-playing field argument would suggest to define a homogeneous set of rules for all banks in all countries, to avoid a potential race to the bottom among national authorities; while the proportionality principle would recommend to design a regulatory setting where national authorities can tailor the provisions to the features of national banking systems.

The study supports the argument that the heterogeneity in the national implementation of prudential regulation might have spurred differences in the risk-taking of credit institutions across EU countries before the crisis, with negative implications on their crisis resilience. In this perspective, the establishment of a level-playing field seems to be a more effective regulatory

device, although not sufficient<sup>259</sup>, to promote the design of an appropriately stringent prudential framework, consistently with the rationale for the Single Rulebook in the Banking Union.

At the same time, the results of the analysis do not exclude that the application of the proportionality principle – for instance through options and discretions – can be consistent with financial stability objectives. This may occur when the provision of a more tailored regulatory treatment is decided by supervisory authorities based on a case-by-case assessment.

In fact, when the supervisor decides whether to apply a more favourable regulatory treatment for specific banks, this raises the incentives of banks for an ex-ante prudent management of their balance sheets, as this is a condition to obtain the regulatory waiver from the supervisor. The results obtained for the bank credit provision highlight this fundamental advantage of supervisory discretion: even when allowing for a more favourable treatment, it introduces an ex-ante supervisory control potentially able to limit excessive risk-taking.

However, the effectiveness of this incentive mechanism depends on the objective function of supervisors: if this is driven by national policy incentives other than the stability of individual banks - like ensuring a large domestic investor base for national sovereign bonds - supervisory discretion may hide more leniency towards those banks more in line with these objectives (i.e. the moral suasion argument for banks' exposures to national sovereign bonds)<sup>260</sup>.

The discussion on national options and discretions, explored in this study for an institutional framework with national supervisors, is very topical also for the current setting with the Single Supervisory Mechanism. In this context, the ECB has taken significant steps to harmonise the options and discretions still existing in the Single Rulebook, both for significant and for less significant institutions<sup>261</sup>. In both cases, the harmonisation contributed to strengthen the level-playing field. As a potential avenue for further research, it would be interesting to analyse the effects of this recent harmonisation process triggered by the ECB, to explore how the centralisation of bank supervision with the SSM and the harmonisation of prudential rules by the ECB may have contributed to reduce the cross-country differences in bank risk-taking. This would provide relevant implications for the future exercise of prudential supervision in the Banking Union.

---

<sup>259</sup> The design of a level-playing field at a supranational level may reduce some issues operating at the national level, like the forbearance of national authorities for domestic institutions, however it does not exclude a priori the potential risk of regulatory capture by lobbying activities.

<sup>260</sup> Subject to the constraints for data granularity in the pre-crisis period, potentially interesting extensions of this analysis would include the study of the composition of banks' sovereign exposures by country of issuance, to investigate the role of supervisory discretion in the sovereign home bias.

<sup>261</sup> For the significant institutions under its direct supervision, the ECB approved in 2016 a regulation for the general options and discretions and a guide for the case-by-case ones; while, for the less significant institutions, supervised by the national competent authorities, the ECB adopted in 2017 a guideline and a recommendation taking into account the principle of proportionality.

## BIBLIOGRAPHY

- Acharya V. V., S. Steffen, and L. Steinruecke (2018): “Kicking the Can Down the Road: Government Interventions in the European Banking Sector”, Working Paper
- Acharya V. V., P. Schnabl, and G. Suarez (2013): “Securitisation without Risk Transfer,” *Journal of Financial Economics*, 107 (3), 515-536
- Acharya V. V., and O. Merrouche O. (2013): “Precautionary Hoarding of Liquidity and Interbank Markets: Evidence from the Subprime Crisis”, *Review of Finance*, 17 (1), 107–160
- Acharya V. V., and M. P. Richardson (2009): “Causes of the Financial Crisis”, *Critical Review*, 21 (2-3), 195-210
- Acharya V. V. (2003), “Is the International Convergence of Capital Adequacy Regulation Desirable?”, *The Journal of Finance*, 58, 2745-2782.
- Adelino M. (2009): “How Much Do Investors Rely on Ratings? The Case of Mortgage Backed Securities,” Working paper, MIT
- Admati A., P. DeMarzo, M. Hellwig and P. Pfleiderer (2013), “Fallacies, Irrelevant Facts, and Myths in Capital Regulation: Why Bank Equity is Not Socially Expensive”, *Rock Center for Corporate Governance*, Working Paper Series No. 161
- Affinito M., and E. Tagliaferri (2010): “Why do (or did) Banks Securitize their Loans? Evidence from Italy,” *Journal of Financial Stability*, 6 (4), 189-202
- Afonso G., A. Kovner, and A. Schoar (2011), “Stressed, Not Frozen: The Federal Funds Market in the Financial Crisis”, *The Journal of Finance*, 66, 1109-1139.
- AFME (2011): “Securitisation Data Report 2010,” European Securitisation Forum
- Agarwal S., D. Lucca, A. Seru, and F. Trebbi (2014): “Inconsistent Regulators: Evidence from Banking,” *The Quarterly Journal of Economics*, 129 (2), 889-938
- Aggarwal R., and K. T. Jacques (2001): “The Impact of FDICIA and Prompt Corrective Action on Bank Capital and Risk: Estimates Using a Simultaneous Equations Model”, *Journal of Banking and Finance*, 25(6), pp.1139–1160.
- Agur I., and S. Sharma (2013): “Rules, Discretion and Macro-prudential Policy,” IMF Working Paper Series, No. 13/65
- Akerlof G. A., and R. J. Shiller (2015): “Phishing for Phools: The Economics of Manipulation and Deception”, *Princeton University Press*.
- Albertazzi U., M. Bottero, L. Gambacorta, and S. Ongena (2016): “Asymmetric Information and the Securitization of SME Loans”, Working Paper No. 1091, Bank of Italy
- Albertazzi U., G. Eramo, L. Gambacorta, and C. Salleo (2015): "Asymmetric Information in Securitization: an Empirical Assessment," *Journal of Monetary Economics*, 71, 33-49
- Altavilla A., M. Pagano, and S. Simonelli (2017): “Bank Exposures and Sovereign Stress Transmission”, *Review of Finance*, 21 (6), 2103–2139.

- Allen F., E. Carletti, and R. Marquez (2011): “Credit Market Competition and Capital Regulation,” *Review of Financial Studies*, 24 (4), 983-1018
- Almazan A., A. Martin-Oliver, and J. Saurina (2015): “Securitisation and Banks’ Capital Structure,” *Review of Corporate Finance Studies*, 4 (2), 206-238
- Altunbas Y., S. Manganelli, and D. Marqués-Ibáñez (2017): “Bank Risk during the Financial Crisis: Do Business Models Matter?,” *Journal of Financial Intermediation*, 32(C), 29-44
- Altunbas Y., L. Gambacorta, and D. Marques-Ibanez (2009): “Securitisation and the Bank Lending Channel”, *European Economic Review*, 53(8), 996-1009
- Ambrose B., M. LaCour-Little, and A. Sanders (2005): “Does Regulatory Capital Arbitrage, Reputation, or Asymmetric Information Drive Securitization?,” *Journal of Financial Services Research*, 28 (1), 113-133
- Ampudia M., T. Beck, A. Beyer, J. E. Colliard, A. Leonello, A. Maddaloni, and D. Marqués-Ibáñez (2019): “The Architecture of Supervision”, *ECB Working Paper Series*, No. 2287, May
- Angeloni I. (2014): “The SSM Sails Past the Starting Line: Seeking High-Quality Supervision and Level Playing Field”, Speech at International conference on “Start of European Banking Union: Perspectives and Challenges”, London, 10 November 2014.
- Angkinand A. P. (2009): “Banking Regulation and the Output Cost of Banking Crises,” *Journal of International Financial Markets, Institutions and Money*, 19 (2), 240-257.
- Angrist J. A., and J. S. Pischke (2009): “Mostly Harmless Econometrics. An Empiricist’s Companion”, Princeton University Press
- Argimon I., G. Arqué Castells, and F. Rodriguez Tous (2012): “Does the Intensity of Prudential Regulation Affect Banks? Evidence from the 2007-2009 Crises”, *Journal of Governance and Regulation*, 1 (3), 14-26
- Argimon I., and J. Ruiz-Valenzuela (2011): “The Effects of Regulatory Stringency and Risk Sensitivity on Banks”, *Journal of Banking Regulation*, 12 (2), 144-166
- Ashcraft A., P. Goldsmith-Pinkham, and J. Vickery (2010): “MBS Ratings and the Mortgage Credit Boom,” Federal Reserve Bank of New York Staff Report, No. 449
- Ayuso J., D. Pérez, and J. Saurina (2004): “Are Capital Buffers Pro-cyclical? Evidence from Spanish Panel Data”, *Journal of Financial Intermediation*, 13 (2), 249–264.
- Bank of England and European Central Bank (2014): “The Case for a Better Functioning Securitisation Market in the European Union,” Joint Discussion Paper
- Barrios V. E., and J. M. Blanco (2003): “The Effectiveness of Bank Capital Adequacy Regulation: A Theoretical and Empirical Approach”, *Journal of Banking and Finance*, 27 (10), 1935-1958,
- Barth J., G. Caprio, and R. Levine (2006): “Rethinking Bank Regulation: Till Angels Govern”, *Cambridge University Press*.



- Barth J., G. Caprio, and R. Levine (2004): “Bank Regulation and Supervision: What Works Best?,” *Journal of Financial Intermediation*, 13, 205–248
- Basel Committee on Banking Supervision (2009): “Report on Special Purpose Entities,” The Joint Forum, Bank for International Settlements
- Bekkum (van) S., M. Gabarro, and R. M. Irani (2018): “Does a Larger Menu Increase Appetite? Collateral Eligibility and Bank Risk-Taking”, *Review of Financial Studies*, 31 (3), 943-979
- Beltratti A., and R. M. Stulz (2012): “The Credit Crisis Around the Globe: Why Did Some Banks Perform Better?,” *Journal of Financial Economics*, 105, 1-17
- Benmelech E., and J. Dlugosz (2010): “The Credit Rating Crisis,” NBER Macro Annual 2009, 161-207.
- Benmelech E., and J. Dlugosz (2009): “The Alchemy of CDO Ratings,” *Journal of Monetary Economics*, 56, 617-634
- Berger A. N., and C. H. S. Bouwman (2013): “How Does Capital Affect Bank Performance during Financial Crises?,” *Journal of Financial Economics*, 109 (1), 146-176
- Berger A. N., R. DeYoung, M. J. Flannery, D. Lee, and O. Oztekin (2008): “How Do Large Banking Organizations Manage Their Capital Ratios?,” *Journal of Financial Services Research*, 34, 123-149
- Berger A. N., R. J. Herring, and G. P. Szego (1995): "The Role of Capital in Financial Institutions", *Journal of Banking and Finance*, 19, pp. 393-430
- Bindseil U., M. Corsi, B. Sahel, and A. Visser (2017): “The Eurosystem Collateral Framework Explained”, *ECB Occasional Paper Series*, No.189
- Blum J. (1999): “Do Capital Adequacy Requirements Reduce Risks in Banking?,” *Journal of Banking and Finance*, 23(5), 755–771
- Boesel N., C. Kool, and S. Lugo (2018): “Do European Banks with a Covered Bond Program Issue Asset-backed Securities for Funding?,” *Journal of International Money and Finance*, 81, 76-87
- Bonner C., I. Van Lelyveld and R. Zymek (2015): “Banks’ Liquidity Buffers and the Role of Liquidity Regulation,” *Journal of Financial Services Research*, 48 (3), 215-234
- Boyd J. H., and M. Gertler (1994), “The Role of Large Banks in the Recent U.S. Banking Crisis”, *Federal Reserve Bank of Minneapolis Quarterly Review*, 18, 2-21
- Boyd J. H., and D. E. Runkle (1993): “Size and Performance of Banking Firms: Testing the Predictions of Theory”, *Journal of Monetary Economics*, 31, 47-67
- Boyer P. C., and H. Kempf (2018): “Regulatory Arbitrage and the Efficiency of Banking Regulation”, *Journal of Financial Intermediation*, forthcoming

- Boyson N. M., R. Fahlenbrach, and R. M. Stulz (2016): “Why Don't All Banks Practice Regulatory Arbitrage? Evidence from Usage of Trust-Preferred Securities”, *The Review of Financial Studies*, 29 (7), 1821–1859
- Brewer III E., G. G. Kaufman and L. D. Wall (2008): “Bank Capital Ratios Across Countries: Why Do They Vary?”, *Journal of Financial Services Research*, 34, 177-201
- Brown C. O., and I. Serdar Dinc (2011): “Too Many to Fail? Evidence of Regulatory Forbearance When the Banking Sector Is Weak”, *The Review of Financial Studies*, 24 (4), 1378–1405
- Brown C. O., and I. Serdar Dinc (2005): “The Politics of Bank Failures: Evidence from Emerging Markets”, *The Quarterly Journal of Economics*, 120 (4), 1413-1444
- Buch C. M., and G. DeLong (2008), “Do Weak Supervisory Systems Encourage Bank Risk-taking?”, *Journal of Financial Stability*, 4 (1), 23-39
- Cahn C., A. Duquerroy, and W. Mullins (2017): “Unconventional Monetary Policy and Bank Lending Relationships”, Banque de France Working Paper Series, No. 659
- Calomiris C. W., and J. R. Mason (2004): “Credit Card Securitisation and Regulatory Arbitrage,” *Journal of Financial Services Research*, 26 (1), 5-27
- Calzolari G., J.-E. Colliard, and G. Loranth (2018), “Multinational Banks and Supranational Supervision”, *Review of Financial Studies*, forthcoming
- Camba-Mendez G., S. Carbo-Valverde, and D. Rodríguez-Palenzuela (2012): “Access to Funding by European Banks and the Financial Crisis”, mimeo
- Carbo-Valverde S., D. Marques-Ibanez, and F. Rodríguez-Fernández (2012): “Securitisation, Risk-transferring and Financial Instability: the Case of Spain,” *Journal of International Money and Finance*, 31 (1), 80-101
- Carbó-Valverde S., R.J. Rosen, and F. Rodríguez-Fernández (2017): “Are Covered Bonds a Substitute for Mortgage-backed Securities?”, *Journal of Economic Policy Reform*, 20(3), 238-253
- Carletti E., and A. Leonello (2018): “Credit Market Competition and Liquidity Crises”, *Review of Finance*, forthcoming
- Carletti E., G. Dell’Ariccia, and R. Marquez (2019): “Supervisory Incentives in a Banking Union”, *Management Science*, forthcoming
- Carpinelli L. and Crosignani M. (2018): “The Design and Transmission of Central Bank Liquidity Provisions”, Working Paper
- Carvallo Valencia O., and A. Ortiz Bolaños (2018): “Bank Capital Buffers around the World: Cyclical Patterns and the Effect of Market Power”, *Journal of Financial Stability*, forthcoming
- Cassola N., A. Hortaçsu, and J. Kastl (2013): “The 2007 Subprime Market Crisis through the Lens of European Central Bank Auctions for Short-Term Funds”, *Econometrica*, 81, 1309-1345

- Cebenoyan A. S., and P. Strahan (2004): “Risk Management, Capital Structure and Lending at Banks”, *Journal of Banking and Finance*, 28 (1), 19-43
- Cerasi V., and J. C. Rochet (2014), “Rethinking the Regulatory Treatment of Securitisation,” *Journal of Financial Stability*, 10, 20-31
- Cihák M., A. Demirgüç-Kunt, M. S. Martínez Pería, and A. Mohseni (2012): “Banking Regulation and Supervision around the World: Crisis Update”, World Bank Policy Research Working Paper
- Choi D. B., and H. S. Choi (2017): “The Effect of Monetary Policy on Bank Wholesale Funding”, *Federal Reserve Bank of New York, Working Paper Series No. 709*
- Coeuré B. (2012): “Collateral Scarcity – a Gone or a Going Concern?,” ECB-DNB Joint Central Bank Seminar on Collateral and Liquidity, Amsterdam
- Cohen A., and M. D. Manuszak (2013): “Ratings Competition in the CMBS Market,” *Journal of Money, Credit and Banking*, 45, 367-384
- Committee of European Banking Supervisors (2008): “CEBS’ Technical Advice to the European Commission on Options and National Discretions”, <https://www.eba.europa.eu/documents/10180/16106/2008-17-10-Final-Advice-on-options-and-national-discretions.pdf>
- Coval J., J. Jurek and E. Stafford (2009): “The Economics of Structured Finance,” *Journal of Economic Perspectives*, 23, 3-25
- Crosignani M., M. Faria-e-Castro, and L. Fonseca (2018): “The (Unintended?) Consequences of the Largest Liquidity Injection Ever”, Working Paper
- Crosignani M. (2017): “Why are Banks not Recapitalised during Crises?,” Working Paper, NYU Stern Business School
- Darmouni O. M. and Rodnyansky A. (2017), “The Effects of Quantitative Easing on Bank Lending Behavior”, *The Review of Financial Studies*, 30 (11), 3858–3887
- Degryse H., M. Kim, and S. Ongena (2009): “Microeconometrics of Banking. Methods, Applications and Results,” *Oxford University Press*.
- De Haas R., and N. Van Horen (2010): “The Crisis as a Wake-Up Call. Do Banks Tighten Screening and Monitoring During a Financial Crisis?,” DNB Working Papers Series, No.255
- Dell’Ariccia G., D. Igan, and L. Laeven (2012): “Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market,” *Journal of Money, Credit and Banking*, 44, 367–384
- Dell’Ariccia G., and R. Marquez (2006): “Competition among regulators and credit market integration”, *Journal of Financial Economics*, 79 (2), 401-430
- De Marco F., and M. Macchiavelli (2016): “The Political Origin of Home Bias: the Case of Europe,” Finance and Economics Discussion Series 2016-060, Board of Governors of the Federal Reserve System

- DeMarzo P. M. (2005): “The Pooling and Tranching of Securities: A Model of Informed Intermediation”, *The Review of Financial Studies*, 18 (1), 1-35
- DeMarzo P. M., and D. Duffie (1999): “A Liquidity-Based Model of Security Design”, *Econometrica*, 67 (1), 65–99
- Demirguc-Kunt A., E. Detragiache, and O. Merrouche (2013): “Bank Capital: Lessons from the Financial Crisis”, *Journal of Money, Credit and Banking*, 45, 1147-1164.
- Demiroglu C., and C. James (2012): “How Important is Having Skin in the Game? Originator-Sponsor Affiliation and Losses on Mortgage-Backed Securities,” *The Review of Financial Studies*, 25, 3217-3258
- Demyanyk Y., and E. Loutskina (2016): “Mortgage Companies and Regulatory Arbitrage,” *Journal of Financial Economics*, 122 (2), 328-351
- Demyanyk Y., and O. Van Hemert (2011): “Understanding the Subprime Mortgage Crisis”, *The Review of Financial Studies*, 24 (6), 1848–1880
- Dewatripont M., and J. Tirole (1994): “The Prudential Regulation of Banks,” *MIT Press*
- Dewatripont M., and J. Tirole (1993): “Efficient Governance Structure: Implications for Banking Regulation”, in (ed.) C. Mayer, and X. Vives, *Capital Markets and Financial Intermediation*, Cambridge University Press
- DeYoung R., and K. Y. Jang (2016): “Do Banks Actively Manage their Liquidity?”, *Journal of Banking and Finance*, 66, 143-161
- Diamond D. and Rajan R. (2011): “Fear of Fire Sales, Illiquidity Seeking, and Credit Freezes”, *The Quarterly Journal of Economics*, 126 (2), 557–591
- Diamond D. W., and R. G. Rajan (2000): “A Theory of Bank Capital”, *The Journal of Finance*, 55, 2431-2465
- Di Maggio M., A. Kermani, and C. Palmer (2016): “How Quantitative Easing Works: Evidence on the Refinancing Channel”, NBER Working Paper Series No. 22638
- Dionne G., and T. M. Harchaoui (2008): “Banks’ Capital, Securitisation and Credit Risk: An Empirical Evidence for Canada,” *Risk Management and Insurance Review*, 75 (4), 459-485
- Drechsler I., T. Drechsler, D. Marques-Ibanez, and P. Schnabl (2016): “Who Borrows from the Lender of Last Resort?”, *The Journal of Finance*, 71, 1933-1974.
- Efung M. (2016), “Arbitraging the Basel Securitization Framework: Evidence from German ABS Investment”, ESRB Working Paper No. 22
- Erel I., T. Nadauld and R. M. Stulz (2014): “Why Did Holdings of Highly-Rated Securitisation Tranches Differ So Much Across Banks?,” *Review of Financial Studies*, 27 (2), 404-453.
- European Central Bank (2016a): “Regulation and Guide of the European Central Bank on the Exercise of Options and Discretions Available in Union Law: Explanatory Memorandum”, European Central Bank.

- European Central Bank (2016b): “ECB Guide on Options and Discretions Available in Union Law: Guide on Options and Discretions Available in Union Law”, European Central Bank.
- European Central Bank (2016c): “National Options and Discretions in the Prudential Regulatory Framework for Banks”, in ECB (edited by), *Financial Integration in Europe*, 99–114.
- European Central Bank (2013): “The Eurosystem Collateral Framework throughout the Crisis,” *Monthly Bulletin*, July, 71-86
- European Central Bank (2011): “Common Equity Capital, Banks’ Riskiness and Required Return on Equity”, Special Feature, *Financial Stability Review*, December 2011
- Fama E., and K. French (2002): “Testing Trade-Off and Pecking Order Predictions about Dividends and Debt”, *The Review of Financial Studies*, 15(1), 1-33.
- Farruggio C., and A. Uhde A. (2015): “Determinants of Loan Securitisation in European Banking”, *Journal of Banking and Finance*, 56, 12-27
- Fecht F., K. G. Nyborg, J. Rocholl, and J. Woschitz (2016): “Collateral, Central Bank Repos and Systemic Arbitrage,” Working Paper, University of Zurich
- Flannery M., and K. Rangan (2006): “Partial Adjustment toward Target Capital Structures”, *Journal of Financial Economics*, 79, 469–506.
- Flannery M., and K. Rangan (2008): “What Caused the Bank Capital Build-up of the 1990s?”, *Review of Finance*, 12, 391–429.
- Fonseca A. R., and F. González (2010): “How Bank Capital Buffers Vary across Countries: the Influence of Cost of Deposits, Market Power and Bank Regulation”, *Journal of Banking and Finance*, 34 (4), 892–902
- Francis W. B., and M. Osborne (2012): “Capital Requirements and Bank Behavior in the UK: Are there Lessons for International Capital Standards?”, *Journal of Banking and Finance*, 36 (3), 803–816
- Francis W. B., and M. Osborne (2010): “On the Behavior and Determinants of Risk-Based Capital Ratios: Revisiting the Evidence from UK Banking Institutions”, *International Review of Finance*, 10 (4), 485–518
- Frank M. Z., and V. K. Goyal (2008): “Trade-Off and Pecking Order Theories of Debt”, in Eckbo B. E., *Handbooks in Finance. Handbook of Empirical Corporate Finance*, Elsevier, 135-202.
- Freixas X., and J. Jorge (2008): “The Role of Interbank Markets in Monetary Policy: A Model with Rationing”, *Journal of Money, Credit and Banking*, 40, 1151-1176.
- Freixas X., and J. C. Rochet (2008): “Microeconomics of Banking,” *MIT Press*, 2<sup>nd</sup> edition
- Gambacorta L. and P. E. Mistrulli (2004): “Does Bank Capital Affect Lending Behavior?”, *Journal of Financial Intermediation*, 13(4), 436–457

- Gambacorta, L. and H. S. Shin (2018): “Why Bank Capital Matters for Monetary Policy,” *Journal of Financial Intermediation*, 35, 17-29.
- Garcia-de-Andoain C., F. Heider, M. Hoerova, and S. Manganeli (2016): “Lending-of-last-resort is as lending-of-last-resort does: Central bank liquidity provision and interbank market functioning in the euro area”, *Journal of Financial Intermediation*, 28, 32-47
- Goodhart C. (2011): “The Basel Committee on Banking Supervision: A History of the Early Years 1974–1997”, *Cambridge University Press*.
- Gorton G. B., and G. G. Pennacchi (1995): “Bank and Loan Sales: Marketing Nonmarketable Assets,” *Journal of Monetary Economics*, 35, 389-411
- Gorton G. B., and A. Metrick (2012), “Securitized Banking and the Run on Repo,” *Journal of Financial Economics*, 104, 425-451.
- Greenbaum S. I., and A. V. Thakor (1987): “Bank Funding Modes: Securitization versus Deposits”, *Journal of Banking and Finance*, 11 (3), 379-401
- Gropp R., C. Gruendl, and A. Guettler (2014): “The Impact of Public Guarantees on Bank Risk-Taking: Evidence from a Natural Experiment”, *Review of Finance*, 18 (2), 457–488
- Gropp R., H. Hakenes, and I. Schnabel (2011): “Competition, Risk-shifting, and Public Bail-out Policies”, *The Review of Financial Studies*, 24 (6), 2084–2120
- Gropp R., and F. Heider (2010): “The Determinants of Bank Capital Structure”, *Review of Finance*, 14 (4), 587–622
- Hahn J., H. S. Shin, and K. Shin (2013): “Noncore Bank Liabilities and Financial Vulnerability”, *Journal of Money, Credit and Banking*, 45, 3-36.
- Hart O. D., and D. M. Jaffee (1974): “On the Application of Portfolio Theory to Depository Financial Intermediaries”, *Review of Economic Studies*, 41 (1), 129-147
- Heider F., M. Hoerova, and C. Holthausen (2015): “Liquidity hoarding and interbank market rates: The role of counterparty risk”, *Journal of Financial Economics*, 118 (2), 336-354
- Hellmann T. F., K. C. Murdock, and J. E. Stiglitz (2000): “Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough?”, *American Economic Review*, 147–165
- Higgins E. J., and J. R. Mason (2004): “What is the Value of Recourse to Asset-Backed Securities? A Clinical Study of Credit Card Banks,” *Journal of Banking and Finance*, 28, 875-899
- Holthausen C., and T. Ronde (2005): “Cooperation in International Banking Supervision”. *CEPR Discussion Paper Series*, No. 4990
- Houston J. F., C. Lin, and Y. Ma (2012): “Regulatory Arbitrage and International Bank Flows”, *The Journal of Finance*, 67, 1845-1895
- Hovakimian A., and E. J. Kane (2000): “Effectiveness of Capital Regulation at U.S. Commercial Banks, 1985 to 1994”, *The Journal of Finance*, 55, 451-468

- Jackson P. (1999): “Capital Requirements and Bank Behaviour: the Impact of the Basle Accord”, *Basel Committee on Banking Supervision Working Paper Series*, No.1
- Jacques K., and P. Nigro (1997): “Risk-based Capital, Portfolio Risk, and Bank Capital: A Simultaneous Equations Approach”. *Journal of Economics and Business*, 49 (6), 533–547.
- Jiménez G., S. Ongena, J.-L. Peydró, and J. Saurina (2014): “Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking?”, *Econometrica*, 82, 463-505
- Jiménez G., S. Ongena, J.-L. Peydró, and J. Saurina (2012), "Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications", *American Economic Review*, 102 (5), 2301-2326.
- Jokipii T., and A. Milne (2011): “Bank Capital Buffer and Risk Adjustment Decisions”, *Journal of Financial Stability*, 7 (3), 165–178.
- Jokipii T., and A. Milne (2008): “The Cyclical Behaviour of European Bank Capital Buffers”, *Journal of Banking and Finance*, 32(8), 1440–1451.
- Kara A., D. Marques-Ibanez and S. Ongena (2016): “Securitisation and Lending Standards. Evidence from the European Wholesale Loan Market,” *Journal of Financial Stability*, 26, 107-127
- Kareken J. H., and N. Wallace (1978): “Deposit Insurance and Bank Regulation: A Partial-Equilibrium Exposition”, *The Journal of Business*, 51 (3), 413–438
- Kashyap A. K., J. Stein and S. Hanson (2010), “An Analysis of the Impact of Substantially Heightened Capital Requirements on Large Financial Institutions”, Working Paper
- Kashyap A. K., and J. C. Stein (2000): “What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?”, *The American Economic Review*, 90 (3), 407-428
- Keeley M. C. (1990): “Deposit Insurance, Risk and Market Power in Banking”, *American Economic Review*, 80 (5), 1183–1200.
- Keeley M. C., and F. T. Furlong (1990): “A re-examination of mean-variance analysis of bank capital regulation”, *Journal of Banking and Finance*, 14 (1), 69-84
- Keys B., T. Muckerjee, A. Seru and V. Vig (2010): “Did Securitisation Lead to Lax Screening? Evidence from Subprime Loans,” *Quarterly Journal of Economics*, 125 (1), 307-362
- Keys B., T. Muckerjee, A. Seru and V. Vig (2009), “Financial Regulation and Securitisation: Evidence from Subprime Loans,” *Journal of Monetary Economics*, 56 (5), 700–720
- Khan M. S., H. Scheule, and E. Wu (2017): “Funding Liquidity and Bank Risk Taking”, *Journal of Banking and Finance*, 82, 203-216
- Kiff J., and M. Kisser (2014): “A Shot at Regulating Securitisation,” *Journal of Financial Stability*, 10, 32-49
- Kim D., and A. M. Santomero (1988): “Risk in Banking and Capital Regulation”, *The Journal of Finance*, 43 (5), 1219–1233.

- Klomp J., and J. de Haan (2012): “Banking risk and regulation: Does one size fit all?”, *Journal of Banking and Finance*, 36 (12), 3197-3212
- Koehn M., and A. M. Santomero (1980): “Regulation of Bank Capital and Portfolio Risk”, *The Journal of Finance*, 35(5), 1235–1244
- Kraus, A., and R. Litzenberger (1973): “A State-Preference Model of Optimal Financial Leverage”, *The Journal of Finance*, 28(4), 911-922.
- Kudrna Z., and S. P. Riekmann (2018): “Harmonizing National Options and Discretions in the EU Banking Regulation”, *Journal of Economic Policy Reform*, 21(2), 144-158.
- Kuncl M. (2018): “Securitisation under Asymmetric Information over the Business Cycle,” *European Economic Review*, forthcoming
- Laeven L. (2017): “The Regulatory Response to the Sovereign-Bank Nexus,” in (edited by) Evanoff D., G. Kaufman, A. Leonello and S. Manganelli, *Achieving Financial Stability Challenges to Prudential Regulation*, World Scientific Studies in International Economics, Volume 61
- Laeven L., and R. Levine (2009): “Bank Governance, Regulation and Risk Taking”, *Journal of Financial Economics*, 93 (2), 259-275
- Laeven L., L. Ratnovski, and H. Tong (2014): “Bank Size and Systemic Risk”, IMF Staff Discussion Note, No.14/04
- Laeven L., and F. Valencia (2012): “Systemic Banking Crises Database: An Update”, IMF Working Paper No.12/163
- Lautenschläger S. (2016): “Single Supervisory Mechanism, Single Supervisory Law”, Speech at the Workshop of the European Banking Institute, Frankfurt am Main, 27 January 2016
- Le H.T.T., R. P. Narayanan, and L. Van Vo (2016): “Has the Effect of Asset Securitization on Bank Risk Taking Behavior Changed?”, *Journal of Financial Services Research*, 49, 39-64.
- Liu P., and L. Shi (2013): “Sponsor-Underwriter Affiliation and the Performance of Non-Agency Mortgage-Backed Securities,” Working Paper
- Loutskina E. (2011): “The Role of Securitisation in Bank Liquidity and Funding Management,” *Journal of Financial Economics*, 100 (3), 663-684
- Loutskina E., and P. E. Strahan (2009): “Securitization and the Declining Impact of Bank Finance on Loan Supply: Evidence from Mortgage Originations”, *Journal of Finance*, 64 (2), 861-889
- Maddaloni A., and J.-L. Peydro’ (2013): “Monetary Policy, Macroprudential Policy, and Banking Stability: Evidence from the Euro Area”, *International Journal of Central Banking*, 9 (1), 121-169
- Maddaloni A., and J.-L. Peydro’ (2011): “Bank Risk-taking, Securitization, Supervision, and Low Interest Rates: Evidence from the Euro-area and the U.S. Lending Standards”, *Review of Financial Studies*, 24 (6), 2121-2165



- Maddaloni A., and A. D. Scopelliti (2016): "Prudential Regulation, National Differences and Stability of EU Banks", in (ed.) Ulbrich J., C. C. Hedrick, and M. Balling: "*The SSM at 1*", SUERF Conference Proceedings 2016/3
- Marcus A. J. (1984): "Deregulation and Bank Financial Policy", *Journal of Banking and Finance*, 8(4), 557–565.
- Memmel C., and P. Raupach (2010): "How do Banks Adjust their Capital Ratios?", *Journal of Financial Intermediation*, 19 (4), 509-528
- Merton R. C. (1977): "An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees. An Application of Modern Option Pricing Theory", *Journal of Banking & Finance*, 1(1), 3–11
- Merton R. C. (1978): "On the Cost of Deposit Insurance when there are Surveillance Costs", *Journal of Business*, 439–452.
- Mésonnier J. S., O'Donnell C. and Toutain O. (2018): "The Interest of Being Eligible", Banque de France Working Paper Series, No.636
- Mian A, and A. Sufi (2009): "The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis", *The Quarterly Journal of Economics*, 124 (4), 1449–1496
- Michalak T. C. and A. Uhde (2010): "Credit Risk Securitisation and Bank Soundness in Europe," *The Quarterly Review of Economics and Finance*, 52, 272-285
- Miles D., Yang J. and G. Marcheggiano (2012): "Optimal Bank Capital", *The Economic Journal*, Vol. 123, 1-37
- Miller M. (1995): "Do the M&M Propositions Apply to Banks?", *Journal of Banking and Finance*, 19, 483-489
- Milne A. (2017): "Bank Capital Buffers", Lecture Notes for Monash Business School
- Milne A. (2009): "The Fall of the House of the House of Credit", *Cambridge University Press*
- Milne A. (2002): "Bank Capital Regulation as an Incentive Mechanism: Implications for Portfolio Choice", *Journal of Banking and Finance*, 26 (1), 1–24.
- Milne A., and A. E. Whalley (1999): "Bank Capital and Risk Taking", Bank of England Working Paper Series, No.90
- Modigliani F. and M. Miller (1959): "The Cost of Capital, Corporation Finance, and the Theory of Investment: Reply", *American Economic Review*, 49(4), 655-669
- Morrison A. D., and L. White (2009): "Level Playing Fields in International Financial Regulation", *The Journal of Finance*, 64, 1099-1142
- Morrison A. D., and L. White (2005): "Crises and Capital Requirements in Banking", *American Economic Review*, 95 (5), 1548-1572

- Myers S. C., and N. S. Majluf (1984): “Corporate Financing and Investment Decisions when Firms Have Information that Investors do not Have”, *Journal of Financial Economics*, 13 (2), 187-221
- Nijskens R. and W. Wagner (2011): “Credit Risk Transfer Activities and Systemic Risk: How Banks Became less Risky Individually but Posed Greater Risks to the Financial System at the Same Time”, *Journal of Banking and Finance*, 35 (6), 1391-1398.
- Nyborg K. G. (2017a): “Central Bank Collateral Frameworks”, *Journal of Banking and Finance*, Vol. 76, 198-214
- Nyborg K. G. (2017b): “Collateral Frameworks. The Open Secret of Central Banks”, *Cambridge University Press*
- Ongena S., A. Popov, and N. Van Horen (2019): “The Invisible Hand of the Government: Moral Suasion during the European Sovereign Debt Crisis”, *American Economic Journal: Macroeconomics*, forthcoming.
- Ongena S., A. Popov, and G. F. Udell (2013): “When the Cat’s Away the Mice will Play. Does Regulation at Home Affect Bank Risk Taking Abroad?”, *Journal of Financial Economics*, 108, 727-750
- Orgler Y., and R. Taggart (1983): “Implications of Corporate Capital Structure Theory for Banking Institutions: Note”, *Journal of Money, Credit and Banking*, 15(2), 212-221
- Osborne M., A. M. Fuertes, and A. Milne (2017): “In Good Times and in Bad: Bank Capital Ratios and Lending Rates”, *International Review of Financial Analysis*, 51, 102-112
- Panetta F., and A. F. Pozzolo (2018): “Why do Banks Securitize their Assets? Bank-level Data from Over One Hundred Countries,” Bank of Italy Working Paper Series, No. 1183
- Pennacchi G. G. (1988): “Loan Sales and the Cost of Capital,” *Journal of Finance*, 43, 375-396
- Peura S., and J. Keppo (2006): “Optimal Bank Capital with Costly Recapitalization”, *The Journal of Business*, 79(4), 2163-2201.
- Poghosyan T., and M. Cihak (2011): “Determinants of Bank Distress in Europe: Evidence from a New Data Set”, *Journal of Financial Services Research*, 40, 163-184
- Pozsar Z., T. Adrian, A. Ashcraft and H. Boesky (2010): “Shadow Banking,” Staff Report No.458, Federal Reserve Bank of New York
- Praet P. (2016), “The ECB and its role as lender of last resort during the crisis”, *Speech at the Committee on Capital Markets Regulation conference on “The lender of last resort: an international perspective”*, Washington DC, 10 February 2016
- Pyle D. (1971): “On the Theory of Financial Intermediation”, *The Journal of Finance*, 26(3), 737
- Rixtel (van) A., L. Romo Gonzalez, and J. Yang (2015): “The Determinants of Long-term Debt Issuance by European Banks: Evidence of Two Crises”, *BIS Working Paper*, No. 513

- Rixtel (van) A., and G. Gasparini (2013): “Financial Crises and Bank Funding: Recent Experience in the Euro Area”, BIS Working Paper Series, No. 406
- Rochet J.-C. (1992): “Capital Requirements and the Behaviour of Commercial Banks”, *European Economic Review*, 36(5), 1137–1170
- Rochet J.-C., and X. Vives (2004): “Coordination Failures and the Lender of Last Resort: Was Bagehot Right After All?”, *Journal of the European Economic Association*, 2(6), 1116-1147.
- Rose A. K., and T. Wieladek (2012): “Too Big to Fail: Some Empirical Evidence on the Causes and Consequences of Public Banking Interventions in the United Kingdom,” *Journal of International Money and Finance*, 31 (8), 2038-2051
- Sarkisyan A., and B. Casu (2013): “Retained Interests in Securitisations and Implications for Bank Solvency,” ECB Working Paper Series No.1538
- Sarkisyan A., B. Casu, A. Clare and S. Thomas (2013): “Securitisation and Bank Performance,” *Journal of Money, Credit and Banking*, 45, 1617-1658
- Saunders A., E. Strock, and N. G. Travlos (1990): “Ownership Structure, Deregulation, and Bank Risk Taking”, *Journal of Finance*, 45 (2), 643-654
- Schaek K., and M. Cihak (2012): “Banking Competition and Capital Ratios,” *European Financial Management*, 18 (5), 836–866.
- Scopelliti A. D. (2014): "Securitisation and Risk Retention in European Banking: The Impact of Collateral and Prudential Rules", in (ed.) Balling M., F. Lierman, D. Masciandaro, and M. Quintyn: “*Money, Regulation and Growth: Financing New Growth in Europe*”, SUERF Study 2014/4
- Segura A. (2018): “Why Did Sponsor Banks Rescue Their SIVs? A Signaling Model of Rescues”, *Review of Finance*, 22 (2), 661–697
- Shim J. (2013): “Bank Capital Buffer and Portfolio Risk: The Influence of Business Cycle and Revenue Diversification”, *Journal of Banking and Finance*, 37 (3), 761-772,
- Shin H. S. (2009): “Securitisation and Financial Stability,” *The Economic Journal*, 119, 309-332
- Shrieves R.E., and D. Dahl (1992): “The Relationship between Risk and Capital in Commercial Banks”. *Journal of Banking and Finance*, 16 (2), 439–457.
- Silva A. (2016): Strategic Complementarity in Banks’ Funding Liquidity Choices and Financial Stability, ESRB Working Paper Series, No. 19
- Stolz S., and M. Wedow (2011): “Banks’ regulatory capital buffer and the business cycle: Evidence for Germany”, *Journal of Financial Stability*, 7 (2), 98-110
- Stolz S., and M. Wedow (2010): “Extraordinary Measures in Extraordinary Times. Public Measures in Support of the Financial Sector in the EU and the United States,” Occasional Paper No.117, European Central Bank

- Tamura K., and E. Tabakis (2013), “The Use of Credit Claims as Collateral for Eurosystem Credit Operations”, ECB Occasional Paper Series No. 148
- Tooze A. (2018): “Crashed. How a Decade of Financial Crises Changed the World”, *Viking Press*
- Uhde A., and T. C. Michalak (2012), “Securitisation and Systematic Risk in European Banking: Empirical Evidence”, *Journal of Banking and Finance*, 34, 3061-3077
- Vazquez F., and P. Federico (2015): “Bank Funding Structures and Risk: Evidence from the Global Financial Crisis”, *Journal of Banking and Finance*, 61, 1-14
- Vives X. (2014): “Strategic Complementarity, Fragility and Regulation,” *Review of Financial Studies*, 27 (12), 3547–3592.
- Wagner W. and I. W. Marsh (2006): “Credit Risk Transfer and Financial Sector Stability,” *Journal of Financial Stability*, 2 (2), 173-193
- Wall L. D., and D. R. Peterson (1995), “Bank Holding Company Capital Targets in the Early 1990s: The Regulators versus the Markets”, *Journal of Banking and Finance*, 19 (3–4), 563-574,
- Walther A., and L. White (2019): “Rules versus Discretion in Bank Resolution,” Working Paper
- Xu, TengTeng and Hu, Kun and Das, Udaibir (2019): “Bank Profitability and Financial Stability,” IMF Working Paper No. 19/5.