What Markets Fear:

Understanding the European Sovereign Debt Crisis Through the Lens of Repo Market Liquidity

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List of acronyms and abbreviations

BIS	Bank for International Settlements
BMA	Bayesian Model Averaging
Bp	Basis point
CC&G	Cassa Compensazione e Garanzia
CCP	Central counterparty clearing house
CDS	Credit default swap
CME	Chicago Mercantile Exchange
CPSS	Committee on Payments and Settlements Systems
CRA	Credit rating agency
CSD	Central Security Depository
EAP	Economic Adjustment Programme
EC	European Commission
ECB	European Central Bank
ECH	European Clearing House
EEC	European Economic Community
EMIR	European Market Infrastructure Regulation
EMS	European Monetary System
EMU	Economic and Monetary Union of the European Union
ERM	European Exchange Rate Mechanism
ERT	European Roundtable of Industrialists
ESRB	European Systemic Risk Board
EU	European Union
FSAP	Financial Sector Adjustment Programme
FSB	Financial Stability Board
G20	Group of Twenty
GAO	General Accounting Office
GC	General collateral
GFC	2007-08 global financial crisis
GSCC	Government Securities Clearing Corporation
HKFECC	Hong Kong Futures Exchange Clearing Corporation
HKFGC	Hong Kong Futures Guarantee Corporation
ICCH	International Commodity Clearing House
ICMA	International Capita Market Association
IMF	International Monetary Fund
IOSCO	International Organization for Securities Commission
IRS	Interest rate swap
IRI	Institute for Industrial Reconstruction
ISDA	International Swaps and Derivatives Association
KLCCH	Kuala Lumpur Commodity Clearing House
LCH	London Clearing House
LIBA	London Investment Banking Association
LSE	London Stock Exchange
LSEG	London Stock Exchange Group
LTROs	Long-Term Refinancing Operations
MATIF	*Marché à Terme International de France*
MIT	Massachusetts Institute of Technology
New York Fed	Federal Reserve Bank of New York
OMT	Outright Monetary Transactions
OTC	Over-the-counter
PASOK	Panhellenic Socialist Movement
Repo	Repurchase contract
RMP	Risk Management Policy

SBBS	Sovereign bond-backed securities
SEA	Single European Act
SGP	Stability and Growth Pact
SIFMA	Securities Industry and Financial Markets Association
SME	Small and Medium Enterprise
SRF	Sovereign Risk Framework
Fed	Federal Reserve System
UK	United Kingdom
US	United States of America

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Declaration

This thesis is entirely my own work and neither the thesis itself, nor any part thereof, has been submitted for examination at any other university.

Summary

This study calls into question the use of sovereign bond yield differentials (spread) as an indicator of fear of default during the euro crisis. The spread between the German bund and other euro area sovereign bonds has been widely employed by academics and regulators primarily as an indicator of the financial markets' perception of sovereign default risk. I argue that the fixation with fear of sovereign default as the key driver of market sentiment stems from a significant gap in the literature regarding the mechanisms underpinning the provision of bank funding in the euro area. On the one hand, sovereign bonds are the main source of collateral in repo contracts, key financial instrument banks use to access short-term funding in the euro area. On the other hand, central counterparty clearing houses (CCPs) clear a significant proportion of repo trades in the euro area, which means that these companies play a fundamental (yet neglected) role in the connection between sovereign debt and bank funding in Europe. One of the arguments made here is that the ways in which European financial integration has been carried out has made sovereign debt markets in the euro area vulnerable to what I call CCP-induced collateral crises. Indeed, the key finding of this study is that the sudden increase in collateral requirements by LCH.Clearnet, one of the world's largest CCPs, reduced the liquidity of Irish, Portuguese, Italian and Spanish sovereign bonds as collateral to access short-term funding in repo transactions. This led banks in the euro area to conduct large-scale bond sell-offs of the abovementioned securities, destabilising sovereign debt markets and widening spreads. This project concludes that the widening of the spreads from 2010 to 2012 was therefore also an indication of investors' concerns with liquidity risk, and not only of fear of sovereign default.

Introduction

> Silvio Berlusconi, who spent nearly two decades atop the world of Italian politics, resigned as prime minister Saturday night [12/11/2011] after lawmakers rushed through a budget bill seen as the first step toward winning back investor confidence and preventing the collapse of the world's eighth-largest economy.
>
> Ultimately forced out of office by a debt crisis instead of personal scandal, the flamboyant billionaire's departure appeared to pave the way for a staid, serious economist, Mario Monti, to attempt to form an interim government and try to pull Italy back from the brink (Faiola, 2011, writing for the Washington Post).

During a bilateral summit with President François Hollande on 3 December 2012, Mario Monti – then Italy's Prime Minister – set the target of 287 basis points spread between Italy and Germany's government bonds as a goal of 'particular significance' (Monti, 2012, my translation). Sovereign bond yield spread, henceforth referred to as spread, is the differential in the interest rates that investors charge when trading government bonds in secondary markets. Following Monti's statement, the press began referring to that specific level of bond yield spread as the *Soglia Monti* (the Monti Threshold) indicating the Prime Minister's numerical threshold as a policy objective to be reached in order to reassure the markets about Italy's public debt sustainability and remove the risk of sovereign default (see Corriere Della Sera, 2012; Lops, 2012; Polidori, 2012). As cited in Italy's leading business newspaper *Il Sole 24 Ore*:

> Monti had already told us. Spread can get down to 287 basis points, halving the 575 basis points that he inherited [from Berlusconi] before getting into office last November. It may have been a joke, or it could have been *a clear message to the*

markets about the improved sustainability of [Italy's] public debt (Lops, 2012, my translation, emphasis added).

Political debates during the height of the Italian crisis centred around the country sliding into sovereign default, whereby spread was often employed as an indicator of the markets' perception of sovereign default risk. More importantly, lowering the spread as a policy objective to reassure markets about Italy's public debt servicing sustainability played a central role in the transition from Silvio Berlusconi to the appointment of technocrat Prof. Mario Monti (see Culpepper, 2014; Hopkin, 2012). The use of spread by politicians and the media is still being retained in Italy today, but in a slightly different context, with the so-called populist and anti-establishment parties – the *Movimento 5 Stelle* (in English, the 5 Star Movement) and the *Lega* (in English, the League, formally the Northern League) – now leading the Italian executive. Spread movements have either been invoked by mainstream media and politicians to describe the markets' disapproval of the public debt sustainability of the new government's policy proposal, or by anti-establishment movements as a political coup by financial speculators to sabotage the new government with the support of the European Union (EU) (e.g. Petrini, 2018; Spezzaferro, 2018; see also Pirro and Van Kessel, 2018).

Hence, the uses of spread as a proxy of market behaviour remains an issue of central political importance in Italy, although in more nuanced ways than during the euro crisis. More generally, this is evidence that the political relationship between the EU and Italy in the aftermath of the euro crisis is still a matter of ongoing negotiations. While this anecdote highlights some of the important factors that shaped political processes in Italy during and after the crisis, it also provides context to understand the importance that spread and fear of default have had for our understanding of the dynamics of the euro crisis more broadly.

This project questions the uses of sovereign bond yield differentials (spread) as an indicator of sovereign default fears during the euro crisis, a view that pervades much academic literature and most policy responses to the crisis. Indeed, as we see below, fear of sovereign default has been identified as being one of the main factors that destabilised sovereign debt markets in the euro area from 2010 to 2012. The main objective of this thesis is thus to overcome the association of spread movements primarily with respect to sovereign solvency, and to emphasise instead the importance of sovereign debt in relation *to the provision of funding liquidity* in the euro area. In order to achieve these objectives, the analysis conducted in this project answers the following research question: what factors contributed to destabilising sovereign debt markets during the height of the euro crisis from 2010 to 2012?

The problem

There is a tendency in the euro crisis literature to utilise sovereign bond yield spreads as a *de facto* proxy for market sentiment towards sovereign solvency. As is explained in more detail below, this thesis refers to market sentiment as the various concerns that investors may have when trading specific securities in financial markets. Research on the euro crisis tends to assume that spread movements were reflecting the investors' changing perception of sovereign default risk during the unfolding of the crisis (e.g. Arghyrou and Tsoukalas, 2011; Lapavitsas *et al*., 2012; De Grauwe and Ji, 2013; Pepino, 2015). While the reasons that triggered fear of default have been extensively debated, i.e. deterioration of macroeconomic fundamentals, self-fulfilling expectation of default risk, lack of intra-European solidarity, a consensus exists that ascribes the widening of the spreads from 2010 to 2012 to heightened sovereign default risk perceptions.

This understanding of spread is not circumscribed to academia and is reflected in more general understandings of the euro crisis as in essence a crisis of confidence in the public debt servicing sustainability of the euro area, which also manifests in the policy responses put in place during and after the crisis. For instance, right in the middle of the Portuguese crisis, the Portuguese Central Bank said:

> The strong deterioration of the prospects of international financial markets players on *the sustainability of the public finances* situation in Portugal has been reflected in a strong increase in the risk premium on sovereign debt (Banco de Portugal, 2010, emphasis added).

The three largest Economic Adjustment Programmes (EAPs) for Greece, Ireland and Portugal, and the Financial Sector Adjustment Programme (FSAP) for Spain, all had a strong emphasis on implementing fiscal consolidation measures (EC, 2010: 6, 10; EC, 2011a: 17, 19, 31; EC, 2011b: 16; EC, 2012a: 14, 46). This was *to restore market confidence* in the public debt servicing sustainability of the affected sovereigns, whereby spread would be used as an indicator of such sentiment. Unquestionably, restoring market confidence was also highlighted in relation to deteriorating bank solvency, as well as collapsing consumer and housing markets that required other equally important forms of structural adjustments than just fiscal consolidation. Nonetheless, references to spread as an indicator of market sentiment towards sovereign solvency, and the implementation of fiscal consolidation programs to restore market confidence towards public debt sustainability, appeared consistently throughout EAPs and the FSAP. For instance, the EAP for Greece, while discussing the previously miscalculated statistics of Greek public debt and deficit, says:

> This delayed implementation of corrective [accounting] measures surprised the markets, which became concerned about fiscal sustainability. Leading rating agencies downgraded the sovereign, and the yield on sovereign bonds…spreads increased sharply since the end of 2009 (EC, 2010: 6)

Similarly, in the EAP for Ireland:

> Since late summer 2010, financial markets have questioned the solvency of the Irish sovereign. Spreads of Irish sovereign bonds vis-à-vis their German counterparts widened to record levels (EC, 2011a: 17).

Hence, it is clear that deteriorating sovereign solvency has been retained as the key aspect that underpinned our understanding of market behaviour during the euro crisis, as well as of the ways in which regulators have responded to it. The fixation with sovereign solvency as the main driver of spread during the crisis is particularly interesting, given that that the euro crisis demonstrates 'the strong interconnection between financial crises and bank funding' (Rixtel and Gasperini, 2013: 25). Indeed, the declining value of euro area sovereign bonds in financial markets during the crisis rendered those assets less valuable to use in repurchase contracts (repos), which are the main short-term funding tools for banks. In other words, it is surprising that spreads are mainly discussed in association with sovereign default risk perception, given that sovereign bonds play a crucial role in the provision of short-term funding for banks.

This is a key point. This thesis seeks to take a step away from the association of sovereign debt primarily in relation to default, dominant in the euro crisis literature, emphasising instead the relationship between government bonds and the provision of short-term funding in the euro area. This important analytical move allows us to improve our

understanding of the dynamics underpinning the euro crisis, because it explores the interconnections between sovereign debt markets and bank funding, an area of enquiry that has been almost entirely ignored.

More specifically, the distinctive way in which the use of central counterparty clearing houses (CCPs) and sovereign debt characterise the functioning of European repo markets has been recurrently overlooked. The absence of repos and CCPs in the euro crisis literature is somewhat surprising, given that both repo markets and CCPs have exacerbated credit squeezes several times during financial crises (e.g. Gorton and Metrick, 2012; Hills *et al.*, 1999). This neglect prevents the examination of the European interbank funding market as a potential source of sovereign debt market instability. Further, it prevents to sufficiently accounting for the importance of sovereign bonds in relation to liquidity, which does not allow us to move beyond sovereign default risk perception as the main driver for spreads during the euro crisis.

The rest of this chapter is structured as follows. I first provide a few technical details about spread. I then move on to show how the euro crisis literature discusses spread in relation to sovereign default risk perception. The significance of the repo market as a lens to understand the euro crisis is thus discussed. I then highlight my original contributions to the literature, before moving on to discuss methodology and case study selection. The key analytical notions employed in this thesis are thereafter discussed, before concluding by providing a summary of the five substantive chapters, as well as explaining the key findings and arguments.

Introducing spread

Spreads are calculated on secondary markets against a given benchmark, which is considered more creditworthy and is therefore taken as the point of reference (see Choudhry, 2006). Hence, a bond's yield relative to its benchmark becomes that bond's spread and is calculated in percentage change in the value of a bond. These are also called basis points (bp), where one bp equals to 0.01% change. For example, a bond's 150bp spread means that it is yielding 1.50% more on secondary markets than its benchmark.

German government bonds (bunds) act as the benchmark in the sovereign debt markets of the euro area, due to the perceived stability of the German economy, particularly with respect to inflation. As put by economist and former Head of Treasury at KBC Financial Products in London, Moorad Choudhry:

> Although Germany no longer offers a deutschmark as the anchor currency for Europe, the German bond market is the continent's safe haven for global investors. This reflects the size and strength of the German economy and its superior performance in maintaining relatively stable inflation levels in the post-war period (Choudhry, 2006: 74).

When it comes to government bonds, widening spreads reflect a relative increase in the public debt servicing cost of a country *vis-à-vis* the benchmark. However, while widening spreads driven by a country's rising yields against the benchmark on secondary markets do not immediately increase the cost of public debt servicing, governments' funding costs in the euro area do tend to rise in the long-term with sustained rising yields (see Scheinert, 2017 for an overview). Furthermore, a bond's price and its yield retain an inverse relationship, in the sense that the higher a bond's price, the lower the yield and vice versa. Hence, the sudden widening of the spread means that the price of a sovereign bond traded

on secondary markets is declining *vis-à-vis* the benchmark, which can indicate the presence of large-scale sell-offs of that bond.

There are undoubtedly many factors at play that can influence the price and yield of a bond in secondary markets, such as the interest rates set up by central banks (see Pimco, 2018). Additionally, there is a vast amount of evidence suggesting that it was largely bond sell-offs that widened the spreads during the euro crisis (e.g. Oakley and Jones, 2010; De Grauwe and Ji, 2013; Pepino, 2015; Baldwin *et al*., 2015). This is an important point to retain for the scope of this project, because Chapter 5 demonstrates that some of the large-scale sell-offs that took place from 2010 to 2012, leading to a widening in the spreads, occurred because of the reduced value of specific sovereign bonds as collateral to access short-term funding, irrespective of considerations regarding sovereign solvency.

Before going any further in explaining how I achieve the above-mentioned goals, it is worth outlining the analytical and argumentative boundaries of this project. First, I do not question the extent to which spread is a reliable indicator of a country's sovereign default risk. The precise relationship between prices on secondary and primary markets has not been examined in great detail and remains a largely contested issue (e.g. Broner *et al.*, 2010; Davis, 2017). Furthermore, as spread is calculated on 10-year issues, the effect of a widening spread on the cost of public debt servicing will vary greatly depending on the specific public debt structures, average maturities and on the timing of sovereign debt issuing of individual countries. While this remains an interesting question, it goes beyond the scope of this project, which instead sheds light on the ways in which sovereign debt in the euro area is significant to investors beyond considerations of sovereign solvency.

Second, I do recognise fear of default as an important factor that influenced the dynamics of the euro crisis. Indeed, as I show in Chapter 1, the unfolding of the Greek crisis around

its fiscal dimension contributed to crystallising concerns regarding sovereign solvency in the euro area, which influenced the actions undertaken by a particular important actor that is examined in this thesis: one of the world's largest CCPs, LCH.Clearnet. As I argue in the next section, the limitation on public debt servicing sustainability imposed by a monetary union can make spread an effective indicator of sovereign default risk.

In short, this project neither disregards the importance played by default risk perception during the euro crisis, nor challenges spread as an indicator of sovereign default risk as such. Rather, I seek to examine the extent to which factors other than sovereign default risk perception have contributed to a widening in the spreads. Specifically, this thesis shifts the analytical focus from the factors that exposed sovereign debt markets to heightened default risk perception to the reasons that increased concerns regarding the use of sovereign bonds to access short-term funding. Through this analytical shift, I shed light on a largely unexplored aspect of the euro crisis: the structural weaknesses affecting the provision of interbank liquidity in the euro area. Ultimately, I emphasise the importance of sovereign bonds to investors with respect to their concerns regarding access to short-term funding, and besides sovereign default risk perceptions.

Spread and fear of default in the euro crisis literature

Since the introduction of the euro, spreads have been employed as indicators of sovereign default risk in the euro area (e.g. Codogno *et al.*, 2003). The rationale goes as follows. Before the euro was introduced, European countries were highly exposed to exchange rate volatility. Indeed, investors often speculated against European currencies by exploiting the fixed exchange rate regimes introduced following the collapse of the Bretton Woods system (see Eichengreen, 2007). After the introduction of the euro, participating countries abandoned national currencies and gave up their monetary

sovereignty to European institutions, whereby exchange rate volatility effectively disappeared. At the same time, governments in the euro area have also become unable to guarantee public debt servicing, lacking the possibility of a devaluation of their currencies in order to reduce the real value of their debt, or to print extra cash to pay out to creditors, should such necessity arise. Thus, '[t]he common theory about spreads in the government bond rates in the euro area is that these spreads reflect default risks', because governments have lost their ability to unilaterally guarantee public debt servicing through conventional monetary tools (De Grauwe and Ji; 2012: 866). In short, a country's spread in the euro area is understood to provide an indication of its government's sovereign default risk relative to Germany.

However, the euro crisis literature has brought this understanding of spread one step further, by effectively utilising spread as a proxy for the markets' perception of sovereign solvency. As concisely put by political economist Pepino, '[f]or Eurozone countries, where exchange rate risk differentials have disappeared, bond spreads to Germany are generally considered to reflect outright *default risk perceptions'* (Pepino, 2015: 10, emphasis added, see also Rommerskirchen, 2015: 758).

Remarkably, this conceptualisation of spread is not only present across different disciplines, namely, political science, economics, political economy and financial economics, but also across several theoretical strands, including orthodox and heterodox economics, rational choice and comparative political economy, comparative political science and institutional economics in the field of varieties of capitalism. For example, a wide range of political scientists, economists, and political economists have ascribed the deterioration of macroeconomic fundamentals as to one of the main factors that led to the erosion of market confidence in the public debt sustainability of Greece, Ireland, Portugal, Italy, and Spain. This contributed to the bond sell-offs that widened their spreads from

2010 to 2012 (e.g. Arghyrou and Tsoukalas, 2011; Buiter and Rahbari, 2010; Lapavitsas; 2012; Hopkin, 2012, Culpepper, 2014; Jones, 2012; Hall, 2014).

There is a clear divide in this group, between those who ascribe the deterioration of macroeconomic fundamentals to domestic factors (e.g. Arghyrou and Tsoukalas, 2011; Hopkin, 2012) or European-level weaknesses (Lapavitsas *et al.*, 2012; Hall, 2014; Gambarotto and Solari, 2015). Yet, they all acknowledge, to different degrees, that the deterioration of macroeconomic fundamentals led to a decline in investors' confidence in public debt servicing sustainability, which led to a widening in the spreads. For example, as in the words of economists Arghyrou and Kontonikas on Greece:

> Overall, the tentative evidence emerging from our estimates is that during the current crisis period Greek spreads have become even more responsive to the movements of macro-fundamentals (Arghyrou and Kontonikas, 2012: 673).

Or, as put by political scientists Pasquino and Valbruzzi examining Italy:

> As to Monti, we could say that he was fundamentally asked to reduce the spread between the Italian and the German bonds, to reform and redesign the domestic market to make it more competitive, and to lift the plummeted prestige of Italy in Europe (Pasquino and Valbruzzi, 2012: 619).

Spread as an indicator of market sentiment towards sovereign solvency has also been employed in studies that examine factors beyond macroeconomic fundamentals as a key driver of market sentiment during the crisis. For instance, Chang and Leblond argue that the lack of intra-European solidarity contributed to erode market confidence in public debt servicing sustainability in the euro area (Chang and Leblond, 2015).

Even more distinctively, there is a large literature in financial economics that examines the actual variables that determined spreads before and after the euro crisis (e.g. Maltritz, 2012; Bernoth and Erdogan, 2012; Aizenman *et al.*, 2013; Beirne and Fratzscher, 2013; Falagiarda and Gregory, 2015). One of their main findings is that investors seem to have reacted to fundamentals differently overtime, in the sense that spread movements were less affected by fundamentals before the onset of the euro crisis in 2009 (e.g. Bernoth and Erdogan, 2012; Aizenman *et al.*, 2013; Beirne and Fratzscher, 2013). A few notable authors, such as De Grauwe and Ji (2013), go even beyond this to argue that a certain amount of spread movements during the height of the crisis (from 2010 to 2012) were completely disconnected from fundamentals, and were rather due to self-fulfilling negative sentiments in financial markets. However, even those authors ultimately anchor their analyses on an understanding of spread as being primarily driven by fear of default.

For example, Bernoth and Erdogan, who found that investors reacted differently to fundamentals over time:

> Financial markets learned that sovereign default is not impossible and that a differentiation between sovereign borrowers is necessary, which will be reflected in more pronounced yield spreads in the future (Bernoth and Erdogan, 2012: 651).

Or De Grauwe and Ji, when discussing that part in the widening of the spreads during the crisis was entirely disconnected from fundamentals:

> There is a self-fulfilling element in this dynamics. When investors *fear default*, they act in such a way that default becomes more likely. A country can become insolvent because investors fear default (De Grauwe and Ji, 2013: 17, emphasis added).

In short, the euro crisis literature examined in great detail how and why investors lost confidence in public debt servicing sustainability within the constraints imposed by a monetary union, which ended up destabilising sovereign debt markets. However, one aspect has received far less attention in this debate: the ways in which interbank liquidity is provided in the euro area, and how this can be a source of sovereign debt market instability.

Understanding the functioning of the European repo market and why it is important

Without a doubt, liquidity (or the lack thereof) has been acknowledged as having played a key role in exacerbating banking crises around the continent, particularly in the case of Ireland and Spain, which contributed to widening their sovereign spreads (e.g. Lane, 2011; Quaglia and Royo, 2015). Furthermore, it should be noted that the reduced liquidity of specific sovereign bonds is sometimes mentioned in relation to spread (e.g. Bernoth and Erdogan, 2012; Herrero and Mencía, 2015). However, these analyses mainly examine the ways in which banking crises affected sovereign debt markets, and do not sufficiently account for how the reduced liquidity of sovereign bonds affects interbank liquidity.

More generally, liquidity is rarely employed as a main analytical focus in these studies, often because of the lack of an adequate framework that explains how interbank liquidity is actually provided in the euro area. The lack of a proper framework to assess the impact of liquidity on spreads can best be exemplified by Herrero and Mencía (2015), who try to isolate the different effects that liquidity and credit risk perceptions can have on spreads. They assess liquidity risk perception through the simple absence of credit risk, which is measured by looking at credit default swap (CDS) rates. Hence, the authors do

not devise a specific measurement to assess the investors' concerns with the liquidity of euro area sovereign bonds.

I argue that the reason why liquidity is insufficiently accounted for in the euro crisis literature is due to a neglect in examining the functioning of the European repo-based interbank funding market. Given how repo markets established extremely close ties between sovereign debt and bank funding, this gap is somewhat surprising in a debate that is highly concerned with sovereign debt market instabilities (see Gabor and Ban, 2016). Indeed, Gabor and Ban show that the structural transformation of European finance after the introduction of the euro has strongly increased the importance of sovereign debt as collateral in repo-based operations in the euro area. Hence, the main original and novel aspect of my research is the focus on the mechanisms underpinning the provision of short-term funding in the euro area, namely repos and central clearing, as the analytical lens through which understanding the unfolding of the crisis.

Repos are short-term collateralised loans, key funding instruments for banks. As a matter of fact, repos are *the main* short-term funding tools for banks in the euro area. Hence, sovereign bonds are closely linked to the funding needs of banks in Europe. Crucially, the repo market was highlighted as a source of systemic instability during the 2007-08 global financial crisis (GFC), because the sudden lack of repo collateral had dried up liquidity in the financial markets of the United States of America (US), effectively making the country's banking system insolvent (Gorton and Metrick, 2012). Yet, the relationship between repo markets and systemic instability has been largely ignored in the euro crisis literature.

Indeed, Chapter 3 shows that the collateralised nature of repo trading retains a highly destabilising potential in financial markets, because it can exacerbate existing liquidity

squeezes in times of financial distress. This is particularly relevant for our understanding of the euro crisis. As I demonstrate in Chapter 4, sovereign debt markets in the euro area are highly vulnerable to the repos' destabilising potential. The ways in which the process of European financial integration has been carried out placed sovereign bonds as the main form of collateral in the European repo market. I argue that such an arrangement exposed the sovereign debt markets of the euro area to the same set of vulnerabilities that affected the US banking system during the GFC.

Furthermore, this thesis sheds light on another key, yet neglected aspect characterising the provision of short-term funding in the euro area: CCPs. CCPs are financial companies that clear transactions between two traders, guaranteeing each trader's contractual obligations (see Norman, 2011; Gregory, 2014). CCPs have become one of the cornerstones of the international efforts aimed at reforming the financial system in the aftermath of the GFC. Indeed, in 2009 the Group of Twenty (G20) leaders pledged to make the central clearing of most over-the-counter derivatives mandatory, which has contributed to an unprecedented expansion in the use of CCPs in global finance. However, while the mandatory clearing commitment was aimed at improving global financial stability and avoiding new too-big-to-fail scenarios, I argue that the ways in which CCPs operate and are now interconnected in financial markets can actually be highly detrimental for systemic stability.

In Chapter 2, I demonstrate that the ways in which CCPs interpose between traders and utilise collateral to shield themselves against the risk of counterparty default make these companies powerful actors in financial markets. CCPs are able to exert particular influence on the liquidity available to investors, because CCPs can suddenly increase the collateral demanded to clear a specific financial transaction. Furthermore, CCPs suffer from risk concentration, because the way in which they operate entails a transfer of risk

exposures from the traders to the CCPs themselves. These mechanisms have underpinned the failures of several CCPs during the 20th century. Indeed, the sudden increases in collateral by CCPs reduced the availability of liquid assets to investors during several financial crises, who then failed to make their payments to the CCPs on time, leading to the default of the CCPs themselves (see Hills *et al.*, 1999). Further, because of the sheer amount of risk exposures they accumulated, the failure of a CCP can shut down the markets where they operate. In short, I shed light on the neglected importance of CCPs for assessing systemic stability in the euro area.

This neglect is remarkable, given that CCPs cleared around 70% of the entire European repo market in 2015 (see ECB, 2015). Furthermore, in the euro area most repo activity is concentrated in one single CCP, which is crucial for considerations regarding systemic stability. In Chapter 4, I argue that the politics surrounding the consolidation of the European exchange industry has led to the creation of the world's largest CCP: LCH.Clearnet, which has become the largest player in the provision of clearing services in the European repo market. Hence, I argue that the sovereign debt markets in the euro area are highly vulnerable to the systemic risks inherent to central clearing, because most of the entire repo market is centrally cleared, and due to how repo exposures are concentrated mainly in one CCP.

In short, this thesis locates the European-interbank repo market as a distinctive and important source of sovereign debt market instability.

Underlying research question

The analysis conducted in this thesis aims at answering the following research question: *what factors contributed to destabilising sovereign debt markets during the height of the euro crisis from 2010 to 2012?*

The reason that prompted me to develop this research question is that sovereign debt market instabilities are one of the key features characterising the euro crisis. As will become clear in Chapter 1, the roots of the crisis are not necessarily linked to government debt markets per se, as the financial distress in each country was often caused by a banking crisis and the credit crunch in the aftermath of the GFC. Nevertheless, sovereign debt markets were one of the main channels through which financial instabilities manifested during those years. Despite the importance of sovereign debt markets, the factors that contributed to destabilise government bond prices receive little attention and are often taken for granted.

Indeed, it is usually assumed that it was the deterioration of market confidence in public debt servicing sustainability that greatly contributed to sovereign debt market instabilities from 2010 to 2012, which was triggered by a variety of debated factors (e,g, Arghyrou and Tsoukalas, 2011; De Grauwe and Ji, 2013; Pepino, 2015). Thus, rather than examining the actual factors that destabilised sovereign debt markets, I argue that the euro crisis literature is largely concerned with examining the factors that *eroded market confidence in sovereign solvency*. Yet, the sovereign debt market-specific factors that caused financial instabilities have not been examined in detail, which does not allow us to look beyond fear of sovereign default as the key explanatory variable for spreads.

The original approach undertaken through this research question is therefore rooted in examining the specific destabilising mechanisms that affected and influenced sovereign debt markets in the euro area. One of the main advantages of this research question is that

it does not force my analysis to retain an *a priori* assumption on what drove investors to sell government bonds during the euro crisis, such as the argument that a heightened fear of default caused large-scale bond sell-offs. Rather, this research question allows me to take the opposite direction analytically. I explain the reasons that induced investors to sell-government bonds by identifying the specific factors that contributed to destabilising sovereign debt markets in the first place.

In a nutshell, the dominant view in the euro crisis literature is that a taken for granted fear of default contributed to destabilising sovereign debt markets. However, the literature does not actually explain how a potential increase in sovereign default risk may have prompted a heightened fear of default among market participants and thus sell-offs, a link which again is often taken for granted (i.e. fear of default did strengthen and sell-offs followed as a consequence). Instead, I examine a set of specific market mechanisms that I demonstrate contributed to destabilising sovereign debt markets, i.e. the systemic weaknesses of the European repo market, in order to arrive at an understanding of what drove investors sell a large amount of sovereign bonds during the euro crisis, i.e. concerns regarding the use of sovereign bonds to access short-term funding.

The novel approach of this research question advances our understanding of the euro crisis on two grounds. First, by providing a thorough understanding of the often-neglected market mechanisms underpinning the provision of short-term funding in the euro area, which also shed light on their destabilising potential for sovereign debt markets. Second, by developing an understanding of what drove investors to sell government bonds during the euro crisis beyond concerns regarding sovereign default risk perception.

Contributions to the literature

The main contribution of this thesis is to the broader euro crisis literature and is the provision of a more nuanced understanding of what drove investors to sell large quantities of sovereign bonds during the euro crisis. Thanks to the insights and findings gathered throughout the next five chapters, I argue that market sentiment towards liquidity risk was a key driver for the spreads in the euro area during the period examined. In answering this project's research question, I find that the actions of LCH.Clearnet in the crisis-prone structure of the European repo markets contributed to destabilising sovereign debt markets, leading to a widening in the Irish, Portuguese, Italian, and Spanish spreads. The main argument that I make in this project is that some of the most destabilising large-scale bond sell-offs that took place during those years occurred due to investors being concerned with the use of sovereign bonds to access short-term funding, and not just with sovereign default risk. That is because the collateral practices of LCH.Clearnet from 2010 to 2012 reduced the value, and thus, the liquidity, of specific sovereign bonds as collateral in repo transactions, which led to the bond sell-offs that widened the spreads of the affected securities.

Hence, the key contribution that I make in this thesis is that spread movements during the euro crisis were not just indicating market sentiment towards sovereign default risk, but also with respect to liquidity risk. This contribution shifts the focus away from understanding government debt primarily in relation to sovereign default (e.g. Arghyrou and Tsoukalas, 2011; Featherstone, 2011; De Grauwe and Ji, 2013; Pepino, 2015), and stresses instead the use of sovereign bonds in connection to the provision of interbank liquidity in the euro area. While providing this main contribution, the analysis conducted in this project allows me to make another four, secondary contributions.

First, this project makes a broader interdisciplinary contribution to our understanding of the euro crisis by bringing several disciplines into conversation with one another. While

I refer to the euro crisis literature as one single body of work, studies examining the origins and development of the euro crisis come from a variety of subject fields, most prominently political science (e.g. Hopkin, 2012; Hall, 2014), political economy (e.g. Kirby, 2010; Gambarotto and Solari, 2015), economics (e.g. Arghyrou and Tsoukalas, 2011; Baldwin *et al.*, 2015), and financial economics (e.g. Maltritz, 2012; De Grauwe and Ji, 2013). Without a doubt, interdisciplinarity is a feature retained in several political economy studies that assessed the development of the euro crisis (e.g. Quaglia and Royo, 2015; Pepino, 2015; Dooley, 2015). However, these tend to import insights from financial economics, without actively engaging into a critical understanding of their findings, which, with a few exceptions (e.g. Rommerskirchen, 2015; Chang and Leblond, 2015), are taken for granted.

An interdisciplinary approach is thus particularly important with regard to the objectives set out in this project, because it is able show that, despite disciplinary, methodological and argumentative differences, these different literatures retain a similar understanding of market behaviour and spread movements. While this interdisciplinary approach is present throughout the whole thesis, in the sense that every chapter relies on insights originating from different fields, Chapter 1 examines similarities and differences across disciplinary boundaries in a more systematic manner. Chapter 1 contributes to our understanding of the euro crisis literature by showing that spread is largely employed as an indicator of default risk perception across the different disciplines that discuss the origins and development of the crisis.

There is some debate as to the explanation of the drivers of default risk perception. For example, some argue that it is driven by deterioration of macroeconomic fundamentals caused by domestic- or European-level factors (e.g. Arghyrou and Tsoukalas, 2011; Lapavitsas *et al.*, 2012). Others argue that the lack of intra-European solidarity (e.g.

Chang and Leblond, 2015), or self-fulfilling expectations of default fear (e.g. De Grauwe and Ji, 2013) are key drivers for such sentiment. Despite these differences, I argue that spread movements in the literature are almost always associated with the markets' changing perception of sovereign default risk.

Second, this thesis makes another broad contribution to the euro crisis literature by emphasising the importance played by the repo market as a source of systemic instability. A few rational choice political economists and post-Keynesian economists do acknowledge the impact that the declining liquidity of sovereign bonds in repo markets had in exacerbating the funding needs of banks in the euro area during the crisis (e.g. Katsimi and Moutos, 2010; Moro, 2014; Pepino, 2015). However, a detailed account of the functioning of repos, as well as how repos are relevant with respect to the funding needs of banks and systemic stability more generally, is a clear gap in the euro crisis literature. Therefore, Chapter 3 discusses the development of repo markets during the 20th century, in order to showcase how this market has historically been exceptionally important with respect to both the provision of short-term funding for banks, as well as for its broader relevance for triggering collateral crises. In short, I contribute to the euro crisis literature by locating the repo market as a source of liquidity as well as systemic instability in financial markets.

Specifically, I shed light on the mechanisms that make repo markets extremely prone to the sudden lack of usable collateral, which can cause liquidity crises and make specific types of securities unusable in short-term funding operations. This is highly relevant for understanding the development of the euro crisis. On the one hand, Chapter 4 will show that the ways in which European financial integration was conducted between the late 1990s and the early 2000s exposed the sovereign debt markets of the euro area to the vulnerabilities of repo-based collateralised finance. On the other hand, Chapter 5 will

demonstrate that it was not just heightened default risk perception from 2010 to 2012 that widened the spreads in Ireland, Portugal, Italy, and Spain, but also how LCH.Clearnet reduced the value for using these countries' bonds as collateral to access repo-based short-term funding.

Third, I examine the development and power of CCPs in financial markets, contributing to both the narrower literature on the political economy of global finance, as well as to the euro crisis and EU integration literatures more broadly. The role played by CCPs in financial markets has been largely neglected in these two scholarships, though to different degrees and with a few important exceptions. Over the past few years, research in political economy has begun to recognise the relevance of these actors in the re-regulation of global finance in the aftermath of the GFC (Helleiner, 2014; Lockwood, 2018). Furthermore, studies on EU financial integration and on the euro crisis noted the potentially destabilising role CCPs played during the height of the euro crisis, although central clearing was not the focus of their analyses (e.g. Jones, 2012; Pepino, 2015, Gabor and Ban, 2016). Indeed, these studies lack an understanding of the core mechanisms at the heart of central clearing. This is a significant neglect, because it prevents examination of the distinctive ways in which CCPs operate, which in turn prevents an assessment of how CCPs can materially influence financial stability.

Chapter 2 contributes to these literatures by showing how CCPs have developed to become the legal counterparty in each trade, while performing their historical role of contract performance guarantors. I argue that this specific characteristic of CCPs allows them to exert a significant amount of power to investors through the unilateral imposition of collateral requirements, which can be highly destabilising in times of financial distress. This is particularly relevant for scholars working on the euro crisis and EU economic integration, because it shows that the specific way in which CCPs are positioned between

traders and collect collateral can destabilise financial markets. Furthermore, this chapter provides an important contribution to the political economy of global finance by showing that CCPs have been central to the development of financial markets since the 18th century, when brokers began to develop into rudimentary CCPs. Given that CCPs have existed for such a long time, the limited scholarly attention paid to CCPs, with the exception of a few studies in financial history (e.g. Norman, 2011; Gregory, 2014; Steigerwald, 2015), is a remarkable finding.

Fourth, the research conducted in this thesis seeks to contribute to the subsection of the euro crisis literature that mostly ascribes the development of sovereign debt market instabilities to the process of European monetary integration, a group of literature that I refer to as the 'European-level explanations'. This scholarship includes many contributions by heterodox economists, both post-Keynesian and Marxist (e.g. Lapavitsas *et al.*, 2012; Moro, 2014; Pettis, 2013) as well as research in varieties of capitalism by political scientists and institutional economists (e.g. Hall, 2014; Gambarotto and Solari, 2015). These studies argue that European monetary integration has created an asymmetric trade regime that compromised the competitiveness of the euro area's periphery (Greece, Portugal, Spain, Ireland) at the benefit of the core (mainly Germany and the Netherlands).

In short, these authors argue that European monetary integration has contributed to the development of macroeconomic imbalances, which created an unsustainable debt-dependant and deficit-driven growth regime in the periphery. Once the 2008 credit crunch struck Europe, these authors argue that the vulnerabilities of the monetary union came to the forefront due to the lack of available credit, exposing the sovereign debt markets of the periphery to the declining confidence of investors in public debt servicing sustainability.

This thesis contributes to the European-level explanations scholarship by showing that sovereign debt market instabilities did not develop only through monetary integration, and by showing that these instabilities were generated by factors other than macroeconomic imbalances. I argue that sovereign debt markets during the crisis were also destabilised due to the vulnerabilities developed during the process of European financial market integration. In that respect, the political processes that supported this process played a key role in the development of systemic instabilities, an area of inquiry that has been largely neglected by the European-level explanations. Indeed, Chapter 4 contributes to this scholarship by arguing that the political developments that underpinned the creation of a single European financial space have made sovereign debt markets in the euro area particularly prone to what I call 'CCP-induced collateral crises'.

Methodology and case study selection

In order to show how investors behaved with respect to liquidity risk during the euro crisis, this study examines the mechanisms underpinning the provision of short-term lending in the euro area. The analysis proceeds in several steps and employs triangulation to bring together different forms of qualitative and quantitative evidence. Chapters 2 and 3 provide an in-depth historical assessment of the development of central clearing and the repo market respectively. Chapter 2, which examines the development of central clearing from the 18th century, relies on a variety of historical material, ranging from central banks and international institutions' reports to secondary sources (e.g. Rees, 1981; Schaede, 1989; Hills *et al.*, 1999; Moser, 1998; G20, 2009; OECD, 2011; Wendt, 2015). These resources are selectively employed to reconstruct a history of central clearing based around the features that make this technology distinctive from traditional intermediation. The material used in this chapter allows an assessment of how the historical function of central clearing – that is, to guarantee the performance of every contract – characterises

the unique way in which CCPs still operate nowadays, which in turn I argue underpins their destabilising potential in financial markets.

In a similar fashion, Chapter 3 relies extensively on both secondary sources and (mostly) reports and studies from central banks, in order to position the significance of repos in relation to the provision of short-term funding for banks (e.g. Fed, 1981; Bundesbank, 1996; Bank of England, 1997; Meltzer, 2003; Gabor, 2016). I also discuss the limited empirical evidence that estimates the role of the repo market on systemic stability, which I use to draw contours of continuity and change with respect to understanding the unfolding of financial crises (e.g. Gorton and Metrick, 2012; Copeland *et al.*, 2014). The material discussed above allows me to shed light onto what appears to be a contradiction inherent to the development of modern repos: their essential role in the provision of short-term funding as well as their destabilising potential on liquidity during financial crises.

Chapters 4 and 5 empirically assess the European repo market. Chapter 4 relies on institutional reports by representatives of the financial industry, the European Commission (EC) and the European Central Bank (ECB) to understand the different factors that have pushed for the expansion of the use of repos in the euro area (e.g. Giovannini, 1999; EC, 1999; ECB, 2002a). Chapter 4 also utilises secondary sources and reports by international organisations in order to understand the different interests at stake in the consolidation of the European exchange industry (e.g. Garfield, 1999; Milner, 1999; G10, 2001; OFT, 2003; Norman, 2011). Overall, Chapter 4 employs these different sources to identify the factors that have shaped the European repo market to be so distinctively reliant on sovereign bonds as collateral and on CCPs. I argue that this reliance rendered sovereign debt markets in the euro area extremely prone to my novel notion of CCP-induced collateral crises.

Chapter 5 assesses the implication of these arrangements on sovereign debt market stability during the euro crisis. The analysis is based upon daily spread data for Ireland, Portugal, Italy, and Spain from 2010 to 2012, whose daily movements are observed in relation to the collateral requirements set up by LCH.Clearnet in repo markets during the period examined. The daily data on spreads was taken from Thomson Reuters' Eikon platform, a professional software widely employed by traders to analyse financial information and trends (Eikon, n.d.). The information about the timing and size of the collateral requirements were gathered from LCH.Clearnet's online database (LCH.Clearnet, n.d.). The chapter seeks to identify when a sudden increase in collateral requirements, such as a margin call on specific sovereign bonds, was followed by a widening of the spreads on the day of the call itself, as well as on the following day. This is a widely used technique to assess the short-term impact of financial shocks on asset prices (e.g. Reuters, 2011, 2012a; Cotterill, 2011). In a nutshell, this chapter examines whether an increase in the cost of using specific sovereign bonds as collateral in repo-based short-term funding operations has contributed to bond sell-offs and a subsequent widening in the spread of the respective bonds.

To provide as much context as possible, I have examined these occurrences by considering other factors that are considered to have acted as short-term shocks on spreads during the euro crisis. This includes credit rating downgrades, announcements by the ECB, domestic political upheavals, bank failures and bailout requests (see for example Falagiarda and Reitz, 2015; Falagiarda and Gregori, 2015; Zoli, 2013; Gärtner *et al*., 2011). Furthermore, the analysis conducted in Chapter 5 is also complemented by a qualitative component. The impact of LCH.Clearnet's collateral policy on spreads is triangulated with qualitative evidence on the specific political and economic contexts particular to each case study, such as the roots of their respective crises, the status of their banking sectors, as well as the crisis-specific developments during the period examined.

The assessment also accounts for other studies, reports and market analyses that discuss the implication CCPs' margin calls on spread during the euro crisis.

In terms of case study selection for Chapter 5, first, I look at the role played by LCH.Clearnet. I chose LCH.Clearnet because it is the CCP in the euro area that clears almost the entire euro-denominated repo market. Hence, the impact of LCH.Clearnet's collateral policy on sovereign debt markets is disproportionately larger than those of other CCPs in the euro area. Second, I examine the impact of margin calls on the spread of Irish, Portuguese, Italian, and Spanish sovereign bonds because LCH.Clearnet only implemented margin calls on those sovereign debt markets during the period examined. Hence, my case study selection represents the totality of the countries that were affected by margin the policies of LCH.Clearnet during the height of the euro crisis.

Analytical notions

It is necessary to clarify two key analytical notions employed in this thesis. The first concerns funding liquidity. Liquidity refers to the extent to which a particular security or asset can readily be sold or purchased in a market without affecting its price. Hence, a liquid asset means that it can be sold very quickly with little to no loss in value. Conversely, illiquid assets are those that are more difficult to sell, and where its conversion into cash entails a loss in the value of the original investment. More specifically, I refer to funding liquidity as 'the ability to settle obligations immediately when due. Consequently, a bank is illiquid if it is unable to settle obligations on time' (Drehmann and Nikolau, 2009: 5). It follows that funding liquidity risk refers to the possibility that, due to the lack of available funding, a bank may be unable to settle its obligations on time.

In this respect, the ready availability of short-term funding is an essential part of a bank's operations that allows them to settle obligations on time, as banks go bust if short-term funding is halted or becomes insufficient (Baldwin *et al*., 2015: 8). Hence, there is a relationship between the liquidity of an asset and the funding liquidity of banks, because the declining convertibility in cash of a particular security can influence the ability of a bank to have sufficient funding to meet obligations on time (Brunnermeier and Perdersen, 2009). This is particularly the case when it comes to repos, because repo contracts entail the sale and repurchase of collateral as a means to access funding. Hence, the declining availability of liquid repo collateral can negatively influence a bank's funding liquidity, as happened in the US banking system during the GFC (see Gorton and Metrick, 2012).

This project thus relies on the notion of liquidity and funding liquidity to examine the extent to which the declining value of sovereign bonds in repo transactions from 2010 to 2012 contributed to the large-scale bond sell-offs. I found that LCH.Clearnet's actions in repo markets led to a decline in the liquidity of sovereign bonds as collateral, which contributed to the destabilising of sovereign debt markets and widened the affected countries' spreads. Likewise, the ways in which LCH.Clearnet's actions influenced the liquidity of sovereign bonds plays a key role in understanding the factors that contributed to putting pressure on the funding liquidity of banks in the euro area. This helps explain why they sold the less liquid sovereign bonds.

The second analytical notion to be clarified concerns the term 'market sentiment', which I employ differently from its common usage in behavioural finance (e.g. Shiller, 2000; Brown and Cliff, 2004). In behavioural finance, market sentiment, investor sentiment, or simply sentiment, refer to 'a belief about future cash flows and investment risk that is not justified by the fact at hand' (Baker and Wurgler, 2007: 129). Market sentiment was developed to overcome some of the limitations of standard finance models, which

understand investors as entirely rational and emotionally unaffected; therefore, capital market prices are inferred to be equal to the rational face value of expected future cash flows (ibid). The numerous stock market crashes that characterised financial history during 20th century, which caused dramatic changes in stock market prices, prompted researchers to question whether purely rationally-driven understandings of investor behaviour are helpful in understanding those crashes. As a result, scholars in behavioural finance argue that investors are also affected by emotional factors when making financial decisions (Shu and Chang, 2015: 206), and have explored whether this so-called sentiment can impact prices and contribute to stock market volatilities (e.g. Siegel, 1992; Shiller, 2000; Brown and Cliff, 2004).

This scholarship advances our understanding of investor behaviour by moving beyond framing investors acting as purely rational actors. However, this understanding of market sentiment falls outside the scope of this study, because it remains anchored upon a dichotomy between investors acting rationally and sentimentally, where sentiment is seen as impairing otherwise rational financial decisions (Dow, 2011). This study is neither concerned with whether investors were acting more rationally or according to sentiment during the euro crisis, nor does it seek to devise new indicators for measuring such sentiment. Nevertheless, this study remains interested in understanding the reasons that prompted investors to sell large amounts of sovereign bonds from 2010 to 2012, which widened the spreads in the euro area.

Thus, this study employs a more general understanding of market sentiment as referring to the various concerns that investors may have when trading specific securities in financial markets, such as default risk, liquidity risk, or exchange-rate risk, although the latter does not apply in the euro area. The same applies to related concepts used in this thesis, such as market confidence and market behaviour towards a particular type of

concern, such as default risk or funding liquidity risk. With respect to the objectives set out in this thesis, I seek to highlight the contextual factors that have likely contributed to raising concerns regarding funding liquidity risk during the height of the euro crisis, from 2010 to 2012.

More broadly, this thesis also engages with the meaning of 'the market', with the objective of questioning the universality of the term (see Watson, 2018; see also Watson, 2005). Markets are often invoked in the euro crisis literature in relation to spread movements. As I discussed above, spread movements reflect a change in the relative price and yield of a given sovereign bond against the benchmark. Therefore, the euro crisis literature retains an implicit understanding of the market which refers, in essence, to the financial operators who affect spreads through the purchase and sale of sovereign bonds. However, scholars engaging in the euro crisis debate do not provide an actual explanation of who these investors were, and generally use the word 'markets' to simply describe investors in sovereign debt securities (e.g. Featherstone, 2011: 194; Lane, 2012: 60; Falagiarda and Gregori, 2015: 293).

Rather than understanding markets as an ensemble of indiscriminate investors, this thesis *specifies* the type of actors that were involved in the bond-sell offs during the period examined, and that were therefore responsible for the widening of the spreads. Through a detailed understanding of the mechanisms underpinning the functioning of the European repo market, I argue these financial market operators were mostly European banks lending to themselves in the interbank lending market, and not an undistinguishable group of investors investing in sovereign debt securities as discussed in much of the literature.

Chapter summaries, main arguments, and key findings

The rest of this thesis is structured into five chapters. Chapter 1 provides an overview of the euro crisis literature, which is an ensemble of studies coming from different disciplines and theoretical standpoints that are concerned with understanding the origins and unfolding of the euro crisis. I identify three different analytical groups, the domestic-level explanations, the European-level explanations, and the financial economics literature. While overlaps between these different categories most certainly exist, as is evidenced in Chapter 1, the groups retain some key differentiating elements.

The domestic-level explanations bring together contributions from orthodox economics, political science, and political economy, and ascribe the onset of the crisis to domestic factors. The dominant view portrayed in this group is that poor domestic economic governance has led to the deterioration of macroeconomic fundamentals, which eroded market confidence of public debt servicing sustainability, destabilising sovereign debt markets and widening the spreads (Arghyrou and Tsoukalas, 2011; Hopkin, 2012; Pereira and Wemans, 2012). I argue that this scholarship, particularly that looking at Greece, is highly important because it contributed to establishing an understanding of the crisis that revolves around the mismanagement of public finances. In turn, this scholarship contributed to crystallising the idea that market behaviour during the crisis was largely driven by default risk perception (e.g. De Grauwe and Ji, 2013; Pepino, 2015).

Although the European-level explanations also ascribe the deterioration of macroeconomic fundamentals as one of the key drivers of market behaviour, they radically depart from the domestic-level explanations as they blame poor economic governance at European level. Indeed, those authors, mainly heterodox economists (post-Keynesian and Marxist) and scholars working on varieties of capitalism, criticise the ways in which European monetary integration has been carried out (e.g. Lapavitsas, *et al*., 2012; Hall, 2014; Gambarotto and Solari, 2015; Stockhammer, 2016). According to

these authors, the introduction of the euro has established an asymmetric trade regime that split the euro area between a deficit, debt-driven, and credit dependant periphery, and a surplus and export-oriented core. Like the domestic-level explanations, European-level scholars ultimately argue that the deterioration of macroeconomic fundamentals – as a consequence of this asymmetric arrangement – contributed to weakening market confidence in public debt servicing sustainability, which destabilised sovereign debt markets and widened the spreads.

The financial economics literature is comprised of a number of scholars that employ econometric modelling to isolate the specific variables that influenced spreads before and after the crisis. While a few align with the domestic- and European-level explanations discussed above, in that they identify the deterioration of macroeconomic fundamentals as the main determinant of spread, the most recent contributions to this scholarship take significant steps beyond fundamentals as the sole explanatory variable. Indeed, these authors argue that the changing perception of sovereign default risk after the GFC became a self-fulfilling prophecy in 2010 and drove the large-scale sell-offs that destabilised sovereign debt markets and widened the spreads (e.g. Bernoth and Erdogan, 2012; Aizenman, *et al.*, 2013; De Grauwe and Ji, 2013).

Hence, the main finding of Chapter 1 is that spread is overwhelmingly employed across the literature as an indicator of sovereign default risk perception during the euro crisis, despite the disciplinary and theoretical differences among these groups. Very little is discussed in relation to the provisions of liquidity and the mechanisms underpinning its provision.

Chapter 2 examines the development of central clearing. I showcase the historical embeddedness of CCPs in the making of financial markets, which helps to understand

their pivotal position in European finance during the unfolding of the euro crisis. The main argument portrayed in this chapter is that the mechanisms at the origins of central clearing, which are centred around the provision of contract performance guarantee, have been kept by modern-day CCPs and retain a highly destabilising potential in financial markets. I trace the origins of central clearing to 18th century Japan, when brokers in the Dojima rice market of Osaka developed into clearing houses to protect traders against the price fluctuations of rice. I then examine the evolution of central clearing through specific clearing innovations in Le Havre, France, and in Minneapolis, US, during the 19th century.

The chapter then moves on to examine the contemporary relevance of CCP with respect to the financial reform agenda put forward by the G20 in 2009, which made the central clearing of almost the entire over-the-counter (OTC) derivatives market mandatory. I found that, following the introduction of the clearing mandate for OTC derivatives in 2009, both the use of central clearing and risk concentration in CCPs has reached an all-time high. This brings me to discuss another key aspect regarding central clearing: its relationship with financial stability. I survey the role played by CCPs during some key moments in 20th century financial history, concluding that the ways in which CCPs replace each side of a trading relationship and impose collateral requirements have contributed to exacerbating liquidity pressures on traders during periods of financial instabilities.

The inability of traders to meet the collateral demands led to their default and, in turn, the failure of the CCPs themselves. Hence, the main conclusion to be retained from Chapter 2 is that while, on the one hand, central clearing has always played a central role in financial markets since the 18th century, on the other hand, the ways in which CCPs operate also retains a highly destabilising potential during financial crises, because they

can reduce the already limited liquidity available to investors. This finding is particularly important for the scope of this project, because it provides a theoretical lens to understand the involvement of LCH.Clearnet during the euro crisis. Indeed, this chapter provides a framework to understand how LCH.Clearnet reduced the liquidity of specific sovereign bonds in repo operations, prompting investors to sell-off the affected securities and contributing to destabilising sovereign debt markets.

Chapter 3 discusses the modern repo market, emphasising the importance of these financial instruments to the banks' short-term funding needs, as well as their significance as a crisis-transmission channel. The development of repos is closely linked to the transformation of monetary policy in the US and Europe during the 1900s. This chapter identifies the origins of the modern repo market to the beginning of the 20th century in the US, when the Federal Reserve Bank of New York (New York Fed) utilised repos to provide cheap financing to underfunded banks. Hence, I argue that the modern repo market has historically been linked to the funding liquidity needs of banks. Crucially, the use of repos greatly expanded in the aftermath of World War II, as the renewed independence given to the Federal Reserve System (Fed) shifted emphasis towards rising interest rates to maintain inflation under control. High interest rates thus made repos a much more appealing source of funding for non-bank securities dealers, due to their cheaper, short-term and collateralised nature.

At the same time, the fast growth of public debt issuing by the US's Treasury provided security dealers with more collateral through which to conduct repo operations. This is crucial, because it marks the moment when the provision and cost of short-term funding began to be increasingly determined in financial markets; this development is known as market-based finance. This is a key point with respect to answering the project's research question, which seeks to uncover the factors that contributed to the destabilisation of

sovereign debt markets during the euro crisis. Indeed, I argue that it is precisely the handling of sovereign collateral through market-based practices that contributed to the destabilising of government debt markets of the euro area.

I then examine the development of repos in relation to financial stability. First, the 1998 Russian currency crisis showed how the sudden lack of repo collateral can trigger liquidity crises, which prompted the international community of central bankers to find consensus around expanding the use of sovereign debt as a safe collateral in repo markets. This is key for the scope of this thesis, as expanding the use of government bonds as collateral in repos brought sovereign debt and bank funding closer together, which I argue is one of the factors that underpinned the sovereign debt market instabilities during the euro crisis. Relatedly, by reviewing the empirical evidence available, I found that the use of repos was highly destabilising during the GFC. The declining availability of sub-prime collateral triggered collateral requirement increases that further decreased the value and the availability of those assets, which, in a procyclical way, further contributed to make the US banking system insolvent.

Chapter 4 identifies the different factors that have made the European repo market distinctively reliant on sovereign bonds as collateral and on CCPs. The general argument made here is that such an arrangement is the result of the politics underpinning the integration of European financial markets following the introduction of the euro. The chapter first examines the involvement of the Giovannini Group, an ensemble of public and private financial market experts set up by the EC to provide advice on financial market integration. In this respect, it is important to point out that the integration of European financial markets was a key political strategy by the EC to reconcile France and Germany's contrasting interests during the process of European economic integration.

Hence, European financial integration became a political imperative for the EC and, at a later stage, the ECB.

The Giovannini Group argued that the poor level of cross-border financing in the euro area was largely due to the fragmentation of repo and collateral markets along national lines. This diagnosis prompted the Giovannini Group to make recommendations to harmonise legal rules for the cross-border use of collateral, as well as to promote a set of trading conventions around the handling of collateral along market-based practices. It should be noted that the promotion of market-based practices to handle sovereign collateral was part of the EC's political strategy to appease Germany's worries about weak fiscal discipline by higher inflationary countries. More broadly, the aim of the Giovannini Group was to push for the integration of European financial markets through repo trading, which essentially envisaged a single Europeanised repo market as the cornerstone for the provision of liquidity in the euro area.

I then examine the key role played by the ECB in bringing sovereign collateral as the centrepiece of repo-driven financial integration in Europe. In line with the Giovannini Group, the ECB argued that the fragmentation of securities markets was one of the main obstacles for financial market integration. Thus, the ECB introduced a mechanism to allow any euro area sovereign bond to be used interchangeably as collateral for its own repo operations, whose pricing would also match those in financial markets. Despite being aware of the potentially destabilising potential of such an arrangement, I argue that the ECB prioritised the imperative of financial market integration over concerns regarding systemic stability. By making any euro area sovereign bonds equal for collateral purposes, and by adopting the same stance of private market actors in the handling of collateral, the ECB established the blueprint for the use of sovereign collateral in the European repo market.

Decisions regarding the use of collateral are also closely linked to the politics surrounding the monetary policy architecture of the ECB. Indeed, the choice of the ECB to opt for market-based practices for the management of sovereign collateral was due to the perceived political legitimacy of its monetary policy, particularly in the eyes of German authorities. Germany worried that allowing any sovereign bond to be used as collateral interchangeably could weaken the fiscal discipline of inflationary member states. Thus, the ECB decided to adopt a market-based stance on the use of sovereign collateral in order to shield itself against implementing discretionary monetary policy decisions, which would undermine its political independence and favour weak fiscal discipline. These findings are particularly important for the scope of this thesis, because they allow me to show that the way in which LCH.Clearnet handled sovereign collateral during the euro crisis is deeply rooted in the specific way the process of European financial integration was carried out by the EC and the ECB. In turn, it is precisely these practices that I argue triggered a collateral crisis that contributed to the destabilisation of government bond markets during the euro crisis.

The analysis conducted in Chapter 4 continues to examine another key process that shaped financial market integration in Europe: the politics underpinning the consolidation of the exchange industry. I discuss the different interests at stake among European exchanges, which led to several consolidation initiatives that aimed at establishing a single European CCP. On the one hand, the insistence of the Paris stock exchange against its German counterpart to maintain central clearing as a key technology consolidated the future of CCPs in the euro area. On the other hand, discussions between European exchanges and British users led to the creation of LCH.Clearnet, Europe's first truly pan-European CCP, which grew to become one of the world's largest by clearing volume. This is crucial, because it is the compromises underpinning the creation of LCH.Clearnet that made European financial markets susceptible to the instabilities inherent to central

clearing discussed in Chapter 2. Ultimately, I argue that the architecture of the European repo market exposed sovereign debt markets to what I call CCP-induced collateral crises.

Chapter 5 provides an examination of the involvement of LCH.Clearnet during the euro crisis, which builds on the theoretical and empirical insights obtained through the previous four chapters. I examine the role played by LCH.Clearnet's collateral management practices in repo markets during the Irish, Portuguese, Italian, and Spanish crises from 2010 to 2012. Through the combination of qualitative and quantitative evidence, my findings suggest that the sudden increase in collateral requirements by LCH.Clearnet led to a widening in the spreads of every case study except Spain. I explain the dynamic as follows. The increase in collateral requirements reduced the liquidity of the aforementioned bonds, because it made it more expensive to use them as collateral in repo transactions. In order to meet the increase in collateral requirements and to get access to more valuable collateral, investors began large-scale sovereign bond sell-offs of the affected securities, which widened their spreads against the German bund.

The impact of LCH.Clearnet's actions varied greatly depending on the size of the increases and on other factors. For instance, in Ireland and Portugal the extent of the increase was so significant that the increases in collateral requirements is likely to have had a procyclical effect on their spreads, creating a feedback loop between declining bond prices and higher collateral demands. In the case of Spain, the spread did not widen immediately after the increases in collateral requirements, because domestic banks had increased their reliance on Spanish sovereign bonds and repos after the 2008 credit crunch. Hence, they could not get rid of sovereign bonds that easily, despite the increases in collateral requirements, since they could not rely on other securities to fund themselves. Conversely, the highest peaks in spread experienced by Italy came right after collateral requirement increases. In general, the evidence collected in this chapter suggests that the

increases in collateral requirements reduced the liquidity of the bonds affected, which contributed to the destabilisation of sovereign debt markets and widening the spread.

The main conclusion drawn from this thesis is that spread movements during the height of the euro crisis were not only an indication of the markets' fear of sovereign default, but also of their concern with the use of specific government bonds as collateral to access short-term funding via repos. In that respect, the structural vulnerability of the European repo market to CCP-induced collateral crises is a central part of this story.

The next chapter will begin developing the argument by reviewing the euro crisis literature and how it discusses spread in relation to sovereign default risk perceptions.

1 Spread and Fear of Default in the Euro Crisis Literature

1.1 Introduction

The euro crisis literature has extensively assessed how investors have become concerned about the potential sovereign default of Greece, Ireland, Portugal, Italy and Spain[1]. These countries all witnessed significant sovereign debt market distress from 2010 to 2012, which manifested in the widening of their sovereign bond yields spreads against the German bund. I should stress straightaway that while I may refer to the euro crisis literature as a whole, these studies do not belong to a single subject field. Indeed, the events that took place from 2010 to 2012 prompted researchers from a variety of disciplines and theoretical standpoints to examine the roots of sovereign debt market instabilities.

Contributions came mostly from political science, political economy, economics and financial economics. One of the key arguments made in this litearture is that investors' confidence towards public debt servicing sustainability eroded during the crisis, and that this was in turn largely due to the deterioration of macroeconomic fundamentals (competitiveness, balance of payments, fiscal deficits, inflation rates) since the introduction of the euro. As argued by these studies (e.g. Arghyrou and Tsoukalas, 2011; Royo, 2010; Gaulier and Vicard, 2013; Hopkin, 2012; Culpepper, 2014; Gambarotto and Solari, 2015; Hall, 2014), the deterioration of economic fundamentals, together with the

[1] Whereas Cyprus has also experienced severe sovereign debt market turmoil during its banking crisis in 2012, the country has not generally been a key focus in the literature, due to the relatively small size of its economy when compared to the other distressed countries of the euro area (for an overview, see Thompson, 2015; Baldwin *et al.*, 2015; Panico and Purificato, 2013).

withdrawal of an implicit government debt servicing guarantee by Germany in 2010, negatively affected sovereign default risk perception, leading to bond sell-offs that widened those countries' spreads. This view is shared by what I call domestic-level and European-level explanations of the euro crisis, and, in a slightly different (but equally significant) way, by the financial economics literature.

Whereas the euro crisis literature explored in great details the different issues arising from the macroeconomic imbalances generated within the monetary union, one area has received far less attention: the weaknesses generated by the mechanisms underpinning liquidity provision in the financial markets of the euro area. By focusing on financial markets weaknesses, I seek to shift the attention of the debate away from the significance of sovereign debt in relation to sovereign default perception. Rather, this study is interested in showcasing the idiosyncrasies of government debt in fuelling the liquidity in the financial markets of the euro area.

Shifting the attention towards the ways in which liquidity is provided in the euro area allows us to emphasise another equally crucial set of factors which are not related to sovereign solvency that drove investors to sell off euro area sovereign bonds during the height of the crisis. As shown in Chapter 4, the ways in which sovereign debt, bank liquidity and CCPs are intertwined with one another in the European repo-based interbank funding market have contributed to make European sovereign debt markets extremely prone to CCP-induced collateral crises. Indeed, Chapter 5 demonstrates that LCH.Clearnet's increase in collateral requirements to use Irish, Portuguese, Italian and Spanish sovereign bonds in repo operations from 2010 to 2012 led to large-scale sell-offs of the affected securities amid concerns about the use of those securities as collateral in repo operations, which widened those countries' spreads with Germany. This is particularly important with respect to our understanding of the euro crisis, insofar as

spread movement as a reflection of markets' concerns with sovereign solvency has strongly influenced the policy responses to the crisis. Hence, the findings provided in this study suggest that policies based on reducing public debt and deficit to restore investors' confidence towards sovereign debt servicing sustainability, or those concerning the recovery and resolution of large financial institutions, did not help to overcome the weaknesses existing within the European repo-based interbank funding markets.

I should stress that this study *does not* reject the argument that sovereign default risk perception was an important driver of market sentiment during the euro crisis, far from it. As will be shown later, the fiscal dimension underpinning the unfolding of the Greek crisis played a major role in shaping the terms of the euro crisis around material concerns with sovereign solvency. Indeed, Chapter 5 discusses how the increased sovereign default risk perception was one of the main factors that pushed the LCH.Clearnet to change its collateral management approach.

On the one hand, the domestic-level explanations, which bring together contribution from orthodox economics, political science and political economy, ascribe the deterioration of macroeconomic fundamentals to domestic shortcomings: lack of competitiveness (Arghyrou and Tsoukalas, 2011; Royo, 2010; Gaulier and Vicard, 2013), unsustainable fiscal regimes (Buiter and Rahbari, 2010; Pereira and Wemans, 2012) and different wage setting mechanisms, which led to different inflation rates across the euro area (Hancké, 2013; Johnston *et al.,* 2014: 1794). Other domestic-level studies have examined the role played by dysfunctional state practices. These range from corruption, tax evasion and clientelism in the case of Greece (see Manolopoulos, 2010), the role of the state in undermining the so-called Celtic Tiger in Ireland (see Kirby, 2010), to how the fragmented power structure of Italian politics prevented successive governments from enacting institutional reforms (Hopkin, 2012).

On the other hand, the European-level explanations, comprised primarily of heterodox economists (post-Keynesian and Marxists), and institutional economists researching on varieties of capitalism, blame the role played by the institutional design of the euro (e.g. Lapavitsas, *et al.*, 2012, Stockhammer, 2016; Hall, 2014; Gambarotto and Solari, 2015). According to these views, the monetary union is essentially incomplete, lacking both an effective system for the supervision and regulation of the financial sector and automatic fiscal stabilisers to overcome macroeconomic imbalances. Indeed, the monetary union is claimed to have fostered an asymmetric trade regime, which constrained the competitiveness of certain European economies, dividing the euro area into an export-oriented and credit-driven core (Germany and, initially, the Netherlands) and an import-dependent and debt-driven periphery (Greece, Ireland, Portugal, Spain) (see Lapavitsas *et al*. 2012; Becker and Jäger 2012; Bellofiore 2013; Stockhammer 2016; c.f. E. Jones 2016). Other authors make similar claims, yet ascribe economic divergence to the irreconcilable integration between Northern and Southern European varieties of capitalism (see Hall 2014; Gambarotto and Solari 2015).

Despite their differences, both group of scholars ultimately claim that it was primarily the deterioration of macroeconomic fundamentals that contributed to raising concerns among market participants about the public debt servicing sustainability of the euro area's periphery, leading to bond sell-offs that widened the spreads. That is because, as investors feared default of a given sovereign, they got rid of that country's government debt in order to reduce their exposure. As concisely put by Pepino:

> For Eurozone countries…bond spreads to Germany are generally considered to reflect *outright default risk perceptions* (Pepino, 2015: 10, emphasis added, see also De Grauwe and Ji, 2012)

In other words, spread movements are used as a proxy for investors' default risk perception. However, a number of authors have taken significant steps towards showing that it was not simply the deterioration of macroeconomic fundamentals that led to widening spreads. Some economists and financial economics have argued that, since the onset of the crisis in Greece, fear of sovereign default spread to Ireland, Portugal, Italy and Spain not because of deteriorating fundamentals per se, but because of investors' doubts about the potential future public debt servicing ability of these countries (e.g. Pagano, 2010, De Grauwe and Ji, 2013; Arghyrou and Kontonikas, 2012). This is often referred to as fear of default contagion.

The financial economics literature assesses this dynamic in a more explicit manner. Some scholars in this group are perfectly in line with the rest of the literature discussed above, arguing that it is mainly changes in fundamentals that affect investors' perception of default risk in the euro area and, therefore, the spreads (e.g. Maltritz, 2012; Hilscher and Nosbusch, 2010). However, later studies have demonstrated that risk perception towards sovereign debt in the euro area is not fixed, but time-dependant, in that the investors' sensitivity to deteriorating fundamentals increased after the 2007-08 global financial meltdown (e.g. Oliveira *et al.*, 2012; Beirne and Fratzscher, 2013). Some others, like De Grauwe and Ji (2013) and Aizenman *et al.* (2013), go even further to argue that part of the widening of the spreads from 2010 to 2012 was completely unrelated to changes in macroeconomic fundamentals. Rather, these spread movements were due to a sudden negative sentiment towards sovereign debt servicing sustainability, which is related to the constraints imposed by a monetary union like the euro area, lacking fiscal unity and unilateral debt guarantee. In short, despite the move beyond fundamentals, financial economists also anchor their analyses on an underlying interpretation of market behaviour as driven primarily by concerns regarding sovereign solvency during the euro crisis.

Differently from these approaches, the analysis conducted in this project enables us to understand another extremely important, yet neglected aspect surrounding the unfolding of the euro crisis: how spread movements also indicated the extent to which sovereign bonds mattered to investors with respect to their funding needs. The rest of this chapter is structured as follows.

Section 1.2 explores the segment of the literature that most explicitly recognises macroeconomic imbalances at the root of the crisis, which is divided between domestic-level and European-level explanations. This section will pay a great deal of attention to Greece. Even though Greece is not one of the case studies examined in Chapter 5 of this project, the fiscal dimension of its crisis is worth examining in detail because it played a key role in fostering an understanding of the euro crisis as closely linked to markets' concerns with sovereign solvency. Section 1.3 examines the financial economics literature, which also focuses on fundamentals, but then moves on to explore the unpredictability of market behaviour during the euro crisis. Section 1.4 introduces liquidity and the functioning of the European repo market as a lens through which to understand market behaviour at the height of the euro crisis. Section 1.5 is dedicated to the concluding remarks, which are that the literature tends to employ spread only in relation to the markets' perception of sovereign default risk, largely neglecting the dimension surrounding liquidity.

1.2 Macroeconomic imbalances and the euro crisis

A significant part of the literature on the euro crisis examines the macroeconomic imbalances that exposed certain euro area economies (Greece, Ireland, Portugal, Spain and Italy) to sovereign bond market turmoil in the aftermath of the GFC. Economists, political scientists and political economists belonging to this category identify the

deterioration of macroeconomic fundamentals as one of the key drivers that raised concerns among market participants about the sovereign debt servicing sustainability (and thus of sovereign default) of governments in the euro area in the aftermath of the financial crisis. On the one hand, scholars have pointed to different factors that have contributed to the development of said macroeconomic imbalances. On the other hand, some orthodox economists have also acknowledged the existence of psychologically-driven behaviour, detached from fundamentals, which presumably influenced investors' concerns with sovereign default beyond Greece. This section of the literature provides what I call 'domestic-level' and 'European-level' explanations. I will examine the former first.

1.2.1 Domestic-level explanations

The domestic-level explanations ascribe the deterioration of macroeconomic fundamentals to domestic shortcomings, including lack of competitiveness, unsustainable fiscal regimes, corruption and different wage setting mechanisms. Let us begin where the euro crisis is regarded to have started: Greece. I should provide an explanation as to why Greece is examined in so much detail in this chapter, while it does not belong to my list of case studies. This project examines the interconnection between sovereign debt, repo-based interbank funding and CCPs as an explanatory tool for understanding part of the wave in bond sell-offs from 2010 to 2012, which caused a dramatic widening in the spreads of specific countries in the euro area. In order to achieve these objectives, the main empirical chapter conducting this assessment (Chapter 5) looks at the involvement of LCH.Clearnet in the European repo market during the euro crisis. While dealing with Irish, Portuguese, Italian and Spanish government securities, LCH.Clearnet was not clearing Greek sovereign bonds at the time (Burke, 2011). Thus, whereas LCH.Clearnet's involvement during the euro crisis allows an evaluation of the impact of its actions in the

Irish, Portuguese, Italian and Spanish repo-based interbank funding markets, a similar analysis cannot be carried out for Greece.

Yet, the unfolding of the Greek crisis is important to examine because its fiscal dimension established the first wave of domestic-level studies blaming fiscal misconduct, which remains key to understanding the literature's and policymakers' fixation with sovereign solvency as the main driver for spread during the euro crisis. Indeed, even those who put the emphasis on European-level factors tend to acknowledge the domestic weaknesses of the Greek economy and how these contributed to the crisis, particularly with respect to endemic corruption and fiscal mismanagement (e.g. Katsimi and and Moutos, 2010; Featherstone, 2011). In turn, I argue that the origins and unfolding of the Greek crisis around its fiscal dimension played an important role in the development of the conventional wisdom of spread as being an indication of markets' concern with sovereign default.

1.2.1.1 Greece

In the case of Greece, almost all of the abovementioned domestic issues are highlighted to have contributed to the country's descent into crisis. For example, deteriorating competitiveness was accounted for by orthodox economists as one of the key factors that made Greece too weak to resist the external shocks caused by the GFC, which compromised the country's GDP growth and tax revenues when credit halted (e.g. Arghyrou and Tsoukalas, 2011; Buiter and Rahbari, 2010). Greece's lack of competitiveness stems from its debt-led economic model adopted in the run up to the euro. This model emerged following a number of economic reforms conducted since the second half of the 1980s as a means to join the single currency, which were aimed at liberalising credit creation and fostering investments in public infrastructure (see OECD,

1994). Nevertheless, together with the decline of the industrial sector, the investments that flowed into Greece's newly investment-friendly economy were largely channelled to the non-tradable sector, primarily private consumption, which made the economy less competitive and led to the accumulation of significant trade deficits (see Markantonatou, 2012).

Upon joining the euro, however, competitiveness and trade deficits would deteriorate even further. The low interest rate regime introduced with the Treaty of Maastricht allowed for cheap cross-border borrowing to push debt-led private consumption to record levels (see Polychroniou, 2013). Thus, while Greece's GDP grew at a staggering 3.5% rate yearly since joining the Economic and Monetary Union of the European Union (EMU) (only behind Ireland), its current account deficit doubled, and its annual average credit growth rate was among the highest in the euro area (see Pagoulatos and Quaglia, 2013). In addition, Greece's recurrently higher-than-the-EMU average inflation rate since joining the single currency, together with much higher increases in real wages than the rest of the euro area, also negatively impacted the country's purchasing power parity. In turn, declining purchasing power parity led to a loss in competitiveness *vis-à-vis* other countries in the euro area, while contributing to the accumulation of large current account deficits (Arghyrou and Kontonikas, 2012). The debt- and deficit- driven model of Greece's economy helps to explain why it had lost much competitiveness, which made the country particularly vulnerable to the credit crunch that followed the GFC (Dooley, 2015: 96). However, what sets Greece apart from the other countries discussed in the literature is the more distinctive fiscal dimension, an issue which has been extensively examined by both orthodox and Keynesian economists (e.g. Baldwin *et al.*, 2015; Arghyrou and Tsoukalas, 2011; Krugman, 2011).

Indeed, among the economies of the euro area that received the largest financial assistance programs during the euro crisis (Greece, Ireland, Portugal and Spain), Greece was the only country whose public finances have been considered as largely unsustainable in the run-up to the crisis (see Buiter and Rahbari, 2010; Arghyrou and Tsoukalas, 2011; Krugman, 2011). The literature has ascribed the growing fiscal imbalances during the two decades prior to the GFC to the close ties between political parties and industrial interest groups. Since coming into power in 1981, the Panhellenic Socialist Movement (PASOK) began implementing a range of socioeconomic policies.

These massively expanded the state enterprise, raised social spending and wages through public borrowing as a means for gathering popular party consensus (see Dooley, 2015: 68; see also Manolopoulos, 2011). Thus, throughout the 1990s and the 2000s, the Greek state began providing generous entitlements and other age-related benefits, while also fostering a poor administration for tax collection and a 'bloated public sector', all of which are considered to have contributed to the deterioration of Greece's fiscal position (Buiter and Rahbari, 2010: 3). By 2009, Greece's budget- and public-debt-to-GDP positions were among the worst in the euro area, at around 13.5% and 11.5% respectively. It should be pointed out, however, that year-to-year fiscal deterioration and increase in public debt-to-GDP ratios before the onset of the GFC were certainly not unique to Greece, or the euro area for that matter, affecting other large world economies like the US and the United Kingdom (UK) (ibid).

However, the case of Greece was distinctive in that growing deficits and debt took place against the backdrop of extensive cases of corruption and clientelism. In exchange for political support, PASOK's (and, later, also New Democracy's) close connection to various industrial interest groups allowed for the provision of generous state subsidies. This was particularly the case with farmers, who ended up receiving around €570 per

hectare in public subsidies in 2009, more than twice the EU average of €250 (Manolopoulos, 2011: 90).

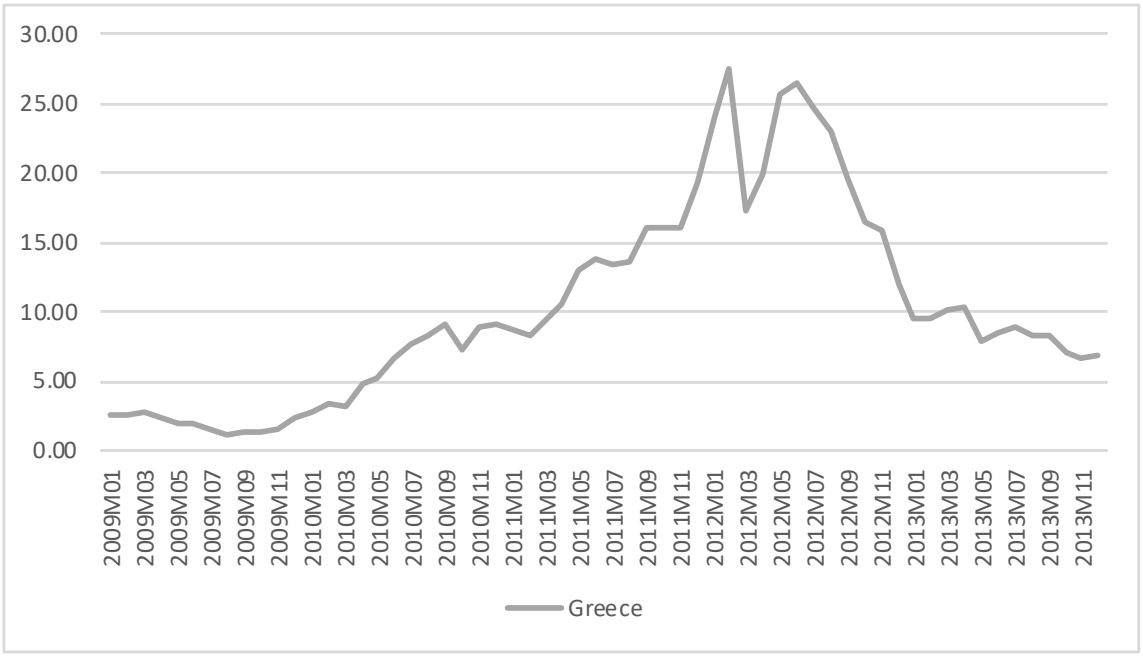
Further, in 2009 PASOK swiftly responded to interest group protests with more generous subsidies in the form of minimum guaranteed prices for agricultural products, freezes on loan repayments, tax-free fuels and pension increases. Additional cash-subsidies were also provided: €75m subsidies to cotton producers, €100m to wheat producers, and €75m of immediate funds available through the Agricultural Bank of Greece, totalling around €500m in subsidies that year (see Bloomberg, 2009). As noted by Manolopoulos (2011: 90), these kinds of subsidies were not unique to 2009, as it was a trend that had lasted throughout the previous 20 years, where successive Greek governments provided easy subsidies in the aftermath of protests in order to preserve political consensus.

Nevertheless, it was not just the accumulation of large fiscal deficits per se that raised doubts about Greece's public debt servicing sustainability, but also that in 2009 and 2010 the deficit figures were revised to be much higher than initially thought. Following a snap election on 4 October 2009, the new government led by PASOK's Papandreou provided a revised figure for the country's budget deficit for that year to 12.7% of GDP, up from the previous official calculation of 6%. The announcement of the revised deficit figure has been considered as the most immediate trigger for the euro crisis, because of the impact it had in creating sudden panic among financial market participants. As put by Baldwin *et al*., '[e]very crisis has a trigger. In Europe, it was revelation of the Greek 'deficit deceit'' (Baldwin *et al*., 2015: 7). Just a few months later, in April 2010, the government provided another revision to that figure, bringing it up to 13.7%.

In short, within a matter of months, official budget deficit figures for Greece more than doubled, which raised sudden panic in financial markets about Greece's fiscal

sustainability within the context of the on-going credit crunch. The revision of Greece's deficit figures was followed both by credit rating downgrades from the world's largest credit rating agencies (CRAs) (Moody's; Fitch and Standard and Poor's) and, as shown in figure 1, by a large widening of the Greek 10-year sovereign spread against Germany, precisely between November 2009 and April 2010.

(Fig. 1) Greece's 10-year sovereign bond yield spread against Germany (in %)



Source: Eurostat, own compilation.

Indeed, credit rating downgrades have been deemed pivotal in the widening of the Greek spread, because they provided investors with an increased default risk assessment for Greek sovereign bonds (see De Santis, 2012). Thus, the conventional wisdom in the literature is that the widening of the Greek spread during the euro crisis indicated rising concerns among investors of the fiscal sustainability of the Greek government, against the backdrop of decades of fiscal irresponsibility (e.g. Buiter and Rahbari, 2010; De Santis, 2012; Arghyrou and Tsoukalas, 2011; Pepino, 2015).

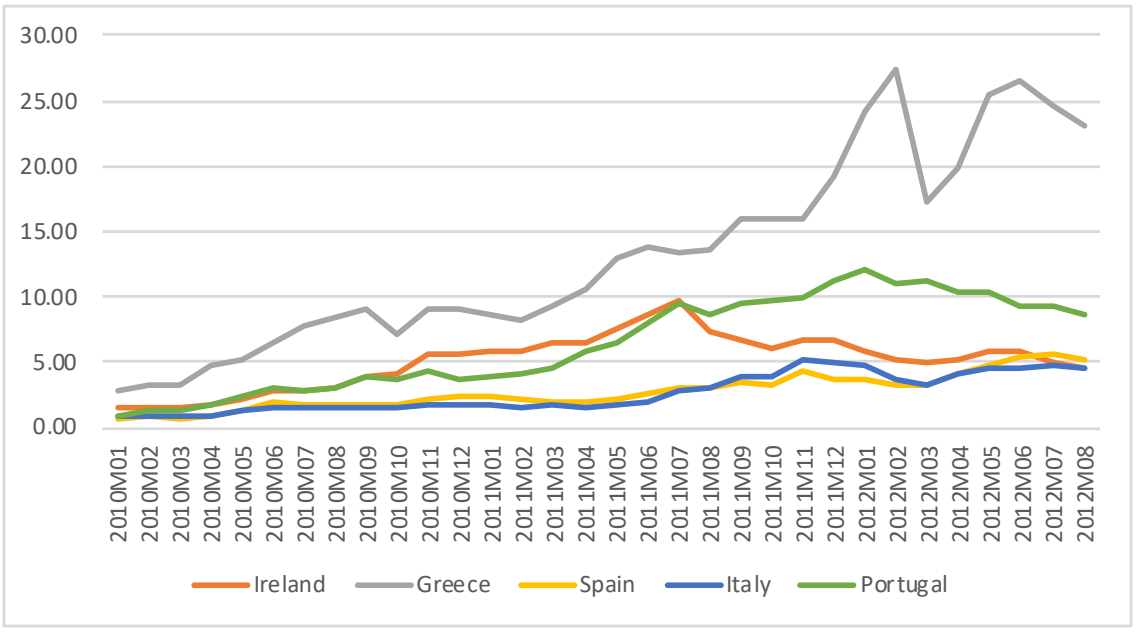
Without a doubt, Germany's withdrawal of an implicit, unconditional guarantee on Greek debt contributed to crystallising fears among investors of a possible Greek sovereign default, which therefore can be considered as another crucial factor that led to the deterioration of market confidence towards sovereign solvency. As noted by Arghyrou and Tsoukalas (2011), amid increasing pressure on Greek sovereign bonds the German government made it clear in February and March 2010 that they would not be prepared to bail out Greece unconditionally. Such position by German authorities led to further downward pressure on Greece's government bonds, which, as shown in figure 1, led to an acceleration in the widening of the Greek spread, because it 'introduced a previously non-existent default risk' (Arghyru and Tsoukalas, 2011: 181).

In other words, the literature recognises the fiscal position and debt sustainability of the Greek government before and during the crisis as the key factors that underpinned its sovereign debt crisis. More importantly, for the sake of this project, the Greek crisis established the blueprint for understanding spread as a reflection of market behaviour during the crisis as being primarily driven by sovereign default fears. This can be best exemplified by showing how the literature has often made references to fear of sovereign default contagion from Greece to other countries in the euro area (e.g. Buiter and Rahbari, 2010; Beirne and Fratzscher, 2013; Pepino, 2015; De Grauwe and Ji, 2012; Hall, 2012; Lane, 2012).

Fear of default contagion during the euro crisis seeks to provide an explanation as to how investors' fears that the sovereign debt markets distress affecting Greece could spill over to other euro area economies, which in turn became reflected in the widening of their respective spreads (figure 2). The timeframe between the beginning of 2010 and summer 2012 represents what I describe as the height of the euro crisis, the period when sovereign debt market turmoil intensified beyond Greece. As clearly evidenced in the figure below,

although spread spikes occurred for each country at different points in time, they also overlapped at specific moments; particularly for Ireland and Portugal at the end of 2010 and summer 2011, and for Italy and Spain at the end of 2011 and July 2012.

(Fig. 2) 10-year sovereign bond yield spreads in the euro area against Germany (in %)



Source: Eurostat, own calculations.

Sovereign debt market contagion during the euro crisis, illustrated by looking at spreads trends in the euro area, is understood as having taken place against the backdrop of the self-fulfilling fear that sovereign default would spread from Greece, affecting one country after another (e.g. Pagano, 2010; Constâncio, 2012; De Grauwe and Ji, 2013). The processes underpinning this self-fulfilling dynamic will be explored in more detail in Section 1.3. For the moment, it is important to retain that contagion in the euro crisis literature is understood with explicit reference to *fear of default*, which began from Greece and affected, in turn, Ireland, Portugal, Italy and Spain, widening those countries' spreads (e.g. Pagano, 2010; Arghyrou and Kontonikas, 2012).

Indeed, as put by economist Pagano, when addressing the question of contagion during the euro crisis:

> As the Greek crisis unfolded, investors started to suspect that other countries with high levels of public debt, namely Portugal, Spain and Italy, would find themselves in a similar situation. But as governments of these countries rushed to point out, their fiscal position is not as dramatic as the Greek on. So why are investors so concerned? Because, as economists say, in this game between sovereign states and investors there can be "multiple equilibria". Even if the government is not highly indebted, investors might start questioning its willingness to raise taxes above a level considered "politically sustainable". In the future, it might seek a renegotiation of the debt, its monetisation, or both. Fear that this will happen can push interest rates to a level so high that the investors' prophecy will eventually come true. At the prevailing interest rates a country which would have otherwise been able to service its debt ends up needing a renegotiation or a monetisation of the debt to avoid full repayment. *So the outcome depends on investors' confidence*. If there is confidence, the "good equilibrium" with moderate interest rates and stable markets prevails; when confidence disappears, the economy jumps to a "bad equilibrium", where a fiscal crisis occurs. The contagion generated by Greek crisis has been exactly of this type. It has weakened investors' confidence in countries which would have otherwise been in a safe situation. Moreover, the burden of Greek bail-out itself is affecting negatively the fiscal position of Portugal, Spain, and Italy. This too may have contributed to weaken *confidence in their ability to service the debt* (Pagano, 2010: 1-2, emphasis added).

In short, according to this view, the Greek experience of the euro crisis with its strong fiscal dimension eroded market confidence in the future public debt sustainability of other economies in the euro area. The fears of default that spilled over to Ireland, Portugal, Spain and Italy became reflected in rising interest rates in the countries affected by this contagion dynamic, widening their respective spreads against the German bund. As also put by the Governor of the Central Bank of Ireland, Philip Lane:

> [t]his revelation of extreme violation of the euro's fiscal rules on the part of Greece also shaped an influential political narrative of the crisis, which laid the primary blame on the fiscal irresponsibility of the peripheral nations, even though the underlying financial and macroeconomic imbalances were more important factors. These adverse developments *were reflected in rising spreads on sovereign bonds* Lane, (2012: 56, emphasis added).

Indeed, as we shall see below, even for those countries whose fiscal dimensions were not as much of an explanatory variable for the crisis as Greece's, spread movements as a reflection of sovereign default fears remained a central analytical lens to understand the unfolding of their crises. Furthermore, it is worth pointing out that acknowledging fear of default contagion in countries that did not have such negative fiscal positions as Greece hints at a type of market behaviour that is detached from fundamentals. Rather, it is a type of market behaviour that is driven by psychological motivations under uncertainty, which recalls the analyses by Keynes of financial behaviour and Minsky's financial instability hypothesis (see Dow, 2009). The issue of spread movement during the euro crisis as disconnected from fundamentals will be explored in more detail in Section 1.3.

The analysis will now continue to examine how domestic-level explanations of the crisis, focused on the deterioration of macroeconomic fundamentals, were also prominent in the study of the Irish, Portuguese, Spanish and Italian crises.

1.2.1.2 Spain

Royo (2010) argues that differences in fiscal consolidation and trade competitiveness helps explaining the growing economic divergence between Portugal and Spain between 2000 and 2007, which contributed to the onset of the crisis in Spain. Whereas Spain had been growing much faster than Portugal during the 2000s, the economic reforms implemented by the Sócrates government, such as the extensive privatisations and fiscal consolidation undertaken between 2006 and 2009, placed Portugal in a better position (at least initially) to tackle the international credit crunch that followed the 2007-2008 subprime mortgage crisis in the US (see Reis, 2013). To an important extent, Spain's slide into crisis has been ascribed to the loss of a significant amount of competitiveness. By having channelled large amounts of foreign investment into the non-tradable sector, particularly construction, this type of growth model allowed a real-estate bubble to make the Spanish economy more prone to external shocks (e.g. Gabrisch and Staehr, 2015).

It should be noted, however, that loss of competitiveness was not unique to Spain, as it was also a factor, as discussed above, in Greece, as well as in Ireland, Italy and Portugal. Although relatively lower competitiveness has often been attributed to differences in export performances in the euro area between the surplus core and deficit peripheral countries[2], economists have argued that it is was actually the faster increase in unit labour

[2] In the euro crisis literature, the core/periphery dichotomy emerged to differentiate between counties of the euro area that had accumulated, on the one hand, large trade surpluses (Germany, France and, initially, the Netherlands) and, on the other hand, large trade deficits (Greece, Ireland, Portugal and Spain).

costs in the non-tradable sector of the deficit countries that eroded competitiveness, rather than poor export performance (e.g. Gaulier and Vicard, 2013; c.f. Gabrisch and Staehr, 2015).

This argument has been supported by comparative political scientists, as well as post-Keynesian and Marxist economists (e.g. Johnston *et al*., 2014; Lapavitsas *et al.*, 2012; Lucarelli, 2011) who claim that the different wage-setting mechanism in the euro area is a key contributor that eroded competitiveness in the deficit countries[3]. Indeed, Johnston *et al*. (2014) argue that the corporatist institutional settings in the core of the euro area have developed sectoral collective bargaining agreements that have restrained wage growth, limiting demand-driven inflationary pressures and thus improving trade competitiveness, a mechanism that is also known as internal devaluation (see also Stockhammer and Sotiropoulos, 2014)[4].

Lacking equivalent (or at least not as effective) wage-restraining mechanisms, the authors conclude that the European periphery was more exposed to the credit crunch that hit the euro area after the GFC. This is because weak competitiveness negatively impacted the European periphery's economic growth the most when credit halted, raising concerns among market participants about sovereign debt servicing sustainability, as reflected in the widening of their spreads (Johnston *et al*., 2014: 1772). In short, the difference in

[3] It should be noted that the difficulty for peripheral countries to introduce stricter wage-setting mechanisms has also to do with the periphery having generally worse real wages and welfare states compared to the core (see Lapavitsas *et al.*, 2012: 4).

[4] Internal devaluation is an economic policy option that seeks to improve international competitiveness, primarily by reducing labour costs through wage suppression or by reducing other indirect costs on the part of the employer. In the euro area, as will be explained in Section 1.2.2, internal devaluation was achieved largely by means of wage suppression in the periphery (see Lucarelli, 2011; Lapavitsas *et al.*, 2012; Stockhammer and Sotiropoulos, 2014).

wage-growth rates in the euro area between the deficit peripheral and surplus core countries is a key element for understanding the dynamics of the crisis. Furthermore, differences in wage-setting mechanisms as a key contributor to macroeconomic imbalances is an important point because it has also been retained by the European-level explanations discussed in the next section, although through a different lens.

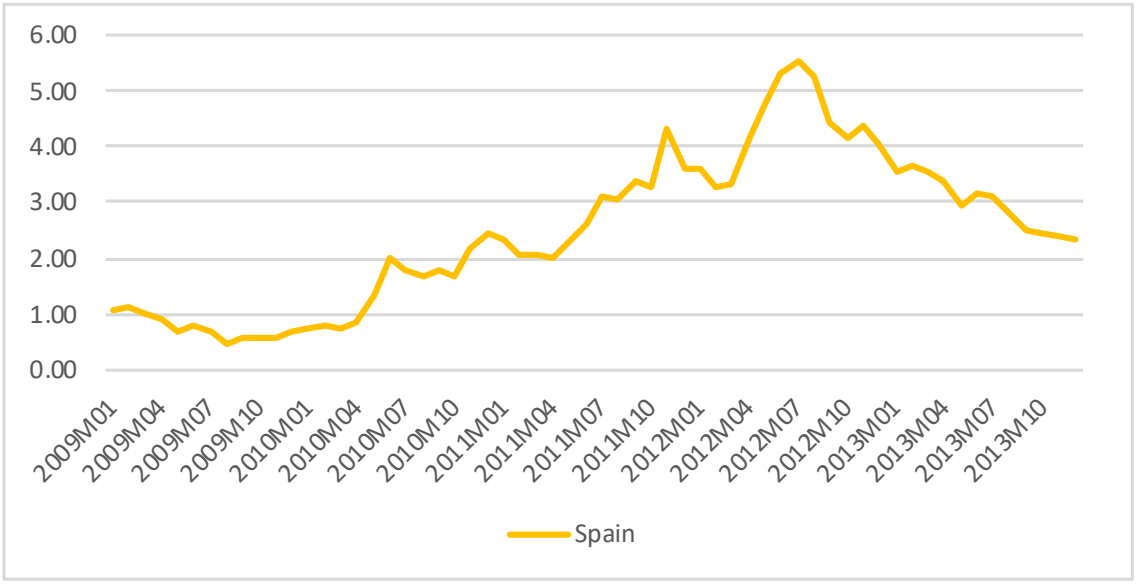
Returning to Spain, when the construction sector collapsed in the aftermath of the 2008 credit crunch, by 2011 Spanish banks had accumulated around €405bn in bad loans, which were connected to real estate (see Quaglia and Royo, 2015: 492). Crucially, the Spanish housing bubble was closely linked to foreign capital, in the sense that domestic banks were channelling large amounts of lending from other European banks into speculative investments in real estate by providing cheap lending to the mortgage market (Royo, 2010).

Although the initiatives developed by the Bank of Spain during the crisis initially prevented a collapse of the banking system[5], the lack of interbank funding, brought about by the credit crunch, eventually made the housing bubble burst, triggering a banking crisis that forced the Spanish economy through a period of dramatic downturn. Indeed, as will be discussed in more detail in Chapter 5, the ways in which the real estate sector had underpinned the growth of the Spanish economy as a whole meant that its collapse also spelled a period of recession. Thus, the economic downturn and the extensive programs of bank recapitalisations between the end of 2011 and throughout 2012 reduced tax revenue and simultaneously increased the budget deficit. According to the literature, this made investors question the public-debt servicing sustainability of the Spanish government, as reflected in the widening of the country's spreads (see Arghyrou and

[5] The Bank of Spain introduced regulatory provisions for Spanish banks to have higher capital requirements dedicated to absorbing losses incurring from the GFC at the time (see Royo, 2013).

Kontonikas, 2012; Pepino, 2015; see also IMF, 2012: 15). Indeed, as shown in figure 3, the height of the Spanish crisis (end of 2011 throughout 2012) was matched by a widening of the Spanish spreads.

(Fig. 3) Spain's 10-year sovereign bond yield spread against Germany (in %)



Source: Eurostat, own calculations.

To sum up, the strong rate of economic growth experienced by Spain developed at the expense of the country's declining competitiveness, the weakness of which manifested in the bursting of the housing bubble and banking crisis that followed the GFC. Thus, even though the Spanish crisis did not initially contain a fiscal dimension, the bursting of the housing bubble and the banking crisis still had repercussions on the public debt servicing sustainability of the Spanish government, leading investors to ask for higher interest rates when trading the country's sovereign bonds, and so widening the spread.

While the ways in which the banking dimension of the Spanish crisis has impacted the economy as a whole have certainly been examined in detail, the ways in which spread hikes during that time were linked to funding needs has not received sufficient attention. Chapter 5 will expand upon this dynamic, to demonstrate that some of the large spread

spikes in 2012 were also closely linked to the interaction between sovereign debt, bank funding and CCPs.

1.2.1.3 Portugal

Deteriorating competitiveness was also recognised as an issue in Portugal by new Keynesian economists and rational choice political economists (e.g. Reis, 2013; Lagoa *et al.*, 2014). Although Portugal did not experience a speculative bubble and has generally witnessed relatively lower levels of economic growth compared to the rest of the euro area, foreign investments were nevertheless channelled to non-tradables. Much like for Greece and Spain, this investment strategy took resources away from the tradable sector, compromising the competitiveness of the Portuguese economy throughout the 2000s (see Reis, 2013).

The economic performance of Portugal after joining the EMU is an interesting case with respect to the unfolding dynamics of the euro crisis, especially when compared to Greece, Ireland and Spain. Paraphrasing a Deutsche Bank report (2010), the Portuguese economy overheated without accelerating. This expression seeks to describe that, despite showing all the signs of strong economic development, such as increased private and commercial lending, consumption and investment, Portugal failed to translate these into concrete GDP growth (see Dooley, 2015: 106). Indeed, differently from Greece, Spain and, as we shall see below, Ireland, all of which experienced strong booms after the adoption of the euro, Portugal went through a period of economic recession.

Despite enjoying strong GDP growth between the late 1980s and 2000, experiencing the EU's fastest growth rate after Ireland and Luxembourg during that time (see IMF, 2002), the Portuguese economy underwent a slump after joining the EMU. In order to implement

the policy prescription of the Single European Act (SEA)[6], a European initiative aimed at liberalising financial markets and removing barriers to trade, Portugal proactively liberalised its regulatory frameworks around banking activities to improve capital mobility (see Leao and Palacio-Vera, 2011). Indeed, until the 1980s, the Portuguese banking sector was built upon extensive state intervention, featuring fixed interest rates and providing financing to specific industries (see Dooley, 2015: 121).

Following the reforms, Portugal experienced a dramatic expansion in credit-based consumer spending, which greatly accounted for the country's economic growth during the 1990s. According to Lagoa *et al.* (2014: 15), private consumption accounted for 66.6% of the GDP growth in Portugal between 1995-2000 (out of 3.6% GDP growth, 2.4% was ascribable to private consumption), whereas net exports accounted for a staggering -0.9%. In short, much more similar to Greece than Spain in this respect, Portuguese banks channelled large amounts of foreign capital primarily into private consumption and infrastructure, which compromised the country's competitiveness *vis-à-vis* its European counterparts. Often described as debt-led domestic demand growth (e.g. Rodrigues and Reis, 2012), the Portuguese model was essentially built around stimulating domestic consumption through the expansion of credit.

Differently from Spain and Greece, however, the Portuguese economy went through a slump throughout the 2000s. As investments ended up funding unproductive companies in the non-tradable sector, including construction but primarily retail and privatised utilities companies, funds were taken away from the tradable sector, which did not lead to a significant acceleration in economic performance. Upon joining the EMU, net

[6] The Single European Act came into force in 1987 and is highly significant insofar as it was the first concrete attempt at establishing a European single market. Most notably, it required signatories of the treaty to undertake steps to reduce trade barriers and liberalise capital movement (Single European Act, 1987).

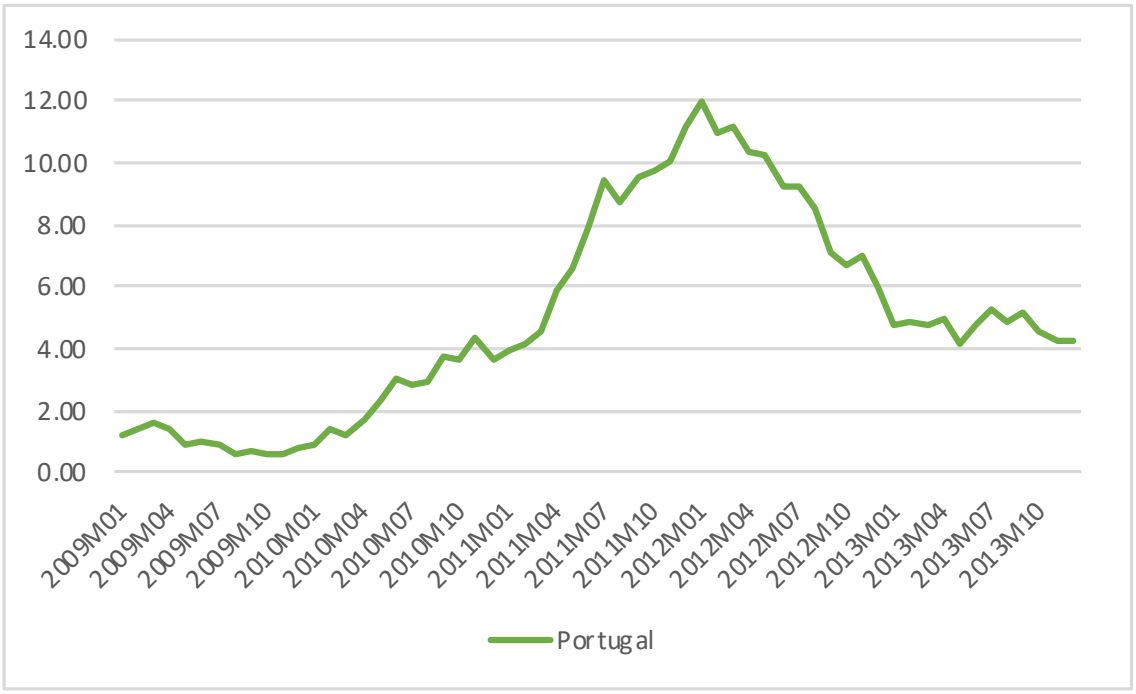
borrowing began to rise even more, as Portugal became increasingly financially integrated with other European economies, while productivity and growth slowed down (see Reis, 2013). Hence, when the GFC hit, Portugal was particularly exposed to the halt in international capital flows. Because of its overly credit-dependant, domestic-demand driven and stagnant performance, the Portuguese economy became severely hit by the credit crunch, which exerted significant pressure on the country's domestic banks.

An interesting aspect of studies on the Portuguese crisis is how they are framed around markets' suddenly increased fears of sovereign default (e.g. Pereira and Wemans, 2012: 18; Lagoa *et al*., 2014: 61; see also Reis, 2013). This is one of the instances in which the Greek blueprint for understanding the euro crisis as essentially a confidence crisis in public debt servicing sustainability is evidenced more clearly. As shown in figure 4, whereas the downturn generated by Portuguese banks' exposure to international credit lines led to a recession in 2009, which greatly reduced tax revenues, it was not until Greece and Ireland had to resort to external financial assistance in 2010 and 2011 that Portuguese's spreads took a decisively upwards trend.

The orthodox economics literature on the Portuguese crisis explains this dynamic as follows. Following the unfolding of the Greek debacle and, particularly, the Irish crisis, investors started questioning the public debt servicing sustainability of the Portuguese sovereign amid declining GDP growth and tax revenues (e.g. Pereira and Wemans, 2012; Kalbaska and Gątkowski, 2012; Arghyrou and Kontonikas, 2012). As a matter of fact, Portugal had been considered the 'most vulnerable' country in the euro area to sovereign debt markets contagion dynamics during the euro crisis, where contagion is understood as cross-country shock transmission channel during times of financial distress (Kalbaska and Gątkowski, 2012). As the eroding confidence in the sovereign debt servicing sustainability of the Portuguese government extended from Greece and Ireland, investors

began large-scale sell-offs of Portuguese government securities in 2010, which widened the Portuguese spread.

(Fig. 4) Portugal's 10-year sovereign bond yield spread against Germany (in %)



Source: Eurostat, own compilation.

Thus, the widening spread in the case of Portugal in 2011 has been described as an indication of the heightened credit risk (i.e. default risk) posed by Portuguese government securities in a struggling economy (Pereira and Wemans, 2012: 18; Lagoa *et al.*, 2014: 61; see also Reis, 2013). However, as I will demonstrate in Chapter 5, the sudden hikes in the Portuguese spread in 2011 and the rising trends in the following months were caused, to an important degree, by LCH.Clearnet's collateral management practices in the European interbank repo market.

1.2.1.4 Ireland

Much like Greece, Spain and Portugal, orthodox economics and rational choice political economy research on Ireland ascribes the deterioration of fundamentals to investments in the non-tradable sector, which led the country into crisis (e.g Lane, 2011: 60; Lane, 2012: 56; De Santis, 2012; Pepino, 2015). Similar to Greece, Ireland experienced remarkable growth rates following its entrance to the EMU, among one of the highest in the euro area. However, much of the Irish economic boom of the 2000s marked a significant break from the growth model of the 1990s, known as the Celtic Tiger (see Kirby, 2010). During the 1990s, Ireland had experienced a massive influx of foreign direct investment from US multinationals, particularly pharmaceutical and tech companies, which greatly contributed to improve Ireland's competitiveness, boosting its exports. Ireland's reliance on US multinationals was so significant that their sales alone contributed to over 40% of the country's GDP growth between 1990 and 1995 (see O'Hearn, 1998).

However, before joining the euro, Ireland had implemented a number of economic policies that aimed at 'injecting untapped capital into the economy', which contributed to a radical change in the direction of Ireland's economic growth trajectory (Dooley, 2015: 147). Indeed, by 1998, the Fianna Fáil-Progressive Democrat coalition government had halved capital gains tax and helped to channel these large amounts of foreign capital into the property, construction and mortgage markets (ibid). To a significant extent, the reason why financing was channelled to real estate has to do with the close personal ties between Fianna Fáil government figures and bankers, property developers and construction companies (see Dellepiane *et al.*, 2013). A large number of Fianna Fáil's political donors were, in fact, also among some of the biggest names in Irish property development (see Byrne, 2012).

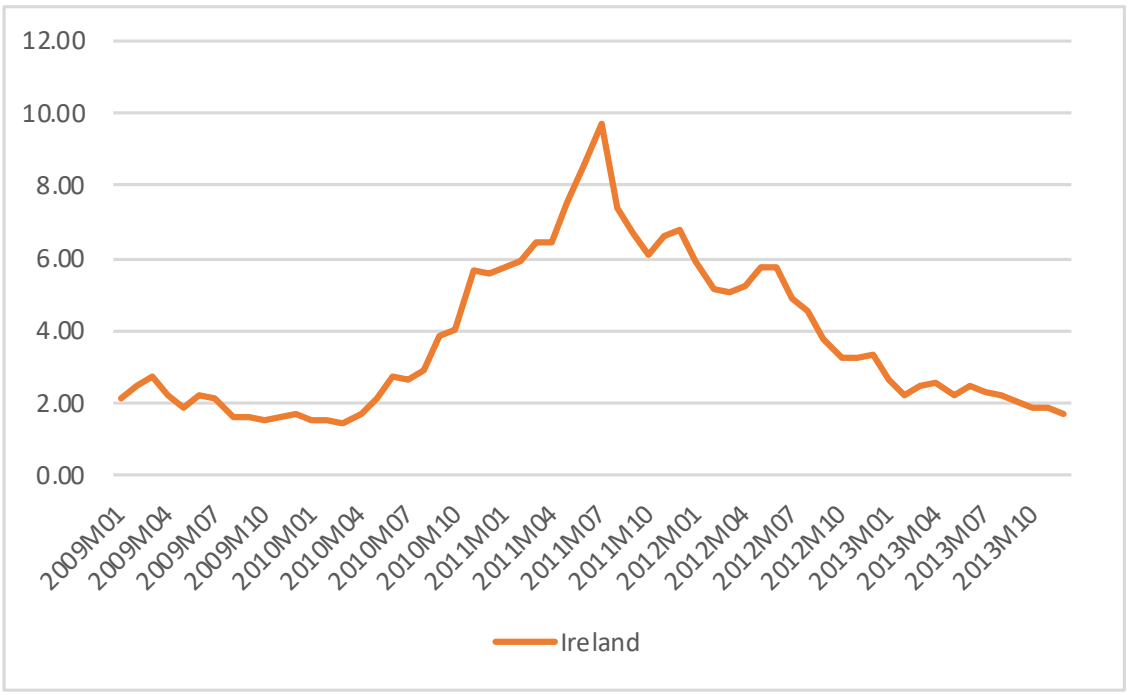
Simultaneously, financial liberalisation in Ireland happened alongside as the EMU's low interest rate regime, which allowed for cheap borrowing to massively expand the Irish

mortgage market and, consequently, household indebtedness. The extensive lending by Irish banks during those years generated a property bubble between 2003 and 2009 (see Lane, 2012). Equally important, the housing bubble became so central that it underpinned other sectors of the Irish economy (Norris and Byrne, 2015). Thus, for much of the 2000s, 'domestic demand replaced export as the main driver of Ireland's economic growth' (Dooley, 2015: 166). However, as the economy began to shift from export towards the property market and construction throughout the 2000s, Ireland went from having an almost balanced current account to accumulating large trade deficits almost continuously between 2001 and 2009. These deficits were financed by the increased exposure of Irish banks to international credit lines, which essentially underpinned Irish growth during the first decade of the euro.

Given Ireland's dependence on external financing to support its domestic demand and construction growth, the 2008 credit crunch that followed the GFC severely hurt its economy, experiencing a decline of roughly 21% of its GDP between 2008 and 2010 (see Lane, 2011: 59). The collapse in property prices and the decline in construction activities caused huge losses to the Irish banking system, which had financed the boom in the first place. As the economy fell into recession, Ireland also underwent a period of fiscal deterioration. Following several years of budget surpluses, the Irish budget developed a deficit of 30% of GDP in 2010. In part, this was also caused by successive banking recapitalisation efforts (see Hendrikse, 2013).

As shown in figure 5, by the end of 2010 the Irish spread began to widen, which the domestic-level literature has interpreted as the financial markets' declining confidence in Ireland's fiscal sustainability, health of its banking sector and the overall status of the country's economy (e.g. Lane, 2011: 60; Lane, 2012: 56; De Santis, 2012; Pepino, 2015).

(Fig. 5) Ireland's 10-year sovereign bond yield spread against Germany (in %)



Source: Eurostat, own calculations.

Thus, the abovementioned studies argue that it is within the shift from an export-oriented to a debt-led domestic demand model that the Irish crisis was rooted. The shift led to a speculative bubble that eroded Ireland's competitiveness, which eventually impacted the Irish government's finances and the rest of the economy, failing to keep spreads under control.

Yet, and very similar to Portugal in this respect, as I will show in Chapter 5 the spread hikes and trends that affected Ireland in 2011 were largely due to LCH.Clearnet's increases in collateral requirements, which led to bond-sell offs of Irish securities amid funding concerns.

1.2.1.5 Italy

A domestic lens has also been used extensively in the case of Italy, in order to examine the sovereign debt market turmoil that hit the country in 2011. However, it should be noted that Italy is distinctive from the other countries discussed. First, unlike Greece, Ireland, Portugal and Spain, Italy did not have to resort to any form of external financial assistance. Second, and also contrary to those countries, Italy did not receive such a large amount of capital inflow after joining the single currency and did not develop any sort of speculative bubble in the years leading up to the crisis. That was largely due to Italy's conservative banking structure, whereby domestic banks did not finance construction to the same extent of Ireland and Spain and were not lending primarily to small and medium enterprises (SMEs) (see Quaglia and Royo, 2015).

However, between the end of 2011 and the summer of 2012, Italy underwent a period of serious sovereign debt market distress, as well as an important political transition. Given the size of its economy and, most importantly, of its sovereign debt market (totalling almost €2tr in 2011, or 116% of GDP), Italy has also been examined in the euro crisis literature because its sovereign default could have spelled the end of the euro area. Indeed, the size of the country's yearly public debt servicing meant that the Italian government was (and remains) simultaneously 'too big to fail' as well as 'too big to bail' (Hopkin, 2012: 36). The Italian experience of the euro crisis has been examined primarily by political scientists working on comparative politics, political economy and public policy as well as institutional economists. These ascribe the onset of the crisis to years of anaemic growth and a large stock-pile of public debt and lack of reform capacity, in turn the result of Italy's dysfunctional capitalism (see Hopkin, 2012; Culpepper, 2014; Quaglia and Royo 2015; Rangone and Solari, 2012).

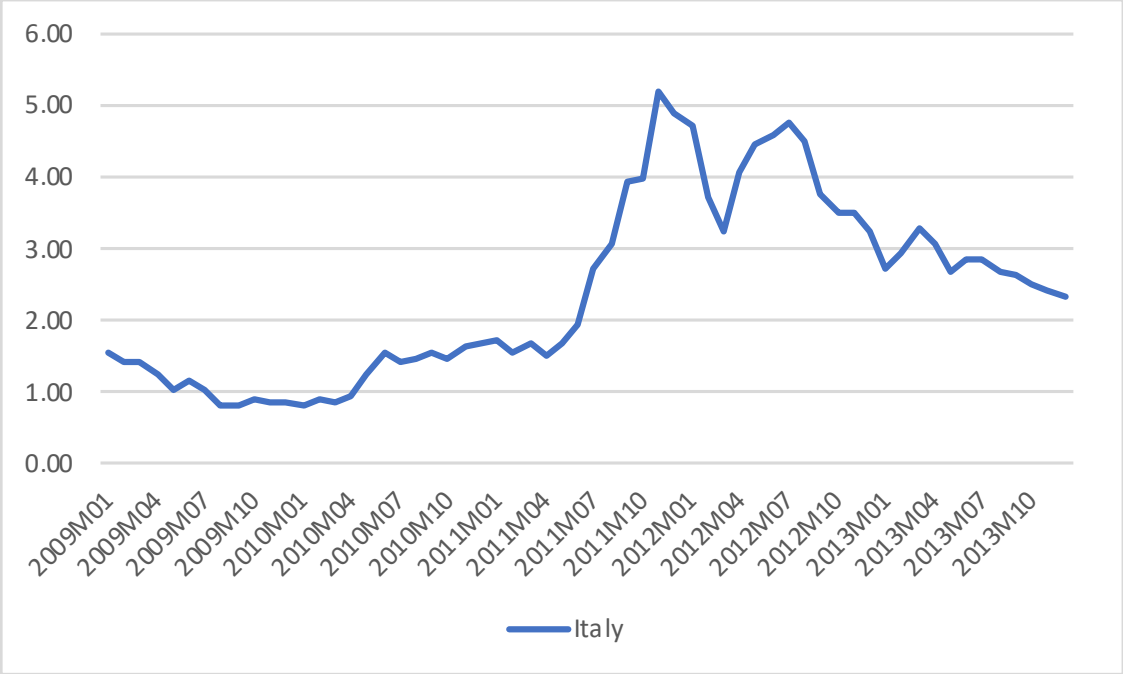
Until the 1980s, the Italian economy was more akin to the Southern European model of capitalism, which entailed a significant involvement of the state in production activities

and market control (Rangone and Solari, 2012; see also Amable, 2003). For example, up until the 1970s, large banks in Italy were in public ownership through the state holding company Institute for Industrial Reconstruction (IRI), whereas smaller local savings banks were controlled by local and regional governments (see Lagna, 2013). In addition, Italy's corporate governance was largely concentrated in the hands of few families, such as in the case of Fiat with the Agnellis (see Deeg, 2005). Further, the power structure of the Italian economy, fragmented between divided private interests, party politics and the collusion between politicians and organised crime, has been argued to have impaired Italy's reform capacity, which prevented the fostering of the country's growth and for the creation of a systematic plan for public debt reduction (Hopkin, 2012; see also Pasquino and Valbruzzi, 2012). Rather, despite going through several periods of downsizing, particularly through the 1980s, the expansion of state enterprises since the mid-1950s significantly added to the general government debt (Segreto, 1998).

A number of reforms aimed at liberalising the economy did not succeed in fully transforming the structure of Italian capitalism. For example, the labour market reforms and the liberalisation of capital movement of the 1980s did not alter the conservative, family-based corporate governance at the root of the Italian economy, (Lagna, 2015; see also Culpepper, 2007). Thus, Italian capitalism has been defined as having only partially shifted towards the more liberal market model, leaving the country with an inefficient model that has crystallised an uneven distribution of economic resources, in turn putting a strain on growth (see Rangone and Solari; 2012; see also Bull and Rhodes, 2007). For this reason, Italy has also been labelled as a 'dysfunctional political economy', making direct reference to how its governmental and economic institutions made the country's institutions unable to deal with declining productivity and a diminishing share of the world's exports (see De Cecco, 2007).

At the height of the euro crisis in 2011, political tensions in Italy intensified, particularly with respect to Berlusconi's declining support at home as well as in Europe. The literature suggests that the fiscal consolidation measures introduced by Berlusconi from the onset of the GFC were unsuccessful in staving off markets concerns about the sustainability of Italy's public debt servicing, particularly due to the country's lack of reform capacity to improve its stagnant growth and large stock-pile of public debt, which inevitably led to a widening of the Italian spread (see figure 6) (e.g. Hopkin, 2012; Culpepper, 2014; Quaglia and Royo 2015).

(Fig. 6) Italy's 10-year sovereign bond yield spread against Germany (in %)



Source: Eurostat, own calculations.

As argued by European studies scholar Jones, the fiscal consolidation and growth stimulation measures introduced by Berlusconi did not succeed in restoring market confidence and keeping the country' spread under control, because the markets considered these actions 'too little, too late' (Jones, 2012: 7). Indeed, the appointment of the technocratic government led by Monti, following the resignation of Berlusconi in November 2011, is understood to have been made with sole objective *of reducing Italy's*

spread and reforming the country's economy (see Pasquino and Valbruzzi 2012; Culpepper, 2014).

In a nutshell, the markets' deteriorating confidence in the public debt sustainability of the Italian government during the euro crisis, reflected in the widening of the spread in 2011, has been largely ascribed to the country's lack of reform capacity with respect to boosting growth and lowering public debt. However, as will be discussed in Chapter 5, the involvement of LCH.Clearnet in the Italian repo market from 2011 to 2012 caused a number of significant spread hikes, largely due to the importance of Italian sovereign debt in underpinning the European repo-based interbank lending market, and not just because of the country's perceived heightened default risk.

1.2.2 European-level explanations

Whereas domestic-level explanations attribute the 2010-2012 decline of market confidence in the public debt servicing sustainability (and spread of default fears) to domestic political and economic developments of the affected countries in the euro area, the European-level explanations take a more macro-structural approach to the study of the euro crisis. By shedding light on European-level weaknesses, this body of literature tends to be more forgiving about the domestic economic and governance issues affecting the periphery. This is precisely where the European-level explanations depart from their domestic counterparts: whereas the latter mostly condemn domestic economic policy making, the former blame how the architecture of the monetary union was designed (or, at least, how it integrates incompatible economic systems). However, an important point of similarity, highly relevant with respect to the objectives set out in this project, is that the EMU design flaws are argued to have led to the same set of macroeconomic imbalances as described by the domestic-level explanations above.

Another important observation to be made before we delve into the European-level explanations has to do with its disciplinary composition and analytical homogeneity. As opposed to the domestic-level explanations, which feature a large number of contributions from orthodox economists and political scientists, the European-level explanations are comprised primarily of research in heterodox economics (post-Keynesian and Marxist) (e.g. Lapavitsas *et al.*, 2012; Cesaratto, 2014; Stockhammer, 2016) and institutional economists as well as political scientists conducting research on varieties of capitalism (e.g. Hall, 2014; Gambarotto and Solari, 2015). Further, the European-level studies are a much more compact and homogenous body of literature than the domestic-level explanations, in that they make similar arguments and arrive at comparable analytical conclusions.

Nevertheless, the more homogeneity of this body of work does not mean that it should be taken as less relevant in the overall debate. The domestic-level explanations received a lengthier discussion only because their studies examine in greater detail the distinctive history of each individual affected country in the euro area. These were worth reviewing in detail in order to show that, despite these explicit differences, fear of default remains a central explanatory variable for understanding spread movements during the crisis.

1.2.2.1 The asymmetric design of the EMU

The most widely adopted view within this body of literature is that the asymmetric nature of the EMU crystallised in trade imbalances within the euro area. For instance, Lapavitsas *et al*. (2012) argue that the exchange rate at which higher inflation economies joined the euro (such as Greece, Italy and Spain) created an outright reduction in the competitiveness of these countries against their lower-inflation counterparts (e.g. Germany and the Netherlands). However, as monetary sovereignty had been shifted to the ECB and the

Stability and Growth Path (SGP) effectively constrained fiscal policy latitude in countries participating in the EMU[7], competitiveness could therefore largely be achieved through internal devaluation, applying downward pressures on wages (see Stockhammer and Sotiropoulos, 2014; see also Lucarelli, 2011).

As discussed above, the difference in wage setting mechanisms between the euro area's core and the periphery, whereby the former was more successful at restraining wages than the latter, implied that the periphery was unable to regain the competitiveness lost to the core, which had managed to significantly reduce nominal labour costs (e.g. Johnston *et al*., 2014; Lapavitsas *et al.*, 2012; Stockammer, 2016). As a matter of fact, Germany had the lowest nominal unit labour costs in the euro area throughout the 2000, which greatly increased the country's current account surplus *vis-à-vis* the periphery (Krugman, 2017). Indeed, since the end of 2001, Germany has consistently run current account surpluses, as opposed to the large deficits experienced by the periphery, which we discussed in the previous section.

More importantly, these surpluses were accumulated within the euro area itself (see Bellofiore and Halevi, 2010: 16). As argued by post-Keynesian economist Lucarelli, Germany's continuous accumulation of trade surpluses is 'increasingly based on its ability to depress wage growth' within the limitations imposed by EMU rules (Lucarelli, 2011: 219). As also put by Marxist economist Bellofiore (2013: 504), the euro 'was born with an original sin', pointing to how the EMU was established with strong differences in relative competitiveness from its very inception. The structural division of the euro

[7] The SGP 'is a set of rules designed to ensure that countries in the European Union pursue sound public finances and coordinate their fiscal policies', which imposes a limit for government debt and deficit (see https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/stability-and-growth-pact_en).

area into a surplus core and a deficit periphery has therefore led to the argument, mainly portrayed by post-Keynesian and Marxist economists, that a short-term fix for the euro area is for surplus countries (mainly Germany) to expand their domestic demand by letting domestic wages and inflation rates increase (e.g. Moro, 2014; Pettis, 2013; Lapavitas *et al*., 2012).

Authors contributing to this body of literature also argue that, unable to compete with Germany, peripheral countries faced no choice but to pursue different growth strategies, which were largely based upon different forms of debt-led growth models and unproductive investments, such as housing bubbles (Ireland and Spain) and domestic consumption (Greece and Portugal) (see Hein, 2013; Stockhammer, 2016).

1.2.2.2 The incomplete nature of the EMU

In this respect, the EMU's lack of an effective system for the supervision and regulation of the financial sector, and automatic stabilisers to overcome said macroeconomic imbalances, have also been identified as some of the main factors that led the euro area into crisis (see Eichengreen 2012: 134; Jabko 2015: 71; Jones, 2015: 44; see also Jones *et al.*, 2016). Indeed, the EU financial markets' lack of sufficient integration and shared risk mechanisms also meant that the governments' bank bailouts inevitably worsened their fiscal positions, increasing their insolvency risk (Jones *et al*., 2016: 1011). In other words, had financial markets in the euro area been more integrated, the euro crisis may have not affected sovereign public debt sustainability as much as it did. As also claimed by ECB President Mario Draghi, 'one important factor [for the euro crisis] was the *incomplete nature of financial integration* in the euro area' (Draghi, 2014; emphasis added).

According to Draghi, the incomplete nature of financial integration in the euro area led to an allocation of banks' assets that was not sufficiently diversified geographically, which made national banks more vulnerable to domestic shocks, and whose cost to overcome their failures was largely borne by domestic authorities. Ultimately, a point that he has also reformulated at a recent speech (Draghi, 2018), Draghi argues that this is the process underpinning the so-called bank-sovereign nexus, which indicates the 'infamous' link between bank assets and sovereign debt (Draghi, 2014). This is a particularly interesting remark, because the design that underpinned European financial market integration is actually strongly based on the close link between bank funding and sovereign debt. Indeed, as I will show in Chapter 4, this arrangement owes much to the ECB's political imperative to strengthen European financial market integration via increasing cross-border lending operations.

One of the crucial contributions of the European-level explanation is to show how the two regimes (export-led and debt-led) interacted in the euro area. Indeed, it has been argued that the periphery was able to develop a debt-led model *because of* the credit flows that were generated by the core's surpluses, which financed housing bubbles and rising household debt (Stockhammer, 2016: 70; Pettis, 2013; 120; Baldwin *et al.*, 2015: 20). Seen from another angle, according to this view the core *would have been unable* to accumulate such large trade surpluses had it not been for the deficit and debt-led model of the periphery (see also Young and Semmler, 2011; Lapavitsas *et al*., 2012). Arriving at similar conclusions, but from very different disciplinary and analytical starting points, political economists and political scientists belonging to the varieties of capitalism school examine the incompatibilities between norther European and southern European capitalisms (e.g. Hall, 2012; Hall, 2014; Gambarotto and Solari, 2015).

According to Hall (2012), it is essentially the inherent incompatibility between the export-oriented economic model of northern European countries and the demand-led growth model of the southern European economies which has generated the structural trade imbalances described above. Indeed, according to authors in this category, as the EMU prevents currency devaluation, the debt-led growth models of southern European countries struggled to remain competitive (see also Hall, 2014).

Similarly, Gambarotto and Solari (2015) claim that the institutional configuration of the EMU, strongly based upon deflationary policies, impaired the coordination mechanisms of southern European countries, which relied extensively on state intervention, competitive monetary depreciation strategies (and thus higher real inflation rates) and lower absolute labour costs, in order to retain competitiveness. Gambarotto and Solari also argue that the EMU introduced a process of 'peripheralization' of the southern European economies, like Spain, Greece and Portugal, which positioned them onto a path of non-sustainable growth patterns. In a nutshell, the EMU's asymmetric design allowed core countries to accumulate large trade surpluses, which were then recycled as cheap credit in the periphery in activities that did not contribute to productivity growth, which led to large trade deficits.

The role of the EMU in fostering macroeconomic imbalances was later also recognised by a group of renowned economists (Baldwin *et al.*, 2015). Hence, the key contribution by the European-level explanations eventually made its way into a disciplinary territory that, as discussed above, had initially been largely focusing on examining (and blaming) domestic-based weaknesses. Indeed, the low-interest rate regime introduced by the Maastricht convergence criteria favoured this type of core-periphery, speculative credit flow, because it provided cheap cross-border funding to euro area economies (see Baldwin *et al.*, 2015). As these imbalances generated structural trade deficits in the

periphery and surplus in the core, the sudden stop of credit in the wake of the GFC, when liquidity dried up, put this asymmetric regime in crisis, hitting the deficit countries the hardest by halting economic activities.

Thus, as discussed by Baldwin *et al*. (2015), the sudden stop in cross-border lending made investors less keen to invest in the private and public sectors of the deficit countries, which resulted in rising sovereign bond yields, widening their spreads. This is because, according to the authors, as the deficit countries mainly relied on foreign investment for economic growth, the halt of credit flows impaired those countries' GDP growth, which worsened their public debt-to-GDP ratios to 'unsustainable' levels in a self-fulfilling fashion, whereby investors' fear of sovereign default made defaults more likely (ibid: 7; see also Chang and Leblond, 2015). This self-fulfilling dynamic is particularly important because it is an argument that is also retained by some authors belonging to the financial economics literature, explored later on in this chapter.

1.2.2.3 The euro crisis as a balance of payment crisis

Given the significant trade imbalances that were generated in the euro area during the 2000s, the euro crisis has also been described by post-Keynesians as a balance of payments crisis (see Dejuán *et al.*, 2013 for an overview). For example, post-Keynesian economist Cesaratto argues that the euro area is a hybrid between a fixed exchange rate regime and a full currency union (Cesaratto, 2013). Whereas in the former banks' capital flows can be balanced out by the national central bank, in the euro area these are financed

by TARGET2, a centralised real-time payment and settlement system managed by the central banks of the euro area, and the ECB's refinancing operations[8].

Crucially, as each country's TARGET2 balances can go negative, a country can run sustained deficits, which are financed in the interbank lending market, as if the banks in the euro area had access to unlimited overborrowing (see also Sinn, 2012 for a collection of similar arguments). The impossibility of governments in the euro area to convert the value of their public debt (currency devaluation is not an option in a currency union) at a given exchange rate (fixed, with the euro) is precisely what has allowed for periphery countries to access cheap funding that financed their current account deficits, because investors had the guarantee of non-devaluation at debt repayment (ibid.). When interbank lending dries up, the ECB fills in the funding gap through its different refinancing operations. Hence, the periphery's trade deficits were financed through negative TARGET2 balances, in turn financed in the interbank lending market and, in the last instance, by the ECB. In other words, the way in which the EMU is designed allows the ECB to simultaneously finance current account deficits as well as capital outflows.

According to Cesaratto, when the 2008 credit crunch hit the euro area, the unwillingness of banks to continuing lending to each other created a liquidity shortage that put into crisis the debt-led and trade deficit-based regime of the periphery. Thus, as the economies of the periphery went through a severe downturn, investors (particularly foreign) pulled their resources from private and public debt markets. However, as the domestic economies of the periphery had accumulated significant deficits, they lacked the resources needed to keep financing both private activities and, more importantly for the scope of this project,

[8] TARGET2 is the Eurosystem's proprietary payment system. It is the mechanism in the euro area 'for processing large-value payments and is used by both central banks and commercial banks to process payments in euro in real time' (see https://www.ecb.europa.eu/explainers/tell-me/html/target2.en.html).

their countries' sovereign debt markets, which led to the widening of the periphery's spreads. Further, according to this view, spreads largely widened because the ECB lacked the competence necessary to act as a lender of last resort for sovereigns. As in the words of Cesaratto (2013: 123), a 'prompt intervention of the ECB as a lender of last resort of peripheral states would have possibly avoided the capital outflow reducing the sovereign spread'.

1.2.2.4 Beyond the domestic/European-level dichotomy

To sum up, the European-level explanations highlight competitiveness gaps and structural trade imbalances as one of the main drivers for economic divergences in the euro area at the root of the crisis, much like the domestic-level explanations. However, scholars in this group place more emphasis on how the introduction of the euro itself has contributed to fostering these imbalances, rather than blaming developments in the domestic economies.

Before moving on to assess the last group of scholars, it is worth mentioning the few notable exceptions that break with my categorisation between domestic-level and European-level explanations. For instance, authors like Featherstone (2011) and Katsimi and Moutos (2010) specifically address the question of the Greek crisis. The authors recognise both the domestic weaknesses of the Greek economy, such as fiscal unsustainability and endemic corruption and clientelism, as well as the EMU's institutional flaws, such as the lack of a timely and unified policy response to the sovereign debt market turmoil and how the introduction of the euro has led to a decline in the savings rate of the euro area's peripheral countries, like Greece.

Furthermore, Dooley (2015) provides the most balanced analysis with respect to domestic-level vs European-level factors. Dooley explains the onset of the crisis in Greece, Ireland and Portugal as stemming from how the specific trajectories of these economies interacted with the process of European integration. Dooley argues that the different crises of the abovementioned countries emerged from how their domestic economies *adapted* to the processes and regulatory requirements of financial liberalisation and monetary union as per the EU treaties.

1.3 The financial economics literature

Through significantly different approaches compared to the studies discussed above, the financial economics literature on the euro crisis explores more directly the question of sovereign spreads during the crisis. This body of literature employs different econometric analyses to isolate the variables that determined spreads before and during the crisis. While most of them also rely on the deterioration of macroeconomic fundamentals as an explanatory variable, such as government budget, debt and balance of payments, the studies below remain anchored, ultimately, to an understanding of spread movements as being closely linked to sovereign default risk perceptions.

For instance, Maltritz (2012) employs a Bayesian Model Averaging (BMA)[9] model to determine what variables influenced the 10-year sovereign yields spreads during the first decade of the euro for Austria, Belgium, Finland, France, Greece, Ireland, Italy,

[9] BMA is employed in studies incurring high model uncertainty, in the sense that the exact values are unknown, whereby uncertainty itself is transformed into probability. BMA takes into account the high uncertainty by acknowledging the entire model space, utilising any possible combination of regressors depending on a given set of potential determinants, instead of making a particular model to fit the existing set of data (see Hoeting et al., 1999).

Netherlands, Portugal, and Spain. Maltritz's use of a BMA model emerged to overcome the difficulties faced by previous studies on the subject, which delivered inconsistent results (e.g. Eichengreen and Mody, 1998; Kamin and von Kleist, 1999; Min, 1998; Arora and Cerisola, 2001; Cantor and Packer, 1996; Bernoth *et al*., 2006; Codogno *et al*., 2003; Manganelli and Wolwsijk, 2007).

Maltritz looks at 10 EMU countries during the timeframe 1999-2009 and finds that the key variables influencing sovereign spreads in the euro area are budget balance-to-GDP, terms of trade, balance of trade and trade openness[10]. Ultimately, he argues that the deterioration of said fundamentals affects spreads by increasing the 'perception of default risk' (Maltritz, 2012: 662). This is particularly the case with respect to worse fiscal positions and poor trading performance, because he argues that they reduce funds available for public debt servicing. Hence, the finding of Maltritz, corroborating those of Hilscher and Nosbusch (2010), are largely in line with what has been discussed by the rest of the literature in previous sections, in that investors are primarily concerned with macroeconomic fundamentals when buying and selling euro area sovereign bonds, thus directly impacting spreads.

It should be noted that the data used in the abovementioned studies rely on annual spread data, as these authors are primarily interested in uncovering 'long-term determinants of spreads and the market perception of default risk, whereas more frequent data is supposed to be *more influenced by short-term influences*' (Maltritz, 2012: 664, emphasis added). Thus, whereas this type of data allows us to understand the extent to which sovereign spreads are influenced by fundamentals in the long-term, they will not be able to assess short-term economic shocks. Hence, this approach is unable to spot any sign of sudden

[10] Terms of trade refers to the ratio of export prices to import prices, whereas trade openness refers to the total value of exports and imports as a share of GDP.

shift in market behaviour as a result of these shocks. This is an important observation, because the data I rely on differs from those employed by these studies. Whereas the data used in the explanatory figures 1-6 employ monthly averages for spread, I rely on daily spread data in Chapter 5, which allows us to detect the extent to which LCH.Clearnet's collateral management strategies during the euro crisis influenced spreads *in the short-term*.

1.3.1 Beyond fundamentals: investors' changing perception of sovereign default risk

This leads us to the next category of authors in financial economics that attempts to break with such a strong correlation between spread and fundamentals. Indeed, the following authors seek to overcome a fairly significant gap left unaddressed by most of the euro crisis scholarship discussed until now, which can be summarised through the following research puzzle: if we are to assume that investors look at fundamentals when buying and selling sovereign bonds, but macroeconomic fundamentals of certain countries in the euro area had been deteriorating already since the 2000s, how and why did spreads started to widen significantly only from 2009?

To answer this question, Olveira, *et al.* (2012) examine the determinants of spreads in the euro area for different maturities (5-, 10- and 15-year) and, more importantly, by dividing the examinations between a pre-crisis and during-crisis period. By accounting for different maturities, the authors seek to obtain a broader view of market behaviour with respect to a wider segment of the governments' sovereign debt market compositions, rather than just focusing on the 10-year maturity as the literature usually does. Further, by accounting for different time-frames Oliveira *et al.* are interested in examining

potential *changes* in market behaviour, in order to understand the trigger of sovereign debt market turmoil during the euro crisis.

Their examination identifies the determinants of sovereign spreads for Austria, Belgium, France, Italy, the Netherlands, Portugal and Spain. Greece and Ireland were excluded on the basis that there were an insufficient number of liquid government bonds for those countries during the crisis, which could have skewed the results This is an interesting observation, because it points towards the importance of sovereign bond market liquidity as a factor which may influence sovereign spreads, which is exactly what I seek to emphasise in this thesis.

The authors find that before the GFC (from 2000 to 2007), spreads were largely driven by returns on stocks and the German sovereign bond yield curve, whereas the domestic countries' macroeconomic fundamentals did not play a big role[11]. In other words, it was primarily the return on investments for equities and German government debt that influenced other euro area sovereign bonds yields spreads before the crisis, whereas domestic variables such as public debt- and budget-to-GDP rations, balance of payments, and inflation rates did not play much of a role. However, from the onset of the GFC, the authors find that country-specific macroeconomic fundamentals, particularly high public debt levels and large current account deficits, began playing a prominent role in widening the sovereign spreads of the countries examined (see also Beirne and Fratzscher, 2013).

With respect to default fears, the authors essentially refer to sovereign bond yield spreads as directly reflecting markets' perception of sovereign default risk, in line with most of the literature discussed so far. However, the novelty brought by the authors is with respect

[11] The yield curve shows all the interest rates (yields) spanning across the different contract lengths, rather than just focusing on an individual maturity (on which spread is usually calculated, i.e. 10-year).

to how they interpret the changing attitude towards sovereign default risk. They argue that the sudden change in market behaviour towards sovereign default was determined by the fact that, as discussed above, investors had assumed the existence of an implicit guarantee on sovereign debt in the euro area, leading to much smaller spreads despite the deterioration of macroeconomic fundamentals of certain economies since the introduction of the euro. The authors argue that the reason why spreads were not wider, despite differences in fundamentals, has to do with a presumed guarantee in the euro area that no sovereign would have been allowed to actually default. Hence, as far as this view go, spreads were smaller in the EMU before the crisis because markets did not perceive any significant risk of default.

However, this implicit guarantee (especially by German authorities) disappeared in the wake of the crisis, particularly since the onset of the Greek crisis (see also Arghyrou and Tsoukalas, 2011; Chang and Leblond, 2015). Thus, Oliveira *et al.* argue that, lacking such a public debt servicing guarantee, investors began perceiving a higher default risk associated with deteriorating fundamentals, leading to a widening of the spreads.

Along those lines, Bernoth and Erdogan (2012) contribute to the debate by accounting more explicitly for how market behaviour can change over time for the same set of variables. The authors employ a semiparametric time-varying coefficient model in order to determine the extent to which spread movements in the euro area are primarily driven by either macroeconomic fundamentals or the changing perception of default risk[12]. The

[12] In contrast to both parametric statistical inferences (requiring strict assumptions such as model linearity, in that assumptions are derived from a specific probability distribution) and nonparametric modelling (making no model assumptions whatsoever) a semiparametric time-varying coefficient model accounts for the dynamism that may exist in the available data sets, where coefficients are not linear, but change over time (see Fan and Zhang, 2008).

authors examine the changing attitude of investors towards euro area sovereign bonds between 1999 and 2010 for Belgium, Finland, France, Greece, Ireland, Italy, the Netherlands, Austria, Portugal and Spain. Their finding is that investor attitude changed at various points throughout the period examined.

This is one of the first studies of its kind arguing that sovereign spreads 'may not only be affected by changes in macroeconomic fundamentals but also by shifts in the pricing of sovereign risks', where sovereign risk refers to sovereign default risk (ibid: 651, see also De Grauwe and Ji, 2012; 2013). Indeed, the authors argue that in the first few years of the euro financial markets mostly looked at public debt-to-GDP ratios. For the next few years until 2006, it looks as if investors were not paying much attention to the government debt or budget deficit positions of countries in the euro area, having had no influence on spreads. From 2006 onwards, spreads began to widen slightly, suggesting that the investors' risk aversion right before the collapse of the subprime mortgage bubble in the US induced them to invest more in German government bonds (i.e. they started considering the German government debt market as a safe asset).

From the onset of the GFC the authors find that spreads in the euro area were widening as a consequence of worsening fundamentals, especially with respect to budget deficits. Similar to the finding of Oliveira *et al*. (2012), Bernoth and Erdogan's study is distinctive in that it shows how market behaviour towards euro area sovereign bond changed over time. More importantly, however, they make an explicit argument about investors 'pricing' (i.e. charging different interest rates on) sovereign debt in the euro area differently depending on the investors' perception of sovereign default likelihood *regardless of the changes in macroeconomic fundamentals*. This is an important argument insofar as it one of the first attempts to frame market behaviour as not being necessarily connected to changing fundamentals in the euro area.

This brings us to De Grauwe and Ji (2012), who take Bernoth and Erdogan's idea further by showing that part of the movements in spreads from 2010 to 2012 (the height of the euro crisis) cannot be explained by fundamentals alone, in the sense that part of the spread movements during that period 'appeared to be dissociated from fundamentals' (ibid: 18, emphasis added). De Grauwe and Ji provide a different type of analysis from the rest of the literature. Their study compares the spreads between the German bunds and other EMU members (Greece, Portugal, Ireland, Italy, Belgium, France and the Netherlands) with the so-called 'stand-alone' countries issuing public debt in their own national currencies (Australia, Canada, Denmark, Japan, Norway, Sweden, Switzerland, United States and United Kingdom).

First of all, the authors find that the sovereign debt market distress in the euro area after the GFC, as reflected by the widening spreads, did not manifest in the stand-alone group, despite most of the EMU countries (with the exception of Greece) not having a worse fiscal position than countries like the US or the UK. Indeed, after 2007, bond market operators became suddenly concerned with country-specific fundamentals in the euro area, such as public debt-to-GDP, budget and current account balances, which resulted in widening spreads of the peripheral countries (see also Beirne and Fratzscher, 2013). However, increasingly high debt-to-GDP ratios in stand-alone countries did not play an important role in influencing spreads.

Crucially, and more importantly for the scope of this project, De Grauwe and Ji found that from 2010 to 2012 a substantial amount of the variation in spread *is not at all correlated with changes in the underlying fundamentals*. In other words, even though investors did become generally more susceptible to the periphery's deteriorating fundamentals in the wake of the GFC when buying and selling their sovereign bonds, there were other factors that influenced spreads during that period, which they initially

refer to simply as a time-dependent variable. This time-dependant variation in spread accounted *for about half* of the total variation in spread in Portugal and Ireland from 2010 to 2012, and for almost *the totality* of the surge in the Spanish spread.

Hence, for these countries, changes in fundamentals alone are insufficient to explain spread movements during the euro crisis[13]. The authors then move on to argue that such time-dependant changes in spreads reflected a negative market sentiment on the expected future public debt servicing capabilities of the peripheral countries (see also Aizenman *et al.*, 2013). In short, *fear of default.*

De Grauwe and Ji argue that countries within a monetary union are more susceptible to such negative sentiment because of their inability to implement currency devaluation and their lack of a public debt servicing guarantee by a national central bank. Hence, investors slowly realised that EMU countries could not provide to sovereign bondholders the same guarantee of stand-alone countries that cash would always be available at maturity (see also Arghyrou and Tsoukalas, 2011).

This is, in essence, what the authors deem had increased investors' fear of sovereign default, which led to a widening of the spreads. There is a self-fulling element to this story. As put by De Grauwe and Ji (2013: 17) '[w]hen investors fear default, they act in such a way that default becomes more likely. A country can become insolvent because

[13] As a matter of fact, a number of studies in financial economics and political economy have pointed to factors other than fundamentals that contributed to pushing the sovereign spreads of the periphery during the crisis. These have highlighted particularly the news (e.g. Büchel, 2013; Beetsma *et al.*, 2013), fiscal policy announcements (e.g. Zoli, 2013; Falagiarda and Gregori, 2015; Falagiarda and Reitz, 2015), and the lack of intra-European solidarity (Chang and Leblond, 2015), because of the ways in which communication and solidarity shape investors' perception of the future public debt servicing sustainability of financially distressed economies.

investors fear default'. This is a plausible argument, because as investors sell sovereign bonds they can lead to an increase in the cost of public debt servicing, which increases the cost of public debt servicing and, thus, potentially compromising the sustainability of public debt-servicing. The emphasis put by De Grauwe and Ji on the changing of market behaviour from 2010 to 2012 is particularly important for the scope of this project, because Chapter 5 will show that it is precisely from 2010 to 2012 that the actions of the world's largest CCP, LCH.Clearnet, impacted the usability of these countries' sovereign bonds as collateral in repo transactions. However, contrary to what is argued by De Grauwe and Ji, I seek to argue that it was also concerns surrounding the use of these sovereign bonds to access short-term funding that widened the spread, rather than just self-fulfilling expectations of sovereign default.

1.4 Liquidity, the functioning of the European repo market and the role of CCPs

Undeniably, the literature has provided us with more than enough evidence to identify the different factors that have compromised market confidence in public debt sustainability during the crisis, and how these led to a widening of the spreads. Among these, the deterioration of macroeconomic fundamentals (caused by either domestic-level or European-level weaknesses), and how they have led to imbalances and unsustainable growth models in the periphery of the euro area, have dominated the debate. Given the functioning of the euro area, which lacks automatic stabilisers and unconditional sovereign default guarantees, investors' confidence in the public debt sustainability of the periphery collapsed in the aftermath of the GFC.

However, some authors, particularly economists and financial economists, have moved beyond fundamentals in order to explain the sudden widening of the spreads during the height of the crisis, identifying the self-fulfilling expectations of sovereign default as

another explanatory variable. Their contribution is key because it shows that market sentiment in the euro area is much more heterogenous and less consistent than what has been discussed in the vast majority of the literature. Yet, even in that case, spread remains understood as primarily reflecting the markets' default fears.

I argue that the reason the literature has remained fixed on fear of default rests on another important aspect that has not been sufficiently examined when understanding spread: its relationship with liquidity. The dimension surrounding liquidity is crucial, because the lack thereof also contributed to the widening of the spreads in the euro area during the euro crisis. Indeed, a number of authors have shown that the declining liquidity (as reflected by falling trading volumes) of specific sovereign bonds has led to sell-offs that widened the spreads. For instance, De Grauwe and Ji (2012; 2013), De Santis (2012), Bernoth and Erdogan (2012), Pepino (2015) all agree that the declining liquidity of a sovereign bond could affect its yield differential (i.e. spread), because the fear that such security could not be traded quick enough without impacting its market price would also lead to massive sell-offs. Nonetheless, these views remain anchored to perceptions of sovereign solvency as the main driver for liquidity crises in the euro area in the first place, as in the words of De Grauwe and Ji (2013: 16):

> When investors fear some payment difficulty, e.g. triggered by a recession, they sell the government bonds. This has two effects. It raises the interest rate and leads to a liquidity outflow as the investors who have sold the government bonds look for safer places to invest (for a similar view, see also De Santis, 2012; Moro, 2014).

Other authors have likewise pointed out the liquidity issues faced by banks in the euro area in the wake of the 2008 credit crunch, which compromised the debt-led growth

models of the periphery, contributing to eroding market confidence on sovereign debt servicing sustainability (e.g. Quaglia and Royo, 2015; Gambarotto and Solari, 2015; Lane, 2011). Further, it has been shown that downgrades by CRAs also decreased the liquidity of specific sovereign bonds for banks, because credit rating downgrades impacted the ability to use specific sovereign bonds to access the refinancing operations of the ECB, which only accepts highly rated assets within its collateral risk policy (e.g. Eijffinger, 2012: 915; Gärtner et al., 2011; De Santis, 2012: 3).

Nevertheless, the mechanisms underpinning the interbank funding market in the euro area, which is the main market segment where banks access short-term funding, have been almost entirely ignored by the literature. This is crucial, because the sovereign debt market tensions experienced in the euro area curtailed access to wholesale short-term funding of banks in the euro area. As put by Rixtel and Gasperini (2013: 25), the euro crisis demonstrates 'the strong interconnection between financial crises and bank funding', because the declining value of euro area sovereign bonds in financial markets during the crisis rendered those assets less valuable in repo operations, which are key short-term funding tools for banks.

To study these mechanisms and the potential impact they may have had in shaping market sentiment, this project examines the role of CCPs in the European repo market, and how these contributed to sovereign debt market instabilities during the euro crisis. Chapter 4 will show that the politics surrounding the integration of European financial markets, between the end of the 1990s and the beginning of the 2000s, has made sovereign bonds the key collateral for the creation of a Europeanised interbank repo market, which brought sovereign debt and bank funding ever closer together. As argued by Gabor and Ban (2016), the creation of a single European repo market has exposed sovereign bonds in the euro area to the procyclical fragilities underpinning collateral-based finance. Yet, the euro

crisis literature overlooks the dynamics underpinning repo trading as a source of systemic instability. Therefore, in Chapter 3 I discuss how collateral-based lending practices have proven to be extremely fragile in modern financial history, exacerbating liquidity shortages during financial crises. In this context, the collateral practices of CCPs during the euro crisis have likewise received insufficient attention. The absence of CCPs from the euro crisis literature is puzzling, considering their historical and contemporary relevance in financial markets. Chapter 2 will in fact argue that CCPs were already important institutions in the 18th century and have become increasingly important in OTC derivatives trading in modern times.

Furthermore, in Chapter 4 I will argue that the politics underpinning the consolidation of the European exchange and clearing business after the introduction of the euro has led to the creation of one of the world's largest CCPs, LCH.Clearnet. By clearing almost the entire euro-denominated repo market, LCH.Clearnet has become the most powerful CCP in that market segment. As CCPs interpose themselves between buyers and sellers in a given transaction, LCH.Clearnet thus retains a huge destabilising potential, thanks to the ways in which they can suddenly demand more collateral from traders. Indeed, Chapter 2 will show that CCPs have exacerbated liquidity shortages during several financial crises in the 20th century, precisely due to how they can demand extra collateral from traders.

Without a doubt, a few authors have in fact pointed out that the sudden increase in collateral requirements by LCH.Clearnet was followed by a widening in the spread of certain euro area economies during the crisis (e.g. Jones, 2012; Pepino, 2015; Gabor and Ban, 2016). However, these discussions are merely speculative in nature, lacking both a detailed examination of the core technologies at the heart of central clearing as well as a systematic assessment of how CCPs have actually destabilised sovereign debt markets during the crisis. Therefore, Chapter 5 will assess the involvement of LCH.Clearnet

during the euro crisis, focusing on four case studies: Ireland, Portugal, Italy and Spain. The chapter will show that LCH.Clearnet's sudden increases in collateral requirements to use Irish, Portuguese, Italian and Spanish sovereign bonds in repo trading raised concerns among investors about the use of those securities to access short-term funding, leading to sell-offs that widened the spreads from 2010 to 2012.

1.5 Conclusions

This chapter examined how the euro crisis literature employs spread to understand the origins and unfolding of the euro crisis. I argued that the vast majority of the literature is anchored on an understanding of spread as an indicator of investors' concerns with sovereign default risk. As a matter of fact, spread has become an actual proxy for market sentiment towards sovereign default perception during the crisis. The deterioration of macroeconomic fundamentals has been interpreted by many scholars as the leading cause of the financial markets' loss of confidence towards the public debt servicing sustainability of the euro area's periphery, leading to the bond sell-offs that widened the spreads. The fundamentals/spread link as a way to understand the markets' declining confidence in sovereign solvency is largely due to the developments of the Greek crisis. Indeed, Greece was the first country in the euro area to have undergone sovereign debt market turmoil during the euro crisis. More importantly, it was the only country to experience a severe, initially hidden, mismanagement of its public finances during the first decade of the euro, which, once revealed, triggered panic on sovereign debt markets that forced the country to ask for a bailout.

The Greek crisis provided the blueprint for understanding the euro crisis as essentially a crisis of confidence in public debt servicing sustainability. For all the other countries discussed in the literature, Ireland, Portugal, Spain and Italy, fiscal mismanagement was

not as much of an important a factor as in the case of Greece. Yet, even in those cases, macroeconomic imbalances, as caused by either domestic-level or European-level factors, have been accounted for as the key drivers for sovereign spread, which continue to be understood as investors' deteriorating confidence in public debt servicing sustainability. However, a number of economists and financial economists have argued that market sentiment during the crisis was also driven by self-fulfilling expectations of sovereign default, which contributed to the sell-offs that widened the spreads. The main contribution of this scholarship, and of De Grauwe and Ji (2013) in particular, is to demonstrate the existence of a certain degree of separation between fundamentals and investor attitude towards sovereign bonds during the euro crisis. Nevertheless, even those authors continue to rely on fear of default as the key explanatory variable for the sudden widening of the spreads from 2010 to 2012.

I argue that the fixation with sovereign default is, to a large extent, linked to the literature's neglect in sufficiently accounting for the mechanisms underpinning liquidity provision in the euro area. That is not to say that the literature ignored issues surrounding the banking and liquidity dimension of the euro crisis. Especially from reviewing the Irish, Spanish and, to a lesser extent, the Portuguese crises, it is clear that unsustainable lending practices, as well as the sudden lack of access to credit, are at the heart of each of these countries' crises. Further, credit downgrades have also played a role in reducing the liquidity of euro area sovereign bonds, as it impaired their use at the ECB's refinancing operations. However, the precise mechanisms underpinning the functioning of the European repo-based interbank lending market, and their implications for sovereign debt market stability, have been largely ignored.

To bridge this gap, I seek to answer the following research question: what factors contributed to destabilising sovereign debt markets during the height of the euro crisis

from 2010 to 2012? In order to answer this question, the rest of this thesis examines the functioning of the European repo market, within which CCPs play a key and, I argue, destabilising role in the provision of short-term funding. Ultimately, this project seeks to demonstrate that spread movements from 2010 to 2012 were not only due to markets' fear of sovereign default, as discussed by much of the euro crisis literature, but also largely influenced by the banks' concerns with funding liquidity risk. The next chapter will examine the development and functioning of CCPs in global finance. This assessment will be carried out to demonstrate that, to a significant extent, the destabilising impact that CCPs can have on systemic liquidity stems from the unique way in which they operate.

2 Understanding Central Counterparty Clearing Houses in Global Finance

2.1 Introduction

This chapter seeks to explain the role played by CCPs in financial markets. CCPs are financial institutions that interpose themselves between the buyer and the seller of a given transaction, effectively guaranteeing each trader's contractual obligations. CCPs have become increasingly important in the aftermath of the GFC. However, outside of financial news and central banks' reports, very little is known about the CCPs' broader significance in global finance. The analysis below is thus conducted against the backdrop of a very limited literature about the nature of those financial companies in the euro crisis literature. There are a few exceptions, however. On the one hand, political scientists and political economists do recognise, to different degrees, the role and impact played by LCH.Clearnet on sovereign debt markets during the height of the euro crisis (e.g. Jones, 2012; Pepino, 2015; Gabor and Ban, 2016). On the other hand, research in the political economy of global finance highlights several regulatory dimensions surrounding the renewed role of CCPs in the OTC derivatives market in the aftermath of the GFC (e.g. Helleiner, 2014; Lockwood, 2018).

However, these studies lack a detailed examination of the core mechanisms at the heart of central clearing and are unable to appreciate the extent to which CCPs have historically been embedded in financial markets. Therefore, this chapter provides a historically-grounded analysis of the development of CCPs. Such a historical examination will shed light on the ways in which some of the most distinctive aspects of central clearing are still relevant today, particularly when it comes to liquidity and systemic stability. The main argument portrayed in this chapter is that the mechanisms at the origins of central

clearing, rooted in the provision of contract performance guarantee, have been retained by the present day CCPs and can reduce the liquidity available to investors during times of financial distress. More broadly, this chapter also seeks to show that, since their inception, the development of CCPs is closely linked to the political contingencies underpinning the functioning of financial markets, such as monetary arrangements, colonial expansions and financial reforms.

For example, the analysis conducted below shows that contract performance guarantee, one of the most defining aspects of central clearing, was already present in the futures market of 18th century Japan, in the Dojima Rice Exchange of Osaka, in order to shield traders against the price fluctuation of rice. The necessity to control the price fluctuation of rice had to do with how Japanese society was organised during the Tokugawa period, whereby the military dictatorship allowed for multiple currencies to exist simultaneously, and who often paid the army in rice. These arrangements in Japanese monetary policy led to development of money exchange brokers, who would be trading rice for other currencies. The rapid expansion in rice markets exposed traders to the price fluctuation of the grain, which laid the foundation for the development of futures markets. Brokers thus developed into actual clearing houses, offering contractual performance guarantee precisely with the aim to protect traders against the price fluctuation of rice.

The first institution to provide contract performance guarantee in the West was the French-based *Caisse de Liquidation des Affaires en Marchandises*, which was mainly involved in the coffee and cotton exchange markets. Similar to what had happened to the rice markets of Dojima, the emergence of the *Caisse* was dependent upon the politics underpinning the development of coffee and cotton exchange markets in France. On the one hand, France's second colonial expansion in the beginning of the 19th century greatly increased the import of coffee. On the other hand, the country's support of American

independence from British rule led to a massive expansion in the French import of American cotton. As the trade of those two commodities increased, so did the traders' exposures to price volatility risk, which led to the creation of the *Caisse* in 1882 to provide contract performance guarantee to coffee and cotton futures contracts.

CCPs developed in such a way throughout the 19th century to legally replace the buyer and the seller in a given trade, a mechanism called counterparty substitution. Differently from traditional intermediation, contract performance guarantee through counterparty substitution entails that the CCP becomes the legal counterparty in each trade, responsible for fulfilling all the contracts' obligations, even in the case of a counterparty defaulting. CCPs have therefore implemented several default management tools, which mainly take the form of collateral demanded from the traders themselves. Among these, the most important are the use margin requirements, which is collateral equal to a portion of the contract's value that is calculated, imposed and held by CCPs throughout the duration of the trade. The imposition of non-negotiable margin requirements by CCPs, while taking the position of both the buyer and the seller in a given transaction, is expression of the power of CCPs in financial markets, because they can constrain the freedom of investors to allocate their assets.

The chapter continues by showing how the embeddedness of CCPs in financial markets extends to modern times, specifically with reference to the politics underpinning financial regulatory reforms that were implemented by G20 leaders after the GFC. This chapter finds that the self-regulatory, opaque and unaccountable nature of OTC derivatives exerted significant pressures on regulators to reform that market, which paved the way to expanding the use of CCPs in global finance. This was particularly the case with respect to how defaults on OTC derivative contracts contributed to the failure of large financial institutions, which had to be bailed out with taxpayers' money. At the same time, the

ways in which LCH.Clearnet relied on its margin requirements to successfully handle Lehman Brothers' default, without causing financial losses to any of its clients, brought CCPs under the spotlight of regulators. Thus, I argue that the calls to improve the accountability and transparency of the financial sector, combined with the excellent performance of CCPs during the GFC, pushed G20 leaders to introduce regulatory provisions that made the central clearing of OTC derivatives *mandatory*. The new key central role of CCPs in OTC markets around the world was designed to change who would bear the risk deriving from the OTC derivatives trading, in the sense that it would no longer be up to the taxpayers to pay for the failures of the financial sector, but the CCPs themselves.

However, as the CCPs' presence in global finance increases in the aftermath of the crisis, this chapter focuses another key aspect surrounding the importance of central clearing in financial markets: its relationship to systemic stability. As will be discussed in more detail below, this chapter argues that, during times of financial distress, CCPs can suddenly demand more collateral by increasing margin requirements, which can lead to a sudden shrink in the liquidity available to investors. This claim is backed by surveying various failures of CCPs during the 20th century.

The three documented failures of CCPs all show that the collection of margin requirements during times of financial instability caused liquidity shocks, which led to traders' default and, in turn, the failure of CCPs themselves. This is a crucial point with respect to answering the research question posed by this study, which aims at identifying the factors that contributed to destabilising sovereign debt markets during the euro crisis. Indeed, Chapter 5 demonstrates that the use of margin requirements by LCH.Clearnet during the euro crisis contributed to destabilising sovereign debt markets in the euro area

from 2010 to 2012, because they caused large-scale bond sell-offs that widened the Irish, Portuguese, Italian and Spanish sovereign spreads.

The rest of this chapter is structured as follows. Section 2.2 discusses the limited attention paid to CCPs by the euro crisis literature. Section 2.3 examines the development of central clearing between the 18th and 19th centuries. Section 2.4 discusses the functioning of CCPs in modern times. Section 2.5 explores the renewed importance of CCPs in the aftermath of the GFC. Section 2.6 showcases the relevance of CCPs for systemic stability. Section 2.7 is dedicated to the concluding remarks, namely, that the way CCPs operate can exert a significant amount of influence over how investors employ their assets, which may contribute to exacerbate liquidity shortages during times of financial distress.

2.2 The limited presence of CCPs in the euro crisis literature

CCPs have played a near-to-inexistent role in the euro crisis literature, in the sense that they have largely been ignored in relation to the events that unfolded from 2010 to 2012. Even when they have been acknowledged, the impact of the CCPs' actions on sovereign debt markets lacks a more systematic examination. For instance, Jones (2012) should be credited to be among one of the first authors to have discussed LCH.Clearnet's involvement during the euro crisis. Specifically, Jones mentions the involvement of LCH.Clearnet in the middle of Italy's crisis in 2011. The author firstly discusses how, in the middle of a domestic political crisis, the declining price of Italian government bonds made the use of those securities less valuable as collateral, and thus more expensive for investors to hold. Jones further talks about LCH.Clearnet's actions in responses to the declining value of Italian government debt. The author points towards the introduction of a numerical threshold for spread by LCH.Clearnet that, if crossed, would have increased 'the cost for using Italian sovereign debt as collateral' (Jones, 2012: 187). As Italian debt

crossed that threshold, Jones notes, LCH.Clearnet actions caused an immediate spike in the Italian long-term sovereign bond yields, widening the spreads.

Without acknowledging LCH.Clearnet itself, Pepino has also made reference to spread thresholds in how they 'generated significant worries and accelerated sell-offs in government bond markets' during the euro crisis (2015: 12). Noting the existence of that spread threshold is particularly important for the scope of this project. As Chapter 5 will show, the introduction of a numerical threshold for spread was a central aspect of LCH.Clearnet's Risk Management Policy during the euro crisis. However, the specific mechanisms that have allowed for LCH.Clearnet's actions to destabilise sovereign debt markets during the crisis remain entirely unexplored in these accounts. More recently, in their study about the creation of a Europeanised repo market, Gabor and Ban (2016) have provided more information about the ways in which CCPs can contribute to sovereign debt market instabilities. By conducting an examination of the historical roots of the European repo market, Gabor and Bank observe that key repo market actors, like the ECB and LCH.Clearnet, increased collateral requirements in a procyclical manner during the euro crisis, exacerbating tensions in the sovereign debt markets of the periphery that further widened their spreads (see also Gabor, 2016).

The authors argue that the sudden increase in collateral requirements by LCH.Clearnet during the crisis led to large-scale sell-offs of the affected government securities, which 'helped creating the perfect storm for periphery governments' (Gabor and Ban, 2016: 631). The study by Gabor and Ban represents an important milestone for our understanding of the relationship between CCPs, bank funding and systemic stability during the euro crisis, as it is the first work of its kind to suggest that CCPs can be a source of sovereign debt market instability. However, their detailed work on the European repo market lacks a more exhaustive account of the CCPs-unique features that can

contribute to instability in financial markets, and their claims about LCH.Clearnet's impact on sovereign debt markets remain speculative in nature.

Differently from the abovementioned studies, which take the destabilising impact of LCH.Clearnet's margin policies on sovereign debt markets for granted, this chapter contributes to our understanding of these dynamics by examining how the specific mechanisms at the heart of central clearing can impact systemic stability. Indeed, these studies are unable to capture that the destabilising impact of LCH.Clearnet during the euro crisis stems from the distinctive way in which CCPs operate, whereby counterparty substitution and the unilateral imposition of margin requirement can have a highly destabilising impact during times of financial distress.

It should be noted, however, that although the presence of CCPs in the euro crisis literature is fairly limited, financial news, as well as national and supranational governmental authorities, paid more attention to CCPs (LCH.Clearnet in particular) during the crisis. For example, the Financial Times and Reuters were following the sovereign debt and repo markets developments very closely during those years. While reporting the LCH.Clearnet's introduction of a spread threshold in the European repo market, they were among the first ones to warn (and eventually recognise) that a sudden increase in collateral requirements could have exerted downwards pressures on the euro area sovereign bonds (i.e. sell-offs), further widening the affected government bonds' spreads against Germany (e.g. Oakley and Jones, 2010; Reuters, 2012a; Cotterill, 2011; Oakley, 2011).

Researchers at the Italian Central Bank have also explored the destabilising impact of CCPs on sovereign debt markets. A report by the Bank of Italy suggests that the increases in collateral requirements by leading CCPs LCH.Clearnet and CC&G in 2011 affected

virtually the entire Italian repo market, leading to sell-offs that widened the spreads (Bank of Italy, 2012: 38). In that respect, the procyclical potential of margin requirement increases has also been picked up by the European Systemic Risk Board (ESRB), a body set up in 2010 for macro-prudential oversight of the European financial system within the jurisdiction of the EU (ESRB, 2017). The ESRB argues that the CCPs' margin requirements pose procyclical threats, which requires their systemic risk to be addressed through macro-prudential regulation. Even in this case, however, the procyclicality of CCPs is taken for granted, and the core mechanisms underpinning CCPs remain obscure in these reports and studies[14].

2.3 The development of central clearing during the 18th and 19th centuries

This section provides a historically-grounded examination of the development of CCPs in financial markets. My historical analysis of CCPs will underscore the long-term importance of CCPs in global finance, which makes their neglect in the literature even more striking. Furthermore, a historical outlook will also allow us to understand how the CCPs' specific mechanisms came into being and why this is still relevant today. CCPs clear transactions by interposing themselves between trading parties and have traditionally been dealing with commodity contracts. For instance, the London Produce Clearing House, renamed International Commodity Clearing House (ICCH) in 1973, played a central role in the establishment and development of many British future markets since 1883 (see Rees, 1981). It is only since the 2010s that CCPs have been used more

[14] It should be noted that many other reports by central bank and international institutions do in fact explore the CCPs' mechanisms and the risks they pose in more detail. However, these studies to not address the euro crisis or sovereign debt market instabilities specifically, but are rather concerned with regulatory discussions or with OTC derivatives (e.g. ECB and Federal Reserve, 2007; Rehlon and Nixon, 2013; Rahman, 2015; Wendt, 2015).

prominently in securities, repurchase and OTC derivatives markets, primarily in advanced economies (Wendt, 2015: 3).

2.3.1 Early clearing in 18th century Japan

Some of the oldest clearing organizations can be traced back to 18th century Japan, in the Dojima Rice Exchange Market of Osaka. During the Tokugawa period in Japan (1603-1867), Osaka was the country's largest rice trading centre, which had even been dubbed as the 'kitchen for the country' (see Wakita, 2001: 535) [15]. As a matter of fact, scholars in the history of future markets consider Dojima to be the world's first established futures market (see Duffie, 1989; Blank *et al.*, 1991) [16]. One of the key characteristics of the Dojima Exchange is that brokers changed rice into cash. That is because, during the Tokugawa period, Japan lacked a single unified currency (see Cargill *et al.*, 2003: 12). Thus, since the military was often paid in rice, the grain became a currency in its own right, whereby trading it for other currencies became common practice. However, as changing rice into cash became more complex and transactions had increased in volume, brokers developed into 'full-fledged clearinghouses' to improve their role as intermediaries between trading parties and guarantee the fulfilment of all contracts (West,

[15] The Tokugawa shogunate was the last feudal military government of Japan (see Yonemoto, 2003 for a full history).

[16] Futures contracts are legal agreements between different parties to buy or sell a specific commodity or financial instruments at an agreed price for a specific time in the future (see Malliaris, and Ziemba, 2015). Usually, this is conducted via an investor, who guarantees the price changes of the underlying commodity. The investor would be making or receiving financial transfers with the affected party depending on the price change of the commodity. Therefore, in its very essence, futures contracts are used to protect the buyers and sellers of a commodity against price volatility, transferring risk between parties. Today, future contracts are often standardized and agreed at the trading floor of a futures exchange.

2000: 2587). These brokers essentially laid down the foundation of what will in the future be known as a CCP, underpinning the creation of more standardised futures markets.

According to West (2000), there were at least four reasons as to why market participants in Dojima succeeded in developing these sophisticated market institutions before Europe. First, the shogunate (the *de facto* military dictatorship of Japan during that time), allowed the existence and competition of different currencies simultaneously, which fostered the development of a huge number of money exchange brokers. Indeed, there were more than a thousand money changers in the Dojima Exchange in 1700, all of which were intermediating rice trade. Second, the feudal political system existing at the time in Japan did not restrict the lords' power in the market places, which would be exerted through brokerage. Third, and related to the previous point, since rice was simultaneously an informal currency and a seasonal, weather-sensitive good, it encouraged these lords to hedge themselves against price fluctuation through brokerage activities.

Last, West argues that even socioeconomic and religious factors may have played a role. Japanese merchants, as opposed to their European counterparts, retained both the ability and the incentive to establish a central marketplace in Osaka. Indeed, Japanese merchants did not have the same market restrictions imposed by Christian or Muslim codes of conduct that punished or, at least, discouraged debt and usury (see Weatherford, 1997: 73). In short, the 'ancestors' of the modern CCPs have their roots in the contingencies underpinning the development of rice futures markets in 18th century Japan, whereby the shogunate's monetary policy deeply shaped how rice would be traded simultaneously as a *de facto* currency and a consumer good.

Crucially, clearing houses in the Dojima rice market were not just intermediaries. They were the first organizations to have some recognisable elements of one of the most

distinctive features of central clearing: *counterparty substitution*. Counterparty substitution offers a legal guarantee provided by the CCP to fulfil all contractual obligations, thereby eliminating what is known as counterparty risk, or the risk that a trading party may fail at honouring her/his obligations. According to Schaede[17], rudimentary counterparty substitution was one of the features that distinguished the Dojima Exchange from its European siblings (see Schaede, 1989; 1991). Schaede found that the ways in which rice trading was conducted in the Dojima exchange was not bilateral. Instead, clearing houses entered each trade as a third party specifically to guarantee the fulfilment of every contract. This means that contract performance guarantee was already offered by brokers in the Dojima Exchange in early 18th century, which is *the feature* retained by modern-time CCPs.

This is highly relevant for the scope of my project, because it is in its virtue of contract performance guarantor that LCH.Clearnet's actions during the euro crisis need to be understood. As discussed in Chapter 5, the CCP's perception of increasing financial risks during the euro crisis prompted its risk committee to formalise a new collateral policy in 2010. This initiative, which was introduced through the name of Risk Management Policy, was designed to ensure that LCH.Clearnet would have enough collateral to continue guaranteeing the performance of every contract during turbulent times (see Burke, 2011), paving the way for the increases in margin requirements that led to a widening in the spreads of the periphery.

However, as we shall see in the next subsection, the process of counterparty substitution in modern times is much more complex and nuanced than Dojima's, both with respect to its legal and its trading implications.

[17] The work by Ulrich Schaede is remarkable in that it is one of the first that examines the exchange and clearing system of Dojima in English.

2.3.2 CCPs in the West

According to Norman, the first CCP-like organisation to have provided contract performance guarantee in the West was the *Caisse de Liquidation des Affaires en Marchandises*, established in 1882 in Le Havre, France (Norman, 2011: 69). Le Havre hosted one of France's fastest growing and busy ports, which had become Europe's leading importers of coffee and cotton. The expansion of the Le Havre port and the creation of the *Caisse* was closely linked to the politics that shaped the trading of coffee and cotton trading during the 19th century. First of all, France's second colonial expansion in Africa during the first half of the 19th century greatly increased the country's extraction and consumption of coffee (see Topik, 2004).

As a matter of fact, due to its colonial expansion in Africa, France became the world's third largest consumer of coffee until World War I. Equally important, the port of Le Havre had also become a major importer of American cotton. Le Havre's involvement in the American cotton market was the direct consequence of France helping American exporters to avoid the British embargo during the American War of Independence (see Lacombe, 1939). France's support of American independence provided American cotton producers new trading avenues into Europe. However, the immediate consequence of France's move was that Le Havre had also become continental Europe's largest importer of US cotton. Indeed, during the 1830s, the port of Le Havre was importing around 15% of all American cotton annually. Thus, the volume of coffee and cotton imports in Le Havre's port became rampant throughout the 19th century, which also exposed coffee and cotton traders to greater price volatility. Brokers and merchants in Le Havre therefore started to look for ways to improve the city's futures market to shield themselves against price fluctuations in cotton and coffee (Norman, 2011: 68).

On 6 November 1882, the *Caisse de Liquidation* was developed precisely with the intention of guaranteeing the fulfilment of all the cotton and futures contracts in Le Havre. The *Caisse* of Le Havre managed to establish its lead against all the other European competitors by providing a guarantee on all the contracts that it registered and became widely employed by local traders and brokers. It is not completely clear why Le Havre took the lead over, for instance, London or Amsterdam, given these cities' roles in financial innovation and commodity trade. However, according to Lacombe (1939), an official from the *Banque de France* based in Le Havre, the establishment of the *Caisse* came after one of Le Havre's leading traders visited the New York Coffee Exchange in 1882, which hosted a clearing house not offering contract performance guarantee. Still, the fact remains that France's colonial expansion in Africa and support of American independence (in what was an essentially an anti-British move) shaped the coffee and cotton markets in Le Havre and led to the development of contractual performance guarantee through the *Caisse*.

It goes without saying that contract performance guarantee was attainable even prior to the innovation brought about by the *Caisse*, through a third-party guarantor for example. However, the difference with the *Caisse* in Le Havre was that it successfully combined performance guarantee, other risk management and transaction cost reduction techniques, such as collateralisation, as well as registration and monitoring of all the open risk positions (see also Steigerwald, 2015: 193). The innovation brought about by the *Caisse* was essentially one of *centralising* the clearing, settlement, and collateral management in one institution. Within five years since its inception, the *Caisse* of Le Havre's clearing method started to become replicated in other large European trading cities, such as Paris, Marseilles, Antwerpen, Hamburg and London. It is fair to say that the *Caisse* of Le Havre has established itself as the blueprint of modern central clearing in Europe, since modern CCPs, like LCH.Clearnet, have retained the same centralisation functions described

above. Although the pay-out guarantee offered by the *Caisse* is very similar to what is provided by today's CCPs, it had not yet exactly involve counterparty substitution intended as the legal replacement of the CCPs with each counterparty in a trade (see Steigerwald, 2015: 194).

This specific form of contract performance guarantee only made its first appearance in 19th century United States at the Minneapolis Chamber of Commerce, later renamed Minneapolis Grain Exchange. Counterparty substitution was introduced by the Minneapolis Exchange in 1891, requesting that '[a]ll transactions…shall be cleared through the clearing association…Upon acceptance by the manager of such transactions, the clearing association assumes the position of *buyer to the seller and seller to the buyer* in respect to such transactions… (in Moser, 1998: 38, emphasis added). The Minneapolis Grain Exchange requested that clearing houses interposing themselves in a trade *must* act as the legal counterparty in each side of exchange-traded contracts. The ways in which counterparty substitution replaces the original trading parties in a given trade is a particularly important feature for the scope of this project. As discussed in section 2.4, the position as both the buyer and seller in a given transaction provides CCPs with the ability to unilaterally impose margin requirements onto traders, which is key for understanding both the power of CCPs in global finance and the implication of central clearing for financial stability.

In a nutshell, the development of modern central clearing is closely linked to the political contingencies underpinning the development of futures markets as a means to control the price volatility of expanding commodity trade in different sectors. In order protect traders against the price fluctuation of commodities, brokers first, and institutionalised companies after, provided the guarantee to perform the contracts they traded, culminating in its most contemporary iteration: counterparty substitution.

2.4 The functioning of contemporary CCPs

2.4.1 Counterparty risk reduction through matched books and multilateral netting

CCPs are widely employed today for their perceived ability to reduce counterparty risk, or the risk that one of the traders involved may fail to honour her/his obligations. The presumed ability of CCPs to reduce such risks owes a lot to how CCPs conduct their contract performance guarantee operations. Counterparty substitution is performed through a process called novation, which brings to an end the contracts held by the original trading parties and replaces them with two new contracts that legally bind each of the initial trading parties to the CCP (see Gregory, 2014: 28). CCPs settle their clearing members' open positions through automatic offsets. Settlement by automatic offset effectively extinguishes a position by entering into an equal but opposite trade with another market participant (Steigerwald, 2015: 184; see also Manning and Schanz, 2009). This is also called a matched book, entailing that 'any position taken on with one counterparty is always offset by an opposite position taken on with a second counterparty' (Rehlon and Nixon, 2013: 2).

Counterparty substitution is one of the main features that makes central clearing distinctive from traditional intermediation. An intermediator is a middle man between two trading parties, and ‘incurs liabilities on its own account for the purpose of acquiring financial assets by engaging in financial transactions on the market’ (OECD, 2003). Hence, intermediators are exposed to a change in the market value of the assets they are trading, also called market risk. CCPs, however, are not. Through a matched book, CCPs will never take on an exposure from a trader that is not matched with an equal exposure from another trader. As a consequence, a CCPs is never exposed to market risk. Seen through a more systemic lens, the central counterparty clearing system is a:

sui generis financial risk management institution that operates by interposing itself between a group of merchants…who have contractually entered into the CCP scheme in order to clear transactions they have entered into, which gives rise to rights and obligations between the clearing members and the CCP (Chamorro-Courtland, 2010: 520).

Hence, differently from traditional intermediation, with central clearing traders are not simply outsourcing the clearing and settlement of a transaction to a third party, they are now directly engaging with the CCP on a bilateral basis. The mechanism of central clearing through counterparty substitution is graphically explained in figure 7.

(Fig. 7) CCPs and counterparty substitution

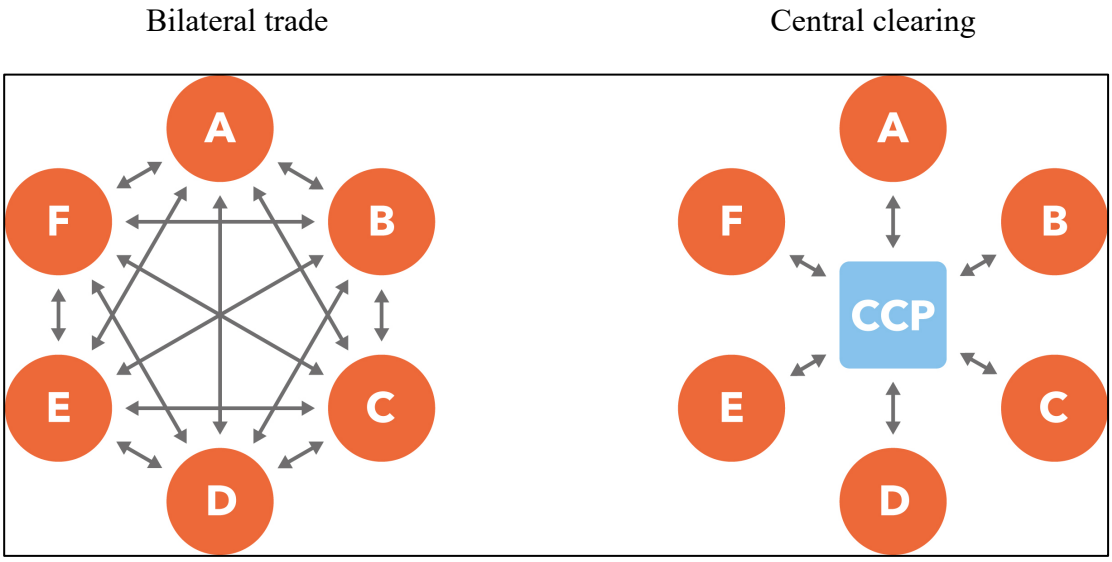


Figure 7 shows how central counterparty clearing works in practice. In bilateral trading, on the left, individual investors are not only exposed to each other's default risk directly (A with B, B with C, C with D, D with E, E with F, F with A), but also indirectly through cross-exposures (A with C, D and E; B with D, E and F; C with A, E and F; D with A, B and F; etc.). With central clearing, on the right, investors are only exposed to the CCP on

an individual basis. Operations are dealt through multilateral netting, an arrangement whereby the parties' multiple transactions are summed with one another through the CCP, rather than being settled individually (see Chamorro-Courtland, 2010). Multilateral netting with a CCP allows not only for operational efficiencies, but also to reduce credit risk for traders (due to the smaller number of transactions that need settling). In short, central clearing involves the replacement of multiple risk exposures between traders with a 'centralised network of exposures between clearing participants and the CCP' (Domanski *et al*., 2012: 60). What this also means, however, is that although CCPs are immune to market risk, they remain exposed to counterparty risk. While CCPs can offset, for example, losses against the buyer with gains from the seller, they remain vulnerable to counterparty default. Indeed, the default of one trading party would 'prevent a CCP from collecting the full amount of any valuation gains with that counterparty', while still owing valuation gains to the non-defaulting counterparty (Heller and Vause, 2012: 2).

Hence, over the years CCPs developed several tools to shield themselves and their clients from the financial losses caused by a defaulting counterparty. Today, it is normally required to first register as a member before utilising a CCP's services. As part of their membership, traders have to deposit cash into a default fund, a form of guarantee that can range in the order of several millions of US dollars for each member. For instance, the Chicago Mercantile Exchange (CME) Group, the world's largest option and future exchange, asks for its OTC clearing members to contribute between $15,000,000 and $50,000,000 to the default fund[18]. Capital requirements and other criteria for financial soundness are also a condition for membership. More important for the scope of this project, CCPs also collect collateral for each transaction they clear, the so-called *margin requirements*.

[18] These costs are available at the following link:

http://www.cmegroup.com/company/membership/clearing/otc.html.

The selected moments in financial history discussed both below and in Chapter 3 demonstrate that the use of margin requirements can be detrimental to systemic stability in times of financial distress, because *they can reduce the liquidity available in the financial system*. The destabilising potential of margin requirements is in line with the finding provided in Chapter 5, which show how LCH.Clearnet's sudden increase in margin requirements from 2010 to 2012 reduced the liquidity of Irish, Portuguese, Italian and Spanish sovereign bonds as collateral in repo transactions, which led to large-scale bond sell-offs that widened the spreads.

2.4.2 Margin requirements

Margin requirements, or simply margins, is collateral that needs to be deposited by the holder of a financial instrument as a way to hedge against the credit risk that he/she may pose to the counterparty handling that contract, usually a broker, a CCP or an exchange. CCPs demand margin requirements in the form of highly liquid collateral, like cash or sovereign bonds. Given the legal obligation of CCPs to fulfil the performance of every contract, margin requirements must be liquid, so that the collateral held can be quickly sold in order to close out open positions of a defaulting counterparty (see Norman, 2011; Gregory, 2014; Rehlon and Nixon, 2013).

Margin requirements can further be divided into three other categories: initial, maintenance and variation margins. Initial margins refer to the amount of collateral that is required to open a position, and, as mentioned above, is usually equal to a percentage of the contract's value. The maintenance margin requirement is the minimum amount of collateral that is required to keep the position with a counterparty open. This means that, normally, the maintenance margin is lower than the initial margin. When the value of the collateral deposited drops below the maintenance requirement threshold, the position

holder needs to deposit more collateral in order to bring the margins back to at least the initial margin. This is also called a *margin call*. Finally, the variation margins are not collateral as such, but daily payments reflecting the profits and losses of the position and is calculated on mark-to-market basis. Mark-to-market is a way of valuing assets based on how much they could be selling for at current market prices. The use of mark-to-market pricing is highly relevant for the scope of this thesis. As I will argue in Chapter 4, the EC and ECB's political imperative for financial market integration has fostered the use of market-based practices, including mark-to-market pricing and margin calls, for sovereign collateral in repo markets. In turn, this arrangement exposed the sovereign debt markets of the euro area to destabilising price volatilities in financial markets.

Margin requirements work as follows (see Choudhry, 2002 for a full explanation). Let's imagine that an investor purchases a wheat future contract for 5000 bushes at a Chicago-based exchange through its CCP, where the price for a bush of wheat at current prices is set for $10, so the contract is worth $50.000. On day one, the CCP will demand $4000 dollars in collateral as the initial margin to open the position, whereas the maintenance margin is set to $1200. As the price of wheat drops to $9.5 per bush on day two, the contract's value declines to $47.500, which means that the investor's margin balance drops to $1500 ($4000-$2500), which is still above the maintenance margin, but it incurred a $2500 variation margin payment to the CCP. On day three, the price of a bush of wheat declines further to $9.4, which brings another $500 losses to the investors, with an equivalent variation margin payment to the CCP and brings the margin balance to $1000. As the margin balance dropped below the $1200 threshold introduced with the maintenance margin, the CCP issues a $3000 margin call to the investor in order to bring the balance back to $4000. Seen through another lens, margining is an accounting technique that allows for the entity managing the financial contract to maintain the investor's collateral account in check.

The use margin requirements are particularly important for the scope of this thesis. As we shall below, as well as in Chapter 3, the implementation of margin calls tends to have procyclical effects in times of financial distress; where procyclical is intended as an amplification of prices fluctuation in financial markets (see Borio *et al*., 2001). This is precisely the same dynamic that will be examined in Chapter 5, which assesses the destabilising impact of LCH.Clearnet's margin calls during the euro crisis.

Margin requirements are central to the CCPs' risk-management strategies. The financial losses incurring from a clearing member's default are dealt with through a series of financial buffers, usually referred to as a 'default waterfall': 1) the defaulting member's initial margin requirements and default fund contribution; 2) a portion of the CCP's equity; 3) other members' contribution to the default fund; 4) other forms of members' contributions; 5) the CCP's own capital (see Eurex Clearing, 2017; LCH.Clearnet, 2016). It is important to note that margin requirements, which are effectively liabilities owed by the CCP to its clearing members, make up almost the entire CCP's balance sheet. In the case of LCH.Clearnet, the world's largest CCPs by clearing volume, this figure was over 99% in 2015, whereas the equity share was only about 0.21% (Cont, 2017: 7).

Simply put, the instruments used by CCPs against the risk of default are mostly made up of clearing members' contributions, particularly margin requirements, which again is important to reiterate are composed by highly liquid assets. Crucially, the prices of the margin requirements are determined solely by the CCP and cannot be contested by the clearing members (see Kenyon and Green, 2013). This is particularly important insofar as it helps highlighting the powerful role of CCPs in financial markets. By occupying both the positions of buyer and the seller of a trading relationship, together with their power to unilaterally increase or decrease margin requirements, CCPs can exert significant influence on how investors can employ the assets at their disposal.

2.5 CCPs in the aftermath of the 2007-08 financial crisis

2.5.1 The regulation of OTC derivatives after the crisis

CCPs have become even more relevant and powerful today. The increased regulation of the OTC derivatives market after the GFC is key to understand the changing role CCPs in global finance. Prior to the financial crisis, OTC derivatives mainly revolved around the decision-making power of large banks, the main dealers within the industry, whose self-regulatory initiatives allowed for both the growth of OTC trading and for the market to be kept outside of public regulatory initiatives (see Pagliari, 2012; Pagliari, 2013: 29).

Derivatives labelled as OTC generally imply that their prices and contractual requirements are not publicly disclosed and are negotiated bilaterally by banks without going through exchanges. It is important to point out that OTC derivatives outnumber their counterparts traded on exchanges before the financial crisis. Indeed, in 2014, around 90% of the entire derivatives market resided in OTC contracts (Rahman, 2015: 284). The OTC market had grown increasingly opaque in the years prior to the onset of the financial crisis, to the point where at the time of the collapse of Lehman Brothers 'no one knew the precise size of the [credit default swaps] on its bonds or who held these contracts' (Helleiner, 2011: 71). OTC derivatives became discredited for how their lack of transparency 'contributed to significant market disruption', which culminated in Lehman's default (Rahman, 2015: 284).

Thus, the waves of bank nationalizations and bailouts that followed had soured the electorate, putting politicians across the Atlantic under pressure to make sure taxpayers would no longer have to pay for the reckless investment practices of the financial sector (see OECD, 2011: 14). As in the words of Timothy Geithner, Secretary of the US Treasury during the first Obama administration: '[t]he politics would be awful. People

hated the idea of government bailouts for mismanaged financial behemoths' (Geithner, 2014: 4). President Obama thus made financial reform one of the flagships of his administration, stressing that taxpayers should no longer pay to rescue banks that are too big to fail (Obama, 2010). Indeed, the issue salience of derivatives following the crisis was the engine that helped to push for OTC derivatives regulation in the US Congress, which also set the tone for the international reform agenda (Pagliari, 2013: 149).

On the other side of the Atlantic, European leaders also committed to no longer having to step in with public money to bail-out bankrupt financial institutions. In the EU, bail-outs became so unpopular that it pushed European legislators to develop bail-in rules, which set regulatory frameworks to make shareholders and creditors pay for the cost of bank failures (Schäfer *et al.*, 2016: 2).

2.5.2 The mandatory clearing commitment

When the G20 leaders met on 15 November 2008, just over two months after the collapse of Lehman Brothers, reform of the OTC derivatives market was on top of the agenda. Credit derivatives, and OTC derivatives more generally, became acknowledged as one of the financial products at the root of the crisis, requiring their systemic risk to be promptly reduced (G20 Leaders Statement, 2008: 7). Soon after that mission statement, CCPs began to acquire an explicit role in those reforms for G20 leaders. In March 2009, the G20 Working Group urged regulators to increase incentives to shift predominantly bilateral OTC derivatives transactions onto CCPs, as well as to increase their oversight (Pagliari, 2013: 32). At the following G20 Summit in Pittsburgh the coming September, the role of CCPs in the OTC market was strengthened further. Indeed, the summit was concluded with a joint statement that sought to make the central clearing of standardised OTC derivatives *mandatory* in order to improve the OTC market and thus contributing to

strengthen the international financial regulatory system (see G20 Leaders Statement, 2009)[19]. In short, between March and September 2009 consensus crystallised among world leaders that shifting OTC derivatives onto CCP would help to improve financial stability.

With regard to the two largest OTC derivatives markets, the clearing mandate was introduced in the US with the 2010 Dodd-Frank Act, and in the EU with the 2012 European Market Infrastructure Regulation (EMIR). Globally, implementation is still a work-in-progress, even though the majority of the Financial Stability Board (FSB)'s members have implemented, or are in the process of implementing, legal requirements to enforce mandatory clearing for standardised OTC derivatives (FSB, 2015: 8). In terms of regulatory oversight, G20 leaders also mandated the Committee on Payments and Settlements Systems (CPSS) and the International Organization for Securities Commission (IOSCO) to establish international standards to supervise and regulate CCPs (see Helleiner, 2014: 80).

There was a specific event that helped to build momentum to expand the use of CCPs. When Lehman Brothers went bankrupt in 2008, the defaulting positions cleared by LCH.Clearnet, who clears most of the global interest rates swap (IRS) market, were resolved without even exhausting the investment bank's margin requirements held by the CCP, only a third of which were used (see Gregory, 2014: 43). LCH.Clearnet's successful management of the default helped consolidate consensus for mandatory clearing among

[19] What the process of standardisation entails is a complex issue, which falls outside the scope of this chapter and will not be discussed in detail. Broadly speaking, it refers to the process of making specific classes of OTC derivatives uniform on legal, processing, and product levels, in order to facilitate central clearing. See CESR (2010) and ESMA (2017) for OTC derivatives standardization in the EU; and CFTC and SEC (2012) for the US counterpart.

G20 leaders, which began to see CCPs as the solution to improve both the transparency of the OTC derivatives market and the overall stability of the financial system (see Lee, 2010). Politically, the clearing mandate helped to solve the more salient problem of state bailouts and the regulation of OTC derivatives. Indeed, mandatory clearing was implemented with the intention of transferring an increasing share of derivative risk to CCPs, so that it would no longer be taxpayers paying for failures of the financial sector, but the CCPs themselves (see Singh, 2011: 4).

Further, the clearing mandate simultaneously transformed and sustained the OTC market. Even though the implementation of both the Dodd-Frank act and EMIR is still a work-in-progress (see FCA, 2016), according to a report by the Bank for International Settlements (BIS) central clearing has been literally 'reshaping the OTC derivatives market' (BIS, 2016: 5). As of the second quarter of 2017, the percentage of IRS cleared via CCPs was over 88.5% of all outstanding positions, up from approximately 21.3% at the end of December 2007 (see ISDA, 2017; ISDA, 2013). This is a remarkable figure, considering that the IRS derivatives segment accounts for around 80% of the entire OTC market.

However, the new role given by G20 leaders to CCPs in the OTC market did not go unchallenged. Big banks, who had long dominated OTC derivatives trading, were among those who most clearly contested such deep reforms. The main concern banks had with the clearing mandate had to do with the reduced profit margins within the new mandatory clearing regime. Indeed, default funds contributions, margin requirements and all the other forms of financial guarantees demanded by CCPs increase the costs for trading OTC derivatives (see Deloitte, 2014). In addition, the transparency requirement included alongside mandatory clearing also reduces revenues of large banks. That is because higher price transparency reduces the amount of money that a trader can earn by exploiting differentials in buyer's and seller's prices, the so-called bid-ask spread,

squeezing revenues from OTC trading. It comes as no surprise, then, that the vast majority of derivatives dealers openly opposed mandatory clearing for standardized OTC derivatives in US Congressional hearings in 2008 and 2009 (Pagliari, 2013: 152).

In Europe, The International Swaps and Derivatives Association (ISDA), the Securities Industry and Financial Markets Association (SIFMA) and the London Investment Banking Association (LIBA) also raised concerns with regard to the European Commission's proposal to introduce mandatory clearing for all standardised OTC derivatives in the EMIR legislation. Although the associations welcomed the EC's intention to strengthen the stability of OTC market, they also argued that 'valid reasons exist for why certain trades are not cleared', reflecting their scepticism towards improving the transparency of a profitable, but opaque market (Metcalfe, Serocold, Huet, 2009: 5).

On the other hand, exchanges are among the main beneficiaries of the mandatory clearing reforms. Exchanges had been trying for a long time to break into the OTC market without annoying the banks, the exchanges' largest customers (Van Duyn and Gangahar, 2009). As in the words of an analyst at Sanford Bernstein, an investment manager: '[e]xpanding the scope of mandatory clearing through central clearing counterparty…is a material step up in the shift from OTC to on-exchange' (Hoffmann-Becking in Van Duyn and Gangahar, 2009). Indeed, most exchanges became in favour of mandatory clearing during the US Congressional debates, though to different degrees (Pagliari, 2013: 153). In this respect, it is important to note that some of the world's largest CCPs are currently majority-owned by exchanges, like LCH.Clearnet (London Stock Exchange), CME Clearing (CME Group) and Eurex Clearing (*Deutsche Börse*). Given that exchanges usually prefer a for-profit business model for their central clearing business, expanding the use of CCPs increases revenues for their clearing activities.

To sum up, the enhanced role of CCPs in global finance is closely linked to the politics surrounding the regulation of the OTC derivatives market in the aftermath of the GFC, whereby the opaque and unstable nature of OTC derivatives increased pressure regulators to change how they had to be governed and traded. More importantly, for the scope of this project, mandatory clearing contributed to dramatically expand the use of CCPs in global finance, which, as we shall see in Chapter 4, has had implications into market segments beyond OTC derivatives. Following the G20 mandatory clearing commitment, the presence of CCPs has also greatly increased in the European repo market, which helps to explain why LCH.Clearnet's actions during the euro crisis have been able to destabilise the sovereign debt markets of the periphery and widen these countries' sovereign spreads to such an important extent. The last subsection will discuss a final, crucial aspect of central clearing: its relationship with systemic stability.

2.6 Central clearing and systemic stability

2.6.1 CCPs and risk concentration

The increasingly key role of CCPs in financial markets has raised concerns among central banks and international institutions about their systemic importance, particularly with regard to how they can become a single failure point. A number of studies have shown that CCPs do in fact suffer from risk concentration, indicating exposures large enough whereby the failure of a single CCP could deal a serious blow to the financial system (see ECB and Federal Reserve, 2007: 44, Gracie, 2015: 2; Domanski *et al*., 2015; Wendt, 2015). Through counterparty substitution, CCPs transfer default risk from traders to themselves, which means that their exposure to counterparty default has significantly increased (see Banque de France, 2010: 34). Furthermore, a recent survey by the FSB shows that many CCPs have relationships with the same clearing members, many of

which are systemically important financial institutions on a global scale and are also the greatest contributors to the CCPs' financial resources (FSB, 2017).

The study finds that, on the basis of this interconnectedness, a default of a CCP's two largest clearing members could result in defaults of the same entity in 23 other CCPs (out of the 26 surveyed). In other words, the default of a large clearing member could simultaneously affect multiple CCPs, with potentially dramatic consequences for the stability of global finance. Issues arising with the CCPs' interconnectedness have also been highlighted with respect to the so-called interoperability agreements (i.e. links between different CCPs), whereby CCPs are exposed to one another and to each other's clearing members (see ESMA, 2016). Relatedly, an important study by Duffie and Zhu found that clearing different OTC derivatives classes among separate CCPs always increases counterparty risk, relative to clearing an entire portfolio with the same CCP, suggesting that the existence of a fragmented CCP market may increase, rather than reduce, counterparty risk (Duffie and Zhu, 2011).

2.6.2 CCPs and liquidity

There is, however, another aspect that has received relatively less attention, and I consider to be of equal systemic importance: the impact of central clearing on liquidity. An improvement in general liquidity conditions and trading activities has been detected since the introduction of the clearing mandate, also thanks to the price transparency requirements that came with it (Loon and Zhong, 2014). Indeed, the CCPs' automatic offsets provide market participants with '[t]he ability to easily enter into positions…and the ability to exit positions…[which] greatly increase the liquidity of the market' (Bliss and Steigerwald, 2006: 26, in Steigerwald, 2015: 184, emphasis in the original). Nevertheless, these conclusions often refer to conditions of financial stability. The world

economy has not yet experienced a large-scale financial crisis since the use of CCPs has expanded, which makes it extremely difficult to make any conclusion on the relationship between CCPs and global liquidity in times of financial distress.

That being said, an important study conducted at the Central Bank of Norway (*Norges Bank*) warns that although central clearing is effective in reducing counterparty exposure among clearing members, margin requirements transform *counterparty risk into liquidity risk* (see Cont, 2017). The reasoning is the following. As discussed above, margin requirements are demanded in the form of very liquid assets, usually cash and sovereign bonds, and CCPs hold a lot of margin requirements, effectively acting as their strongest resource against counterparty risk. According to the same study, in 2016 some of the world's major CCPs held an average of around $400 billions of liquid assets in the form of collateral gathered from their clearing members (ibid: 6). For comparison, the four largest broker dealers in the US only held around $25 billion in cash reserve in 2015. Given that margin requirements are the largest reserve of collateral to protect the CCP against the risk of counterparty default, and that margin requirements are by definition liquid assets, CCPs do not run as much into problems of solvency (due to the use of a matched book) as they would with liquidity. At the same time, because the actual amount of the collateral is the result of risk-based calculations, margin requirements can greatly increase in times of economic turbulence, where the CCPs' default risk perception strengthens.

If this analysis is correct, the study at the Central Bank of Norway effectively suggests that an increase in margin requirements could shrink the liquidity available in financial markets during times of financial distress. As the perception of counterparty default risk increases, CCPs would likewise demand more liquid collateral, which would shrink the liquidity available to investors. CCPs have thus been deemed as 'too interconnected' in

financial markets and therefore 'too important to fail' (Wendt, 2015: 1), alluding to the potentially catastrophic consequences that could stem from a CCP collapse. Although, as discussed above, CCPs do have a number of mechanisms in place to shield themselves against heightened counterparty risk, CCPs did go bust in the past, and liquidity (or the lack thereof) was a central aspect of these failures.

2.6.3 When (and how) CCPs fail

There have only been three documented failures of CCPs: 1) the Paris-based *Caisse de Liquidation des Aiffaires en Merchandise* – 1974; 2) the Kuala Lumpur Commodity Clearing House (KLCCH) – 1983; 3) the Hong Kong Futures Exchange Clearing Corporation (HKFECC) – 1987 (see Alloway, 2011). The failures shared a number of crucial aspects: clearing members were unable to meet their margin requirement obligations in times of financial distress, and the default funds were insufficient to absorb all financial losses.

The failure of the Paris *Caisse* is closely linked to the excessive degree of speculation that was taking place in the white sugar market in 1974. Between November 1973 and November 1974, the prices for white sugar increased by a factor of six (see Bignon and Vuillemey, 2017, see also Chalmin, 1990). In Paris, white sugar prices further doubled between September and November of 1974, before experiencing a fall on 21 November. The sudden crash of sugar prices hit several speculators, particularly brokers, many of which were clearing members of the Paris *Caisse* and had been trading at those speculative prices on behalf of their clients without authorisation by the CCP (Norman, 2011: 131). As the sugar prices were plunging, the *Caisse* issued several margin calls for its sugar futures contracts. Due to the massive decline in profits, many clearing members were unable to meet the increase in margin requirements, which added to their liquidity

shortage. There was one particularly large sugar broker-firm, Maurice Nataf, which underwent massive losses and was a member of the *Caisse*. In addition to the existing problems in collecting margin requirements, the crisis took a turn for the worst when Maurice Nataf announced to the *Caisse* that it would not be able to meet a margin call on 2 December (see Bignon and Vuillemey, 2017). The *Caisse* decided to close the market and cease its activities on 3 December, which did not re-opened until January 1976 when the *Caisse* was, in effect, liquidated, leading to the creation of a new CCP, the *Banque Centrale de Compensation*.

When it comes to the Malaysian KLCCH, the CCP had only been operating for about three years prior to its failure, and its troubles derive from a crash in the futures market for palm oil in 1983. Similar to what had previously happened with the *Caisse* in Paris, the sudden decline in the price of palm oil led six clearing members to default on around $70 million of palm oil futures contracts amid declining profits, which made them unable to meet the margin calls issued by KLCCH (see Gregory, 2014: 268). Just like in the previous case, the Malaysian CCP shut down its market operations before failing altogether thereafter. According to a Bank of England report, the Malaysian government heavily criticised the ways in which the KLCCH handled the crash, as there had been a 12-day gap between the squeeze in the market and the brokers' default, suggesting that the CCP could have attempted issuing margin requirements beforehand (Hills *et al.*, 1999). Thus, as opposed to the *Caisse*, in the case of KLCCH a big responsibility lay in the inexperience of the CCPs' managers, as well as the lack of coordination between the CCP and the exchange in handling the crash (see Norman, 2011: 33). Still, the fact remains that the inability to meet the KLCCH's increases in margin requirements led to a liquidity shortage that contributed to the default of clearing members and the CCP itself.

Lastly, the failure of the HKFECC in 1987 brought a near-financial disaster in the global economy. The clearing system in Hong Kong at the time was slightly more complex than the other cases. Whereas the HKFECC was the institution managing the actual clearing of the contracts traded on the Hong Kong Futures Exchange, the guarantor of these contracts was a different institution, the Hong Kong Futures Guarantee Corporation (HKFGC). The fragmented structure of the clearing system in Hong Kong created a regime of moral hazard (see Gregory, 2014: 269). First, whereas HKFECC (the CCP) was responsible for monitoring the positions traded on the exchange, it was not exposed to losses in case of default, which would have been borne by the HKFGC instead. Secondly, while the HKFGC was exposed to the losses stemming from default risk, it had no say in risk monitoring and standards, which were set by the HKFECC instead. Thus, when the Hang Seng Index (the Hong Kong Stock Market index) experienced close to a 50% drop on 19 October 1987 – the so-called Black Monday – the Hong Kong clearing system suffered from the lack of properly coordinated risk management practices, which had been reflected by the sustained price growth on futures prices during the previous years (see Hills *et al*., 1999).

In a similar fashion to what happened to the previous two instances, traders were not able to meet the sudden increase in margin requirements by the HKFGC following the price drop. In that respect, the margin calls added a squeeze to their already limited available liquidity. However, differently from Paris and Kuala Lumpur, the HKFGC actually had to be bailed out. After contributions from shareholders, members and large brokers, the bailout still cost taxpayers around HK$1bn. Equally important, the crash in Hong Kong could have compromised global financial transactions, as the local division of the London-based CCP ICCH was heavily invested in the Hong Kong commodity market.

In light of the failure of CCPs discussed above, what can be said about the relationship between the new key role CCPs in the OTC market and systemic stability? Firstly, mandatory clearing does not reduce OTC derivatives risk per se, it transfers it from banks to CCPs, which are perceived as more adept at managing counterparty risk. At the same time, the increased exposure to the default risk of OTC derivatives traders means that the 'systemic consequences of a CCP default could be unprecedented' (Cœuré, 2014: 5). As put by Financial Times editor Philip Stafford, CCPs have become 'the new too-big-too-fail institutions', an expression previously used to describe over exposed and thus systemically important banks during the GFC (Stafford, 2017). Mandatory clearing commitment has created new single failure points in the financial system, which may actually be detrimental to financial stability. Therefore, I argue that mandatory clearing may undermine the original intent of the G20 financial reform agenda, aimed at improving systemic stability and preventing future tax payers' bailout. The scope of the changes brought about by the clearing mandate in the OTC derivatives market could prove to be dysfunctional, insofar as they simultaneously promote OTC derivatives risk concentration and make the global financial system more prone to liquidity crises.

Back to liquidity, the three CCP crashes described above show that the sudden increase in collateral requirements by CCPs can add pressure to the traders' already weakening funding availability during times of financial turmoil, effectively compromising their ability to meet payments, including the margin calls themselves. This is a key finding when it comes to answering this project's research question, which seeks to examine the factors that contributed to destabilising sovereign debt markets during the euro crisis. While LCH.Clearnet's actions during the euro crisis did not lead to a full-blown liquidity crisis, the CCP's sudden increase in margin requirements did reduce the liquidity of specific sovereign collateral markets, which added pressures on the funding liquidity needs of the banks in the euro area. In other words, the transmission channel through

which LCH.Clearnet contributed to destabilising sovereign debt markets is funding liquidity. The link connecting CCPs to liquidity will be explored in further detail in the next chapter, which explores the functioning of repo market, the market segment where most interbank lending operations are conducted and where LCH.Clearnet triggered its large margin calls in the euro area from 2010 to 2012.

2.7 Conclusions

The analysis conducted in this chapter sought to bridge a pretty significant gap about the role and functioning of CCPs existing in euro crisis literature, and in the political economy of global finance scholarship more broadly. This gap is particularly staggering, considering that I have shown that central clearing technologies already exited in the 18thth century, albeit in rudimentary form. As a matter of fact, this chapter has shown that CCPs have historically been embedded in the political contingencies underpinning the development of financial markets: monetary policy during the Tokugawa period in the 18th century, France's second colonial expansion in the 19th century and the post-GFC financial reforms.

The key finding of this chapter is that the main features of CCPs, margin requirements and counterparty substitution, were developed over the centuries within the context of their historic role in financial markets: guaranteeing the performance of every contract. In this respect, the peculiar position of CCPs as both the buyers and the sellers in a given transaction, together with their ability to unilaterally impose margin requirements, makes CCPs powerful actors in financial markets. Following the mandatory clearing reforms in the OTC derivatives market, CCPs have become even more significant in global finance.

As the use of central clearing witnessed a dramatic expansion, CCPs have also become more relevant with respect to financial stability, as also shown by the many studies (carried out primarily by central banks) that are particularly concerned with risk concentration. Undoubtedly, contract performance guarantee through counterparty substitution and multilateral netting is highly effective in reducing the risk that one of the counterparties may fail to honour its contractual obligations – which is one of the reasons that underpinned the CCPs' expanded use in the OTC market in the first place. However, the ways in which CCPs can unilaterally impose margin requirements, which is key to the CCPs' role to fulfil contractual obligations, can also compromise the liquidity available in the financial system.

Because of the highly liquid nature of margins, when a CCP hikes collateral requirement in times of financial distress it puts pressures on the liquidity of investors who are already struggling to meet their funding needs. The three cases of CCP collapse throughout the course of the 20th century provide evidence of this dynamic. Speculation and the subsequent crash of white sugar prices in France in the 1970s, the sudden decline of palm oil in Malaysia, and the crash of the Hong Kong futures market in the 1980s, all share a similar dynamic when it comes to the involvement of CCPs. As prices in commodity and futures markets dropped, CCPs began demanding more collateral through margin calls. Amid declining profitability form the price drop, the increase in margin payments put a strain on the funding liquidity of investors. Unable to meet margin calls, the investors defaulted, leading the respective CCPs to fail as well.

The findings of this chapter are highly relevant to answer the research question posed by this project, namely: what factors contributed to destabilising sovereign debt markets during the height of the euro crisis from 2010 to 2012? First, the embeddedness of CCPs in the development of markets will help to highlight the pivotal role that CCPs play in

European finance. Indeed, Chapter 4 shows how the contrasting interests in the process of European economic integration on the one hand, and within the European exchange business on the other, shaped the European interbank funding market in such a way to be highly dependent on CCPs, particularly on LCH.Clearnet. In turn, this helps to explain why it was LCH.Clearnet in particular that destabilised different sovereign debt markets over the course of the euro crisis.

Second, the evidence of the destabilising impact of the CCPs' margin requirements provides the historical backbone against which to examine the role of LCH.Clearnet during the euro crisis, particularly with respect to the dimension of liquidity. Chapter 5 demonstrates that the increases in margin requirements for using Irish, Portuguese, Italian and Spanish sovereign bonds reduced their liquidity as collateral in repo transactions, which led to large-scale sell-offs that contributed to destabilising their respective sovereign debt markets, widening the spreads.

3 The Repo Market

3.1 Introduction

One of the main arguments made in the previous chapter was that the destabilising potential of CCPs stems from the specific ways in which they function. The position that CCPs retain as buyers and sellers in a clearing agreement, which allows them to unilaterally impose margin requirements, can be destabilising in times of financial distress. In that respect, the impact that margin calls can have in shrinking the liquidity available to investors was central to the analysis, because it provided a framework to understand how LCH.Clearnet contributed to destabilising sovereign debt markets during the euro crisis. This chapter focuses on a second important pillar that allows us to further explore the relationship between central clearing, margin calls and financial stability during the euro crisis: the repo market. Repos are short-term collateralised loans, which have historically been used by central banks and investors. Much like CCPs, repo trading did not feature much in the euro crisis literature, which does not allow us to understand the role played by the provision of short-term funding in the sovereign debt markets of the euro area (see Katsimi and Moutos, 2010; Bibow, 2013; Pepino, 2015 as notable exceptions).

The scope of this chapter is thus to examine the different aspects surrounding the functioning and development of modern repo markets, which is an essential prerequisite before assessing the ways in which its European variant is structured (Chapter 4), and the role that CCPs play therein (Chapter 5). Like in the previous chapter, the dimension of liquidity remains central to the analysis. This chapter traces the origins of the modern repo market to the 20th century US, when the New York Fed used repos as a way to provide short-term liquidity to underfunded banks (see Garbade, 2006). This is an

important point that shows how the repo market has always been closely linked to banks' liquidity since its inception. However, because repo lending is collateralised, the availability of collateral is a key aspect surrounding the stable functioning of these markets. As will be examined in more detail below, the declining quality of repo collateral during the GFC shrank the liquidity available to investors, contributing to making the US banking system insolvent (Gorton and Metrick, 2012). The ways in which the declining liquidity of repo collateral can lead to systemic instabilities is a central point when it comes to answering this project's research question.

As I will argue in Chapter 4, the European repo market's reliance on sovereign bonds and central clearing on the one hand, and market-based practices on the other, makes the sovereign debt markets of the euro area extremely prone to what I call CCP-induced collateral crises. In the euro area, government bonds act as the main form of collateral in the European repo market, and the vast majority of repo-lending is centrally cleared. Therefore, the liquidity and stability of specific sovereign bond markets can be compromised should CCPs ask for additional margins when clearing a given government security in repo transactions. This is precisely the dynamic explored in Chapter 5, which examines the ways in which LCH.Clearnet increased margin requirements to use Irish, Portuguese, Italian and Spanish sovereign bonds in repo transaction from 2010 to 2012.

The analysis conducted below will proceed in several steps. In Section 3.3, I introduce what a repo contract is and what repos are used for, focusing on how repos are undertaken through the sale and repurchase of collateral used to guarantee an exchange of cash. I therefore explain how repos are used both as monetary policy tools by central banks and as short-term funding instruments by banks. Section 3.4 moves on to discuss how the expansion of repo markets have largely been determined by the politics surrounding the transformation of monetary policy in US and Europe in the aftermath of World War II.

This section stresses the separation between monetary and fiscal policy and the shift to market-based finance between the 1950 and 1980s in the US as one of the main drivers that contributed to the expansion of repos. The analysis then examines how the expansion of the repo market in Europe between the 1980s and 1990s largely built on previous developments in the US, which inevitably intertwined with the politics of European integration.

The chapter moves on to a crucial event that would significantly change the development of repos: the 1998 Russian currency crisis. The crisis demonstrated that the lack of collateral can generate liquidity shortages in market-based financial systems; thus, central banks and international institutions found in sovereign debt the anchor collateral that would preserve repo-funding in times of financial distress. This brings us to the last topic discussed in this chapter: the ways in which repo markets connect to financial (in)stability. In Section 3.5, I therefore evaluate the empirical evidence on the performance of repo markets during the GFC, which points towards a procyclical effect in how margin calls triggered sell-offs in the run up to Lehman's collapse in 2008. The procyclical effect of margin requirements on the declining availability of repo collateral is highly relevant for the scope of this project. Indeed, in Chapter 5 I will show that LCH.Clearnet's margin calls had a procyclical impact on the sovereign spreads of Ireland and Portugal during the euro crisis.

The rest of the chapter is structured as follows. Section 3.2 examines the gap existing in the euro crisis literature on the functioning and importance of repos. Section 3.3 explains what repos are, the different type of repos contracts and what repos are used for. Section 3.4 examines the development of the modern repo market as embedded in the politics of post-war monetary policy restructuring and of the process of European economic integration. Section 3.5 discusses the implications of repo markets for systemic stability,

while Section 3.6 is dedicated to the concluding remarks, which are that the collateralised nature of repo lending makes this type of financing susceptible to sudden funding shocks.

3.2 Repos and the euro crisis

Almost as staggering as the case of CCPs, repo contracts have not been discussed in much detail in the euro crisis literature. This is surprising given that, as will be examined below and in Chapter 4, repos represent the point of intersection between government debt and bank funding, particularly in the euro area. The lack of a detailed examination of repo markets is remarkable insofar as both rising sovereign bond yields and deteriorating bank liquidity were central to the unfolding of the euro crisis.

A number of studies in rational choice political economy and heterodox economics do, however, mention the role played by declining liquidity of repo markets in the distressed economies of the euro area. For instance, Katsimi and Moutos note that, by mid-2010, Irish, Portuguese and Spanish repo markets 'were becoming less liquid', which prompted investors to become more aware of the sovereign debt market exposure of European banks (Katsimi and Moutos, 2010: 569). Furthermore, Moro argues that the ECB played a key role in improving markets' perception of sovereign default risk in the euro area prior to the crisis (2014: S12). By reducing the haircuts demanded when accepting sovereign bonds as collateral in its own repo-based monetary policy refinancing operations, the ECB's collateral policy contributed to lower bond yields (and thus lower spreads) across the euro area (see also Bibow, 2013).

In other words, according to Moro, the low haircuts on sovereign bonds placed by the ECB in its repo operations contributed to reduce the investors' perception of sovereign default in the euro area, leading to lower spreads across the board.

From a different angle, but equally relevant for the scope of this study, Pepino notes how the Irish banks' reliance on repo funding had reached over €136bn by November 2010 (which she considers to be disproportionately large when compared to the country's GDP); however, these operations were largely collateralised through Irish government debt, and the liquidity of Irish securities had been deteriorating during that time, which made it increasingly difficult for Irish banks to fund themselves appropriately (2015: 113). Although she does not address the specific question of why repo liquidity for Irish government securities had been deteriorating during that time, which is treated as an existing condition affecting the global economy since 2008, she does point to the fact that the increasing reliance of Irish banks to repo funding took place precisely when the liquidity of the collateral used (Irish government bonds) was in decline.

Pepino makes an important point when it comes to answering the research question posed by this project, which seeks to uncover the factors that contributed to destabilising sovereign debt markets from 2010 to 2012. Chapter 4 will show that the ways in which the European repo market is structured around the market-based handling of sovereign collateral allowed for LCH.Clearnet's actions to put an additional strain on the liquidity of Irish banks through the increases in collateral requirements. In turn, Chapter 5 will argue that that these actions contributed to making Irish government securities less liquid, which led to sell-offs that widened the Irish sovereign spread.

However, the studies mentioned above do not make the declining liquidity of repo collateral the central focus of their analyses, calling for more work to be conducted on repos in the euro crisis debate. Conversely, the works by Gabor (2016) and Gabor and Ban (2016) are among the few studies in political economy examining the interconnections between sovereign debt, collateral availability and bank liquidity in repo markets. While the authors discuss how the development of repos within the context of

market-driven financial integration has made European financial markets extremely prone to the instabilities related to procyclical collateral crises, they do not engage with the euro crisis debate as such.

In other words, whereas, on the one hand, the euro crisis literature has largely neglected repos as a central feature of their analyses, on the other hand, the few studies that do examine the systemic relevance of repos are not concerned with the unfolding of the euro crisis as such. Thus, one of the contributions of this chapter, and of this project more broadly, is to draw on existing studies and extending the repo market as a central analytical focus to understand the unfolding of the euro crisis.

3.3 Introducing repos

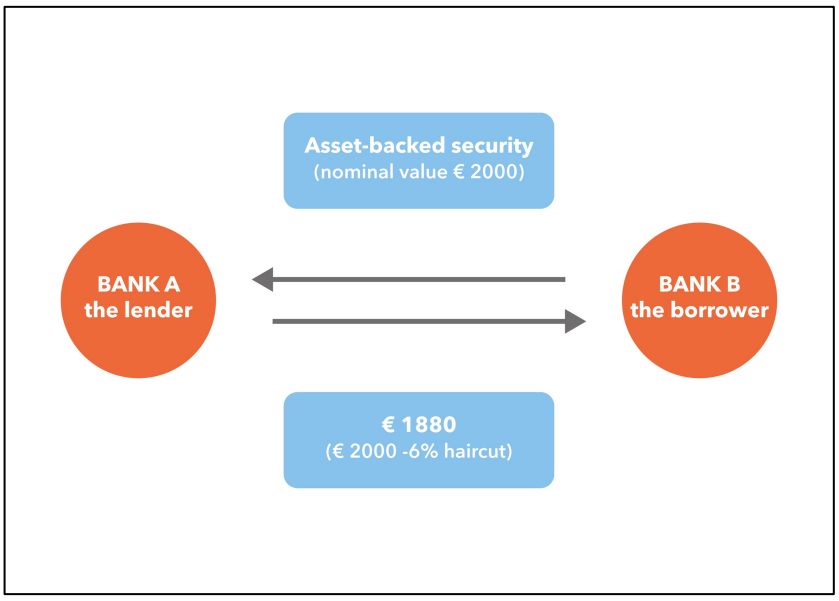
3.3.1 The repo contract

In a repo contract, a borrower sells an asset in the form of collateral to a lender in exchange for cash, with the promise to repurchase the asset on a given date at a given price. In short, this kind of transaction allows the seller of the collateral (the borrower) to lend money from the buyer (the creditor). The security being traded is held as collateral, which serves as protection for the buyer against the possibility that the seller may fail to repurchase that security. In a sense, 'a repo transaction may be thought of as a collateralized loan to the seller of the repo' (Wells Fargo, 2017). From a legal perspective, the formal ownership transfer of the security for the duration of the agreement provides protection against credit risk, because, should any of the traders fail to complete the transaction, the collateral can simply be liquidated by the other party (see CGFS, 1999a: 5).

When purchasing the security, the buyer demands a payment for holding the security (i.e. for lending the money). The difference between the price paid by the buyer and the amount of money received by the seller at the end of the contract is called the repo rate, which is quoted as an annualised percentage. Depending on the volatility of the security's market price and inflation, a positive repo rate indicates that the lender is making a profit, whereas a negative rate means that the lender is making a loss. Further, when lenders purchase the asset, they seek financial buffers in order to shield themselves against the potential loss of value of that asset, either due to price volatility or for covering the estimated cost of liquidating the collateral following a default. The financial buffers either take the form of a percentage deduction from the market price of the collateral (e.g. 4%), called a haircut, or is expressed as a percentage of the collateral purchase price (e.g. 104%), referred to as an initial margin (see ICMA, 2012).

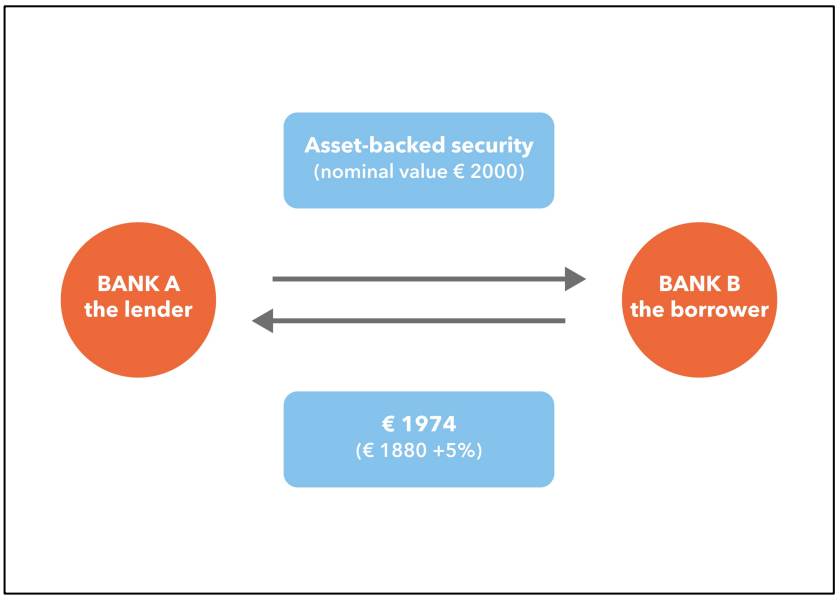
Figure 8 shows bank A, a lender, and bank B, a borrower, undertaking a 1-week repo. Bank A purchases a security from bank B (in the example, an asset-backed security), with a nominal value of €2000, for €1880, where the €120 deduction from the market price represents a haircut of 6%. Thus, bank A temporarily holds a €2000-worth security, for which €1880 was paid to bank B.

(Fig. 8) How repos work – 1



After 1 week, figure 9 shows that bank B re-purchases the security by paying the discounted price of €1880 plus €94, the latter used to cover for the lender's repo rate of 5%, which also represents the net profit made by the lender.

(Fig. 9) How repos work – 2



3.3.2 What repos are used for

3.3.2.1 Central banking

Broadly speaking, repos are money market instruments, meaning that they are mostly used for highly liquid assets and with short-term maturities (usually overnight, but up to a one year) (see Gorton and Metrick, 2012). Repos are routinely used by central banks for monetary policy purposes, and that is largely due to two reasons (see CGFS, 1999a: 11; see also Spörndli, 1998). First, repos are an effective tool for liquidity management. By conducting repo transactions with the banks within their regulatory remit, a central bank can inject liquidity on a short-term basis. At the same time, the liquidity injections can be reversed once the contract ends. Indeed, central banks can absorb liquidity by not rolling over the repos reaching maturity. Similarly, central banks can also reduce liquidity by conducting reverse repo operations, whereby it is the central bank that sells the security, thus withdrawing liquidity from the financial system. In short, repos provide central banks with precise control over liquidity provision.

Repo operations can also function as monetary policy signalling. For instance, the ECB utilises repo contracts for its main refinancing operations, which is where the bulk of short-term funding for banks comes from. Thus, the repo rate on the main refinancing operations is the short-term interest rate of the ECB's monetary policy (i.e. the key policy rate), which can be set in a way to signal the monetary policy stance and therefore influence investors' inflation expectations[20].

[20] In countries where the main policy rate is not the repo rate, but the discount rate (like the Fed), repos can still be used to provide *an indication* of the monetary policy stance, or the general direction of the key official rate (see CGFS, 1999a: 12).

3.3.2.2 The different types of repos in the interbank funding market

Aside from monetary policy, repos are one of the main sources of short-term funding in the interbank lending market (see Mancini *et al.,* 2015; FSB, 2012). The interbank lending market is a market segment where banks lend to each other at a short maturity, usually overnight. Interbank lending plays a central role in the financial system because short-term funding is 'vital for banks' liquidity management' and is divided between the secured and unsecured segment (Heider and Hoerova, 2009: 5). The secured market segment is composed to a large extent by repos, which, as mentioned above, are a form of collateralised (secured) financing transaction. The unsecured market segment makes no use of collateral, like federal funds in the US or bank deposits. Without a doubt, repos (and, by extension, secured loans) have almost entirely replaced unsecured loans for the short-term funding needs of the vast majority of large banks (see FSB, 2012).

Generally, repo trading in the euro area can be divided in three segments: bi-lateral, triparty and CCP (see Copeland *et al.*, 2014; Mancini *el al.*, 2015: 1751). Bi-lateral repos are conducted directly by the two trading parties, whereby the margin requirements are the result of negotiations and both parties are exposed to counterparty risk in case of default. In a triparty repo, there is a third actor that is responsible for the settlement and the handling of the collaterals. However, the triparty agent is not involved in the calculation of margin requirements and counterparty risk is still borne by the two trading partners (see Comotto, 2017).

Besides the involvement of a third party, what distinguishes triparty from bi-lateral repos is the selection of collateral that is usually employed. Whereas triparty repos are used to finance general collateral, which means that cash providers are usually keen to accept any security within a specific asset class, in bi-lateral repos traders often impose a narrower

restriction on the type of securities accepted as collateral (see Copeland *et al.*, 2014). Thus, one of the reasons for choosing either triparty or bi-lateral repos has to do with the general higher cost efficiency in the case of triparty (due to the wider selection of collateral accepted), or the need for trading a particular security, thanks to the more specialised collateral nature of bi-lateral contracts (ibid).

Finally, CCP repos extend the technology of central clearing to the repo market. As will be discussed in Chapter 4, the vast majority of repo trading in the euro area is conducted by CCPs, which makes central clearing extremely relevant with respect to systemic stability. As explained in the previous chapter, through the mechanism of counterparty substitution CCPs become the legal counterparty to each trader, they calculate margin requirements and bear financial losses in case of a counterparty defaulting. Thus, the wide adoption of CCPs in the European repo market links the potentially destabilising technology of central clearing to the interbank lending market in Europe. This is a key point in answering the research question posed by this project because, as we shall see in Chapter 5, it is precisely the ways in which LCH.Clearnet applied margin requirements on the use of particular securities as collateral in repo transactions that contributed to destabilising sovereign debt markets during the euro crisis.

More generally, investors decide to carry on their repo trades through a CCP because of the perceived extra guarantees that central clearing provides (see Mancini *et al*., 2015). First, trading through a CCP is anonymous and counterparty exposure is eliminated *de facto* by counterparty substitution, meaning that investors will no longer be exposed to each other's failure to meet contractual obligations (c.f. Duffie and Zhu, 2011). A CCP liquidates the collateral and distributes the losses among its clearing members should one of them default, which provides an added layer of counterparty protection. Finally, as CCPs only rely on safe and highly liquid collateral, the use of central clearing *in theory*

reduces all the risks associated with potential individual or systemic runs (see Norman, 2011; Gregory, 2014; Mancini *et al.*, 2015).

However, this thesis will disprove the assumption that CCP-based repos prevent potential systemic runs. First, as I will examine in Chapter 4, the ways in which the European repo market is built around the use of sovereign bonds as collateral and is dependent on the concentration of clearing activities makes European financial markets prone to collateral shocks by individual CCPs. Second, Chapter 5 will demonstrate that LCH.Clearnet's actions, while not having caused a systemic run on repos per se, did cause a run on specific repo collateral, with detrimental consequences for sovereign debt market stability.

Given the repo's fragmentation in different markets, quantifying a precise figure of the overall size of the repo market as a whole becomes a particularly difficult exercise. However, some estimates have been made. Copeland *et al.* (2012) estimate the repo size in the US – intended as the amount of collateral used in repo transactions – at around $3tr. The International Capital Market Association (ICMA)'s estimate for outstanding repo contracts in the EU in December 2014 was €5.5tr, while the Fed's counterpart for the same period was around $4.6tr – or €4tr at the time (ICMA, 2018a). Though this may seem like a large amount, it is comparable to the foreign exchange market turnover, which, in April 2016, was just above $5tr (BIS, 2016).

At first glance, the repo market may seem even less impressive in comparison to the OTC derivatives market. For the second half of 2015, the total notional amount outstanding for OTC derivatives contracts globally was over $492tr, more than $384tr of which taken up by interest rate swap contracts alone (BIS, 2017). However, these figures should not let us downplay the importance of the repo market in global finance, quite the contrary. Chapter 4 and 5 will show that the ways in which the repo market in Europe brought

together sovereign debt, bank funding and central clearing led for even such a comparatively smaller market to contribute to significant financial market turbulence during the euro crisis. Indeed, the importance of the repo market should be understood *in spite* of its trading volume.

3.4 The politics at the root of repos

3.4.1 The birth of the modern repo market in the 20th century

Repos are not just important financial instruments with respect to their key presence in financial markets, but also by their political relevance. Historically speaking, loans secured with some form of collateral can be traced back to ancient China, some 3000 years ago (Acharya and Öcü, 2010: 323). However, modern repo contracts were introduced by the New York Fed in US financial markets at the beginning of the 20th century. Repos were used by the New York Fed in 1917 as a tool to extend credit to its member banks when a wartime tax on interest payments on commercial papers made it increasingly expensive for them to look for affordable funding (see Garbade, 2006).

Thus, since its very inception, the modern repo market has been closely linked to supporting the financial sector's funding liquidity needs. The use of repos to support the funding liquidity of banks is an important point to retain for the development of this project's analysis. As I will examine in Chapter 4, during the 2000s the ECB pushed for an integrated repo market in the euro area precisely with the objective of fostering the liquidity of European financial markets through enhanced cross-border lending. The use of repos experienced a decline in the aftermath of the Great Depression, which, however, was followed by a rapid revival during the transformation of the world economic order after World War II, particularly in the 1980s. The use of repos became central to the split between monetary and fiscal policy, whereby central banks were released from their

obligation to monetise government debt, and the rise of financial stability through market-based finance after World War II. Market-based finance denotes that the cost and availability of lending has become increasingly determined in financial markets (see Hardie *et al.*, 2013)[21]. Gabor (2016) provides a detailed account of how the sovereign bonds and the repo markets have developed a symbiotic relationship since the restructuring of monetary policies between the 1950s and the 1980s; in the US first, but then quickly spreading to Europe.

3.4.2 Monetary policy transformations in post-war US

A central part of this story are the changes that took place in US monetary policy following the Treasury-Federal Reserve Accord of 1951, which re-introduced the Fed's independence from discretionary monetary policy (see Meltzer, 2003 for a full history). During World War II, the Fed kept interest rates at less than 0.5% in order to provide cheap funding for military expenses, despite skyrocketing inflation. The 1951 accord

[21] The conventional wisdom is that, whereas in bank-based financial systems (traditionally, like in Japan and Germany) it is mostly banks that are central in mobilising savings, allocating capitals and investments to firms and beyond, in market-based financial systems (traditionally, like in the US and the UK) banks share that role closely with securities markets (see World Bank, 2018). Thus, according to this dichotomy, banks in bank-based financial systems have more financial power to influence the market prices of their loans because these are not traded financial instruments (see Zysman, 1983). However, it should be noted that this dichotomy has been contested insofar as it does not sufficiently acknowledge the changing role of bank lending in supposedly bank-based systems, which is increasingly constrained by the banks' own ability to borrow from financial markets due to deposits no longer funding the majority of the banks' liquidity needs (see Hardie *et al*., 2013). Thus, I employ the expression of market-based finance as a synonym of Hardie *et al.* (2013)'s notion of 'market-based banking', which denotes the transformation of *bank lending that is increasingly market determined*.

brought new emphasis on inflation control while simultaneously diminishing the emphasis on keeping low interest rates.

Thus, during the period of high inflation experienced in the US between the 1970s and the early 1980s, there were three conditions that allowed for the use of repos to flourish. First, rising short-term interest rates between the end of the 1960 and throughout the 1970s; second, an increase in the issuing of marketable Treasury bills after 1974; third the increased volatility of intermediate- and short-term interest rates since the end of October 1979 (see Garbade, 2006: 30). The ever-rising level of short-term interest rates led an increasing number of corporations and local authorities to begin using repo contracts with the help of brokers and other small security dealers. That is because repos allowed them to access cheaper funding than what had been available through banks, whose lending had become more expensive due to rising rates.

Because their demand increased among debtors, repos became increasingly more attractive to creditors as well. Simultaneously, the fast growth of tradable Treasury bills after 1974 fostered the expansion in the dealers' government securities' position and financing (see Fed, 1981; 1982). That was particularly the case for nonbank dealers in Treasury securities, which were looking for cheaper funding than what had been available from New York banks, which had traditionally been funding the vast majority of the dealers' loans. In this respect, repo transactions by the New York Fed represented precisely that alternative source of funding.

Because of higher short-term interest rates, repos were cheaper than bank loans, entailed minimal risk (the collateral can be liquidated should the borrower fail to repurchase it) and the maturities could be negotiated, thus becoming ideal both for securities dealers and institutional cash managers. As repos were treated in effect as the sale and repurchase

of collateral, repo lenders could re-use the collateral they purchased through a repo contract for other kinds of investments and hedging, such as short-selling. The expansion of the repo market therefore marked an important transformation in how lending would be provided from that moment onwards. As repos are essentially built on securities markets (for collateral), the use of repo lending in place of bank loans marked a deep structural shift towards market-based finance, whereby the availability and cost of funding would be increasingly reliant on, and constrained by, financial market actors (see Hardie *et al*., 2013).

Indeed, while the use of repos became increasingly more common, in their 1992 Joint Report, the Treasury, the Fed and the Securities and Exchange Commission (SEC) began praising repos as cheaper, more flexible and administratively easier to manage funding instruments than commercial bank loans (see Treasury, SEC, Fed, 1992: A-11). By pushing the use of repos and via increasing the availability of sovereign collateral, the Treasury and the Fed assumed a 'market-building' approach built on a narrative about the positive role of repos in fostering financial market liquidity (Gabor, 2016: 976). On the one hand, in its role of sovereign debt issuer, the US Treasury began playing a central role within the context of an expanding repo market that needed liquid collateral. On the other hand, from a financial stability perspective, having a centralised repo market would provide a much clearer picture of the size and trend of the government security market. The commitments to repos lending of the Treasury, SEC and the Fed can also be witnessed by how they were actively pushing the Government Securities Clearing Corporation (GSCC) to develop new automated technologies for the processing of repo contracts, such as an automated system that would register and display the different stages of a repo transactions (opening, closing, setting up a reverse repo or closing a reverse

repo) (Treasury, SEC, Fed, 1992: 31) [22]. As the use of repos began to greatly expand in the US, Europe would soon after build on that momentum.

3.4.3 Repos and the politics of European economic integration

In a bid to obtain a stronger position in global finance, in the 1980s France was the first European country to emulate what the US did in terms of repo market liberalisation, which entailed monetary policy restructuring through the use of interest rate management for inflation control, abandoning credit controls and embracing financial liberalisation (see Jabko, 2006). Under the direction of the *Banque de France*, France liberalised domestic repo markets by providing a regulatory framework that allowed for collateral management and ownership-transfer of collateral. As noted by Gabor (2016), France's move was based upon two interlinked objectives. First, France sought to imitate the US by recognising the increasingly important role played by the repo market in global finance. As both US and European banks with a global outlook became more involved in securities trading throughout the 1980s (mostly thanks to the repo developments in the US described above), French politicians aimed at competing with the US to attract international investors, thus encouraging the use of French sovereign collateral. The benefit of this strategy would have also led to the benefit of reducing the French government's funding costs thanks to decreasing sovereign yields. Indeed, the more French sovereign bonds were in demand, the higher their prices would become, matching a reduction in long-term yields (with a long-term reduction in the cost in public debt servicing).

[22] The GSCC was founded in the US in 1986 to provide clearing and settlement of government securities.

Second, France's move had also to do with the power struggles underpinning the process of European economic integration. As the Deutsche mark had dominated currency markets during the European Monetary System (EMS), by effectively locking European currencies into a Deutsche mark zone (see De Grauwe, 1991), France aimed at competing with Germany with the issuing of sovereign bonds *in euro* by deregulating its repo market to attract international investors. In other words, if Germany was the anchor for Europe's currency markets in the EMS, France aimed at becoming the benchmark issuer for sovereign debt in the euro area.

Interestingly, the Bundesbank initially opposed the liberalisation of the bund repo market until the second half of the 1990s, amid concerns that investors would prefer cheaper repo funding and thus shift away from the uncollateralised money market, where the Bank implemented its monetary policy operations. Indeed, despite pressure from the financial sector, the Bundesbank was against more short-term, market-based sovereign debt management approaches, as it would have impaired the effectiveness of its monetary policy and compromised macroeconomic stability more generally (see Trampusch, 2015: 122). Therefore, the Bundesbank kept strict minimum reserve requirements on the repo liabilities of banks, in order to maintain systemic stability and preserve its monetary policy transmission channel on the unsecured market (see Krauskopf, 1999: 12). Thus, as conducting repo contracts in Germany had become fairly expensive, by 1996 German banks relocated more than half of the deutsche mark repo business to London (see Prati and Schinasi, 1997: 286). This move would contribute to the Bundesbank's change of mind later on.

It was a similar story in the case of Britain. The Bank of England initially opposed the liberalisation of its repo market, as it was concerned about the systemic stability implications of market-based financing. Indeed, although the Bank of England officials

'… recognised the possible benefits [of repos] ...', they were concerned about the impact of a liberalised repo market on other market segments, for instance the failure to account for accrued interest rates when valuing collateral (see Bank of England, 1997: 187). As a matter of fact, the Bank of England's concerns were grounded upon a general scepticism towards the repo market that stems from the aftermath of what had previously happened to the US security dealer Drysdale Securities in 1982.

Drysdale Securities was a dealer in secondary markets of government securities and was utilising reverse repos to provide broker-dealer firms with Treasury bills. However, while the government securities were being traded, Dysdale Securities did not have sufficient funds to provide the buyers the interest rates accrued when the US government began paying out interest rates on its bonds on 15 May 1982. Unable to meet its interest rate transfers, Drysdale Securities closed down and began liquidating its business on June 15 (see Vartan, 1982; Garbade, 2006). Thus, on financial stability grounds, the Bank of England maintained strong control over repo traders in the gilt markets until 1996.

The Bundesbank's and the Bank of England's concerns regarding a liberalised repo market and market-based finance, with respect to the threat that it posed on systemic stability, is particularly relevant in order to understand the events that I will describe in Chapter 5. Indeed, the ways in which LCH.Clearnet destabilised the collateral market for repos in the euro area provides support to exactly the same set of concerns that these central banks had at the time.

The politics surrounding the introduction of the euro inevitably impacted upon the European central banks' attitude against market-based finance. On the one hand, the German government's demand to make the country's financial markets more competitive internationally, in order retain Germany's economic dominance in post-EMU Europe (see

Dyson, *et al.*, 1995), contributed to soften the Bundesbank's strict position against short-term finance. In this respect, the position of the German government should be contextualised in relation to France's aggressive financial liberalisation efforts in its repo market, which Germany had to emulate in order to assert its economic prowess in the upcoming euro area. On the other hand, pressure from the financial sector also played an important role. Due to an increasing share of bund-denominated repo business being relocated to London, on 5 December 1996 the Bundesbank lifted the restrictions on the minimum reserve requirements for repo liabilities up to one-year maturity, in order to win back that market share lost to the City (see Bundesbank, 1996: 57).

In short, the Bundesbank agreed to make it easier to conduct repo trading in Germany. To obtain a unified and, most importantly, internationally competitive euro money market, Germany had to be active in repo markets in order to attract foreign investors, which ultimately meant joining together the European money and government debt markets through repos (McCauley, 1999: 4). By 1997, having Germany to compete as the leading European sovereign debt issuer began to matter even more to the Bundesbank. The German macroeconomic authorities realised that foreign investors would no longer only look at fiscal policies when investing in the countries of the upcoming euro area, but also to their sovereign debt-management strategies, favouring those with a wider selection of maturities and *enough liquidity* for each sovereign issue (e.g. 3-year, 5-year, 7-year, 10-year, etc.) (see Euromoney, 1997; see also Galati and Tsatsaronis, 2003). The reasons that led the Bundesbank liberalising its repo market are particularly important points with respect to the objectives set out in this project, because they highlight the importance of sovereign debt to investors *in relation to their liquidity* and beyond considerations regarding debt-servicing sustainability.

The UK also followed the example of France and Germany. Before liberalising Britain's repo market, the Bank of England only allowed for a few selected institutions to borrow and short its gilts. Opposition to a liberalised repo market stems from considerations regarding financial stability. The Bank of England's concerns need to be contextualised within the dramatic impact that speculative short-selling had on its monetary policy and the declining value of the pound in 1992, which forced the UK out of the European Exchange Rate Mechanism (ERM) (see Eichengreen, 2007: 364)[23].

However, the UK Treasury, heavily influenced by the Conservative Party at the time, argued instead that liberalising Britain's gilt market would have reduced the government's funding cost, while simultaneously increasing the market's liquidity and improving the City's attractiveness to foreign investors *vis-à-vis* the other European capitals (see Gabor, 2016: 979; see also Baker, 1999). Thus, in its July 1995 debt management review, the UK Treasury encouraged the Bank of England to adopt a more modern sovereign debt management approach, citing the examples of the US and France and thus pushing for repo market liberalisation (see UK Parliament, 1999). Following the pressure from the Treasury, the Bank of England eventually agreed to liberalise the UK's repo market for its gilts in January 1996 (see Bank of England, 1997).

Three considerations are worth noting with respect to the repo market's development in Europe discussed above. On the one hand, repo liberalisation in Europe should be contextualised in relation to the growing power of finance in shaping domestic politics since the end of the fixed exchange regime under the Bretton Woods System (see Helleiner, 1994; Seabrooke, 2001, Konings, 2007). This is evidenced on two accounts. First, the growing importance given by domestic politicians to compete against the US in

[23] The ERM was introduced in 1979 as a tool to reduce exchange rate volatility among countries belonging to the EMS (see Eichengreen, 2007 for an overview).

attracting foreign capital, beginning with France, played an important role in repo market liberalisation. Second, the pressure exercised by the financial sector also contributed to repo market liberalisation; the relocation of repo activities from Germany to Britain is an example of this dynamic.

On the other hand, repo market liberalisation was also an outcome of institutional struggles at domestic level. With the exception of the Banque de France, Europe's most important central banks were initially opposed to repo market liberalisation because of concerns regarding financial stability. Indeed, it was not until the British and German government started pressuring their respective central banks that repo markets were liberalised. In this respect, the German and British governments' willingness to modernise their repo markets to catch-up with the US and France played a key role towards liberalisation. Lastly, as will be discussed in Chapters 4 and 5, the ways in which the European repo market is prone to CCP-induced collateral crises lends support to the initial scepticism towards liberalised repo markets by the Bundesbank and the Bank of England, on systemic stability grounds.

3.4.4 The transformation of repos in the aftermath of the 1998 Russian currency crisis

Whereas the politics underpinning the liberalisation of European finance was an important dimension that allowed the fostering of the use of repos, there was another particularly important event that significantly shaped the course of the repo market's development: the 1998 Russian financial crisis. Since the collapse of the Soviet Union, the Russian economy had gone through significant modernising efforts (see Chiodo and Owyang, 2002). By the end of 1997, Russia had, to a large extent, privatised its manufacturing and natural resources sector. In February of the following year, inflation

had dropped to single digits, largely thanks to a fixed exchange rate regime. However, the government's continued subsidies to what it considered as a 'vulnerable manufacturing sector' greatly added to its fiscal deficit, which led to a steep increase in government debt (see Pinto and Ulatov, 2010: 34). I

In turn, government debt expansion was fuelled by Russian banks keen on lending easily due to low interest rates, which increased the sovereign debt exposure of domestic Russian banks. The money lent to the government was collateralised with the shares of oil, metal and telecoms companies with the agreement that, were the loans not to be repaid, the bank would acquire the shares, thus representing a clear shift towards market-based finance in Russia (see Popov, 1999). More importantly, due to the financial liberalisation efforts undertaken in 1997, Russia had effectively removed restrictions for foreign participation in its sovereign debt and stock markets, which made the country extremely vulnerable to external shocks (see Pinto and Ulatov, 2010). Indeed, by mid-1998, non-resident foreign creditors held an estimated 30% of Russian short-term Treasury bills.

When the 1997 Asian crisis spread to Russia in August 1998, productivity slowed down, and the country's current account slipped from the surplus it held the year before to deficit. Thus, the rouble came under speculative attacks. In order to maintain the fixed exchange rate, monetary policy was tightened, and a large amount of foreign reserve was used, which led to a massive increase in the real interest rates of short-term sovereign bonds. As the value of Russian government security plunged, foreign creditors started to demand additional collateral for their repo loans with Russian banks, who had been dealing Russian government bonds (see UNCTAD, 1998). The timing of the margin requirement increases severely hit the Russian interbank funding market. Indeed, margin

calls were implemented exactly when a large number of syndicated loans were due in August that year (see Pinto and Ulatov, 2010).

In addition, Russian banks had to raise more funds just when the central bank had been draining up liquidity to protect the fixed exchange rate regime. Russian banks thus had no alternative but to close their repo positions by repaying their borrowing in US dollars. This move put further downward pressure on the rouble and the fixed exchange rate regime, leading to further restrictive monetary policy measures that exacerbated the decline in the price of Russian government securities, which led to a continuing rise in their interest rates. Amid unsustainable government funding costs, due to the rising interest rates of Russian sovereign bonds, the Russian government, together with its central bank, devalued the rouble and defaulted on its debt.

Given the far-reaching consequences that the Russian crisis had in the rest of the world in shaking up lending markets (see Van Rijckeghem and Weder, 2001), the global community of central bankers began to explore how to improve the stability funding markets. As noted by Gabor (2006), the Russian crisis made it clear that it is the lack of sufficient collateral that dries up liquidity in market-based financial systems, which set the Russian economy towards a downward spiral. Thus, in search of a safe market that could provide continuous liquidity, consensus built among central bankers and international institutions about making *sovereign bonds* the cornerstone of financial stability in repo-based interbank funding markets (see CGFS, 1999b; IMF, 2001). Indeed, sovereign bonds could provide precisely that type of liquid asset, which is creditworthy enough to be subjected to minimal price fluctuation, thus guaranteeing repo funding-liquidity during times of turmoil. In other words, sovereign bonds would act as the safe collateral in repo markets during periods of financial instabilities, which would allow the preservation of funding liquidity in the financial system.

As a consequence, the use of sovereign bonds in repo contracts began to expand thanks to the consensus among central bankers that the stability of collateral-based finance necessitates liquid government bond markets and deregulated repo markets, something that Gabor (2016: 969) dubs as 'the repo trinity'. This is key. As I will explain in more detail in Chapter 4, the use of market-based practices to handle sovereign collateral in the European repo market is one of the factors that underpins its fragility, because it allowed for LCH.Clearnet's margin calls to destabilising sovereign debt markets during the euro crisis.

The consensus built around the use of free repo markets for obtaining financial stability and market liquidity was embraced in both the US and Europe, a process that developed alongside the liberalisation of repo markets in Europe's most important financial capitals, as discussed above. However, following the fallout from Lehman's default in 2008, the liquidity assumptions of the repo trinity collapsed, which brings my analysis to a discussion of the extent to which repo markets relate to systemic instabilities and other financial crises.

3.5 Repo markets, margin calls and systemic instabilities

3.5.1 Margin calls in the US repo market during the 2007-08 global financial crisis

Repos were central to the GFC. An influential study by Gorton and Metrick (2012) has argued that the GFC was similar to a systemic bank run; however, this time it differed in that the run did not unfold through the withdrawal of bank deposits, but of repo contracts. This has led the authors to coin the term 'run on repo'. By using a large data-set, which included hundreds of securities bonds (asset-backed securities, collateralised debt obligations, and credit default swaps), Gorton and Metrick found that changes in the

LIBOR-OIS spreads are strongly correlated with credit spread rates and repo rates for the abovementioned bonds[24].

The LIBOR-OIS spread is considered a key indicator of credit risk in the banking sector. It is the differential between the average interest rate that banks charge to one another when lending to each other in the unsecured market (the LIBOR) and the index in the overnight swap market, where financial institutions swap their interest rates (the OIS). Usually, it is the fixed interest rate (the central bank's overnight rate) that's swapped with the variable interest rate. The difference between LIBOR and OIS is employed as a measure of the health of the banking sector 'because it reflects what banks believe is the risk of default associated with lending to other banks' (Thornton, 2009: 1).

In other words, the correlation between the LIBOR-OIS spread and the repo rates for securitised bonds found by Gorton and Metrick indicated that fears about shrinking banking liquidity was induced by decreasing returns on repo lending. That is because, the authors argue, as the size of subprime exposures in the repo market were unknown, investors worried that liquidity for collateral would quickly decline, particularly for non-subprime collateral, which would have been more in demand due to them being the safest securities at that point. As concerns about the liquidity of those securities intensified in early 2007, particularly since the collapse of Lehman in 2008, their price declined, which effectively reduced their value as collateral in repo transactions. In fear that banks would begin large-scale sell-offs of those bonds, lenders started to demand more collateral by increasing margin requirements on repo contracts. In a procyclical way, the increase in

[24] Whereas LIBOR refers to the London interbank offer rate (the rate at which banks indicate their willingness to lend to other banks), the OIS is the overnight indexed swap (the rate on a derivative contract on the central bank's overnight rate).

collateral requirements further reduced the collateral-value of those bonds, leading to more sell-offs that triggered more margin calls.

Crucially, instead of acting as the collateral of last resort in repo markets, US government bonds generated capital flight from bilateral repo markets to the US sovereign debt market, drying up liquidity from the interbank funding market. In essence, the combination of declining asset values and increasing margin requirements is what reduced funding liquidity and made US banks insolvent. Although these findings have been criticised for not having accounted for triparty repo operations (see ICMA, 2018b), the work by Gorton and Metrick remains a landmark study because it shows that the ways in which lenders apply haircuts to repo collateral in times of financial distress can be a procyclical transmission mechanism that exacerbates liquidity shortages. The findings of Gorton and Metrick's study also laid the foundations for similar works conducted in the same area in following years.

An important paper by Martin *et al.* (2014) corroborates Gorton and Metrick's study, in that it also finds short-term collateralised borrowing via repos to be a particularly unstable source of funding in times of financial distress. More importantly, however, their work also finds that such funding fragilities, or repo runs, are highly dependent upon the specific 'microstructure' of a particular funding market, highlighting the different ways in which the runs unfolded in bilateral and triparty repo market segments (ibid: 980).

Relatedly, Copeland *et al*. (2014) argue that what characterised the 2007-08 repo instabilities were not systemic runs in every segment of the US repo market. The authors found that whereas margin requirements were indeed increased across the board in bilateral repo contracts (which was the market segment examined by Gorton and Metrick), margins remained relatively stable in the triparty markets, and investors mostly

maintained repo funding in that segment, with the exception of a sharp decline when Lehman defaulted, when investors withdrew funds rather than increasing margins. The authors conclude that the dynamic experienced in triparty repo markets resembled more of a traditional bank run, as it had more to do with sudden fund withdrawal rather than being related to the specific mechanisms underpinning the functioning of repo markets and changes in margin requirements. In short, the authors argue that the run on repos in the US was not systemic but limited to the bilateral segment.

Still, there is by now unequivocal evidence to suggest that the use of margin calls in repo markets during the GFC had a procyclical effect, shrinking the liquidity available in the financial system. This argument has been corroborated by a theoretical model elaborated by Brumm *et al*. (2012), which also concludes that the increase in margin requirements on collateralised borrowing can contribute to market volatility, especially during times of financial distress. This is a key finding in relation to the objectives set out in this project. As Chapter 5 will show, LCH.Clearnet's margin calls in the European repo market during the euro crisis both increased pressures on domestic banks to access short-term funding in the euro area and retained a distinctive procyclical impact on the Irish and Portuguese sovereign debt markets. That is because the ways in which LCH.Clearnet introduced margin requirement increases in rapid succession for both Ireland and Portugal exerted a continuously increasing pressure on their sovereign debt markets. Higher margin requirements led to sell-offs that widened their sovereign spreads, which, in a procyclical way, caused more margin calls that further widened the spreads.

To sum up, the 'Lehman crisis was the result of a situation whereby financial institutions drastically and suddenly curtailed access to funding that had been collateralised with asset- and mortgage-backed securities' (Ban and Gabor, 2016: 903). As noted by Gorton and Metrick, when the sub-prime mortgage market in the US collapsed, investors began

increasing margin requirements on bilateral repos for mortgage-backed securities, triggering massive scale sell-offs of the affected securities. In a search for safer assets, investors relocated their funds onto the US Treasury bill market, which, rather than sustaining interbank lending, drained liquidity away from the financial system.

Central bankers realised that funding shocks of highly leveraged shadow banks, in effect, stopped collateral trading, which eroded market liquidity *irrespective of the creditworthiness of the collateral issuer* (Gabor, 2016: 985). Indeed, central bankers were faced by the crude reality that free repo and liquid sovereign bond markets do not necessarily guarantee stability in times of financial distress. Whereas the strain put on liquidity by margin calls has only been recently documented in the repo market, it is not unique to the GFC. More importantly, the triggering of a collateral crisis irrespective of the creditworthiness of the collateral issuer lends support to the argument that I am trying to develop in this thesis. Namely, that the sovereign collateral sell-offs that widened the spreads in the euro area from 2010 to 2012 were not only due to default fears, but also because of concerns regarding those securities' reduced liquidity to access short-term funding.

3.5.2 The procyclicality of margin calls in modern financial history

In 1929, the US faced one of the most devastating stock market crash of its history, whose impact contributed to the longest economic decline experienced by the global economy in the 20th century. The origins of the crash lie in a stock market bubble that developed in the 1920s, where the US stock markets witnessed very strong quarterly gains almost constantly between 1924 and 1929 (see Santoni, 1987: 18). The bubble was driven by the

growth of securities markets and the expansion of investments trusts, which allowed firms to substitute bonds and stocks for commercial loans (see White, 1990) [25].

This development led to a reduction of the traditional roles of banks as financial intermediaries. Indeed, the banks' commercial loans as a percentage of their total earning assets declined from 58% in 1920 to 39% in 1929 (see Currie, 1931). As a consequence, banks began both offering new financial services, such as insurances and trusts, and, more importantly, they became more involved in the brokerage between the public savers and the industrial sector, which in the meantime had experienced a massive expansion (see White, 1984). A growing industrial sector and an increasing channelling of household savings into the stock market created the perfect condition for the developing of a financial bubble.

However, after reaching a historic peak in September 1929, the stock market began to suddenly plummet on Thursday October 23. Amid increasing panic, massive sell-offs took place once the stock market opened again on Monday 28 September counting through 'Black Tuesday', respectively leading to a fall of the Dow Jones Industrial Average index by a staggering 12.8% and 11.7%. It has been recorded that 16 million shares were traded during those days, as investors were getting rid of their stocks in the fear that their value would decline even further.

An often-under-appreciated element of this story is the role played by margin calls during the crash. A study by Smiley and Keehn (1988) found that, while an ever-increasing number of borrowers began investing in the stock market, lenders began increasing margin requirements in October 1928 to historic levels, suggesting that they did not share

[25] Investments trusts were financial institutions selling securities to the public and re-investing their gains in stocks and bonds (see Carosso, 1970).

the same optimism of borrowers when it comes to rising stock prices. The increase in collateral requirements did not have much of an impact on stock prices, as during that time the market was still growing at unprecedented levels. However, the effect of margin calls on sell-offs quickly changed as the crash began to occur. It has been documented that, starting from 28 October 1929, the margin calls introduced following the severe decline in stock prices caused another significant plunge, as investors kept selling their holdings amid rising collateral requirements (White, 1990: 68).

Hence, though not directly attributable as a direct cause of the crash, the sudden increase in margin requirements contributed to exacerbate the size of the sell-offs (see Brumm *et al.*, 2012). In this sense, the effect of margin calls during the 1929 stock market crash is similar to what has been previously discussed in the case of the repo market during the GFC, whereby the increase in collateral requirements exacerbated a liquidity shortage. Even more significant for the scope of this study is the role played by the margin calls implemented by CCPs during another stock market crash more than 50 years after Black Tuesday: Black Monday of 1987.

To an important extent, the stock market crashes experienced around the world on Monday 19 October 1987 are an effect of contagion, in the sense that a price shock in one particular market spread to another (see Yang and Bessler, 2008). Like in the previous case, the crash began in the US. Starting from October 14, the Dow Jones Industrial Average index declined by 31% during that week; the derivative markets of Chicago also plummeted during the same time. The decline in stock prices quickly spread around the world, hitting stock markets in Hong Kong, London and Sydney on the same day. The Hang Seng index in Hong Kong (a stock market index) dropped 11.3% on October 19, before stock markets even opened in the US and Europe. The London Stock Exchange

(LSE) fell by a comparable amount, whereas prices on the Sydney exchange collapsed by almost 25%.

The 1987 stock market crash is unique in that it exposed the vulnerabilities of electronic trading, which is closely linked to the onset of the crash. Indeed, electronic trading systems interacted in such a way with price declines that they exacerbated the crisis creating liquidity shortages. In this respect, the role of central clearing was crucial. In a report presented to US Congressional Committees in 1990, the General Accounting Office (GAO) found that during the events of 1987 some clearing members did not have sufficient funding to meet their collateral obligations to CCPs; hence they had to increase their borrowing from other banks (GAO, 1990: 3). This was due to the complexity of the clearing system in the US, which generated 'delay and confusions over payments of margin calls triggered by stock price falls, raising concerns over the solvency of securities brokers and the ability of exchange clearing houses to make payments' (IMF, 2003: 82).

As trading systems were unable to process large volumes of transactions at once, investors became uncertain about the price information they were getting, which led them to pull out of the markets. On the morning of the crash, the clearing services offered by CME requested over $1.2bn intra-day variation margin requirements from its clearing members. By the end of business, CME asked for another $1.3 billion (Norman, 2011: 137). However, clearing members received a report showing that they were being asked for an extra $2.5 billion on top of the initial $1.2bn, because the CME's trading system had not accounted for the $1.2 billion that had already been requested earlier (see CME, 1988: 48). The difficulty for clearing members to provide the extra collateral put a strain on their available liquidity, which forced them to seek additional credit from other banks (see IMF, 2003: 64). Similar issues were faced by another Chicago-based CCP, the Option Clearing Corporation. The CCPs of the future markets in Chicago asked for over

$4bn in intra-day variation margins between Monday and Tuesday and were thereafter criticised for having drained liquidity from the financial system in a time of economic turmoil (see Bernanke, 1990: 147).

In a short, clearing systems did not allow for market participants to easily meet large margin requirement increases during the crash, causing illiquidity and payment difficulties to spread across the financial markets (see IMF, 2003: 64). Crucially, this led to deep scrutiny of the clearing system as a whole. One of the most significant impacts was the 1988 Brady Report, which was compiled by the Presidential Task Force on Market Mechanisms on behalf of President Ronald Reagan. The report acknowledged how the clearing systems had exacerbated the crash (see Brady, 1988: 51), pointing towards the need to an overall improvement of their trading system and how margin requirements were implemented.

Whereas the context in which LCH.Clearnet implemented its margin calls during the euro crisis are different from those discussed above (particularly with respect to the absence of a flaw in electronic trading systems), the role of the CCPs' margin calls during the 1987 stock market crash are still important with respect to answering this project's research question, which seeks to examine the factors that contributed to destabilising sovereign debt markets during the euro crisis. Much like as discussed in Chapter 2, the evidence provided in this chapter suggests that the CCPs' margin calls can add further pressure on the already weakening funding liquidity of investors, because it forces them to post more collateral when credit lines are tight. This is precisely the dynamic that will be examined in Chapter 5, whereby banks in the euro area were forced to sell sovereign bonds to find the cash needed to meet the margin requirement increases by LCH.Clearnet from 2010 to 2012. At the same time, meeting the margin calls contributed to destabilising

sovereign debt markets, as the bond sell-offs led to higher sovereign bond yields and therefore wider spreads.

We can thus draw contours of continuity and change with respect to the repo market and systemic instability. To an important degree, the negative relationship between margin calls and liquidity in times of financial distress shows that there is a much more generic dynamic at play in how financial crises unfold, which is not unique to a specific crisis. Indeed, margin calls during a crisis tends to have procyclical effects, because the sudden increases in collateral requirements further reduces the value of assets, securities or contracts already undergoing large-scale sell-offs.

The 1929 stock market crash demonstrates this dynamic pretty clearly, since margin calls only really exacerbated sell-offs while stock prices were already declining, having had virtually no effect in slowing down the unsustainable stock market growth in previous years. Margin calls were even more central to the developments surrounding the 1987 debacle. The ways in which CCPs applied margin calls during the 1987 stock and derivative markets crash also caused strong liquidity strains, as banks were unable to meet the payments following the hike in margin requirements, exacerbating distress in times of financial instability. Arguably, the 1987 crash was largely related to the dynamics and flaws surrounding the functioning of the then-emerging electronic trading systems, which worsened the procyclical impact of the CCPs' margin calls.

At the same time, however, because CCPs calculate and impose non-negotiable margin requirements (as opposed to bi-lateral and triparty arrangements), individual CCPs had a relatively higher impact on systemic stability than single traders, as was recognised by the US. This point contributes in highlighting the potentially self-defeating objective of the G20's mandatory clearing commitment for OTC derivatives, which I discussed in the

previous chapter. Indeed, the ways in which the CCPs' risk concentration negatively impacted systemic stability during the 1987 stock market crash continues to affect global finance today, although now on a larger scale, given the unprecedented exposure of CCPs to an enormous amount of OTC derivatives risk.

Thus, while the GFC does share the more general procyclical element with regard to how margin requirements reduce financial market liquidity during a crisis, repos do retain a distinctive element. Differently from both the 1929 and the 1987 crashes, margin calls during the GFC directly impacted bank funding. As the repo market is a major source of interbank short-term funding, the increases in collateral requirements directly affect banks' liquidity, which adds a much stricter banking dimension to the crisis, centred on repos.

3.6 Conclusions

This chapter has set up a framework that allows us to understand the importance of the repo market with respect to systemic stability within the context of the objectives set out in this project. Starting from how the New York Fed used repo transactions to provide financing to underfunded banks in the early 20th century, repos have always been involved in the provision of the banks' short-term funding liquidity needs. Indeed, over the years repos have become the main tools through which banks lend to each other in the wholesale funding market.

The chapter showed that the development of modern repo markets is closely linked to the politics underpinning the transformations of the world economic order in the aftermath of World War II. Thanks to the detailed works of Garbade (2006) and Gabor (2016), this chapter has shown that the shift to market-based finance in the US has largely determined

the development of repos between the 1950s and the 1980s. In the context of higher interest rates to combat high inflation, repos became widely employed in the US as a cheaper and more reliable funding alternative to the more expensive bank loans. Crucially, these transformations took place against the backdrop of a Treasury that had in effect become an active repo market participant, supporting market liquidity through the issuance of sovereign bonds. These trends were adopted in Europe as well during the 1980s and 1990s, starting from France.

The analysis then moved on to show how the 1998 Russian currency crisis further shaped the development of repos. The sudden lack of repo collateral during that crisis contributed to build consensus among central bankers and international institutions to expand the use of sovereign bonds in repo markets as a way to provide a highly liquid collateral that would guarantee repo-funding in times of financial distress. Expanding the use of sovereign bonds as collateral has been a highly significant change in the functioning of repo markets, which brings us one step closer to answering this project's research question: what factors contributed to destabilising sovereign debt markets during the height of the euro crisis from 2010 to 2012? Indeed, as will be discussed in Chapter 4, the centrality of sovereign bonds as the main source of collateral in the European repo market is one of the factors that makes European financial markets prone to CCP-induced collateral crises and sovereign debt market instabilities. Furthermore, Chapter 4 shows that, just as described in this chapter, the development of a single European repo market around market-based practices is also closely linked to the politics of underpinning the creation of a single European financial space following the introduction of the euro.

This chapter has also expanded upon another crucial aspect that allows us to answer the research question posed by this project: namely, the relationship between repos and financial crises. The collateralised nature of repo lending makes this type of financing

susceptible to sudden funding shocks. As shown by discussing the available scientific evidence on repo markets, the sudden withdrawal of repo collateral, as a consequence to procyclical margin policies, contributed to make the US banking system insolvent during the GFC, because it shrank the funding liquidity available in the interbank lending market. While there does seem to be a broader procyclical dynamic in place, in that the use of margin requirements during crises is generally associated with declining stock prices and liquidity, margin calls during the GFC led to a withdrawal of repo collateral that caused insolvencies.

This is highly relevant for the scope of this project, insofar as it helps understanding the dynamics to be explored in Chapter 5. The ways in which LCH.Clearnet implemented margin calls on sovereign repo collateral during the euro crisis led to large-scale bond sell-offs that destabilised sovereign debt markets, contributing to widening the spreads of Ireland, Portugal, Italy and Spain. Equally important, the examination of the repo market conducted in this chapter also provides an empirical backing to one of the main arguments put forward by this project. Given the importance of repo collateral to access short-term funding, the increase in margin requirements by LCH.Clearnet to use Irish, Portuguese, Italian and Spanish sovereign bonds in repo transactions reduced the usability of those securities to access short-term funding. Thus, the large-scale bond sell-offs that took place following LCH.Clearnet's margin calls in repo markets, widening the spreads, were the result of investors being concerned with the usability of the affected government securities to access short-term funding, and not just driven by fears of sovereign default.

We now turn to Chapter 4, which examines how the European repo market was created and developed systemic vulnerabilities.

4. European Financial Integration and Repo Market Vulnerabilities

4.1 Introduction

The previous chapter has identified repos as a potential source of credit shocks in the interbank lending market, which crystallises this project's focus on liquidity (or the lack thereof) as a key explanatory variable for financial market instabilities. The purpose of this chapter is to examine the functioning of the European repo market, thus bringing the analytical focus back to Europe. More specifically, this chapter contributes to the euro crisis debate by examining how the integration of European financial markets through repo trading has exposed sovereign debt markets to systemic vulnerabilities.

As discussed in Chapter 1, the European-level explanations have been primarily concerned with examining the impact that European monetary integration had in generating macroeconomic imbalances, which laid down the foundations for the onset of the crisis. However, whereas the imbalances affecting the monetary union have been extensively examined, the potential imbalances arising from the integration of European financial markets have been ignored by this scholarship. Understanding the difference between monetary and financial integration is key. The process of European economic integration tends to be examined only through the lens of monetary integration, that is, how countries in the euro area have given up monetary sovereignty by adopting a common currency, the euro, thus shifting monetary authority at European level.

I seek to make a key contribution to the European-level explanations by showing that, after the introduction of the euro, European financial markets also began an integration process, which has had important repercussions for sovereign debt market stability.

Differently from monetary integration, European financial integration refers to processes that sought to increase the level of cross-border financing among the economies of the euro area, which was relatively low at the onset of the single currency. I argue that the creation of a single European repo market for cross-border interbank lending has made sovereign debt markets of the euro area extremely prone to systemic instabilities.

The main finding of this chapter is that the European repo market is distinctive in that its trading activities are almost entirely dependent on sovereign bonds as collateral and that they are cleared largely by CCPs, particularly on one of the world's largest, LCH.Clearnet. In monetary terms, this equates to roughly €6.2tn worth of sovereign bonds as collateral being cleared in December 2017, and where LCH.Clearnet is responsible for clearing around €6tn of European repos and €125tn of OTC derivatives worldwide during the same month. The analysis developed in this chapter contributes to answering the research question posed by this project, which aims at identifying the factors that facilitated the sovereign debt markets distress during the height of the euro crisis. Indeed, I argue that the specific ways in which the European repo market is structured established extremely close links between sovereign debt, bank funding, and CCPs, which has made European financial markets highly vulnerable to what I define CCP-induced collateral crises. This is a novel notion I devised, which recognises the concentration of repo exposures in one CCPs as a potential trigger for collateral crises. A collateral crisis is a situation whereby a market shock creates a hierarchy between good and bad collateral, restricting the use of the latter (see Gorton and Ordoñez, 2014).

The impact of these arrangements on financial stability manifested during the euro crisis and are examined in Chapter 5, where I demonstrate that the margin calls by LCH.Clearnet likely led to large-scale sovereign bond sell-offs from 2010 to 2012, which destabilised sovereign debt markets, widening the spreads. Thus, this chapter takes us one

step closer to show that spread movements during those years were also highly influenced by the usability of these securities to access short-term funding via repo contracts, and not just by sovereign default risk perceptions. These dynamics are key to the objectives set out by this project, which seek to put into question the use of spread as an indicator of markets concerns with sovereign default risk.

The analysis developed in this chapter owes a lot to the work of Gabor and Ban (2016), which shows that the development of a European repo market established new, fragile links between sovereign debt and bank funding. My analysis provides two novelties in this regard. First, I evaluate the process of European financial integration with a sharper focus on issues regarding systemic stability. Second, I contribute to our understanding of European financial market integration by exploring the importance played by consolidation of the European exchange industry in this process, which has led to the creation of one of the world's largest CCP. Ultimately, I show that central clearing retains a key destabilising potential in the relationship between sovereign debt and bank funding in European finance.

Crucially, this chapter examines a specific process that has shaped the European repo market to be so reliant on sovereign bonds, namely, the EC and ECB's political imperative of financial market integration. While research in comparative political science and political economy has examined at great length the politics in the run up to the euro, particularly with respect to the different interests between the French and German negotiators in the process of European monetary integration, these have neglected repo market integration (e.g. Feldstein, 1997; McNamara, 1998). Further, according to the European-level explanations of the euro crisis literature, it is the result of these compromises that shaped monetary integration in such a way which, as discussed in Chapter 1, led to the development of macroeconomic imbalances at the root of the euro

crisis (e.g. Hall, 2014; Lapavitsas *et al.*, 2012; Bellofiore, 2013). I seek to contribute to this debate by showcasing the interests of public and private market actors in fostering the creation of a single European financial space. Differently from previous chapters, I should note that I will focus extensively on the ECB here, because it has had a key role in shaping the functioning of the European repo market. In particular, I will examine the role played by the ECB in the consolidation of market-based practices for the handling of sovereign collateral, which I conclude make sovereign debt markets prone to price volatilities in financial markets.

The analysis will be conducted in two stages. Section 4.2 examines how repos and sovereign bonds became among the main drivers for European financial integration. During the end of the 1990s, the EC put together a group of financial market experts, called the Giovannini Group, to provide advice on how to strengthen the integration of European financial markets. It is important to note that, besides the EC and the ECB, the Giovannini Group was in essence made of representatives coming from the international financial industry (Giovannini, 1999: 61), meaning that their ideas and actions were essentially based upon their *de facto* status as an interest group for the financial sector. The Giovannini Group promoted the harmonisation of collateral and repo trading rules, in order to foster liquidity in European finance through integrated repo markets. Welcoming the Giovannini Group's advice, the EC instituted repos as the main instruments through which integrating European financial markets. However, I argue that by rooting the provision of short-term funding in repo loans the involvement of the Giovannini Group has exposed European financial markets to collateral crises.

It should be noted that the role of the Giovannini Group in shaping the integration of European financial markets has been completely ignored in the euro crisis literature, while it has only received some attention in EU studies on European economic policy

after the introduction of the euro (e.g. Hartmann *et al.*, 2003). Further, the impact of the Giovannini Group in shaping the functioning of the European repo market has never been examined in relation to systemic stability, with the exception of Gabor and Ban (2016), who wrote a few years after the euro crisis. The increasing attention given to the functioning of the European repo market is evidence of just how much the link between repos and systemic stability are becoming evident in scholarly debates in recent years.

The ECB's actions during those years would provide the next, crucial building block that took the integration of European financial markets even further: the introduction of general collateral (GC) baskets for euro area sovereign bonds. With the objective to further integrate European financial markets, the ECB provided banks with the possibility of utilising the sovereign bond interchangeably of any area when conducting repo operations with the central bank. The ECB sought to improve the liquidity of European financial markets by allowing investors to use any euro area sovereign bond in repo transactions.

To shield itself against discretionary monetary policy criticism, the ECB began employing market-based practices to handle sovereign bonds for collateral purposes, such as daily mark-to-market and margin calls. This is crucial, because the ECB established the blueprint for the use of sovereign collateral use in the euro area through these practices which, as discussed in Chapters 2 and 3, retain a highly destabilising potential. Thus, I argue that, on the one hand, the ECB's actions have dramatically expanded the use of sovereign bonds in the European repo market, but, on the other hand, the promotion of market-based practices has also exposed the sovereign debt markets of the euro area to collateral crises.

Section 4.3 assesses another process that characterised the integration of European financial markets: the consolidation of the European exchange industry, centred around the creation of a single European trading platform. This process has also received virtually no attention in the euro crisis literature, or in EU studies more generally, while it has been documented in financial history (e.g. Norman, 2011; Gregory, 2014). I found that the contrasting interests between the German, French and London stock exchanges, to create a pan-European trading platform between the 1990s and 2000s, were based upon their rivalry in the cross-border exchange and clearing industry within the (then) developing European financial space. In this respect, the insistence of the Paris stock exchange to preserve central clearing as a key technology laid the foundations for the dominance of CCPs in European financial markets. Furthermore, the compromises on the type of clearing model to adopt, which took place during the early 2000s between British users and European exchanges, paved the way for the creation of LCH.Clearnet, one of the world's largest CCPs by clearing volume. While the European repo market has become increasingly reliant on central clearing, I argue that the concentration of the repo business in one CCP made the sovereign debt markets of the euro area highly susceptible to CCP-induced collateral shocks.

The rest of this chapter is structured as follows. Section 4.2 examines the role played by repos and sovereign bonds in the integration of European financial markets. Section 4.3 analyses the consolidation of European exchange industry and the creation of a single European CCP. Section 4.4 is dedicated to the concluding remarks, which are that the politics underpinning the integration of European financial markets has made the sovereign debt markets of the euro area vulnerable to collateral instabilities.

4.2 The integration of European financial markets through repos and sovereign bonds

4.2.1 The Giovannini Group and the making of a single European financial space

After coming into force in 1999, the euro represented the most important milestone in the convergence efforts of European economies since the establishment of the European Economic Community (EEC) in 1957. Most importantly, European monetary integration had finally succeeded in putting an end to over two decades of failed attempts to prevent exchange rate volatility between European currencies after the demise of the Bretton Woods international monetary arrangement in 1971 (see Eichengreen, 2007). However, whereas the process of European integration had finally reached a monetary union, the integration of European financial markets still lagged behind. The reason for the poor integration of European financial markets had to do with the low degree of cross-border financing among European banks, which was to a significant extent reflected in the fragmented nature of the repo markets in Europe.

As noted by Galati and Tsatsaronis, there were structural constraints that prevented the development of a Europeanised repo market (Galati and Tsatsaronis, 2003: 171). Differences in regulatory, legal and tax regimes, as well as market practices, included: short-selling restrictions, restrictions in the type of securities that could be held, and general lack of tradition in securities lending; these all contributed to a fragmented securities markets in Europe. These limitations were recognised by the Giovannini Group, an ensemble of financial experts who came from the private sector and EU institutions, appointed by the EC to provide advice on financial market integration.

Before going any further, is important to note that financial market integration needs to be understood as part of a key political strategy by the EC to achieve the single currency,

which required reconciling the different interests at stake regarding the future of European integration. In order to satisfy, on the one hand, the France and Italy's desire to regain what they perceived as lost monetary sovereignty to the EMS and, on the other, to reassure Germany about avoiding the risk of high inflation within the monetary union, in the late 1980s the EC simultaneously promoted the liberalisation of capital markets as well as further monetary integration (see Jabko, 1999).

While capital market liberalisation provided German authorities with assurances that future euro countries would submit their economic policy to market discipline – because free movement of capital would limit fiscal policy latitude – introducing a single currency also put to rest France's disapproval of the EMS as being too German-centric[26]. In short, the integration of European capital markets needs to be understood as a key political priority by the EC and, as we shall see later, the ECB, which was instrumental in promoting further financial market integration. Hence, it is within the EC's political strategy of financial market integration that the appointment of the Giovannini Group needs to be contextualised.

The Giovannini Group is named after Alberto Giovannini, an US-educated Italian Professor in finance and economics. After obtaining his PhD from the Massachusetts Institute of Technology (MIT), Giovannini was hired by the Columbia Business School in New York and worked at several prominent think tanks, like the Centre for Economic

[26] Since the end of the Bretton Woods system, the market discipline hypothesis suggests that international financial markets discipline governments by forcing them to adopt more conservative, sound and non-inflationary fiscal policies (see Helleiner, 1995). According to the market discipline hypothesis, financial market actors react to governments, on what they deem unsound fiscal policy, punishing them by taking investments out of the country's sovereign debt market or by asking higher interest rates when lending money, which both tend to increase the government's borrowing costs in the long-term (Rommerskirchen, 2015).

Policy Research. He also worked for the Italian Treasury, as well as serving in numerous company boards, such as for the Italian electric utility provider ENEL. Widely respected across the continent, in the mid-1990s Giovannini was tasked by the European Commission to recruit financial market experts in order to assess and advise on the impact of the single currency on European capital markets (see Hartmann *et al.,* 2003).

It should be noted that the Giovannini Group was largely composed of key representatives of the financial industry, both European and international, such as *Deutsche Bank*, ING Group, Morgan Stanley, the *Paris Bourse*, JP Morgan, ISMA, and more (Giovannini Group, 1999: 61). These were among the same figures who had been lobbying to liberalise capital movements in Europe since the end of the 1980s (see Underhill, 1997: 110). Therefore, I argue that the Giovannini Group can be thought of as essentially a lobbying organisation for the financial sector, whose interests aimed at liberalising and enhancing capital movements in the EU, which aligned with the EC's political ambition to integrate the European financial markets. Indeed, an integrated repo market would 'fit this political strategy that invoked the appealing vision of a single financial space, further cementing the alliance between the Commission, European banks and technocracies' (Gabor and Ban, 2016: 623).

While, in the past, the Giovannini Group did not reach agreements on issues such as the creation of a single debt instrument in the euro area backed by mutual guarantees, repo market integration gathered broad consensus among its members (Hartmann *et al.*, 2003: 208). The Giovannini Group claimed that European financial markets lacked the sufficient degree of integration and efficiency necessary to foster the development of the European economy (Giovannini Group, 1999: 2). Integrating repo and collateral markets in Europe was thus identified as the solution to this problem, on the assumption that it

would have improved the liquidity of securities markets and thus laid the foundations for a truly integrated, pan-European capital market.

The Giovannini Group recognised the fragmentation of European finance into (back then) 15 separate repo markets as one of the main problems that prevented the proliferation of cross-border security trading, which negatively impacted the overall liquidity of European financial markets. Although the introduction of the euro had provided 'a firm base' upon which to build capital market integration, it fell short in fully harmonising market practices and legislative frameworks across the continent (ibid: 10). Thus, the Giovannini Group provided market participants as well as national and EU authorities with a series of recommendations in order to improve the integration of repo markets across Europe, which would have a long-lasting impact in shaping the functioning of European financial markets.

The alternative to this vision, the Giovannini Group argued, was for European repo markets to remain largely divided along national lines, which would have impaired cross-border liquidity provision. This is an important point to retain for the scope of this project, because repo market integration in effect implied liberalisation, providing access to domestic repo markets by foreign investors. As discussed in Chapter 3, Europe's most important central banks, notably the Bundesbank and the Bank of England, initially opposed repo market liberalisation because of concerns regarding the systemic stability of liberalised short-term collateralised finance.

Hence, whereas the Giovannini Group, representing the interests of the financial sector, condemned repo market fragmentation, in the view of central banks *the fragmented approach helped to maintain systemic stability*. This is key, because the argument I am developing in this chapter shows that the specific ways in which European repo markets

were integrated along the lines suggested by the Giovannini Group made European financial markets prone to systemic instabilities. More broadly, my thesis lends support to the arguments against this type of repo liberalisation made by the Bundesbank and the Bank of England at the time.

To market participants, the Giovannini Group suggested to remove any restriction on repo activities by institutional investors, based on the idea that larger repo trading volume conducted by those actors would greatly improve the liquidity of securities trading. It also suggested that market players employ market-based practices with respect to collateral management, such as daily mark-to-market, haircuts and margins. To regulators, the Giovannini Group advised, firstly, to remove any existing tax disincentive to repo activities. Second, to conduct a detailed survey of market rules and netting in each Member State, in order to provide the widest possible mutual legal recognition of netting practices across the continent. Third, to provide a pan-European legal framework for the recognition of collateralisation techniques and practices across the continent, to facilitate the use of collateral cross-border. Finally, the mutual recognition of both bilateral repo activity as well as the clearing and settlement systems underpinning the functioning of the repo market as a whole.

As discussed in the previous chapter, until the mid-1990s a consensus existed between governments and central banks (pushed by the latter) to restrict and control repo activities, particularly to prevent short-selling in government bond markets and to maintain an effective transmission channel of monetary policy operations. However, following pressure from financial market operators, and to compete with France's aggressive repo liberalisation strategies, that consensus began to crumble, which helps to explain why the Giovannini Group's proposals were endorsed by domestic authorities as well as by the EU.

Indeed, the EC 'warmly welcomed the report', supporting the Giovannini Group's objective to integrate European financial markets via enhancing cross-border repo trading in the euro area (EC, 1999). Almost quoting the report itself, the EC argued that a 'unified EU repo market will ensure *efficient liquidity management* in the euro-area', thus committing to the Giovannini Group's recommendations to implement the necessary legislative initiatives at EU level (ibid, emphasis added). The Giovannini Group's guidelines were translated into the Directive 2002/47 on Financial Collateral Arrangements, which provided the legal foundations for cross-border use (and re-use) of collateral. (see Council Directive, 2002).

Directive 2002/47 aimed at tackling the issues raised by the Giovannini Group and enacting its suggestions, including: 1) the removal of the major legal barriers for the cross-border use of collateral; 2) creating effective and simple regulatory and market regimes for financial collateral arrangements; 3) the recognition of specific risk mitigation techniques (indirectly making reference to the market-based collateral-management practices described above), all of this in order to: 4) improving the integration and cost efficiency of European financial markets; 5) strengthening the stability of the financial system as a whole and reducing of risks and losses (as discussed in Chapter 3, repos had been considered instrumental for financial stability in both the US and Europe); 6) enhancing overall cross-border transactions and competitiveness.

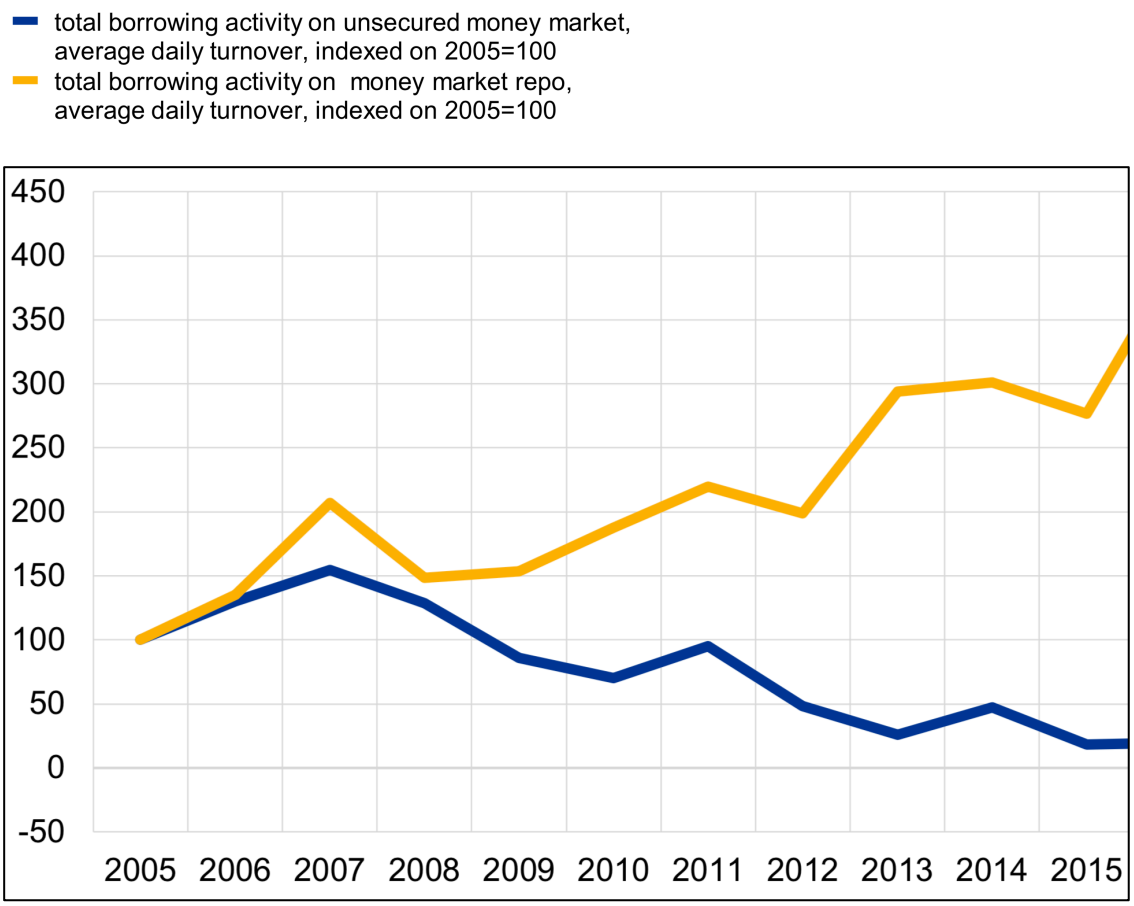
In a nutshell, by adopting the Giovannini Group's guidelines through Directive 2002/47, the EC 'effectively institutionalized pure market-based governance' in the provision of short-term funding in the euro area, meaning that lending practices and prices would increasingly be determined in financial markets through repo trading (see Gabor and Ban, 2016: 623). Ultimately, repo, and, more generally, financial integration according to market-based practices was a political success for the EC, because it managed to reconcile Italy and France's demands for a less German-centric monetary arrangement and

Germany's objective for a low inflationary regime thanks to enhanced market discipline (see Jabko, 1999). As I will discuss in more detail in the following subsection, national governments did not oppose those proposals because the ECB engineered a way to manage collateral that, in theory, would have prevented a Europeanised repo market to create asymmetries by causing capital flights from less to more liquid government bond markets (see Gabor and Ban, 2016). However, as demonstrated in Chapter 5, I argue that these measures would not be effective in preventing CCPs from causing exactly these types of asymmetries in sovereign debt markets.

Before moving forward, I draw a parallel between the role played by the Giovannini Group and the much more documented involvement of the European Roundtable of Industrialists (ERT) in the process of European integration. The ERT is a forum of Europe's largest and most internationalised industrial corporations, which deeply shaped European monetary integration in the 1980s by proposing the creation of a European single market in 1983 (see Van Apeldoorn, 2002; Holman, 2006). Similarly to the Giovannini Group, the ERT blamed the fragmentation of European markets for goods as the cause of Europe's declining competitiveness, which could have been overcome through the creation of a *single European market* (ERT, 1983). Just as in the case of how the Giovannini Group's guidelines were implemented in the Directive on Financial Collateral Arrangements, the ERT's proposals were incorporated into the European Commission's White Paper on Completing the Internal Market. Hence, I argue that the interests of private sector groups, like the ERT and the Giovannini Group, have played an important role in shaping the integration of Europe's markets for goods as well as financial services.

In any case, I found that cross-border repo lending in the euro area dramatically increased following the introduction of the Directive on Financial Collateral[27]. Figure 10, which measures the daily percentage change in cross-border lending activities in the euro area, shows that the total borrowing activity on the secured money markets (like repos) has dramatically increased, at the expense of the unsecured segments (such as bank deposits)[28]. In short, this piece of legislation greatly contributed to the creation of a single European financial space.

(Fig. 10) Borrowing activity in the secured and unsecured markets of the euro area



Source: ECB (2017).

[27] Reporting only started in 2005.

[28] As explained in Chapter 3, secured money markets are mainly repos.

It should be noted, however, that by the time the report was published in 1999 the supply in sovereign bonds issuing had taken a downwards trend in Europe, which was matched by an equal increase in private debt issues (e.g. corporate and financial institutions bonds). Indeed, the Giovannini Group's initiative aimed at promoting a unified European repo market by strengthening the appeal of private paper, and not government bonds. This means that, although the Giovannini Group's report should certainly be credited for having pushed financial market integration through the creation of a pan-European repo market, it did not specifically address sovereign bonds as the catalyst for achieving this goal. As will be shown in the next section, sovereign bonds only became more central in repo trading in the euro area at a later stage.

4.2.2 Integrating European financial markets through the ECB's general collateral baskets

Politicians across Europe broadly supported the EC's efforts for currency union and financial market integration, in the hope that the EMU would prove more stable than the currency crisis-prone EMS (see Eichengreen, 2007: 357). The EMS, which preceded the EMU, was established in 1979 as a monetary arrangement between European currencies. The main objective of the EMS was to link the currencies of the EEC's members together as a means to limit exchange rate fluctuations. The exchange rate arrangement allowed for fluctuations at different percentage bands over its years of operation (1979-1998). Albeit no currency was formally employed as the benchmark of the system, the German mark quickly became the currency anchor of the arrangement, due to its relative stability with other currencies and low inflation. However, as most other countries could not keep up with the low-inflationary interest rate regime of Germany, the EMS became target of significant currency speculation in 1992 that, ultimately, led to several currency crises

that put the regime in crisis and paved the way for the euro (see Eichengreen, 2007 for a full history).

Thus, regulators were worried that a Europeanised sovereign bond market could also lead to speculation and capital flights, as investors could decide to opt for more liquid and stable securities, like German government debt. Therefore, the ECB became instrumental in achieving a liquid, presumably stable and Europeanised repo market, because it argued that an integrated securities market for the euro area would have facilitated the transmission mechanism of its interest rate-based monetary policy (see ECB, 2017). More broadly, the ECB's position on European financial market integration was largely in line with those of the Giovannini Group, in the sense that it also regarded repo market fragmentation as the largest obstacle to further integration. Furthermore, as the ECB's 'political legitimacy in concentrating monetary powers at European level rested on its ability to deliver price stability' (particularly in the eyes of German authorities), the ECB saw in European financial integration an effective monetary policy transmission tool for the whole euro area (Gabor and Ban, 2016: 625). Hence, the ECB's saw the overcoming of financial market fragmentation central to its political legitimacy.

As in the words of the ECB, '[t]he remaining obstacles to [financial market] integration lie in the diversity of the types of securities in the euro area' (ECB, 2002a: 66). While the ECB shared the Giovannini Group's view of financial integration, the ECB also had the additional burden of having to develop and implement concrete strategies to make a Europeanised repo market work in practice. As we shall see below, these strategies resulted in the ECB establishing the blueprint for collateral management of European repo trade, which significantly transformed the market and made it increasingly reliant on sovereign bonds. In order to foster a single European repo market and prevent capital

flights across the euro area, the ECB promoted the use of GC baskets that integrated all of the euro area sovereign bonds for its own repo transactions (see ECB, 2002a).

GC are built upon an agreement that explicitly recognises which securities are to be *treated equally* for collateral use. GC baskets were introduced by the ECB so that different euro area sovereign bonds could be used interchangeably as high-quality collateral. For example, through the use of GC baskets, a buyer in a repo contract could be purchasing €500 worth of Greek sovereign bonds and returning an equivalent amount in German government securities.

The ECB explicitly praised the use of GC as a means to strengthen the integration of European financial markets. In the ECB's own words:

> [Financial] [m]arket integration would benefit from the extension of a euro GC approach, enabling participants to put securities with similar, although not the same, characteristics in the same basket (ECB, 2002a: 66).

Thus, the introduction of GC baskets by the ECB helped to engineer a single market for euro area sovereign bonds, despite that each participating government issued its own debt – albeit in a common currency – and despite that those bonds did not share the same liquidity or credit rating.

Treating all euro area sovereign bonds equally for collateral purposes was considered a highly politically move, as it could lead to moral hazard by less creditworthy sovereigns in terms of fiscal policy, an unacceptable move for an independent central bank (see Buiter and Sibert, 2005). An influential paper by former international advisor to Goldman Sachs and current chief economist of Citigroup, Willem H. Buiter, (co-authored by

economics Professor Anne Sibert) argued that the ECB's collateral policy would have weakened the fiscal discipline of low-rated government bonds in the euro area, because GC baskets allowed for any sovereign bond to be treated equally for collateralised repo operations (Buiter and Sibert, 2005). In other words, the authors argued that such a policy incentivised weak fiscal discipline by low-rated sovereigns, because their debt issuing would always be liquid in the eyes of the ECB, even if they had received comparatively lower ratings.

This issue became highly political because of Germany's long-held monetary policy priority to have a politically independent central bank. According to German authorities, the independence status would guarantee price stability and not directly financing government spending, contributing to maintain fiscal discipline (see Jabko, 1999: 481). Indeed, Germany was co-opted by the EC into the monetary union precisely thanks to having guaranteed that the ECB had to remain independent and be unable to directly finance sovereign debt, a principle that was enshrined in the Eurosystem's statute (Protocol 4, 1998).

Thus, to shield itself against the German criticism of implementing discretionary monetary policy decisions, the ECB decided to handle sovereign collateral according to market-based practices, such as margin calls, haircuts, and daily mark-to-market pricing like any other private repo market participant (see Issing, 2005). To this date, the ECB considers it essential for risk management purposes to 'accurately' value collateral, in order to ensure that the money the central bank provides to a counterparty does not exceed the 'actual' collateral value (Bindseil *et al.*, 2017: 15, see also ECB, 2002a: 58). By actual value, the ECB refers to a security value on financial markets. Indeed, according to the ECB, when the value of an asset fluctuates over time in open markets, it is key for its own collateral value to be re-assessed and for new collateral to be demanded, should prices

drop below a certain threshold (i.e. triggering a margin call). As in the words of the ECB's former Executive Board member and Chief Economist Otmar Issing '[i]n its collateral policy, the ECB therefore relies on the judgement of the market to distinguish among government bonds and, implicitly, the fiscal behaviour of member states' (Issing, 2005). In other words, in its understanding of collateral management, the ECB's accurate value of a security is essentially its market price at a given moment.

This is important, because it indicates that the ECB implements its collateral management practices – within the remit of its monetary policy operations – acting like private market actors, hence demanding more collateral in order not to be exposed to the changing value of an asset. As I discussed in Chapter 3, the ECB implements repo and reverse repo operations as a monetary policy tool not only to control liquidity, but also to manage inflation expectation among market participants. Thus, this explicit market-based collateral management approach is central to how the ECB runs its monetary policy within the euro area.

The ECB's market-based approach, implying that the price of sovereign debt would be increasingly determined by financial markets, was in stark contrast to the approach of the other large European central banks before the introduction of the euro, which were not adopting mark-to-market pricing or margin calls on sovereign collateral. With the exception of the Dutch central bank, which was applying weekly, and not daily, mark-to-market pricing and rarely used margin calls, the Belgian, French, German and Italian central banks did not make use of either of the two (Gabor and Ban, 2016: 628). More practically, the ECB's market stance on collateral management means that, should private investors judge, for example, German sovereign bonds less creditworthy, then the ECB would also implement margin calls on the same security accordingly. Similarly, utilising a daily mark-to-market approach meant that the ECB would be valuing a particular

government bond according to the daily price of that asset on financial markets. In short, the ECB has been acting like a private investor with respect to the use of sovereign collateral for its refinancing operations, marking a significant break from how other European central bank handled government debt until then. This is a particularly interesting point that I make with respect to the ECB/Bundesbank comparison, as the former is seen as being largely a replication of the latter in terms of institutional design (e.g. Kaltenthaler, 2005). As in the words of economics professor and candidate-Governor to the Fed Kathryn Dominguez:

> The ECB was modeled on the Bundesbank, both because Germany had a large influence on its design, and because of the perception that the Bundesbank represented "best practice" among the European central banks (Dominguez, 2006: 73)

In what is an original observation made in this thesis, I argue that whereas this similarity may well be the case with respect to monetary policy stance, in that the ECB adopted the Bundesbank's definition of price stability and monetary targeting strategy, the same cannot be said when it comes to collateral management. This is line with what I discussed in Chapter 3, whereby the Bundesbank was, at least initially, largely opposed to market-based and short-term finance, because of the potential negative effect it may have on monetary policy transmission and macroeconomic stability.

Interestingly, the ECB seemed aware that the use of GC baskets could have influenced the investors' pricing of sovereign bonds in the euro area, resulting in lower yields even for those sovereign bonds that received lower credit ratings (ECB, 2002b: 67). At the same time, however, it is precisely this diversification in sovereign bond pricing that was recognised as a main obstacle for the pursue of European financial integration by the

ECB. As discussed above, and along the lines of what ought to be pursued by the Giovannini Group and the EC, European financial market integration had become a key objective for the ECB. Hence, the ECB's move aimed to strike a balance between its political independence and the objective to achieve financial market integration, which resulted in the use of both GC baskets and market-based practices (Gabor and Ban, 2016: 627).

More generally, the introduction of GC baskets by the ECB could be seen as a tool to promote bond yield convergence as prescribed by the so-called Maastricht criteria, an essential condition (and *a priori* requirement) for the smooth functioning of the monetary union[29]. The convergence of long-term interest rates required for the convergence sovereign bonds yields in the euro area. GC baskets facilitated such convergence because it provided securities within the basket with the same value for collateral purposes. However, it is unclear whether this was the ECB's actual intention. Indeed, the ECB has never been explicit about the use of GC baskets to promote interest rate convergence, which, as discussed above, could have been perceived as a highly political move that would have weaken fiscal discipline in the euro area.

Regardless of the political contentions surrounding its monetary policy architecture, the ECB's implementation of GC baskets for sovereign bonds became extremely successful. Indeed, the ECB's decision to create GC baskets for its own repo operations paved the

[29] Agreed by member states as part of the Treaty of Maastricht in 1991, the Maastricht convergence criteria, also known as the Maastricht criteria, are a number of conditions that EU member states need to meet in order to adopt the euro. Such criteria require for the candidate country to convergence on a set of common targets with respect to inflation, government budget deficit, government debt-to-GDP ratio, exchange rate stability and long-term interest rates. For a more detailed explanation, see https://ec.europa.eu/info/business-economy-euro/euro-area/enlargement-euro-area/convergence-criteria-joining_en.

way for dramatically expanding the use of GC baskets across the euro area. By 2008, Europe's largest private repo market actors, such as the CCPs LCH.Clearnet and Eurex Clearing, had also begun adopting GC baskets. Eurex Clearing is a division of Eurex Exchange, Europe's largest futures and options market, which is in turn owned by the *Deutsche Börse* Group. In 2005, Eurex was one of the first large CCPs in Europe to introduce GC baskets for its repo services (see Eurex, 2018). Around two years later, LCH.Clearnet, the world's largest CCP by clearing volume, also announced that it would launch its own GC basket for repo operations in the euro area, which came into force in 2008 (see LCH.Clearnet, 2007). LCH.Clearnet described the introduction of its GC clearing service as a 'step-change improvement in collateral management and efficiency' (ibid).

Indeed, in the announcement note of the GC basket service, John Burke, LCH.Clearnet's former director for fixed income products, claimed that participants of the new GC euro programme would benefit from 'increased liquidity' due to standardized baskets, and, consequently, enhanced trading efficiency (ibid). In short, the ECB established the blueprint for the use of GC repo in Europe. More importantly, the ECB's move had far reaching consequences on the structure of the European repo market, placing sovereign bonds as one of its pillars.

However, the ways in which the ECB simultaneously fuelled the use of euro area sovereign bonds as collateral in repo transactions through market-based practices also exposed government debt markets to collateral crises. As discussed by Gorton and Ordoñez (2014), a collateral crisis emerges whenever a financial shock creates a previously non-existent hierarchy between good and bad collateral, which restricts the usability of the latter. A collateral crisis could affect sovereign debt markets in the euro area in the same ways as during the GFC, which I examined in Chapter 3. The use of

margin calls and haircuts underpinning the collateral practices of repo market participants (that the ECB contributed to institutionalising) could suddenly reduce the liquidity of certain government bonds as collateral in repo transactions, reducing the value of these securities to access short-term funding.

Nevertheless, my understanding of collateral crises goes beyond that of Gorton and Ordoñez, because I claim that the specific position of CCPs in the European financial markets can be a distinctive trigger of collateral crises. I define this dynamic with the novel notion of CCP-induced collateral crisis. As will be discussed in Chapter 5, this is precisely what affected the Irish, Portuguese, Italian and Spanish sovereign debt markets from 2010 to 2012, whereby LCH.Clearnet's margin calls reduced the usability of those countries' sovereign bonds to access short-term funding via repo. More generally, margin calls on selected securities would establish a hierarchy between more and less liquid sovereign collateral, leading to a widening in the spreads between those countries' sovereign bonds (whose liquidity was reduced) against more liquid securities, like German government debt. Therefore, and in light of the findings to be provided in the next chapter, I argue that the ECB's collateral management approach is dysfunctional, because it promotes precisely the dynamic that its GC baskets aimed at preventing in the first place: capital flights from one government debt market to another. This observation is a key contribution that I make to our understanding of the ECB's collateral policy. While Gabor and Ban (2016) do acknowledge the potentially destabilising impact of the ECB's collateral policies, their claims are speculative in nature, as it does not provide any empirical backing to their claims. Thus, in this thesis I contribute to our understanding between repo collateral practices and systemic instabilities by empirically showing that the adoption of repo GC baskets by CCPs has destabilised, and led to capital flights from, the Irish, Portuguese, Italian and Spanish sovereign debt markets, which is precisely what the ECB aimed at preventing.

In this respect, it is interesting to point out that the ECB also acknowledged that, despite its merit in liquidity provision and overall systemic risk reduction, collateralised loans through repos could 'also alter the market dynamics in certain circumstances, in particular through abrupt adjustments of collateral standards (e.g. haircuts) in times of stress' (ECB, 2002b: 64). In other words, the ECB was aware of the potentially destabilising impact of repos. Yet, the ECB also argued that the fragmented structure of repo trading at the time had not reached 'the level of integration and efficiency that is needed to reap the full benefits of the financial area which has flourished with the advent of the single currency' (ibid.).

Thus, I argue that the political imperative of European financial integration (through the creation of a Europeanised repo market) outweighed considerations regarding financial stability. This is a plausible argument to make, especially when considering that the ECB was aware that its collateral management policy would have led to sovereign bond price convergence despite the heterogeneity in the original credit ratings, liquidity profiles and prices of government securities in the euro area.

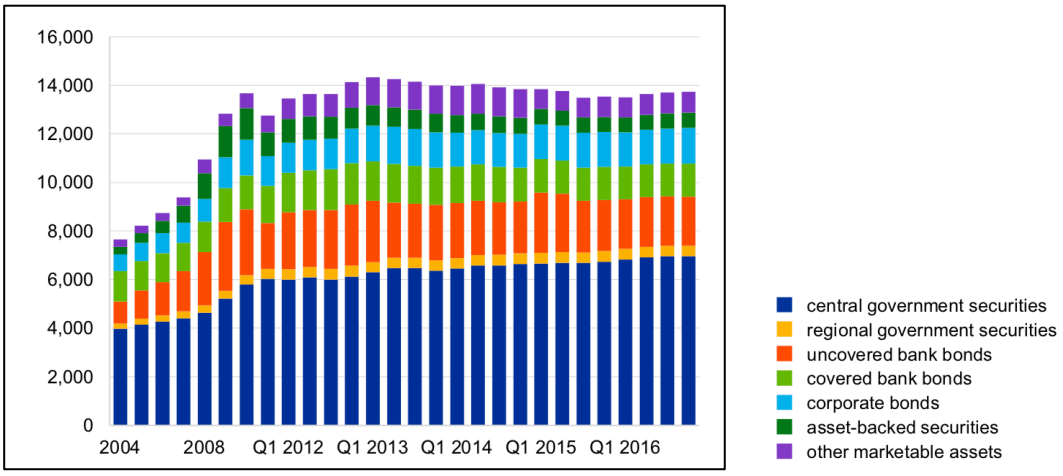
4.2.3 Sovereign bonds in the European repo market today

I found that the use of government bonds as collateral in the euro area greatly expanded since the introduction of GC baskets by the ECB, at over €6tn in the first quarter of 2016 (Fig. 11)[30]. As a matter of fact, figure 11 shows that government bonds have become the fastest growing collateral in the euro area since 2004. The ways in which the introduction of GC baskets by the ECB played a key role in bringing about this significant shift goes as follows.

[30] Reporting only started in 2004.

Whereas the ECB's move was indeed largely successful at preventing capital flight from one sovereign debt market of the euro area to another during the first decade of the euro, it also greatly improved the overall cross-border liquidity of government debt securities in European financial markets. Through the use of GC, the ECB incentivised assets that belonged to that basket when compared to those outside of it. This is due to two factors. First, banks in the euro area are heavily affected by the so-called domestic bias, whereby banks hold large quantities of the sovereign bonds they are headquartered in (Manna, 2011; Moro; 2014: S12). This means that banks in the euro area holding large quantities of domestic sovereign debt found themselves with even more valuable assets, because their domestic debt holding could be employed in repo trading in exchange for any other euro area government bonds.

(Fig. 11) Use of collateral in the euro area (in EUR bn)

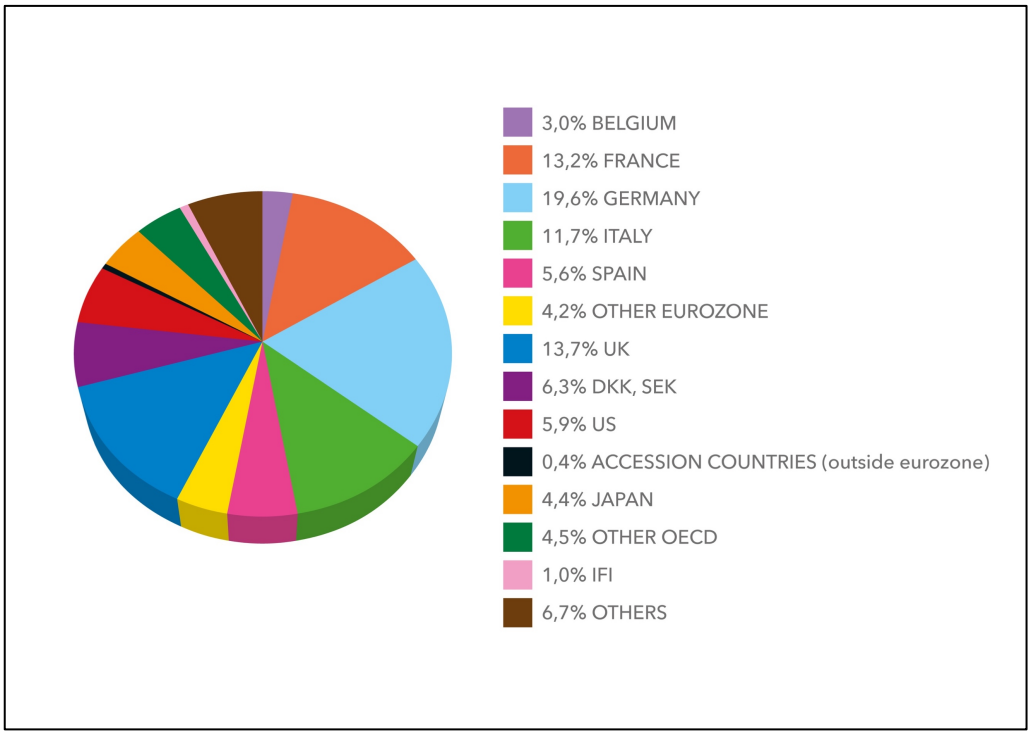


Source: Bindseil, *et al.* (2017: 24).

Secondly, buying and selling sovereign bonds belonging to GC baskets also created profitable earnings for banks by exploiting the price differentials among euro area sovereign bonds, which were much wider when compared to what was available through non-sovereign assets, such as mortgage-backed securities (see ECB, 2002a: 62).

The most immediate consequence of the ECB's move was the transformation of the European repo trading. The unification of collateral and repo markets in the euro area caused for repo trading to become increasingly dependent on sovereign bonds. As shown in figure 12, the share of all government bonds within the pool of EU-originated collateral utilised in repo contracts stood at almost 85.7% in December 2017, roughly €6.2tn.[31] It is interesting to note that traders also rely on non-EU government securities, particularity Japanese and American, which helps to highlight just how much the European repo market participants have become reliant on sovereign bonds as collateral.

(Fig. 12) Fixed-income collateral composition of the European repo market (as a % of total)



Source: ICMA's 2018 European Repo Market Survey (Comotto, 2018: 14).

[31] This figure is derived from the 65 institutions who participated in ICMA's 2018 European Repo Market Survey.

In the US (together with the EU, the world's largest repo markets) the collateral used is much more heterogeneous, which means that the use of sovereign bonds in the euro area is distinctive insofar as they underpin the vast majority of interbank funding operations. Except for bilateral contracts, most of the US repo market does not rely as much on Treasury bills, but employs a combination of corporate bonds, mortgage-backed securities, asset-backed securities, etc. (Martin, 2015). Indeed, according to a recent report by the SIFMA, the American trade group acting on behalf of securities firms, banks, and asset management companies, the use of US Treasury bills as collateral in repo operations stood at around 54% in 2017 (SIFMA, 2017).

As pointed out by the same report, the second largest component of the US repo market collateral base is made of asset- and mortgage-backed securities, at around 26%. Even when compared to other large repo markets, the European one remains unique in how much it relies on sovereign bonds as collateral. For instance, in the Chinese inter-bank repo market, which, worth around $720bn, is roughly one third of its American counterpart, Chinese government bonds make up around 40% of the collateral used, which is equal in size to bonds from financial corporations (see Kendall and Lees, 2017: 76; J.P. Morgan, 2015). In short, although sovereign bonds represent an important collateral base in repo markets across the world, nowhere is their use so prominent as in the European repo market. This means that the European repo-based interbank funding market is closely intertwined with the sovereign debt issuing of the governments in the euro area. This is a particularly relevant finding for the scope of this thesis, because it highlights the importance of sovereign bonds in the provision of short-funding in the euro area.

4.3 The CCP-centred nature of the European repo market

To summarise what has been discussed so far, the European repo markets presented the following characteristics following the introduction of the euro. Thanks to the suggestions contained in the report by the Giovannini Group first, and their implementation in the Directive 2002/47 later, the integration of European financial markets was driven primarily by repo trading and through market-based practices. This means that, aside from the regulatory efforts to harmonise trading rules, it has been up to financial markets to guarantee funding liquidity through repo lending. Therefore, the involvement of the Giovannini Group played a crucial role in the creation of a single European financial space.

Furthermore, sovereign bonds have in effect become the cornerstone of European finance, in their role as the most important collateral in the provision of liquidity. This was mainly due to the efforts by the ECB to improve the integration and liquidity of European financial markets, achieved through the introduction of GC baskets for its own repo transactions. The ECB's handling of sovereign collateral through the use of GC baskets and market-based practices, such as daily mark-to-market and margin calls, has shaped the ways in which sovereign bonds would be treated by large repo market actors in European financial markets.

However, whereas these initiatives aimed at improving the liquidity of European finance through increased cross-border transactions and a unified financial space, they have also exposed sovereign debt markets to CCP-induced collateral crises. This is a key point with respect to answering the research question posed by this project, which seeks to examine the factors that contributed to destabilising sovereign debt markets during the euro crisis. Indeed, I argue that sovereign debt markets in the euro area can be severely destabilised by collateral asymmetries, and not just by the macroeconomic imbalances as claimed by many in the euro crisis literature (see Chapter 1).

The centrality of sovereign bonds in the European repo market helps to highlight the connection between sovereign debt and bank funding as a central aspect that characterised the euro crisis (see Genito, 2013). Indeed, the existence of close links between sovereign debt and the repo-based interbank funding is a central element of the analysis conducted in the next chapter. Chapter 5 shows that spreads from 2010 to 2012 also winded due to investors' concern with funding liquidity risk, and not just by fears of sovereign default, because LCH.Clearnet's margin calls reduced the liquidity of Irish, Portuguese, Italian and Spanish sovereign bonds as collateral to access short-term funding via repos.

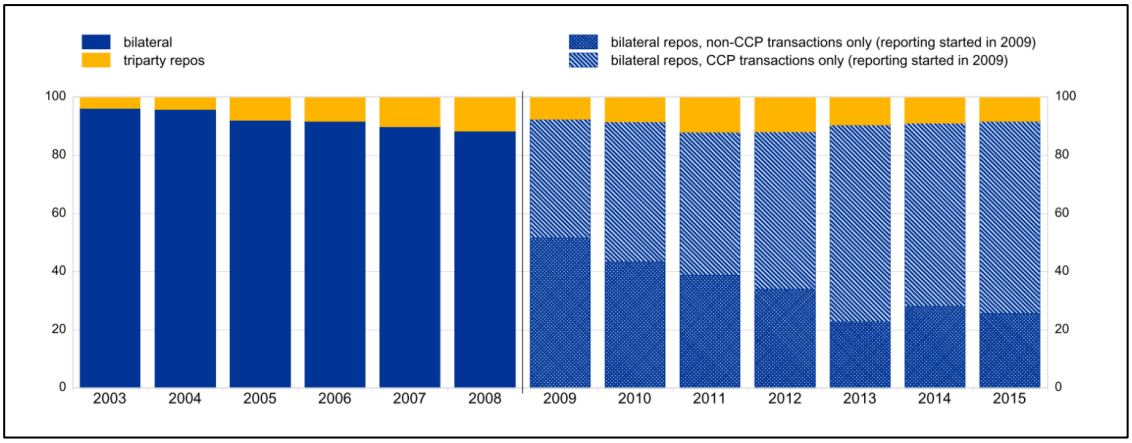
This section discusses another aspect that characterises the European repo market: its reliance on CCPs. As shown in figure 13, in 2015 around 70% of the repo market in the euro area was centrally cleared, whereas triparty arrangements and bilateral non-CCP contracts only contributed to a relatively smaller proportion of the total trade. The figure also shows that the increase in the share of CCP-repos began in 2009, precisely after the introduction of the G20 clearing mandate for OTC derivatives (see Chapter 2). Thus, to an important extent, the expansion of the use of CCPs in the euro repo market is a direct consequence of the new role that CCPs now hold in the OTC derivatives market (see Wendt, 2015)[32].

However, there is more to it. A closer look at how CCPs are differently employed in repo markets in the US and Europe helps highlight differences in how repo trading is conducted across the Atlantic. In the US, more than 50% of repos are managed by triparty agents, while CCPs are largely unused in repo markets (see Copeland *et al*. 2012). Conversely, as shown in figure 13, even before the clearing mandate was implemented, CCPs were already important actors in the euro area, clearing around 40% of the repo

[32] Until 2009, the ECB reporting on the market structure of repo lending in the euro area did not differentiate between non-CCPs bilateral and CCPs bilateral transactions, treating them both simply as 'bilateral'.

market. The main reason for such a significant divergence has to do with how repo markets are structured in the US and Europe, which makes the features of central clearing differently employable between these two markets. In the US, repos are mainly used by securities dealers (non-banks), where market participants are much more heterogeneous, meaning that the collateral they trade is highly diversified (e.g. a mix of corporate bonds, asset-backed securities, mortgage-backed securities, equities, US Treasury bills, etc.) (see Martin, 2015).

(Fig. 13) Breakdown of total secured market (percentages of total)



Source: ECB Money Market Survey (2015: 16).

Indeed, 'in most segments of the U.S. repo market, at least one of the counterparties is a securities dealer', and the collateral is often traded to hedge or speculate on the changes in the market value of those securities (Copeland *et al.,* 2012: 2). This is different in the euro area, where repos are primarily utilised in the much more homogenous interbank funding market, which, as previously mentioned, mainly relies on sovereign bonds as collateral. The more homogenous collateral composition of the European repo market is one of the factors that helps to explain why CCPs have become more widely employed in the EU than the US.

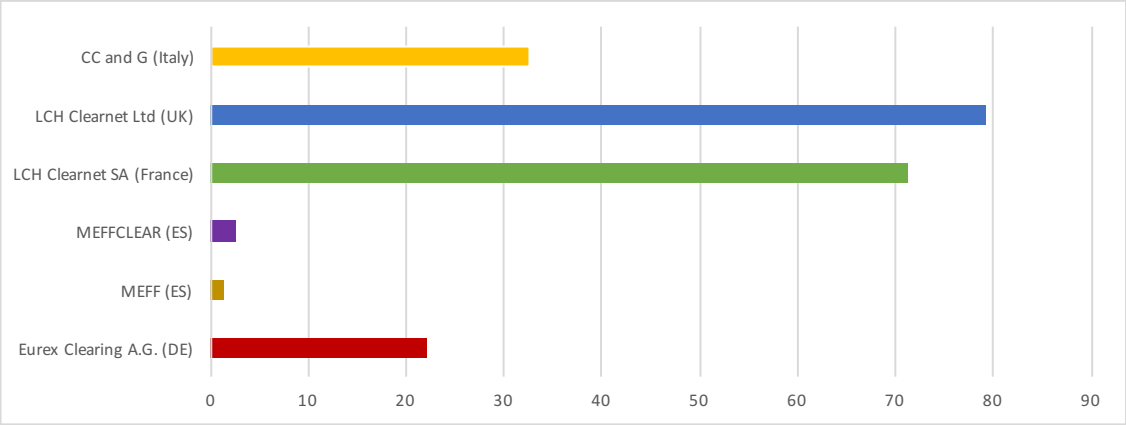
In more technical terms, this has to do with multilateral netting which, as explained in Chapter 2, is one of the core functions of CCPs. Multilateral netting is more effective in markets that trade the same asset class (in Europe, government bonds), because it allows CCPs to sum transactions among different market participants to then see who owes what to whom, instead of settling trades individually. Netting multiple transactions undertaken with the single asset-class, like sovereign bonds in Europe, decreases the number and volume of trades that need settling (see Lee, 2011: 61; Duffie and Zhu, 2011; Gregory, 2014: 72). This is an important point to keep in mind, because it provides a structural determinant as to why CCPs have been more prominent in the European repo market than the US counterpart. The ways in which the European repo market is structured around the same asset class (sovereign bonds) creates an incentive for banks in the euro area to use CCPs in order to reduce both costs and counterparty risk when seeking short-term funding.

This makes central clearing more suitable for the Europe than the US, whose repo market, as discussed before, relies on a more heterogenous collateral composition. However, given what I have discussed in the previous sections, to an important extent the difference in collateral composition between the US and the EU can be ascribed to the ways in which European financial integration was carried out, which has resulted into a massive expansion in the use of sovereign bonds as collateral in repos. This, in turn, has made the collateral market for repos in the euro area much more homogenous. Hence, I argue that the European repo market's higher suitability for the use of CCPs, compared to its US counterpart, can be located to the EC and ECB's political objective of financial market integration.

Nevertheless, the European repo market is not simply reliant on CCPs in general, but on one CCP in particular. Indeed, I found that LCH.Clearnet is the largest CCP in the

European repo market by clearing volume, which alone cleared 75% of CCP-based repo contracts in 2015 (see LCH.Clearnet, 2015). The dominance of LCH.Clearnet in the European repo market is also exemplified by looking at figure 14**,** which compares the notional amount of repo contracts cleared by LCH.Clearnet *vis-à-vis* the other four largest European CCPs. The LCH.Clearnet Group (comprising the London-based LCH.Clearnet Ltd and the French subsidiary LCH.Clearnet SA) together cleared more than twice the value of euro-denominated repo contracts than all the other large CCPs combined. By recalling what has been discussed in Chapter 2, the concentration of OTC derivatives risk in CCPs has recently been highlighted as a systemically relevant issue by regulators, in relation to the objectives set out in the G20 clearing mandate for the reduction of OTC derivatives risk.

(Fig. 14) Value of repo contracts using debt securities cleared in 2015 (in EUR tn)



Source: ECB's Statistical Data Warehouse, own calculations.

Although, as discussed in Chapter 3, the repo market is significantly smaller than OTC derivatives trading, the way in which CCPs accumulate risk exposure remains relevant with respect to the objectives set out in this project. Because repo trading is highly concentrated, large CCPs like LCH.Clearnet are able to exert a particular amount of

influence on traders and sovereign bond prices in the euro area. This is largely due to how CCPs interpose between traders through counterparty substitution and their unilateral imposition of margin requirements (see Chapter 2).

First, it makes sense, from a collateral management perspective, to concentrate your portfolio into a single CCP, especially if you already clear large amounts of assets or contracts with that CCP. Indeed, 'the more assets that are cleared through a single CCP…the lower the total amount of collateral that is likely to be required of each individual participant' (Lee, 2011: 61). That is because a CCP offsets margin requirements in one category of assets against the positions in other categories of assets that are correlated with one another. Hence, investors will need to provide less collateral to clear a diversified portfolio through a single CCP than among multiple CCPs.

However, whereas this point may help to understand the existence of concentration of the clearing business in general, it does not explain the extent of this concentration in the European repo business, and within LCH.Clearnet in particular rather than other CCPs. More importantly, it does not explain why Europe's other leading CCPs lag so far behind LCH.Clearnet in terms of overall clearing volume. In order to understand how and why LCH.Clearnet has come to dominate the European repo market, we need to examine the different interests surrounding the consolidation of the exchange and clearing business in Europe following the introduction of the euro.

4.3.1 Consolidating Europe's exchanges through the creation of a single CCP

This subsection examines the different interests at play in the consolidation of the exchange and clearing business in Europe between the 1990s and the mid-2000s. This analysis is particularly relevant with respect to objectives set out in this project, because

it shows how the specific negotiations and compromises among European exchanges and users gave life to the largest CCP in the world, whose impact on sovereign debt markets from 2010 to 2012 I argue has been highly destabilising. Had these negotiations not led to a final agreement, the clearing and exchange business in Europe may have remained much more fragmented than it is now. As we shall see below, whereas a fragmented clearing industry could have impaired cross-border trades, it may also have prevented LCH.Clearnet from becoming such a systemically important giant in the European repo market.

Until the late 1990s, European exchanges did not have many cross-border relationships outside of their close neighbourhood. Indeed, before euro came into use in 1999, consolidation efforts were mainly regional in nature (see G10, 2001: 61). For example, one of the first significant cross-border mergers was between the stock exchanges of Copenhagen and Stockholm, which, by the end of the 1998, gave life to NOREX. Although the initiative attracted interest from all the other exchanges of the Nordic-Baltic Eight group, with the exception of Finland, NOREX never really managed to expand to include them. The Nordic-Baltic Eight is a regional co-operation organisation made of 5 Nordic countries (Denmark, Sweden, Norway, Iceland, Finland) and 3 Baltic states (Estonia, Latvia and Lithuania). Furthermore, the German *Deutsche Börse* was created in 1993 after the merger of various regional stock exchanges in Germany; and a similar process took place in the Netherlands and Belgium. In other words, pre-euro mergers had a pronounced regional nuance.

The ongoing integration of European financial markets brought by the introduction of the euro would, however, change these regional efforts. Whereas, on the one hand, more integrated financial markets increased competition among Europe's leading exchanges (ibid.), on the other hand the increasingly interconnected nature of European finance also

led to a wide range of possibilities among users and exchanges with respect to enhanced cross-border cooperation, mergers and links. Quite distinctively, these more pan-European cooperation efforts were centred around a series of competitive struggles for the creation of a single European CCP. Indeed, the plan for creating a single European CCP was first proposed respectively by the French and German CCPs Clearnet (owned by the *Bourse de Paris*) and *Deutsche Börse Clearing* (owned by the *Deutsche Börse*), as well as by the Luxembourgish Central Security Depository (CSD) Cedel to merge and create a pan-European clearing and settlement platform, called the European Clearing House (ECH) in May 1999. A CSD is a financial organisation that holds securities (such as shares or bonds) and allows for ownership transfer to take place through a book entry, rather than transfer of actual certificates. Differently from a CCP, a CSD does not assume counterparty risk. Whereas CCPs intervene during the trading phase, by replacing both sides of a trading relationship and thus assuming the responsibility to fulfil contractual obligations, CSDs only take care of the settlement for a given transaction.

Broadly speaking, the ECH was launched hoping that the initiative would have thereafter attracted many other exchanges, CCPs and CSDs from around the continent (see Garfield, 1999). This move began creating tensions among banks and exchanges, however, as Cedel, which was owned by several European banks at time, was also in merger talks with Euroclear, a Belgium-based CSD that was owned by JPMorgan. However, Cedel worried that it would have been completely overshadowed by Euroclear as a consequence of the merger, by virtue of its Belgian counterpart being a substantially larger CSD (see Milner, 1999). Thus, Cedel decided to drop its discussions with Euroclear and joined the French and the Germans in the ECH project. The talks would not last long, as a disagreement between the German and French negotiators broke down the discussions. The disagreement revolved around the different stances of *Deutsche Börse* and the *Bourse de Paris* about the future role of central clearing technologies in European finance.

Whereas the German stock exchange envisaged real-time processing becoming the most efficient alternative to central clearing – which instead nets down positions at the end of the day – the Paris stock exchange insisted upon maintaining its CCP Clearnet as a central block within the ECH project in the years to come (see Norman, 2011: 228).

I argue that the Paris stock exchange's insistence on maintaining central clearing (and Clearnet in particular) as one of the cornerstones of the ECH project is key, because it contributed to fostering the development and expansion of CCPs in Europe. Had the ECH been created according to the *Deutsche Börse*'s vision, central clearing may have become much less significant in Europe than it is now, as it would have likely been replaced by real-time processing. Hence, the destabilising potential of CCPs, which we explored in Chapters 2 and 3, may not have been retained in the European repo market had exchange consolidation happened according to the *Deutsche Börse*'s stance.

Furthermore, the disagreement on central clearing between the French *Bourse* and the German *Börse* also marked an important departure by the latter in the creation of a single trading platform in the euro area. Since the end of the ECH project, *Deutsche Börse* became in fact less engaged in merger deals within the euro area, turning its eye on the LSE instead (see Watson, 2007: 189). The *Deutsche Börse*'s change of direction did not spell the end of Europe's exchange consolidation efforts, however. Quite the opposite in fact.

Despite the internal frictions among the ECH participants, the initiative created the precedent for a rival project. Just a few months after the announcement of the ECH, the Brussels and Amsterdam stock exchanges began discussing creating links with, and incorporating the technologies of, the British CCP London Clearing House (LCH) and the Belgian CSD Euroclear. Although this venture did not materialise either, the renewed

relationship between the Brussels and Amsterdam exchanges on the one hand, and Euroclear on the other, turned out particularity useful when the ECH project fell apart. As the Paris *Bourse* turned its back onto the ECH project, it began looking elsewhere to expand its cross-border business (see Galati and Tsatsaronis, 2003).

Following several rounds of talks among exchanges, CSDs and CCPs, in March 2000 the Brussels, Amsterdam and Paris stock exchanges announced their merger and the creation of Euronext, a new multinational exchange (New York Time, 2000). Without the opposition of *Deutsche Börse* with regard to central clearing, the Paris-based CCP Clearnet was incorporated as a subsidiary of Euronext and linked to Euroclear, in turn dedicated to settlement services (see Stevens, 2010: 172). Back to the point I made above, the importance of Clearnet in this first trans-European exchange needs to be contextualised in relation to the Paris *Bourse'*s insistence on pushing central clearing as a key technology in European financial markets. As Clearnet became integrated as Euronext's clearing arm, the Paris *Bourse* succeeded in establishing central clearing as the core technology at the heart of Europe's newly instituted international exchange. This is important for the scope of this research, insofar as it helps to highlight the contingent nature of central clearing in European finance, and therefore of the relevance of CCPs with respect to systemic stability.

It should also be noted that the integration of Cleaarnet was not an automatic consequence of the *Bourse*'s involvement in Euronext, in the sense that there were also specific reasons as to why the French CCP was chosen as the new exchange's clearing platform. Clearnet originates from the *Banque Central de Compensation*, which was founded in 1888 as a French CCP and had traditionally been clearing commodity contracts in Paris (see Hasenpusch, 2009: 349). It started trading as Clearnet upon being acquired by the *Bourse de Paris* in 1998, after which it merged with several other French CCPs, becoming one

of the largest in Europe. Most importantly, in 1990 the *Marché à Terme International de France* (MATIF), a former French-based futures exchange, acquired the *Banque Central de Compensation* as part of its bid to increase its cross-border activities (see Norman, 2011: 156)[33].

Thus, the *Banque Central de Compensation* first, and Clearnet after, became one of the first European CCPs to have had significant and successful involvement in cross-border clearing outside of its own country. Clearnet's expertise in cross-border clearing quickly became appealing to Euronext's owners, who had created the international exchange precisely with the intention of increasing their cross-border business, thus deciding to integrate Clearnet as a subsidiary. Clearnet's expertise in cross-border clearing has been retained in LCH.Clearnet, which in turn played a key role in making the CCP the central node of the European repo market. This is important, because it helps to understand that Clearnet's expertise in cross-border lending allowed LCH.Clearnet to simultaneously affect different sovereign debt markets, a central aspect of the analysis to be conducted in Chapter 5.

Before moving forward with the analysis, it is important to understand that the creation of Euronext and the integration of Clearnet (as well as of Euroclear) is highly significant insofar as it was based upon a broad consensus and shared interests among some of Europe's largest stock exchanges. In effect, Euronext became the first successful attempt at creating a large cross-border trading and clearing platform in Europe. This

[33] Established in 1986 by the French Treasury, the MATIF first acquired the commodity exchanges of Paris, Lille and Le Havre in 1988, and then in 1993 made an agreement with the *Deutsche Terminbörse*, a German derivatives exchange belonging to *Deutsche Börse* group, to expand each other's cross-border activities (see Norman, 2011: 156). In 1998, the MATIF became part of the *Bourse de Paris.*

consolidation paved the way for the creation of a truly pan-European CCP. Indeed, in 2003 Clearnet and LCH announced a strategic initiative to merge (see OFT, 2003).

However, LCH, formally known as the ICCH, has had a different development from Clearnet (see Rees, 1981), which would create a number of issues to be resolved before the merger could materialise. The London-based CCP became a user-owned, user-governed clearing house in 1996, when its majority ownership was sold from a consortium of six British banks[34] to clearing members (other large banks), while four exchanges[35] became minority shareholders. Thus, whereas Clearnet was owned by European exchanges, LCH has traditionally been in the hands of British banks. These different models, which are usually referred to respectively as vertical- and horizontal-structured CCPs, reflect Europe's main competing approaches to central clearing. The nuances underpinning this divide are particularly important for the scope of this study, because it is precisely the compromise between these models that allowed for the merger to finalise, and thus for LCH.Clearnet to become one of the world's largest and most influential CCPs.

4.3.2 Horizontal and vertical approaches to central clearing and the creation of LCH.Clearnet

Generally speaking, horizontal and vertical models refer to different ownership structures for a CCP. A vertically-structured CCP means that it is incorporated within a trading platform, a model that was born in 1970s US in the futures exchanges of Chicago (see Norman, 2011: 18). In Europe, this is best exemplified by looking at Clearnet, which was

[34] Barclays, Lloyds, Midland, National Westminister, Standard Chartered, Williams and Glyn.

[35] International Petroleum Exchange, London Commodity Exchange, London International Financial Future Exchange, London Metal Exchange).

'vertically' integrated when it became legally incorporated within Euronext. One of the consequences of vertical integration is that the CCP becomes specialised in clearing only the asset classes traded on that platform. This creates a relatively close clearing environment, in the sense that the exchanges often provide preferential clearing treatments to traders on their platforms, making it inconvenient for a trader not utilising a given exchange to use the latter's vertically integrated CCP (see Gregory, 2014). Another characteristic of vertical integration is that CCPs owned by a trading platform, like exchanges, usually opt for a business model that prioritises revenues rather than reducing clearing costs for members (see BIS, 2010: 30). This is key, because the prioritisation of a for-profit business model by the vertical approaches was one of the central contentions that had to be resolved before the LCH.Clearnet merger finalised.

A horizontally-structured CCP refers to when a CCP is majority owned by clearing members themselves and does not belong to the corporate structure of any specific exchange. Therefore, one of the main differences from vertically integrated CCPs is that they are institutionally separate from exchanges and clear across multiple markets and asset classes (see Gregory, 2014). This was the model employed by ICCH first, and LCH later, which were primarily owned by banks and where exchanges were minority shareholders. The horizontal model provided LCH clearing members with the ability to utilise the CCPs' services across multiple exchanges, without being restricted to one in particular as is the case with Eurex's Clearnet. Historically, horizontally-structured CCPs have retained an at-cost business model, whereby the clearing house operates by providing the lowest possible costs for its clearing members, and where increasing clearing-driven revenues is not necessarily a priority (see Norman, 2011: 18)[36].

[36] There is also an important dimension surrounding the different risks posed by each of these two models, which, however, fall outside the scope of this thesis. See BIS (2010) for a general understanding of this subject.

Since the end of the 20th century, most European exchanges employed the vertical model for the clearing of their futures trading, thus following their US counterparts (see Levy-Garboua, 2016). Besides Euronext and Clearnet, this was case with *Deutsche Börse*'s and Eurex's clearing houses. The Intercontinental Exchange employed the same strategy after it acquired the London International Financial Futures and Option Exchange, where the products were cleared by ICE Clear Europe. One important exception to this trend was the London Stock Exchange Group (LSEG). The LSEG preferred the horizontal integration approach for their clearing activities because it did not have its own derivatives trading platform, meaning that it had to rely on other exchanges and CCPs in order to engage in futures contracts[37]. LSEG's preference for horizontally-structured CCPs also allowed for the members-owned LCH to flourish independently of the exchange, while simultaneously becoming one of its biggest clients (e.g. Gregory, 2014; Norman, 2011).

4.3.3 The compromises at the heart of LCH.Clearnet

Clearnet's and LCH's different vertical and horizontal approaches to central clearing inevitably created frictions to be resolved before the merger could be finalised, specifically with respect to what business model the future CCP had to adopt (see Pagano and Hoare, 2003). On the one hand, LCH's horizontal structure meant that, being owned largely by clearing members themselves, the latter wanted the widest possible access to different exchanges and for the future merger to be operating an at-cost business model, prioritising lower fees and costs over larger profits (Lee, 2011). On the other hand, Clearnet inherited Euronext's approach to central clearing, as it had been vertically

[37] This was until 2015, when the LSEG launched its own interest rate derivatives exchange venture called CurveGlobal (see Fintech Futures, 2015).

integrated within the multinational exchange. Euronext saw central clearing as part of its exchange business, prioritising high profit rather than low fees (ibid).

In short, whereas continental Europe's exchanges wanted to ensure high profit margins, British clearing members sought to reduce the exchanges' influence over the future CCP's governance and to lower its membership costs. Ultimately, a deal was struck, however compromises were made from both sides. As the merger between LCH and Clearnet gave life to LCH.Clearnet in 2003, its final design would be a middle ground between LCH's horizontal and Clearnet's vertical approaches to central clearing. As discussed in detail by Lee, the corporate and business model of the new CCP upon the completion of the merger was complex (Lee, 2011: 232).

First, LCH.Clearnet was going to operate as a horizontally-structured CCP, without giving preferential access to Euronext's platforms. Second, it would maintain a for-profit business model to guarantee Euronext a steady income stream. Third, LCH.Clearnet's ownership would be equally divided between users and exchanges. In 2003, LCH.Clearnet was owned 45.1% by exchanges (41.5% of which was held by Euronext, 2.7% by the London Metal Exchange and 0.9% by the International Petroleum Exchange); another 45.1% was divided among user-members; and the remaining 9.8% was held by Euroclear. This was to be expected, in the sense that the ownership was evenly distributed among the main actors at play (continental Europe's Euronext, UK banks owning LCH, and the Belgian-based CSD Euroclear). Fourth, despite having formally agreed for LCH.Clearnet to generate profits, the business model adopted was unique. Negotiators decided to opt for a limited for-profit basis, whereby 70% of any yearly profit exceeding €150m would have been re-distributed to the clearing members (see Hasenpusch, 2009: 356). Seen through another lens, the partial re-distribution of LCH.Clearnet's profit can be thought as a form of clearing fee subsidy for LCH's

members, which again preferred an at-cost business model to reduce the cost of their clearing activities.

In a nutshell, the final corporate structure and design of LCH.Clearnet satisfied both Euronext's for-profit aspiration and LCH's preference for both a less restrictive clearing model that allows users to clear across multiple trading platforms, as well as for a relatively more affordable fee structure than what was available through vertically-structured organisations. I argue that it is precisely the compromise between the interests of clearing members and exchanges interests in European financial markets that allowed for the creation of one of the largest CCPs in the world, clearing a wide range of products across the British, European and American financial markets. In other words, the compromise between the vertical and horizontal approaches contributed to the concentration of almost the entire European repo market in one single CCP, which makes LCH.Clearnet highly relevant for considerations of systemic stability in the euro area.

This is particularly the case with regard to how the CCPs' margin requirements can impact upon liquidity in times of financial distress. As I argued in Chapter 2, the sudden increase in margin requirements can exacerbate liquidity shortages during a financial crisis, because CCPs demand margin collateral in the form of highly liquid assets. In the case of the European repo market, a highly concentrated repo market within a single CCP means that LCH.Clearnet alone could significantly reduce the liquidity of particular government securities as collateral to access short-term funding. Thus, I argue that the reliance of European repo markets on CCPs, and on a single CCP in particular, does not make European financial markets just prone to collateral crises, but to CCP-induced collateral crises.

Margin calls implemented by LCH.Clearnet in times of financial distress can therefore impact upon the liquidity of a variety of euro area government bonds, potentially at the same time, which retains highly destabilising potential to sovereign debt markets. This is precisely the dynamic that I will examine in the next and chapter of this project. Before moving on to my concluding remarks, I will briefly discuss the importance of LCH.Clearnet beyond Europe, in order to provide a sense of just how important this CCP is for global systemic stability.

4.3.4 The importance of LCH.Clearnet in global finance

Besides its absolute dominance in the European repo market, in 2017 and 2018 LCH.Clearnet alone cleared over 50% of the global IRS market (or €136tn), as well as providing clearing services for some of the world's most important exchanges. In terms of raw numbers, table 1 compares the nominal value of repo and OTC derivative contracts cleared by LCH.Clearnet, Eurex Clearing, and CME Clearing for December 2017. Eurex Clearing is Europe's second largest CCP, vertically integrated with the Eurex Exchange, which is in turn owned by *Deutsche Börse*. CME Clearing is an American-based, vertically-structured CCP belonging to the CME Group. By accounting for the amount cleared by LCH.Clearnet Ltd and LCH.Clearnet SA together, the LCH.Clearnet trumps Eurex Clearing and CME Clearing with respect to both repos and OTC derivatives. Hence, as more of the global OTC derivatives trade is being channelled through CCPs, the systemic importance of large CCPs like LCH.Clearnet is more relevant than ever before.

Table 1

Clearing volume for December 2017 (in euros, nominal*)			
	LCH.Clearnet (Ltd+SA)	Eurex Clearing	CME Clearing
Repos	12.4tn	3.8tn	N/A
OTC derivatives	250tn	116m	3.9tn

Sources: Own elaboration based on data available at lch.com; eurexclearing.com; cmegroup.com.

*For repos, these numbers refer to the sum of the contracts' bond nominal value cleared. For OTC, it refers to volume of the cleared transactions. However, it should be noted that transactions cleared by CCPs suffer from double counting, because novation splits the original contract in two. Hence, the actual value of the collateral being cleared in repo by CCPs is half of the face value (same applies for OTC contracts).

These findings indicate that LCH.Clearnet clears a substantially larger amount of trade than other big CCPs. In turn, LCH.Clearnet's size and market share lends support to the discussions about the systemic relevance of CCPs for financial stability, which I discussed in Chapters 2 and 3. CCPs have become increasingly more exposed to OTC derivatives risk than ever before, and thus more interconnected and pivotal for global financial stability. This is also an important point with respect to the objectives set out by this project, which seek to bridge the significant gap in in the euro crisis literature about the systemic importance of CCPs in European financial markets, and of LCH.Clearnet in particular.

4.4 Conclusions

Before the onset of the euro crisis, the European repo market presented the following characteristics: 1) it had one Europeanised collateral market for repos; 2) it was operating largely through the use of sovereign bonds as collateral; 3) it was mainly cleared by one single CCP, LCH.Clearnet. This chapter has shown that this distinctive arrangement is dependent on the politics underpinning the process of European financial integration. Most significantly, the political imperative of financial market integration played a key

role that pushed the EC and the ECB to follow the Giovannini Group's advice and move forward with the creation of a single European financial space through repo trading. In that respect, the ECB's introduction of GC baskets played a key role in expanding the use of sovereign bonds as collateral.

Covering around 85% of the repo collateral base in 2017, sovereign bonds underpin the majority of the short-term funding liquidity needs of banks in the euro area. In no other large repo market jurisdiction do sovereign bonds occupy such a large proportion of the collateral base, which means that government debt has essentially become the life-blood of European finance. In short, European financial integration was developed in such a way as to strengthen the links between sovereign debt and bank funding in the euro area. However, despite the original intent to foster cross-border liquidity, I argued that the integration of European financial markets through market-based practices also made European sovereign debt and repo markets particularly prone to collateral crises. That is because, as envisaged by the Giovannini Group and put into practice by the ECB, repo sovereign collateral would be valued and handled according to the fluctuating prices in financial markets and subjected to daily collateralisation practices such as margin calls. Thus, as the ECB's GC baskets created a single collateral market for repos, the use of margin calls during a crisis could trigger a collateral crisis, meaning creating a hierarchy between good and bad collateral, which would significantly reduce the liquidity of specific securities in favour of others. I claimed that the wide adoption of market-based practices for collateral policies undermines the main objective for the introduction of GC baskets in the first place: preventing capital flights from one sovereign debt market to another.

Furthermore, this chapter has examined the different interests among European exchanges and users that sought to establish a single European trading platform after the

introduction of the euro. In this respect, the insistence by the *Paris Bourse* to retain central clearing as a key technology in European financial markets is a crucial factor that contributed to the expansion of CCPs in Europe. The creation of Euronext in the year 2000, and the acquisition of the French-CCP Clearnet as the new exchange's clearing arm, paved the way for the creation of one of the world's largest CCPs by clearing volume. Following negotiations with LCH's owners on the type of business model to adopt, Euronext and British users finally agreed on the creation of LCH.Clearnet, which would become a leader in different market segments across both the American and European financial markets.

However, the consolidation of Europe's trading platforms did likewise lead to the concentration of the euro-denominated repo market in LCH.Clearnet. This arrangement, I argued, made the already crisis-prone nature of the European repo market also vulnerable to what I call CCP-induced collateral crises. That is because LCH.Clearnet is the largest CCP operating in the euro area, which means that its collateral practices could have negative repercussions on both the provision of short-term funding for banks and the liquidity of sovereign debt markets in the euro area.

These are particularly relevant points with respect to answering the research question posed by this project, namely: what factors contributed to destabilising sovereign debt markets during the height of the euro crisis from 2010 to 2012? First, I have established that, before the onset of the crisis, the euro area was not just exposed to the macroeconomic imbalances and trade asymmetries that stem from the politics of European monetary integration, as discussed by the European-level explanations (see Chapter 1). The analysis conducted in this chapter has also highlighted how the politics of European financial market integration has shaped the European repo market in such a way to expose sovereign debt markets to systemic instabilities. In short, before the crisis

the European sovereign debt markets were not just vulnerable to macroeconomic imbalances, but also to collateral weaknesses.

The next chapter of this project will assess the implication of this arrangement on European sovereign debt markets by examining the involvement of LCH.Clearnet during the height of the euro crisis.

5. LCH.Clearnet and the Euro Crisis

5.1 Introduction

This chapter assesses the role played by LCH.Clearnet during the euro crisis. The analysis relies strongly upon the insights developed throughout the course of this thesis. Central to the assessment conducted below is how CCPs, collateralised lending via repos and the architecture of the European repo market all retain highly destabilising potentials in their own distinctive ways.

Chapter 2 has shown that the ways in which CCPs interpose themselves between traders through counterparty substitution allow them to unilaterally impose margin requirements. The highly liquid nature of the collateral required by CCPs implies that a sudden increase in margin requirements can greatly reduce the liquidity available to investors during a crisis. As demonstrated by reviewing several CCP failures during the 20th century, I show that margin calls reduced the liquidity of assets available to investors, which led to payment difficulties that contributed to the default of traders and the CCPs themselves. In short, the CCPs' use of margin calls during times of financial distress can exacerbate existing liquidity shortages.

Chapter 3 has examined the role played by repo trading in the provision of short-term funding in financial markets. Repo transactions have historically allowed central and commercial banks to foster short-term liquidity in the financial system. However, because repos are essentially collateralised loans, I showed that the sudden lack of repo collateral can generate liquidity shortages in market-based financial systems. Furthermore, the chapter has also shown that margin calls implemented by repo traders can also have a procyclical effect on the value of repo collateral. The increase in margin requirements on

particular assets makes the latter less valuable as collateral to access short-term funding via repos, leading to sell-offs that can trigger further margin calls. Hence, while repos can be an effective source of short-term funding, these instruments can also reduce the value and liquidity of specific securities. In other words, a collateral crisis.

Chapter 4 has examined the distinctive way in which the European repo market is structured. I argued that, on the one hand, the EC and ECB's political imperative for financial market integration and, on the other, the different interests at play in the consolidation of the exchange industry in Europe, have made the European repo market particularly prone to what I call CCP-induced collateral crises. That is because the European repo market is dependent on different euro area sovereign bonds as collateral and is highly concentrated in one particular CCP: LCH.Clearnet.

All of the above brings us to the fifth chapter of this thesis, which will examine the involvement of LCH.Clearnet in the European repo market from 2010 to 2012. It does so by evaluating the impact of LCH.Clearnet's collateral management strategies on repo markets during the Irish, Portuguese, Italian and Spanish crises. Collateral management is a fundamental part of the CCPs' risk strategies. At the same time, as mentioned in Chapter 2, increasing or decreasing the margins required for using specific securities as collateral can have important consequences on financial stability, due to the impact these actions have on the liquidity of these securities.

Studies that assess the involvement of CCPs during the euro crisis generally praise how they have been able to preserve the repo market as a whole (e.g. Mancini *et al.,* 2015). However, the tendency of the literature to assess the provision of repo funding in aggregate overlooks the potentially destabilising consequences of the CCPs' risk management strategies *on specific collateral markets*, such as those of individual

sovereign bond issuers. Therefore, assessing how LCH.Clearnet implemented its collateral management strategies in each different collateral (i.e. sovereign debt) market provides the last building block to answer the research question posed by this project, which seeks to identify the factors that contributed to the destabilisation of sovereign debt markets during the euro crisis.

The main finding of this chapter is that the margin calls implemented by LCH.Clearnet on Irish, Portuguese, Italian and Spanish sovereign bonds have led to large-scale sell-offs, which led to a widening of their respective spreads. In light of what has been discussed in previous chapters, and by examining the specific contexts in which margins and sell-offs took place, I argue that LCH.Clearnet's increase in collateral requirements contributed to a widening of the spreads because they reduced the value of those securities to access short-term funding in repo operations. Therefore, it is the ways in which LCH.Clearnet implemented its collateral policy within the crisis-prone structure of the European repo market that contributed to the destabilisation of sovereign debt markets during the height of the euro crisis. These findings are crucial for the objectives set out in this thesis, because they demonstrate that spread movements during the euro crisis were not only reflecting investors' concerns with sovereign default risk, as discussed by the many studies we examined in Chapter 1.

A note of caution is necessary, however. This chapter does not seek to ascribe to LCH.Clearnet a deterministic power in conditioning market behaviour, because the CCP was not acting in a vacuum. As we shall see below, LCH.Clearnet took many of its collateral policy decisions based on existing spread values, which in effect means that the CCP was being influenced by how investors were trading sovereign bonds before the margin calls were triggered. At the same time, this chapter shows that the collateral management practices of LCH.Clearnet in turn influenced how investors were trading

those sovereign bonds, because the increases in collateral requirements made the cost for using those securities in repo transactions increasingly expensive.

The case study selection has to do with how LCH.Clearnet adopted its collateral management strategies during the euro crisis, which only targeted the sovereign debt markets of Ireland, Portugal, Italy and Spain. Methodologically, the evaluation of LCH.Clearnet's involvement during the sovereign debt crises of the abovementioned cases combines quantitative as well as qualitative analytical techniques. In order to explore the effect of LCH.Clearnet's collateral requirement increases on bond sell-offs, I have collected daily data on the Irish, Portuguese, Italian and Spanish 10-year sovereign bond yield spread against the German bund from the Thomson Reuters' Eikon platform, from 2010 to 2012, which is the timeframe when LCH.Clearnet implemented its margin calls on sovereign collateral (Eikon, n.d.). The spread's daily movements are examined in relation to the timing of the margin calls in each country, the latter collected from LCH.Clearnet's online database (LCH.Clearnet, n.d.).

To assess the impact of margin calls on spread I look at whether an increase in margin requirements matches a widening in the spread on the days the margin calls were announced, as well as the following day. As the spread data refer to the markets' closing price, yield variation from the previous day as a result of margin-induced sell-offs is reflected in the final price at the end of business, as well as on the following day, a technique that is widely employed by financial analysts to assess the impact of day-to-day shocks on bond prices (e.g. Reuters, 2011, 2012a; Cotterill, 2011). Secondly, I examine the long-term impact of margin calls on spread by placing spread and margins data together onto line charts. This allows me to identify long-term trend changes in spread movements since margin calls were introduced, regardless of the short-term, day-to-day effects of the margin increases on the bond sell-offs. Further, as a means to

compare margin calls to other factors that may have influenced spread movements during the period examined, the analysis below also considers credit rating downgrades, monetary policy intervention by the ECB and domestic political upheavals, such as changes in governments, bank failures and bailout requests. These have all been deemed as some of the most important factors that influenced government bond prices and thus their spreads during the euro crisis (see Falagiarda and Reitz, 2015; Falagiarda and Gregori, 2015; Zoli, 2013; Gärtner *et al*., 2011).

There are a few further points to make with respect to the ways in which I conduct the assessment below. First of all, the limited number of the margin calls for each individual country – 10 for Ireland; 6 for Portugal; 4 for Italy; 3 for Spain – do not allow for generalisable findings outside of the case studies examined, or to quantify the effect of margin calls on spread. At the same time, that is also the reason why a regression analysis was not feasible, as larger sample sizes are required in order to correctly estimating relationships between variables (see Bryman, 2012; Agresti and Finlay, 2013). Indeed, the financial economics studies examining the determinants of spread in the euro area all rely on much larger sample sizes (e.g. Büchel, 2013; Beetsma, *et al.*, 2013; Oliveira, *et al.*, 2012; Bernoth and Erdogan, 2012; Falagiarda and Gregory, 2015; De Grauwe and Ji, 2013). However, as I discussed in Chapter 1, these studies are often based on monthly spread data to identify long-term predictors of spread. While their approach allows for a generalisation of the long-term variables which can have an impact on spreads, they are unable to assess the impact of short-term shocks on spread movements, as they themselves acknowledge (e.g. Maltritz, 2012: 664).

In order to assess the short-term impact of LCH.Clearnet's margin calls on spread, I conduct the quantitative analysis alongside a qualitative component, which will allow me to triangulate my findings. The data on margin requirements and spread are examined

throughout a commentary of the specific political and economic contingencies that I have taken into account for each country, such as the roots of their respective sovereign debt crises, the status of their banking sectors, as well as the crisis-specific developments during the period examined. In addition, this chapter also considers other studies, reports and market analyses examining the implication of margin calls on spread during the euro crisis. In short, this chapter employs a contextual understanding of causality. That is to say, the combination of quantitative and qualitative evidence will help me to identify the main contextual factors that are likely to have driven spread movements in relation to the actions undertaken by LCH.Clearnet.

The rest of the chapter is structured as follows: Section 5.2 discusses existing research that assesses the role of CCPs in the European repo market. Section 5.3 explains the introduction and functioning of LCH.Clearnet's new collateral management policy during the euro crisis. Section 5.4 examines the involvement of LCH.Clearnet during the Irish, Portuguese, Italian and Spanish crises. Section 5.5 is dedicated to the concluding remarks, which are that LCH.Clearnet's collateral policies from 2010 to 2012 contributed to reduce the liquidity of Irish, Portuguese, Italian and Spanish sovereign bonds as collateral in repo operations, which led to large-scale sell-offs that widened their spreads.

5.2 Assessing the role of CCPs in the European repo market

As a result of the lack of research looking specifically at the European repo market, studies examining the role of CCPs in the euro area are relatively recent. Indeed, as Hardie *et al.* (2013: 715) already argued a few years back, despite repos are an essential segment of the European short-term funding market, most research on repos has primarily focused on the US (e.g. Gorton and Metrick, 2012; Martin *et al.*, 2014; Copeland *et al.*, 2014). Things have started to change over the past few years, however. The euro crisis debacle

has sparked more attention, particularly in financial economics, to the role played by CCPs on the liquidity provision in the European repo market.

Overall, these studies praise the performance of this market during the euro crisis, arguing that short-term funding via repos in aggregate was not compromised by the turmoil on sovereign debt markets (e.g. Mancini *et al.*, 2015). Although repo rates widened during the height of the crisis (see Chapter 3), which means that the cost of short-term funding actually increased (e.g. Miglietta *et al.*, 2015; Boissel *et al.*, 2017), the repo market as a whole has been resilient. Indeed, Mancini *et al.* (2015) found that repo lending volume did not shrink during the euro crisis, as in the case following the collapse of Lehman in 2008 (see Chapter 3). That is because, these authors argue, CCPs acted as a 'shock absorber', in the sense that repo lending via CCP increased while fear of default was strengthening, something that did not happen in other non-CCP euro repo interbank markets segments or repo markets in the US. Mancini *et al.* argue that it was precisely the mechanisms underpinning central clearing (anonymous trading, counterparty substitution, CCP-imposed margin requirements and the overall reduction of counterparty risk) that provided clearing members with strong financial guarantees, ultimately allowing them to continue accessing short-term funding.

However, the potentially destabilising role of the CCPs' actions during the euro crisis has been entirely overlooked (see Armakola *et al.,* 2017; Bottazzi *et al.*, 2017 as notable exceptions). This is somewhat of a surprising finding, considering what has been discussed in Chapters 2 and 3 about the destabilising potentials of both the CCPs' margins and repo-based financial systems. Therefore, this chapter seeks to further examine the relationship between CCPs, repo margins and financial stability in the euro area. Indeed, whereas the involvement of CCPs during the euro crisis has certainly preserved repo funding in the euro area as a whole, the negative impact of CCP-imposed margin

requirements on collateral markets has been largely overlooked. I argue that the reason for this neglect stems from the tendency to focus on only one criterion when assessing the involvement of CCPs during the euro crisis: whether it was successful in guaranteeing repo liquidity.

These deficiencies manifest on several grounds. First, the central clearing segment of the European repo market is examined in aggregate, without paying sufficient attention to the actions undertaken by systemically important CCPs (see Miglietta *et al*., 2015 as a notable exception). Second, the literature portrays certain assumptions about the functioning of European repo market, whereby the interests of CCPs are understood to be aligned to, and in fact indiscernible from, those of every actor involved in the repo market. CCPs are examined with respect to whether they are successful in guaranteeing the aggregate provision of short-term liquidity via repos, implicitly regarded as the sole functional necessity of the European repo market. As put by Steigerwald, 'CCP's interests, however, may not be exactly aligned with its members' interests or the objectives of public policy', suggesting the decision taken by CCPs may not necessarily be in line with the regulators' requirements to maintain systemic stability (Steigerwald, 2015: 188). The Fed's former Governor Ben Bernanke has in fact argued in 2011 that effective regulation and oversight of CCPs is necessary, in light of the potential risk these institutions pose to systemic stability (see Bernanke, 2011).

With respect to the involvement of CCPs in the euro area, there has also been insufficient attention paid to the systemic impact of their actions with reference to domestic banking systems, as well as when it comes to exacerbating the cost of public debt servicing of governments in the euro area. Indeed, as suggested by Gabor and Ban, the haircut and margining policies of key repo market actors, like the ECB and LCH.Clearnet, has 'helped create a perfect storm for "periphery" governments between 2010 and 2012',

which exacerbated pressures on sovereign debt markets (Gabor and Ban, 2016: 631). Nevertheless, these claims remain speculative in nature, and the precise mechanisms underpinning the CCPs' pressures on the sovereign debt markets of the euro area during the crisis remain almost entirely ignored. This gap calls for a more thorough and systematic empirical observation of said dynamics. Thus, I seek to uncover the significance of the CCPs' relevance for systemic stability in the euro area, providing an assessment of the actions undertaken by LCH.Clearnet during the Irish, Portuguese, Italian, and Spanish sovereign debt crises.

5.3 LCH.Clearnet's Sovereign Risk Framework

LCH.Clearnet implemented its Sovereign Risk Framework (SRF) as a reaction to the perceived changes in market conditions during the Greek crisis in 2009. The SRF was a revised collateral policy in light of the increased sovereign default risk perception that the CCP was facing in the European repo market. As discussed in Chapter 1, the unfolding of the Greek crisis around its fiscal dimension was crucial in shaping an understanding of the euro crisis as essentially a confidence crisis in public debt servicing sustainability. This is mostly clearly evidenced in LCH.Clearnet's SRF, because it was implemented precisely to protect the CCP against increasing default risk while also guaranteeing access to funding for its repo market members (see Burke 2011: 4). That is because, it is important to reiterate, the main task of a CCP is to guarantee the performance of every contract, even in case of default: when it comes to interbank repos, that performance guarantee is directly linked to the continued provision of short-term funding. Thus, while the dimension surrounding sovereign default risk perception remains key to understand the introduction of the SRF, this chapter shows that the margin calls implemented by LCH.Clearent led to a widening of the spreads because they reduced the liquidity of the affected securities as collateral in repo contracts. Hence, I shed light to the role played by

fears regarding the lack of access to short-term funding as a central concern for investors when trading sovereign bonds during the euro crisis.

The SRF introduced three indicators that LCH.Clearnet judged would signal a significant increase of default risk for a given security: 1) sovereign bonds reaching 450bp yield spread at the 10-year maturity against a highly-rated benchmark; or 2) 500bp CDS spread for 5-year positions; or 3) a credit rating drop to B1. If a security, like a sovereign bond, were to meet any of these three criteria, LCH.Clearnet would increase the margin requirements to use that security as collateral. It should be noted that, despite the availability of these criteria, LCH.Clearnet only ever cited sovereign bond yield spreads as the trigger to its margin requirement increases. This can also be evidenced by margin calls having always preceded credit rating downgrades to B1 or CDS widening to 500bp.

In more technical terms, through the introduction of the SRF, LCH.Clearnet sought to ensure that the CCP would have sufficient collateral to close out open positions in case of a clearing member defaulting, in order to conclude the repo agreement. Such an approach to margin requirements and collateral management fits with the contract performance guarantee mission of CCPs, which, as discussed in Chapter 2, has distinguished the development of central clearing since its early stages in 18th century Japan. Equally important, the SRF was approved by LCH.Clearnet's own Risk Committees and board but was developed together with the Fixed Income Risk Working Group, which is made up of major participants in the affected markets, mainly international members (see ibid: 4). In other words, the SRF resulted from a decision taken by LCH.Clearnet in consultation with repo markets' largest international participants. This is important, because, as clarified below, while the actions undertaken by LCH.Clearnet preserved the functioning of the European repo market as a whole (in practice guaranteeing funding liquidity for international investors), it compromised the

liquidity of certain domestic banks and the sovereign debt markets of the affected governments.

As sovereign debt markets were the main channel through which the euro crisis unfolded, the analysis below utilises daily spread data in order to assess the role of LCH.Clearnet therein, which remains a key under-reported factor. Before moving on to the actual assessment, it should be noted that LCH.Clearnet was not acting in a vacuum, meaning that its actions need to be contextualised in relation to other key market actors and processes that took place during the period examined. Firstly, the ECB: a surge in the spread of lower-rated government bonds was noticeable when the ECB announced that its haircut policy would include sovereign bonds in August 2010[38]. Further, the ECB's actions to ease sovereign debt market turmoil in 2011 and 2012 caused declines in sovereign bond yields spread (Dewachter *et al.*, 2016). Secondly, margin calls were often implemented in rapid succession with credit downgrades by CRAs, which have also influenced sovereign yields during the crisis (see Gärtner *et al.* 2011). As mentioned in Chapter 1, sovereign yields are evidenced to have been influenced by a number of different factors during the euro crisis, including country-specific macroeconomic fundamentals and rising sensitivity to deteriorating fundamentals (see Beirne and Fratzscher 2013; De Grauwe and Ji 2013), the news (Beetsma *et al.* 2013), statements by politicians, governmental officials and fiscal policy announcements (Büchel 2013; Falagiarda and Gregori 2015).

Hence, while it can certainly be said that credit rating downgrades and the ECB's intervention during the crisis have influenced sovereign yields, these were just some

[38] A haircut is intended as a reduction of the value of a security used as collateral. In April 2010, the ECB announced the introduction of gradual haircuts on the assets it accepted as collateral, should their credit rating fall in the BBB+ BBB- range (see ECB, 2010).

among many other factors. The same goes for LCH.Clearnet's actions during the crisis, meaning that its margin calls were only one among many other factors that may influence sovereign spreads. Thus, the analysis below assesses LCH.Clearnet's likely impact in influencing sovereign spreads by taking into account the interaction of the CCPs' actions with other key events for each of the individual countries examined, including credit downgrades, political crises, bailout requests and the ECB's interventions.

Further, it is important to point out that LCH.Clearnet did not undertake its decisions in a political void. Although the SRF was developed in-house, it was actually forwarded to stakeholders, like regulators, central banks, and national treasuries already in September 2010, before the framework's public announcement in October 2010 (Burke, 2011). This means that macroeconomic authorities had an opportunity to examine the SRF beforehand. More importantly, when the SRF was triggered for Irish sovereign bonds in November 2010, it was only invoked 'after discussions with the ECB, the Irish Treasury and Central Bank' (ibid: 9). Similarily, LCH.Clearnet's decisions on Portuguese collateral were only undertaken after similar discussions with the Portuguese authorities. In short, regulatory bodies around Europe were aware of what LCH.Clearnet had planned in order to preserve the euro-denominated repo market. However, regulators were informed that LCH.Clearnet's SRF would have only protected the CCP (and its clients) from increasing collateral risk while guaranteeing its members' funding needs, without any mention of the potential destabilising effects the framework may have had on the stability of sovereign debt markets (see ibid: 4). Interestingly, there is no evidence of any of them being concerned about the systemic implications of LCH.Clearnet's actions when the SRF was released, and attention was limited in the subsequent years (e.g. Bank of Italy, 2012).

It should also be noted that although international and EU institutions had become increasingly aware of the potential systemic risk posed by repo markets after the introduction of the euro (see CGFS, 1999a; ECB, 2002b), studies that empirically assessed these instabilities, such as the landmark paper by Gorton and Metrick (2012), had not come out yet, and CCPs themselves were not considered destabilising actors in repo markets. Moreover, up until very recently, there was a general absence of Europe-focused repo market studies, which adds to the overall lack of understanding of the functioning of these instruments in the euro area (see Hardie *et al.*, 2013).

In sum, it is fair to conclude that regulators were not *fully* aware of the systemic impact that the SRF would have on the structural integrity of the euro area and its sovereign debt markets.

The analysis conducted below seeks to provide a distinctive contribution to the literature on the involvement of CCPs in the euro area by showing that the LCH.Clearnet's margin requirement increases compromised the usability of the affected government securities to access short-term funding via repos, which destabilised sovereign debt markets and the liquidity of primarily domestic banks, leading to a widening of the affected countries' spreads.

5.4 LCH.Clearnet's involvement during the Irish, Portuguese, Italian and Spanish crises

The SRF was published in October 2010 and was first implemented for repo market participants by LCH.Clearnet's London-based subsidiary, LCH.Clearnet Ltd, under the name of Risk Management Policy (RMP). The RMP included the following provisions:

> We would generally consider a spread of 450 basis points over the 10-year AAA benchmark to be indicative of additional sovereign risk and LCH.Clearnet Ltd may materially increase the margin required for positions in that issue. As a guide, materially would likely mean an increase in the order of 15% of position size, with further material increases in margin charged as the spread deteriorates further. We will also consider whether additional margin is required from indicators in CDS prices or Market Implied Rating data.
>
> Where a sovereign issuer is downgraded to sub-investment grade by a major rating agency we would generally expect market liquidity to be significantly impacted and may seek to apply additional margin for positions in that issuer.
> If a Clearing Member and sovereign issuer subject to increased 'jump-to-default' risk are highly correlated ('wrong-way' risk) we would also seek additional margin. (LCH.Clearnet, 2010a).

In effect, the RMP transposed the SRF's general provisions into concrete collateral management policies, which included several, better defined criteria that would trigger a margin call. First, the sovereign yield spread differential. The RMP established a numerical threshold (450bp) of yield spreads as an indicator of increasing default risk for sovereign bonds used as collateral in repo transactions. If crossed, LCH.Clearnet would likely increase the margins required to use those bonds as collateral by 15%, making the use of those bonds less appealing (i.e. more expensive) *vis-à-vis* other bonds. Margin requirements would increase further, should the spread against the benchmark deteriorate. Second, LCH.Clearnet would judge the credit downgrade of a major CRA to sub-investment grade and CDS spread data as another indicator for increasing margin requirements, due to the impact the downgrade would have on the liquidity of the security. Third, additional margins could have been demanded by LCH.Clearnet if a clearing

member and a sovereign debt issuer – whose bond prices have been subjected to high price fluctuations – are highly correlated with one another[39]. However, as we shall see below, I found that only spread movements would be cited by LCH.Clearnet as the reason underpinning the margin calls, never referring to the other criteria cited above.

The following figures were developed through an original compilation of: i) daily sovereign bond yields spreads information, gathered from the Thomson Reuters' Eikon platform; ii) credit rating downgrades; iii) LCH.Clearnet's margin requirement increases, collected from the LCH.Clearnet Group's online database; iv) internal and external market shocks that are deemed to have exerted significant sovereign debt market pressure during the euro crisis (e.g. Falagiarda and Reitz, 2015; Falagiarda and Gregori, 2015;

[39] The last criterion utilises the expressions jump-to-default risk and wrong-way risk. Jump-to-default risk, also termed price dislocation, or market dislocation, indicates 'large and widespread asset mispricings', whereby there is a sudden change in the market price of an asset (see Pasquariello, 2014: 1868). It should be noted that the concept of mispricing is based upon an assumption in financial and behavioural economics whereby an asset's correct price is inferred by investors acting rationally (e.g. Baker and Wurgler, 2007). Therefore, according to this view, in times of severe financial distress investors may start acting sentimentally, or irrationally, leading to a sudden change in the pricing of an asset that deviates from its price as rationally inferred in normal times (e.g. Shu and Chang, 2015; Siegel, 1992; Shiller, 2000; Brown and Cliff, 2004). Discussions about the presumed rational and irrational foundation of asset prices go beyond the scope of this study. Thus, this analysis understands jump-to-default risk only with respect to the sudden change in an asset price, without prejudice to the rational/irrational dichotomy of asset pricing. On the other hand, wrong-way risk refers to 'when exposure to a counterparty is adversely correlated with the credit quality of that counterparty' (NASDAQ, 2011). In other words, it is a type of risk where an investor's exposure to a particular asset increases while the default risk of that particular asset rises too. In more concrete terms, LCH.Clearnet probably took into account this type of risk because of the relatively strong 'home bias' in the euro area, whereby banks are highly exposed to the sovereign debt of the country they are headquartered in (see Moro, 2014; see also Manna, 2011).

Zoli, 2013; Gärtner *et al*., 2011). All the examinations, calculations and figures made below are my own, and resulted from an assessment of the abovementioned data.

5.4.1 Ireland

The first country to have experienced the RMP was Ireland, which was undergoing a severe banking crisis at the time. Ireland's financial troubles were rooted in a period of speculative developments in the property market since the end of the 1990s. However, before the speculative boom, Ireland had experienced a decade of strong of export-led economic expansion. Throughout the 1990s, Ireland's economy grew at a considerably higher rate than the rest of its European neighbours, while witnessing a dramatic decline in unemployment. To a large extent, this growth was due to the increasing number of high-value companies (mostly from the US), such as computer and pharmaceutics, who took advantage of Ireland's favourable business environment to access the newly unified European single market (Lane, 2011: 59). Thus, as those multinationals channelled large amounts of foreign direct investments into the country, Ireland accumulated large trade surpluses, while also maintaining budget surpluses between 1996 and 2000.

The 2001 international recession that followed the burst of the doc.com bubble did not, as many expected, slow down the previous 10 years of strong export-led economic growth in Ireland, which had in the meantime been dubbed as the 'Celtic Tiger' by Dublin-based economist and Morgan Stanley employee Kevin Gardiner (see Donovan and Murphy, 2013: 16). Although export-led growth began to slow down in the aftermath of the bursting of the dot.com bubble, economic growth started accelerating very fast by 2003. However, this time around Ireland's economic successes were not driven by the export-led model that had characterised the 2000s.

Rather, from the turn of the century until the GFC, the Irish economy experienced staggering levels of economic growth driven by a boom in investment in housing and commercial property, which was funded by reckless lending practices from local Irish banks, like Anglo Irish Bank, Bank of Ireland, and Allied Irish Bank (see Lane, 2011: 64). On the one hand, property investment was fuelled by international short-term interbank funds, which had become cheap and widely available thanks to the process of European economic integration (Dooley, 2015: 174). On the other hand, the increasing presence of foreign banks in Ireland, like the Royal Bank of Scotland, increased competitive pressures on Irish banks who began to offer mortgages at much cheaper rates, which also increased household debt (see Kelly, 2014).

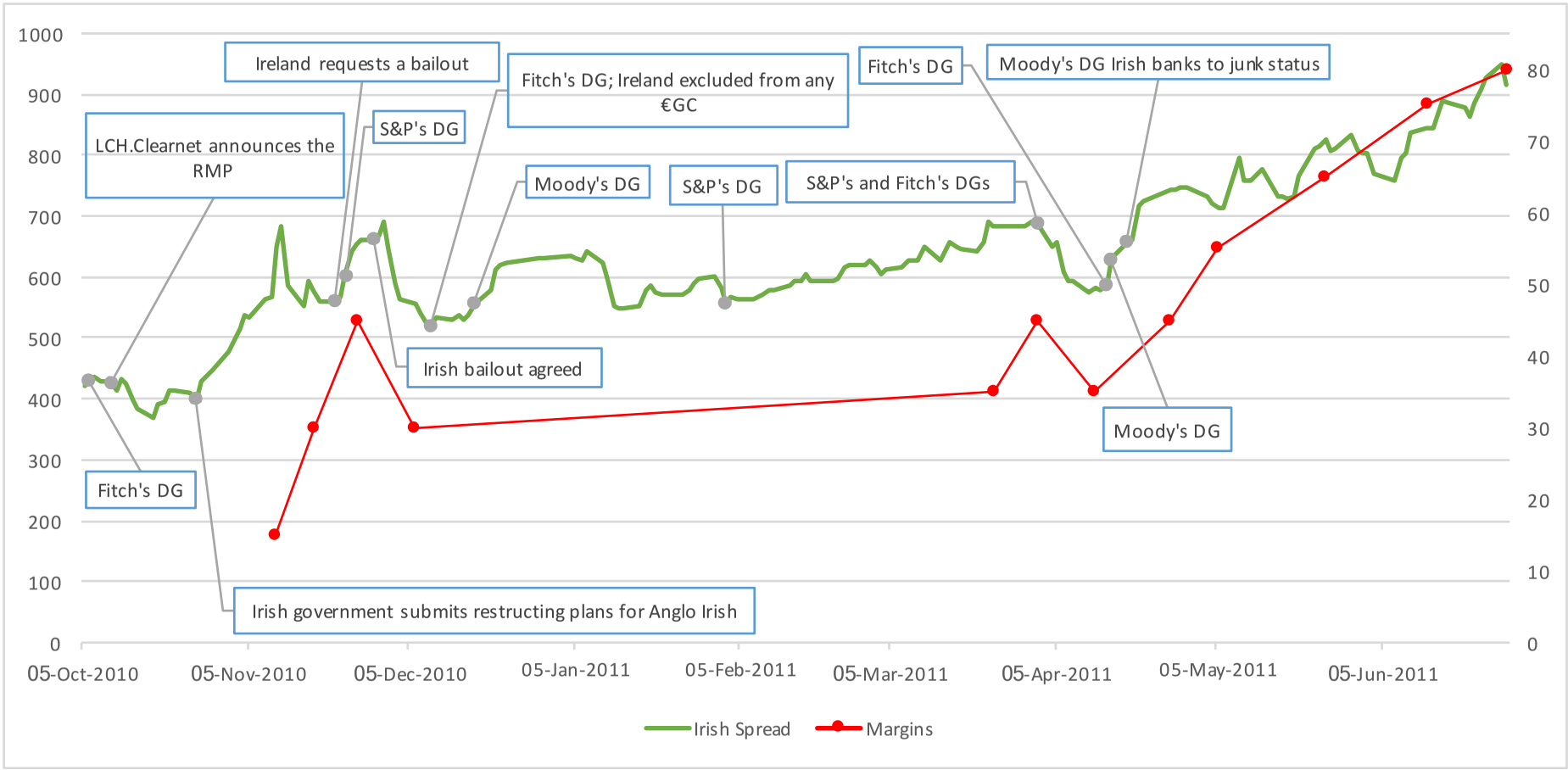
Unquestionably, the GFC triggered Ireland's crisis. As the availability of cheap and reliable funding suddenly stopped, Irish banks suddenly pulled back from the property market as they kept accumulating massive losses (Lane, 2011: 65). The Irish government thus introduced the Government Guarantee Scheme, a blanket guarantee for bank liabilities and deposits for over €400 billion to protect its sinking banking sector (see Hendrikse, 2013: 192). Although the Irish government did not expect to have to pay out on this guarantee, the financial positions of the country's banks turned out to be much worse than initially thought. In addition, the government's funding costs were soaring due to widening sovereign spreads, which ultimately forced the Irish government to make a formal request for international financial assistance. The package totalled €85bn; €35bn of which were dedicated to recapitalising the country's banking system, while €50bn would be used to finance government spending.

LCH.Clearnet's had a key role in exacerbating sovereign debt market turmoil during that period. LCH.Clearnet's actions can be traced back to when the Irish government submitted to the EC on 26 October 2010 the third restructuring plan for its struggling

Anglo-Irish Bank (specialised in commercial property lending) (see EC, 2012b: 19). Amid panic of an imminent banking collapse, investors in Irish government securities began to sell-off Irish government bonds. As Ireland's spreads hovered around 450bp threshold for several days, LCH.Clearnet issued a 15% margin call for using Irish bonds as collateral in repo operations on 10 November (see figure 15). The margin call increased the cost for using Irish government bonds as collateral in repo contracts, which reduced their liquidity. The reaction on Irish sovereign debt markets was immediate. The margin call was followed by large bond-sell offs, as evidenced by the steep widening of Irish spreads on the day of the margin call itself, as well as the following day. Indeed, one of the key findings of this analysis is that the premium that investors were demanding to hold Irish government bonds hit a record high on the day LCH.Clearnet announced the increase in margin requirements for clearing Irish collateral (see appendix I).

The extent of influence that the RMP had on the Irish crisis was deep; as in the words of a broker: '[t]he move by LCH should not be underestimated. It was the increase of margin payments by LCH last November that put Ireland under so much pressure' (in Oakley 2011). Indeed, domestic banks held 15%-20% of all Irish sovereign bonds in circulation in 2010 (see Merler and Pisany-Ferry, 2012). Thus, market analysts estimate that a staggering €8 billion worth of Irish government debt held by local banks was being cleared through LCH.Clearnet, which forced 'Irish banks to sell government bonds as they scrambled to raise the cash needed to meet the new margin requirements' (Oakley and Jones 2010). On the one hand, the cash was needed because Irish banks suddenly found themselves with around €1 billion cash-call by LCH.Clearnet in order to cover the extra margins (see also Jones *et al*. 2010). On the other hand, Irish banks were getting rid of Irish collateral due to its lowered value as collateral in repo transactions, which they badly needed to keep accessing short-term funding.

(Fig. 15) Irish 10-year sovereign bond yield spread (left-hand scale), LCH.Clearnet's margin requirements (right-hand scale)



Source: Thomson Reuters' Eikon and LCH.Clearnet's database, own elaboration.

DG=credit downgrade.

The margin calls compromised the funding liquidity of Irish banks, which effectively contributed to destabilising the country's banking system and sovereign debt market. On 17 November, LCH.Clearnet issued another margin call, this time to 30%. As it became explicit in the notices to its members, the decision to implement margin calls with respect to Ireland was '… based solely on publicly available yield spread data and in no way represents a forward looking market view' (LCH.Clearnet, 2010b). This means that LCH.Clearnet was sticking to one of the key criteria set out in its RMP, whereby further margin calls could be issued should the spread deteriorate. As we shall see below, the fact that further margin calls were implemented as a reaction to widening spread is extremely important, because that is precisely what caused the RMP to retain a procyclical element.

The increase in spread following the margin calls also compromised the funding cost of the Irish government, which found financing government spending increasingly expensive due to the higher yields. With a struggling banking sector and rising government funding costs, on 21 November the Irish government had no choice but to formally request a banking and government bailout. The bailout request caused more sell-offs of Irish securities, which triggered another margin call by LCH.Clearnet on 25 November. The margin call increased the collateral required to clear Irish securities in repo transactions to 45%, causing more sell-offs that were matched with a further widening of the Irish spread. Pressure on Irish spread eased after the bailout was eventually agreed on 28 November. As the RMP follows spread trends, Ireland's securing of €35bn to recapitalise its banks, which guaranteed the funding needs of the Irish banking system, led to a decline in yield differentials that led to a reduction in the Irish margin requirements to 30% on 6 December.

However, another moment that created further stress on Irish sovereign debt markets is linked to Fitch's downgrading of Irish sovereign bonds to sub-investment grade on 9

December, which prompted LCH.Clearnet to exclude Irish sovereign debt from delivery in any euro denominated GC basket (LCH.Clearnet, 2010c). The exclusion meant that a repo contract using Irish sovereign bonds as collateral could have only been concluded with Irish public debt, and no longer with any sovereign bond in the euro area as part of the GC basket. In short, LCH.Clearnet had effectively shut out Ireland from the European repo market.

Spread levels remained relatively stable until the end of March 2011, when LCH.Clearnet made a margin call to 35% on the 24 of that month, which widened the spread, thus triggering another margin increase to 45% on 1 April. Pressure on the Irish sovereign debt market eased after that last increase, particularly in early April 2011, when the EC, the International Monetary Fund (IMF) and the ECB announced that Ireland was making good progresses in overcoming the crisis (EC, ECB, IMF, 2011). This update was followed by a decline in spread and a subsequent reduction in margins back to 35% on 12 April. However, on 18 April the CRA Moody's downgraded the long-term deposit creditworthiness of Irish banks to junk status (Ba1 and Ba2), which followed a downgrade on Irish sovereign debt a few days earlier, due to fears that Ireland would be unable to properly implement fiscal reforms and restructure its banking sector (Moody's, 2011).

Another wave of bond-sell offs followed, widening the spread. LCH.Clearnet reacted by implementing severe margin calls for the next two months, increasing the collateral requirements to 45%, 55%, 65%, 75% and culminating to 80% on June 28 (see appendix I). This study finds that the Irish spreads greatly increased after each margin call, widening to over 900bp after the last increase (a 300bp jump between April to June), which indicated a further wave of concerted selling of Irish government securities. Overall, out of the 10 margin calls that LCH.Clearnet implemented on Irish sovereign bonds, 9 of them were matched by an increase in spread (see appendix I).

To put this into perspective, when Irish bonds were trading with 80% margins it meant that to borrow, for example, €100 with Irish securities, LCH.Clearnet demanded at least €500 worth of collateral. Hence, the finding above suggests that LCH.Clearnet's increases in collateral requirements had a procyclical impact on the Irish spread, in the sense that the consecutive reductions in the value of Irish sovereign bonds as collateral led to sell-offs that further reduced the value of those bonds. The procyclicality of LCH.Clearnet's margin calls on the Irish spread is evidenced by looking at figure 15. Indeed, given the Irish banks' large exposure to Irish sovereign debt, the procyclical impact of margin requirements turned out to be particularly impactful for Irish banks, which were already heavily distressed. Crucially, the sell-offs were taking place despite Ireland having secured state aid in its bailout negotiations. This is key, because it implies that spread kept widening not so much because of investors' concern with the debt-repayment ability of the Irish state, which had been secured through the bailout programme, but primarily due to the reduced liquidity of Irish debt as collateral in short-term repo funding operations as a consequence to the margin calls.

The impact of LCH.Clearnet's margin requirements on the Irish sovereign debt market is particularly evident when compared to the different credit rating downgrades implemented by CRAs during the period examined. Quite remarkably, as shown in figure 15, Irish spreads perfectly match the margins' trend of LCH.Clearnet, both rising and declining, and certain margin calls were followed by pronounced hikes (on 10 November 2010, 25 November 2010, 1 April 2011, 5 May 2011, 25 May 2011, 28 June 2011), something that did not happen with all the credit downgrades. More importantly, LCH.Clearnet did not announce its margin requirement increases due to credit downgrades, as the CCPs' decisions were only based upon spread movements.

That is not to downplay the importance of sovereign credit downgrades in the context of the Irish crisis, however. Indeed, sovereign credit downgrades were matched by a visible (yet comparatively much smaller) widening of Irish spreads, particularly discernible on Fitch's and Moody's downgrades on 17 December 2010 and 15 April 2010 respectively. In this sense, credit downgrades did have an indirect impact on the margin calls through the sell-offs and the widening in spread they caused. Further, LCH.Clearnet's margin calls from April 2011 onwards were implemented only following Moody's sovereign credit and long-term deposit bank rates downgrades, and the exclusion of Irish bonds from delivery in any euro-denominated GC repo was also caused by credit downgrades, which adds to the importance of credit downgrades in the context of the Irish crisis. However, in certain cases there does not seem to be any visible impact of the downgrades of the Irish spreads, or their impact was relatively minimal (Fitch in October 2010, S&P in February 2011, and S&P and Fitch in April 2011).

In short, LCH.Clearnet's 9 out 10 different increases in collateral requirements were followed by immediate reactions on sovereign debt markets, as matched by the large scale bond-sell-offs that widened the Irish 10-year sovereign spread. Thus, what is to be learned from LCH.Clearnet's involvement in the Irish crisis? The Irish banking system was already undergoing a severe banking crisis, which was closely linked to speculative investments in the property sector since the end of the 1990s, which made Irish banks particularly susceptible to external shocks in funding markets. Thus, when LCH.Clearnet publicly announced its SRF in October 2010, its actions contributed to exacerbate pressures on the Irish banking sector via a sovereign debt market shock. Troubled Irish banks were highly exposed to Irish sovereign debt, meaning that margin calls reduced the liquidity of Irish government securities in repo transactions, which made it even more expensive for Irish banks to finance themselves on the repo-based interbank funding market.

It is important to reiterate that I am not trying to argue the that dimension surrounding sovereign default risk perception did not matter – after all, LCH.Clearnet's actions were themselves based upon an increased perception of sovereign default risk. However, the widening in the spread *following LCH.Clearnet's margin calls* were also driven by the reduced liquidity of Irish government bonds in repo transactions, and not only by the increased fear of sovereign default as argued by most of the euro crisis literature (see Chapter 1). Indeed, given the Irish banks' high exposure to Irish sovereign debt, the increase in collateral requirements directly compromised the use of Irish government securities to access short-term funding via repos, which led to the large-scale sell-offs showed above.

This point can be corroborated if we look at how margin calls are associated with the sell-offs *even after Ireland had secured bank and state bailouts*. Upon agreeing a state bailout, Ireland had effectively guaranteed public debt servicing sustainability for the next three years, meaning that the possibility of sovereign default had, in effect, disappeared. Yet, spread kept widening as margin calls were increased, suggesting that banks were not concerned with sovereign solvency during that time, but with the declining value of Irish government securities as collateral in repo transactions. In short, the evidence provided in this analysis indicates that sell-off activities around the time of the margin calls were influenced by the strain on liquidity that LCH.Clearnet had put on Irish government securities to be used as collateral in repo contracts.

Two considerations can finally be made with respect to Ireland. First, as LCH.Clearnet based its collateral requirement decisions purely on bond yield spread data, the sell-offs caused by the margin calls further widened the spread, leading to more margin calls and sell-offs. This dynamic indicates the presence of margin procyclicality on the Irish spread, because the increase in collateral requirements led to bond price declines that triggered

more margin calls, leading to further price declines. Second, the political implication of LCH.Clearnet's margin calls. The destabilising role of LCH.Clearnet between November and December 2010, which made the cost of bank and sovereign debt funding increasingly expensive, can be ascribed as one of the factors that pushed the Irish government to request external financial assistance. Seen through another lens, as the bailout negotiations were essentially a political process (see Hancock, 2015), the political implication of LCH.Clearnet's actions lies precisely in that the RMP represented one of the sovereign debt market destabilising factors that pushed the Irish government to negotiate that bailout program.

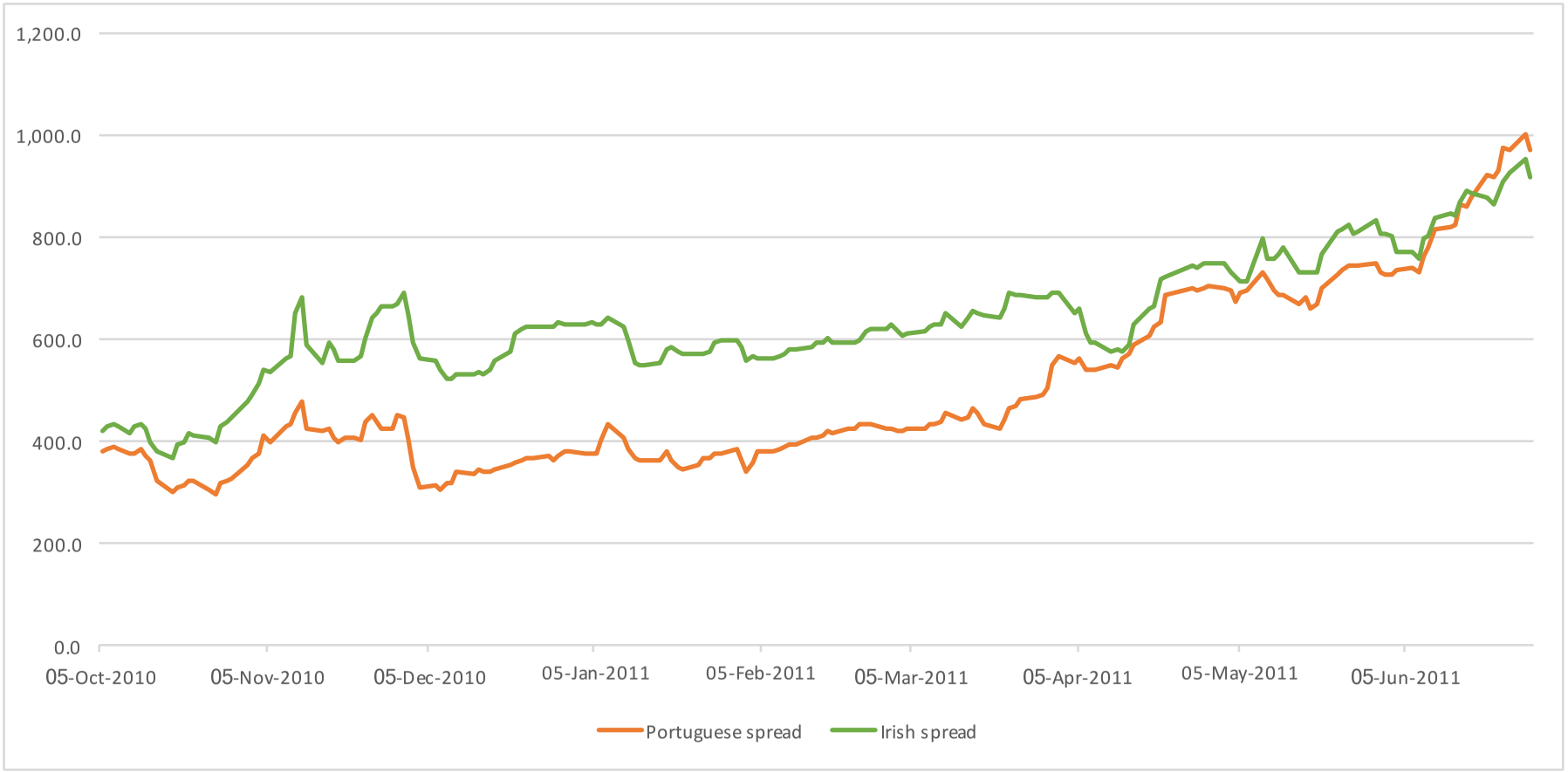
5.4.2 Portugal

The next country to become target of the RMP was Portugal. Differently from Ireland and Spain, Portugal did not experience a property bubble, did not have as much of a dramatic increase in public debt and deficit as Greece, but had one of the lowest growth rates of the entire euro area since the introduction of the euro (Lagoa *et al*., 2014: 6). Two of the main reasons for the Portuguese slump have been ascribed in the channelling of capital inflow in the unproductive, non-tradable sector and the generous pension arrangements (see Reis, 2013). This is far from being only a domestic story, however, as, much like Ireland, reliance on external capital is closely linked to Portugal's joining the processes of European financial liberalisation from the end of the 1980s onwards (see Dooley, 2015: 132). Instead of causing a boom, private unproductive capital inflows led to a slump from the 2000s onwards, which caused both a decline in the productivity of the whole economy and real exchange to rise, compromising the competitiveness of the tradable sector (see Blanchard, 2007). Further, taxes were increased during the slump to meet past promises on old-age pensions, which also contributed to almost a decade of dismal economic performance. Portugal's high dependence on foreign capital meant that,

as capital inflow suddenly stopped, economic activity and domestic consumption also came to a halt. This brought such a significant drop in tax revenues that budget deficit almost tripled in 2009.

Most distinctively, the Portuguese crisis is closely linked to what had previously happened to Ireland. In part, this has to do with the fact that its high private external indebtedness and long-standing productivity difficulties made Portugal the country in the euro area most susceptible to external shocks (see Kalbaska and Gątkowski, 2012). Indeed, the Portuguese crisis was to an important extent the consequence of contagion dynamics, which is when a shock in one given country or region affects others. With respect to Portugal, contagion took place on sovereign bond markets. This dynamic can be evidenced by looking at figure 16 showing that, besides following a very similar trend throughout the crisis, Portuguese sovereign spreads underwent the same hikes experienced by Ireland between October and December 2010, which matches the exact timeframe when LCH.Clearnet first introduced the RMP and triggered margin calls for Irish sovereign bonds. In short, the sovereign debt market shocks inflicted by LCH.Cleranet in Ireland were also felt in Portugal.

(Fig. 16) Ireland's and Portugal's 10-year sovereign bond yield spreads (in percentage points)



Source: Thomson Reuters' Eikon, own calculations.

Interestingly, Portuguese authorities at the time denied the existence of contagion dynamics. This view is best exemplified by the position of the Portuguese Central Bank, blaming the country's sovereign debt market distress on the declining confidence of international investors 'on the sustainability of the public finances' of the Portuguese government (Banco de Portugal, 2010). This position resonates with the analyses portrayed in the euro crisis literature I discussed in Chapter 1, particularly the domestic-level explanations, that ascribe the declining sustainability of domestic finances as one of the factors that deteriorated market confidence towards sovereign solvency.

As the Irish government announced its restructuring plans for the Anglo Irish bank on 26 October 2010, investors reacted in Portugal in a similar fashion as they did with Ireland, which led to sell-offs of Portuguese bonds that widened the country's spread (see appendix I). Moreover, figure 16 shows that LCH.Clearnet's subsequent margin increases on Irish bonds on 10, 17 and 25 November 2010 were matched by similar spread hikes on Portuguese spreads as they did in Ireland. The susceptibility of Portuguese yields to the Irish crisis is also evident once the Irish bailout was agreed at the end of November 2011, whereby Portuguese spreads followed a similar decline as the Irish ones, alongside the falling margins.

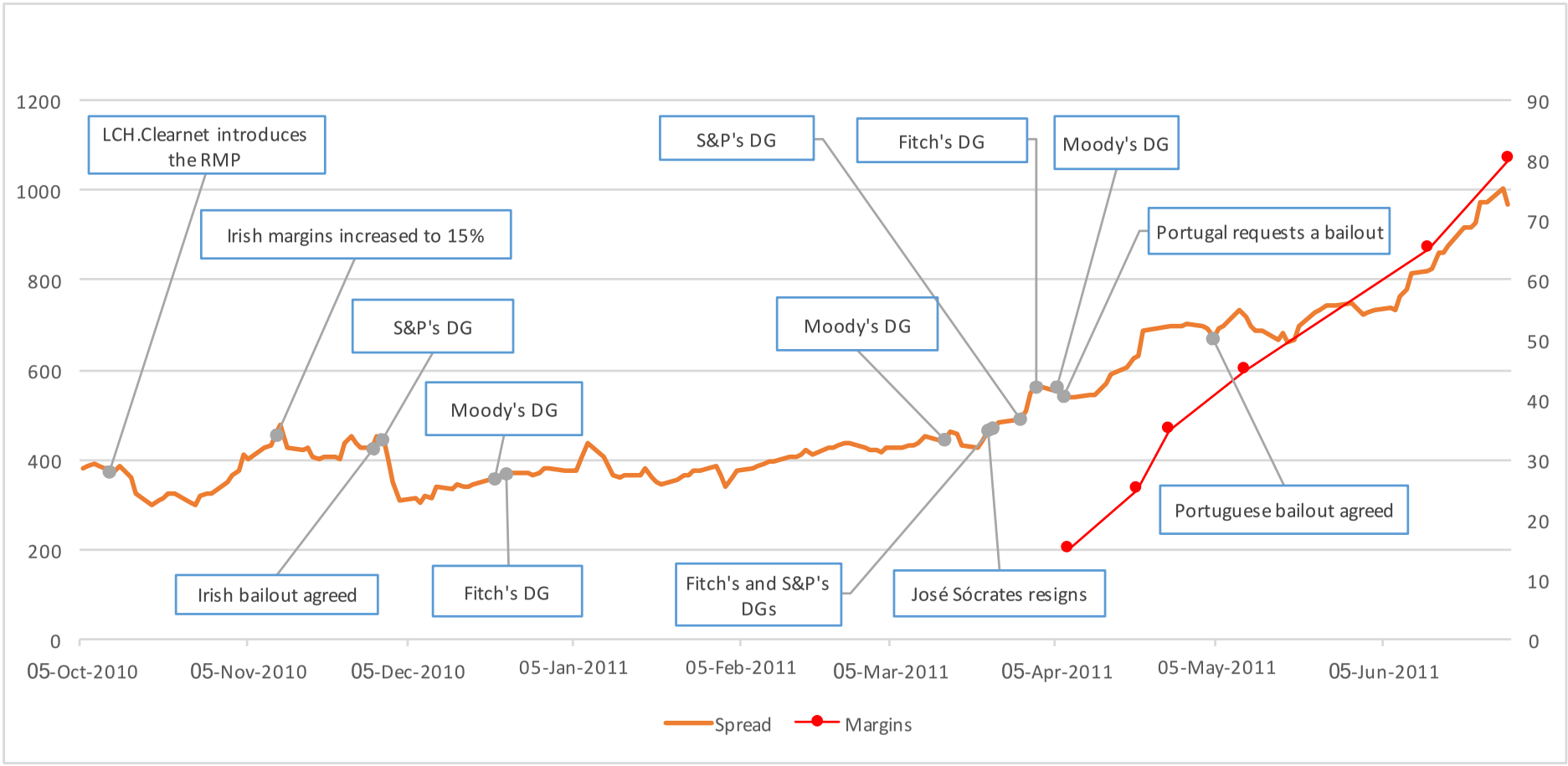
Despite it being closely linked to the developments in Ireland, the Portuguese crisis took a decisive turn for the worse when José Sócrates, then Portugal's prime minister, resigned on 23 March 2011 while failing to pass his fourth package of austerity measures that year. The political instability that followed triggered several credit rating downgrades by Fitch, S&P and Moody's between 24 March and 5 April, which brought Portuguese government debt below investment grade, triggering a yield hike that widened the Portuguese spreads (see appendix I). Just as had happened in Ireland, due to the downgrade LCH.Clearnet

excluded Portuguese collateral from being eligible for delivery in any euro-denominated GC repo basked (LCH.Clearnet, 2011a).

Hence, Portugal remained locked out of the European repo market. Differently from Ireland, however, the exclusion from euro-denominated GC baskets came during a time of serious distress on Portuguese sovereign debt markets, due to the country's political instability. Amid rising spread, on 6 April the Portuguese government requested a bailout, which was immediately followed by a 15% LCH.Clearnet's margin call on Portuguese debt the coming day. As LCH.Clearnet introduced its margin requirement increases only after the Portuguese government requested a bailout, the CCP cannot be said to have had any direct implication with respect to exacerbating sovereign debt market pressure in the lead up to the bailout request. At the same time, however, the actions of LCH.Clearnet contributed to destabilising Portugal's sovereign debt market.

LCH.Clearnet made it unambiguous that its decision to increase collateral requirements on Portuguese sovereign debt was based exclusively on publicly available yield spread data, which had been hovering around the 450bp threshold for several days (LCH.Clearnet, 2011b). In other words, the CCP considered neither the bailout request nor the credit rating downgrades below investment-grade when it implemented margin calls on Portuguese government debt. Indeed, this study finds that LCH.Clearnet increased margin requirements on Portuguese bonds five times from April until June, despite the Portuguese government eventually agreed the previously requested bailout on 4 May (see figure 17). Each of these margin requirement increase (25%, 35%, 45%, 65%) was followed by sell-offs that widened the spread, which likely triggered subsequent increases (see appendix I).

(Fig. 17) Portuguese 10-year sovereign bond yield spread (left-hand scale), LCH.Clearnet's margin requirements (right-hand scale)



Source: Thomson Reuters' Eikon and LCH.Clearnet's database, own elaboration.

DG=credit downgrade.

Then, on 28 June 2011, LCH.Clearnet increased Portuguese margins to 80%, around the time when the Portuguese spread witnessed a similar hike and levels experienced by its Celtic counterpart. Due to the steady increase in margins up to 80%, by the end of June 2011 Portuguese government bonds were no longer usable collateral in repo transactions, since they were worth only 20% of their original value.

In addition, just before the last margin call, Portuguese government securities had peaked to a record high of 1000bp. Thus, this study finds that margin calls are likely associated with a long-term decline in the price of Portuguese government debt, as evidenced by the steep widening of the spread between the first and the last margin call. Crucially, that steep increase in spread since the triggering of the first margin call also indicates the presence of procyclicality (figure 17). The reduction in the value of Portuguese government securities as collateral in repo transactions widened the spread, which led to further margin requirement increase that further widened the spreads. This affected domestic Portuguese banks the most.

Although most major Portuguese banks were less exposed to toxic financial instruments than their European counterparts (see Pereria and Wemans, 2012: 11), they were also large holders of Portuguese government securities. Indeed, between April and June 2011 domestic banks held close to 40% of all the Portuguese government debt in circulation (see Merler and Pisany-Ferry, 2012). It should also be noted that the bailout for Portugal, which was requested before the first margin call, included financial assistance for the banking sector, which is likely the reason why LCH.Clearnet's actions did not compromise the Portuguese banking system to the same extent as in Ireland and, as we shall see below, Spain (see McCaffrey, 2011).

In addition, since the mid-2010s Portuguese banks had been relying a lot on the ECB for their funding needs (Cavalier, 2011: 7). However, the increase in margin requirements remained a troubling event for domestic banks. As they held a large stock-pile of Portuguese government bonds, the increases in collateral requirements compromised the ability by domestic banks to use Portuguese sovereign debt to finance short-term funding need through repos (see Caldas, 2017). Hence, as shown in figure 17, investors began a massive sell-off since LCH.Clearnet started increasing margin requirements from 7 April all the way through June, which is evidenced by an increase in spread trends.

In conclusion, what can we learn from the Portuguese experience of LCH.Clearnet's RMP, with respect to the importance of liquidity in relation to spread? It is important to recognise that the Portuguese crisis is linked to a large degree to contagion dynamics from Ireland, as evidenced by the Portuguese sovereign bond sell-offs that took place during key moments of the Irish crisis. Further, the involvement of LCH.Clearnet during the Portuguese crisis was less impactful than in the case of Ireland, primarily because the RMP was triggered after the Portuguese government requested a bailout. This means that, differently from Ireland, we cannot ascribe any direct role of LCH.Clearnet's actions on the bailout request, as the margin calls took place after Portugal asked for financial assistance. For the same reason, the increase in collateral requirements, despite having increased funding pressure for Portuguese banks, did not destabilise the Portuguese banking system as a whole, as the bailout also provided funds to recapitalise the country's banks.

However, LCH.Clearnet's margin calls did retain a destabilising impact on Portuguese sovereign debt market. Out of the 6 margin calls that LCH.Clearnet implemented on Portugal sovereign debt, 5 of those are matched by an increase in spread (see appendix I). A question arises, however, about the timings of the margin calls. If investors were

rather concerned with the public debt servicing sustainability of the Portuguese sovereigns, a view often employed in the euro crisis literature (see Chapter 1), then why would sell-offs take place *after* the Portuguese government had secured both a state and bank bailout, and after the Portuguese government introduced austerity measures? In light of what discussed above, I argue that the sell-offs took place in the aftermath of the margin calls because LCH.Clearnet's actions reduced the liquidity of Portuguese government securities as collateral in short-term funding operations.

This is a particularly important point with respect to the objectives set out in this project, because these finding suggest that the spread hikes in Portugal from April to June 2011 reflected the concerns that investors had with the declining liquidity of Portuguese government securities to access short-term funding, and not with their heightened sovereign default risk. Therefore, the involvement of LCH.Clearnet during the Portuguese crisis provides us with similar insights as in the case of Ireland, with respect to the relationship between sovereign spread movements and market sentiment regarding funding liquidity.

Equally important, like in Ireland, LCH.Clearnet based its collateral requirement decisions for Portuguese government securities explicitly on the RMP's threshold and only on bond yield spread data. Thus, as the margin calls reduced the value of Portuguese government bonds, leading to large-scale sell-offs, LCH.Clearnet further increased margin requirements amid rising spread, which led to further sell-offs. Hence, the dynamic explained above shares the same element of margin procyclicality that I discussed in the case of Ireland, and that I have examined in relation to the US subprime mortgage crisis in 2008 (see Chapter 3).

Finally, a difference with Ireland is the role of credit downgrades. CRAs have exacerbated stress on Portuguese sovereign debt markets much more significantly than in the case of Ireland. Fitch's and Moody's downgrade of Portuguese government securities to sub-investment grade triggered an increase in spread around and above the 450bp threshold that, a few days later, triggered a margin call by LCH.Clearnet. Indeed, credit rating downgrades did not directly trigger the RMP, as LCH.Clearnet based its collateral requirement decisions on Portugal solely on bond yield spreads data. However, given the more impactful effect they had in triggering sell-offs, credit downgrades can be argued to have indirectly underpinned the triggering of LCH.Clearnet's first margin call due to the more visible role they had in influencing spread movements.

Margin requirement increases also took place for Italian and Spanish sovereign bonds. These margin calls were issued by LCH.Clearnet SA, the Paris-based subsidiary of the LCH.Clearnet Group, which was more heavily involved in the Spanish and Italian domestic sovereign bond markets than LCH.Clearnet Ltd. Interestingly, LCH.Clearnet SA applied its margin requirement increases in a different way to LCH.Clearnet Ltd.

5.4.3 Shift in attitude: LCH.Clearnet's different collateral management approaches for Italy and Spain

Differently from LCH.Clearnet Ltd, LCH.Clearnet SA was not formally employing the RMP, and did not disclose to market participants which criteria would thereafter trigger margin calls (see Keohane 2012; see also Cotterill, 2011). Further, as shown below, this study finds that the actual size of the margin increases for Italy and Spain was substantially lower than what was previously experienced by Ireland and Portugal. Before moving on to assess the last two cases, some commentary is required in order to make sense of LCH.Clearnet's different approaches to Italy and Spain.

This is an interesting puzzle, because it seems plausible that LCH.Clearnet deliberately took a softer approach in how it treated Italian and Spanish government bonds. However, this story is not that straightforward. LCH.Clearnet received no formal criticism by European authorities with respect to how it implemented its margin calls within the context of the SRF/RMP. Quite the opposite in fact, as EU regulators generally praised CCPs for the ways they preserved repo funding in the euro area during the euro crisis (e.g. Constâncio, 2012). That is not to say that central clearing had been overlooked by regulators, because CCPs were most clearly under scrutiny during those years. At the time, however, EU policy makers were still mostly concerned with implementing the G20 mandatory clearing provisions for OTC derivatives (see Chapter 2). EMIR, the relevant European legislation that introduced mandatory clearing for OTC derivatives, was proposed by the EC in September 2010, and had been undergoing legislative scrutiny by the European Parliament and the Council of the European Union between July 2011 and July 2012 (see Pagliari, 2013). However, EMIR was not directly concerned with repos, as it only aimed at transposing the mandatory clearing commitment for OTC derivatives into EU law, which means that the systemic relevance of CCPs was only being assessed in relation to OTC derivatives risk.

LCH.Clearnet's changing approach may have come from within the company itself, which is relatable to how LCH.Clearnet handles risk management in more general terms. Given the CCPs' primary objective to guarantee the performance of every contract, LCH.Clearnet's risk management strategies do not seek to terminate the operations of markets, like the euro-denominated repo market for instance, not even in times of severe turmoil. Indeed, while presenting the SRF at the ECB's Money Market Contact Group in 2011, LCH.Clearnet's former executive director and head of fixed income John Burke stated that:

> [The SRF] [a]llows for LCH.Clearnet to protect itself from increasing risks in a transparent way whilst providing certainty of funding for fixed income participants – (*we will not cease clearing a market*) (Burke, 2011: 4, emphasis added) [40].

LCH.Clearnet's increase in collateral requirements did not, in fact, close repo operations. It certainly caused liquidity strains for Irish, Portuguese (and, as we shall see below, Italian and Spanish) banks, excluded Irish and Portuguese collateral from the euro GC baskets, and made it more expensive to use those securities in repo transactions, but it never actually stopped accepting any of the affected security as collateral or offering repo services. At the same time, LCH.Clearnet's risk management 'philosophy' for its RepoClear service is to cause 'minimal disruption to the market', which essentially means to keep its repo clearing services open even in times of financial distress (LCH.Clearnet, 2018).

If we are to assume, with the benefit of hindsight, that LCH.Clearnet became somewhat aware of the destabilising implication of its margin calls, it could be argued that LCH.Clearnet may have decided to revise its collateral management policy. Indeed, the disruption caused by LCH.Clearnet calls in Ireland and Portugal, by exacerbating pressures on their respective sovereign debt markets and banks, may have compelled LCH.Clearnet to adopt a softer approach with Italy and Spain, whose sovereign bond

[40] Founded in 1999, the Money Market Contact Group is a forum for discussing issues related to the money market in the euro area, such as short-term market developments, changing regulatory trends, and the ways in which the euro money market works more generally. The Money Market Contact Group meets several times a year, is composed of representatives of the ECB and of the different commercial banks of the euro area.

markets represent respectively the third and fourth largest collateral-base of the European repo market as a whole.

This means that the collapse of the Italian or Spanish sovereign debt markets could have spelled the end of the euro area, wiping out the entire European repo market and thus compromising the funding liquidity of all LCH.Clearnet's clearing members, international or domestic alike. Though this was never made explicit by LCH.Clearnet (the internal discussions undertaken by LCH.Clearnet's risk committees are highly confidential), it does remain a plausible interpretation, especially given the lower margin requirement increases overall in Italy and Spain, the absence of a formal numerical trigger or other criteria, and, perhaps most importantly, the fact that Italy and Spain are some of the largest sovereign debt (and repo collateral) markets in the euro area. The view that LCH.Clearnet SA's softer approach for Italy and Spain came from within the company has also been portrayed by some financial news commentators (e.g. Kehoane, 2012; Cotterill, 2011). However, even they have admitted that they are not fully aware of the context in which LCH.Clearnet SA took a different margin policy when compared to LCH.Clearnet Ltd., precisely because of the relatively more opaque nature of the collateral decision-making of the former. Now, back to the case studies.

5.4.4 Italy

With regard to Italy, its conservative banking sector had proven fairly resilient to the credit crunch of 2008. Indeed, much like their Portuguese counterparts, Italian banks maintained a very low exposure to the complex financial instruments that underpinned the GFC (see Quaglia and Royo, 2015). Further, Italian banks were lending mostly between themselves. As a matter of fact, it has been estimated that the Italian banking system maintained the highest 'home bias' in the euro area between 2004 and 2009,

meaning that Italian banks were the least likely to undertake cross-border lending outside of Italy (see Manna, 2011: 25). Thus, whereas Italian banks were still reliant on wholesale, interbank funding, this was conducted mostly with other Italian banks.

Very differently from Portugal, Ireland and, as we shall see below, Spain, Italian banks did not channel their funding onto property developers (Ireland and Spain), and did not foster a credit boom (Portugal). Indeed, Italian banks mostly lent to non-financial corporations, a third of which went to services and industry (see Bank of Italy, 2008). This all contributed to a banking system that was fairly resilient to the sub-prime mortgage crisis of the US, and the credit crunch that followed. However, the combination of a large stock-pile of public debt, over a decade of sluggish growth, and mounting domestic political instability, laid the foundations for market turbulence to extend to the country's sovereign debt market.

According to the Eurostat, in late 2011 Italy was the second largest sovereign debt issuer in the euro area, followed by Germany. Italy suffered from decades of low growth and labour productivity rates, contributing to a debt-to-GDP ratio above 100% since the 1990s, as well as having sustained significant trade deficits since the introduction of the euro (see OECD, 2012: 7). However, these trends were long-term trajectories of the Italian economy, meaning that investors did not make unexpected discoveries about Italy's fiscal stance (like they did in the case of Greece) or suddenly started worrying about the country's bank solvency (like they did in Ireland, Portugal and Spain). To a degree, then, the turmoil on Italian sovereign debt markets between 2011 and 2012 has been ascribed to broader fears about the future of the euro, given the limited response of the ECB and the divisions among European leaders at the time (see Hopkin, 2012; Pagano, 2010). At the same time, it also became increasingly clear that, given the size of its public debt and funding needs, Italy was deemed too big to be bailed out, suggesting

that Italy's sovereign default could have severely compromised the structural integrity of the euro area.

Pressure on Italy's sovereign debt markets began to exacerbate during the second half of 2011, when Berlusconi's parliamentary majority began to crumble, raising doubts about the government's handling of the crisis. In addition, external pressures from European politicians and institutions (particularly the ECB, which, in a leaked letter[41], asked Berlusconi's government to implement much harsher spending cuts than its administration had already committed to) posed further uncertainty about Italy's political stability and economic future. As Italy's spread kept widening, on 9 November 2011, LCH.Clearnet SA raised the margin requirements for 10-year issues from 6.65% to 11.65%. Before going any further, it is necessary to provide a short commentary about the difficulty of spotting any long-term trend of margin calls on the Italian spread, as opposed to what was witnessed in Ireland and Portugal.

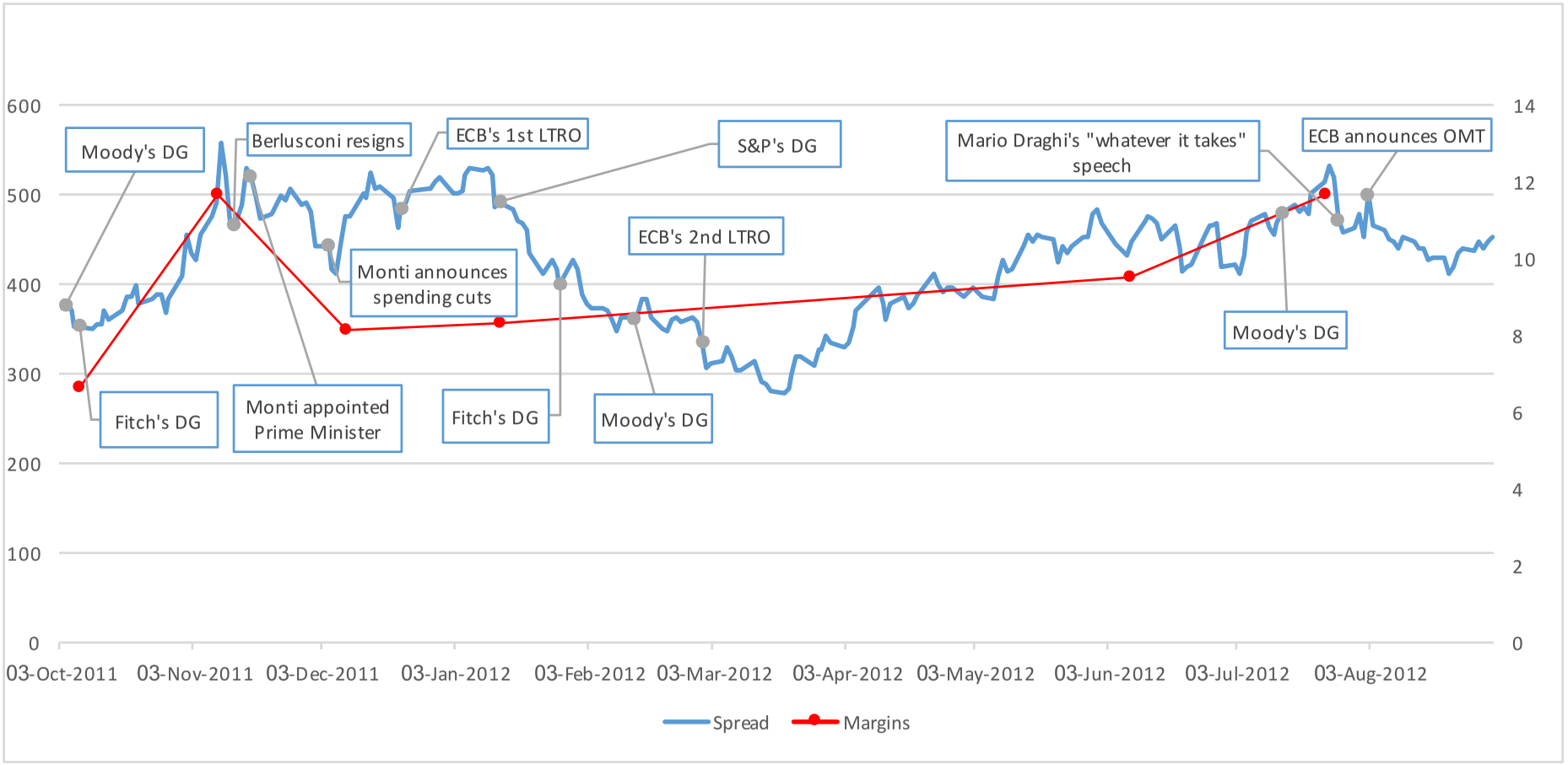
First, LCH.Clearnet only increased margin requirements on Italian sovereign bonds four times, which makes any long-term trend assessment unfeasible. Secondly, there were two important factors that made Italian sovereign debt extremely volatile. The reason why Italian spread kept hiking and declining so suddenly between the end of 2011 and early 2012 is because, to a significant extent, Italian sovereign bonds were subject to severe speculative activities during those years (Jones, 2012). This can be witnessed by the much more intense and frequent hikes and declines of Italian spreads when compared to Ireland and Portugal. Indeed, the extent of speculation has been so dramatic that Italy even took Deutsche Bank to court in 2016, citing market distorting practices caused by the bank's sudden massive sell-offs of Italian sovereign bonds in early 2011, despite having informed its clients that Italy presented no real risk (see Damiani, 2016). Similarly, in late

[41] See Draghi and Trichet (2011).

2012, Italy banned short-selling and imposed restrictions on the use of CDSs with government bonds (Consob, 2012).

In addition, the ECB exerted a strong downward pressure on Italian spreads. The ECB's launch of its 3-year Long-Term Refinancing Operations (LTROs), on 21 December 2011 and 29 February 2012, caused a downward trend of Italian sovereign spreads (see figure 18). The two LTROs allowed banks in the euro area to borrow money from the ECB at a very low (1%) interest rate with a three-year maturity, funding which was made even more accessible thanks to the ECB's increase in collateral availability by reducing the rating threshold for certain asset-backed securities. In other words, the LTROs gave banks (particularly sovereign bond-rich institutions) a much more convenient source of funding than what was available in the interbank market, particularly useful if we consider the LCH.Clearnet-led fragmentation of the European repo market and its increases in collateral requirements. In short, the LTROs ought to improve the access to financing for banks in the euro area.

(Fig. 18) Italian 10-year sovereign bond yield spread (left-hand scale), LCH.Clearnet's margin requirements (right-hand scale)



Source: Thomson Reuters' Eikon and LCH.Clearnet's database, own elaboration.

DG=credit downgrade.

It should be stressed that the stated objective of the 3-year LTROs was not to reduce sovereign bond yields, neither directly nor indirectly. Through its LTRO programme, the ECB only formally sought to 'support bank lending and liquidity in the euro area', and not government spending (ECB, 2011). As discussed in one of its own studies assessing the impact of the LTROs, the ECB only ever made reference to the positive impact of its actions on the funding conditions of banks in the euro area (see ECB, 2012). Yet, evidence suggests that the cheap funding provided with the 3-year LTORs encouraged banks in the euro area to buy higher yielding sovereign bonds (a practice that is also called carry-trade), which materially contributed to a decline of Italian spread in the 3 months following the two programmes (see Casiraghi *et al.*, 2016: 299). Given the above, it is plausible to assume that the LTROs overrode other shocks on Italian sovereign debt market during that time, such as the credit rating downgrades on 13, 27 January 2012 and 13 February 2012.

Therefore, the very small number of margin calls, speculation on Italian sovereign bonds during the crisis, and the ECB's refinancing interventions make the identification of specific long-term patterns between margin calls and spread unworkable. However, Italy's spread often widened in the aftermath of LCH.Clearnet's collateral requirement increases, suggesting the existence of a short-term impact of individual margin calls on the sell-offs of Italian sovereign bonds, which are worth exploring in more detail.

Indeed, after LCH.Clearnet triggered a margin call on 9 November 2011, Italy witnessed a severe spread hike (see figure 18). To an important degree, the extent of the increase is linked to the interoperability agreements with the Italian-based CCP *Cassa Compensazione e Garanzia* (CC&G). Among the different forms of interoperability agreements, which are essentially links between CCPs (see ESMA, 2016), the one characterising the relationship between LCH.Clearnet SA and CC&G allows investors

trading financial instruments on selected trading platforms to be clearing members of either of the two CCPs, as if they were a single entity. In short, two clearing members belonging to LCH.Clearnet SA and CC&G can conduct a repo transaction as if they were being cleared by the same CCP.

Taken together, LCH.Clearnet SA and CC&G, which are used respectively by international and domestic financial institutions, clear over 90% of Italian repos traded on the MTS, the largest electronic trading platforms for Italian government securities (Miglietta, *et al*., 2015: 7). Crucially, for such an interoperability agreement to work, margin requirements from both CCPs need to coincide, so that if one CCP changes its margin requirements for a particular security, then the other needs to follow suit. In other words, any margin call by LCH.Clearnet SA also triggers the margin requirement increases by CC&G and vice versa.

After LCH.Clearnet SA triggered its margin call on Italian debt on 9 November, CC&G also increased its margin requirements in order to maintain its interoperability links with the French-based CCP, affecting virtually the entire Italian repo market (see Bank of Italy, 2012: 38). Following the margin calls by the two CCPs, this study finds that Italian spreads for long-term (10-year) issues peaked to over 520bp, reaching a historic high since the introduction of the euro (see appendix I). Quite significantly, the sovereign debt market distress caused by that margin call contributed to discrediting Berlusconi's already weak positions with its European counterparts, and, most importantly, with its domestic coalition members.

The rising funding costs for the Italian government increased domestic pressure on Berlusconi to resign, which he did after losing a key vote in Parliament but following a successful attempt to implement further austerity measures into law (see Culpepper,

2014; Pasquino and Valbruzzi, 2012). The moment Berlusconi resigned, pressure on Italy's sovereign yields eased slightly, which contributed to a decline in the Italian spread. Spread kept going down very rapidly once the technocratic government led by Mario Monti was appointed to form a new emergency government, putting an end to domestic political instability. As a consequence of the decline in spread, LCH.Clearnet SA and CC&G lowered the margin requirements for Italian 10-year issues to 8.15. In addition, as discussed above, the ECB's LTRO was also one of the largest contributors to ease pressure on Italian sovereign debt markets until April 2012.

However, the relative calm on Italian sovereign debt market was short-lived, as the stability of the Spanish banking system (analysed in more detail below) deteriorated very quickly in the spring of 2012. Following the nationalisation announcement of Bankia by the Spanish government on 9 May, Italian sovereign bonds became the target of new speculative attacks, which triggered an intense period of short-selling, as evidenced by the quick succession of hikes and declines of Italian spreads (figure 18). This led LCH.Clearnet to increase its margin requirements for Italian government debt to 9.5% on 8 June, and then 11.65% on 23 July, which were followed by strong spread hikes in both occasions. In between the last two margin calls, Moody's downgraded Italy's sovereign bonds below investment grade, and, despite being followed by spread hike, it was relatively minor in comparison to the one caused by LCH.Clearnet's margin call. Indeed, this study finds that the Italian spread widened significantly after each of the four increase in margin requirements by LCH.Clearnet during the Italian crisis (see appendix I). As a matter of fact, the two highest peaks in Italian spread took place precisely the day after LCH.Clearnet's announcements of a 11.65% margin requirement increase on both 8 November 2011 and 23 July 2012.

As also argued by the Bank of Italy in its 2012 Financial Stability Report, the '…very substantial increase in margins [by LCH.Clearnet and CC&G] impacted on the secondary market of Italian government securities, provoking a further widening of the BTP-Bund spread…*and liquidity strains* for participants in the guarantee system' (Bank of Italy, 2012: 38, emphasis added). Further, given the size of Italy's sovereign debt market, accounting for around 10% of the collateral-base of the European repo market, even that relatively small increase in margin requirements (when compared to Ireland and Portugal) impacted upon the ability of both domestic and international investors to net their positions through LCH.Clearnet SA and CC&G, because they reduced the liquidity of Italian government securities as collateral to access short-term funding.

In line with Ireland and Portugal, the increase in spreads caused by the margin calls did worsen the availability and cost of repo-based short-term funding to the domestic banks, not least because Italian banks had a large exposure on Italian sovereign bonds (see Albertazzi *et al.* 2014; see also Merler and Pisany-Ferry, 2012). However, differently from Ireland and Portugal, Italian banks were in good financial health (due to the reasons discussed above), and thus the rising spreads and margin requirements did not compromise the Italian banking system. Indeed, the Italian government did not need to intervene or seek financial assistance for any of its major banks, as in the case of Ireland, Portugal and, as shown below, Spain.

However, just a few days after the last margin call, on 26 July the ECB President Mario Draghi made his famous speech at the Global Investment Conference in London, where he strongly stated that, within its mandate, 'the ECB is ready to do whatever it takes to preserve the euro' (Draghi, 2012). The reaction on sovereign debt markets was instantaneous, even before the ECB announced, a week later, its next government security purchase programme, the Outright Monetary Transactions (OMTs). The ECB's pledge to

inject even more liquidity into national banking systems, should that necessity have arisen, sent a strong signal to investors and speculators, which led to a decline in sovereign bond spreads in Italy, Spain and across the euro area.

Before moving on to our last case study, Spain, it is worth providing a short commentary about what we can learn about the role of LCH.Clearnet during the Italian crisis. The evidence discussed above suggests that the margin calls had a strong impact in causing short-term bond sell-offs, as evidenced by spread hikes in four out of four collateral requirement increases. The impacts of the margin calls were various, and retain important implications for our understanding of spread movements and the unfolding of the euro crisis.

Even though the Italian government resorted to neither a bank nor a state bailout, the margin call on 8 November 2011 caused the highest spread hike during the Italian crisis. This timing of the spread hikes (which took place following the margin calls) suggests that the bond sell-offs took place precisely because LCH.Clearnet's increases in collateral requirements reduced the liquidity of Italian government debt in repo-based short-term funding operations. To an important extent, even though the size of the margin increase was not as dramatic as in the case of Ireland and Portugal, the hikes occurred largely because Italian government debt provided around 10% of the collateral basis of the entire European repo market at the time, making those securities one of the most important sources of collateral for accessing short-term funding for banks in the euro area.

Relatedly, Draghi's 'whatever it takes' speech, and the launch of the ECB's OMTs programme, need to be contextualised within the stress that Italian and Spanish sovereign debt markets were undergoing during that period of reduced liquidity.

Hence, as opposed to what is often argued by euro crisis literature, it was not just the sudden realisation of investors about the long-term weakness of the Italian economy to drive the spreads up during the height of Italy's crisis (see Chapter 1). Rather, the reduced liquidity of Italian securities to access short-term funding via repos, in the aftermath of the LCH.Clearnet's margin calls, also played a key role in the sell-offs that widened the spreads to the highest peaks experienced by Italy during the euro crisis. Furthermore, given the level of the sell-offs in November 2011, the spread peak caused by LCH.Clearnet's margin call on 8 November contributed exacerbated existing domestic political pressure on Berlusconi, whose political position had already weakened both domestically and internationally.

However, the relatively limited number of margin calls, the extent of speculation, and the open market operations of the ECB do not allow an examination of any potential long-term impact of the margin calls on spread trends. The absence of any long-term trend assessment also excludes the possibility of ascribing a potential margin procyclicality on Italian government bonds, as in the case of Ireland and Portugal. In addition, differently from Ireland, and more similar to Portugal in this respect, the increases in collateral requirements did not destabilise the Italian domestic banking system. The soundness of Italian banks at the time prevented any significant banking crisis to develop as a result LCH.Clearnet's and CC&G's increase in collateral requirements, despite the evidenced strain that margin calls put on the liquidity of Italian banks. It is also worth noting that the much smaller size of the margin calls caused lower absolute increases in the Italian spread when compared to Ireland and Portugal, which received substantially larger collateral requirement increases by LCH.Clearnet.

Finally, with respect to CRAs, the credit downgrades caused little to no evincible increase in Italian spreads on 4 and 7 October 2011, as well as on 13 July 2012, when Moody's downgraded Italy below investment grade.

5.4.5 Spain

The crisis in Spain is similar to the one in Ireland, in that it unfolded upon a housing and construction bubble, fuelled by large amount of foreign capital. Indeed, Spain attracted extensive European investments during the 2000s that, much like Ireland and Portugal, was to a large extent a consequence of the cheaper funding regime that emerged alongside the processes of European monetary and financial integration (see Quaglia and Royo, 2015). Joining the EMU allowed Spain to borrow at very low interest rates, which was used to sustain massive construction and mortgage credit booms (see In't Veld *et al*., 2014). Channelling the majority of that capital into construction compromised the competitiveness of the Spanish economy, as the tradable sector did not benefit from those foreign investments as much as the real estate sector. As a consequence, Spain's current account deficit had reached 11% of GDP in 2008 (see Royo, 2010).

It should be noted that the boom was not caused by capital inflows alone, however. Mortgages in Spain were usually based upon floating rates and short-term, where 100% loan-to-value ratios became relatively common (Gros, 2012: 10). This is quite the opposite in the case of Germany and Northern Europe, where mortgages were mostly longer-term, roughly 2-3% more expensive than in Spain, and where the loan-to-value ratio was limited to around 60% of house's value (ibid). In short, the conditions for mortgages in Spain were more advantageous, and exposed the banks to much higher potential losses.

However, the peculiar way in which Spain's banking system had been run adds a distinctive element to the Spanish story, which contributed to triggering a full-blown banking crisis that led to numerous bailouts and nationalisations. Until the onset of the euro crisis, the Spanish banking system was divided between private commercial banks and public savings banks, the latter called *cajas*. The *cajas* were different from the country's private banks in that they were not listed on the stock market, accounted for more than half of the financial sector's assets and had very close ties to regional and local authorities, whereby the Bank of Spain had minimal supervisory competence (Royo, 2013). The political control of the local authorities on the *cajas* has been ascribed to as one of the key factors that laid the foundations for Spanish crisis (see Garicano, 2012). Due to their relative autonomy and regional ties, the *cajas* had become particularly involved in 'turbocharged' unsupervised lending to local property developers and consumer mortgages, which was fuelled by the cheap wholesale financing (Quaglia and Royo, 2015: 493). Once market financing suddenly stopped in the wake of the 2008 credit crunch, the real estate bubble burst, severely damaging the banking system's funding liquidity needs.

Crucially, in the case of Spain the importance of CCPs increased precisely in the aftermath of the credit crunch, when *cajas* needed to find new sources of funding. As the commercial paper which funded the activities of the *cajas* lost value, the public banks became increasingly reliant on repo funding via CCPs in order to get access to affordable and reliable financing (Alloway, 2010). As a part of this process, Spanish domestic banks also increased their share of Spanish sovereign bonds, on which they had grown increasingly dependent, collateral-wise, for CCP-based repos. Indeed, by the second quarter of 2012, a staggering 70% of Spanish sovereign bonds was held by domestic banks, up from 48% in 2007 (see Merler and Pisany-Ferry, 2012). In October 2010, LCH.Clearnet SA announced that it would begin to start clearing the Spanish government

bonds and repo markets, which was followed by membership application by some of the country's largest *cajas* (LCH.Clearnet, 2010d). This means that Spanish public banks had the highest exposure to domestic sovereign debt than any other of the cases examined, and that sovereign debt had been extensively used for accessing short-term funding via CCP-based repos.

Before moving forward, it is not possible to assess any long-term effect of LCH.Clearnet's margin calls on the Spanish spread, because of similar reasons to what I mentioned in the case of Italy. Indeed, the number of margin calls implemented by LCH.Clearnet on Spanish sovereign debt were only three, lower than in Italy. That being said, even in the Spanish case, the impact of the margin calls retained an important short-term effect in shaping the course of the Spanish crisis, even though most of margin increases are not matched with *an immediate* widening in the spread.

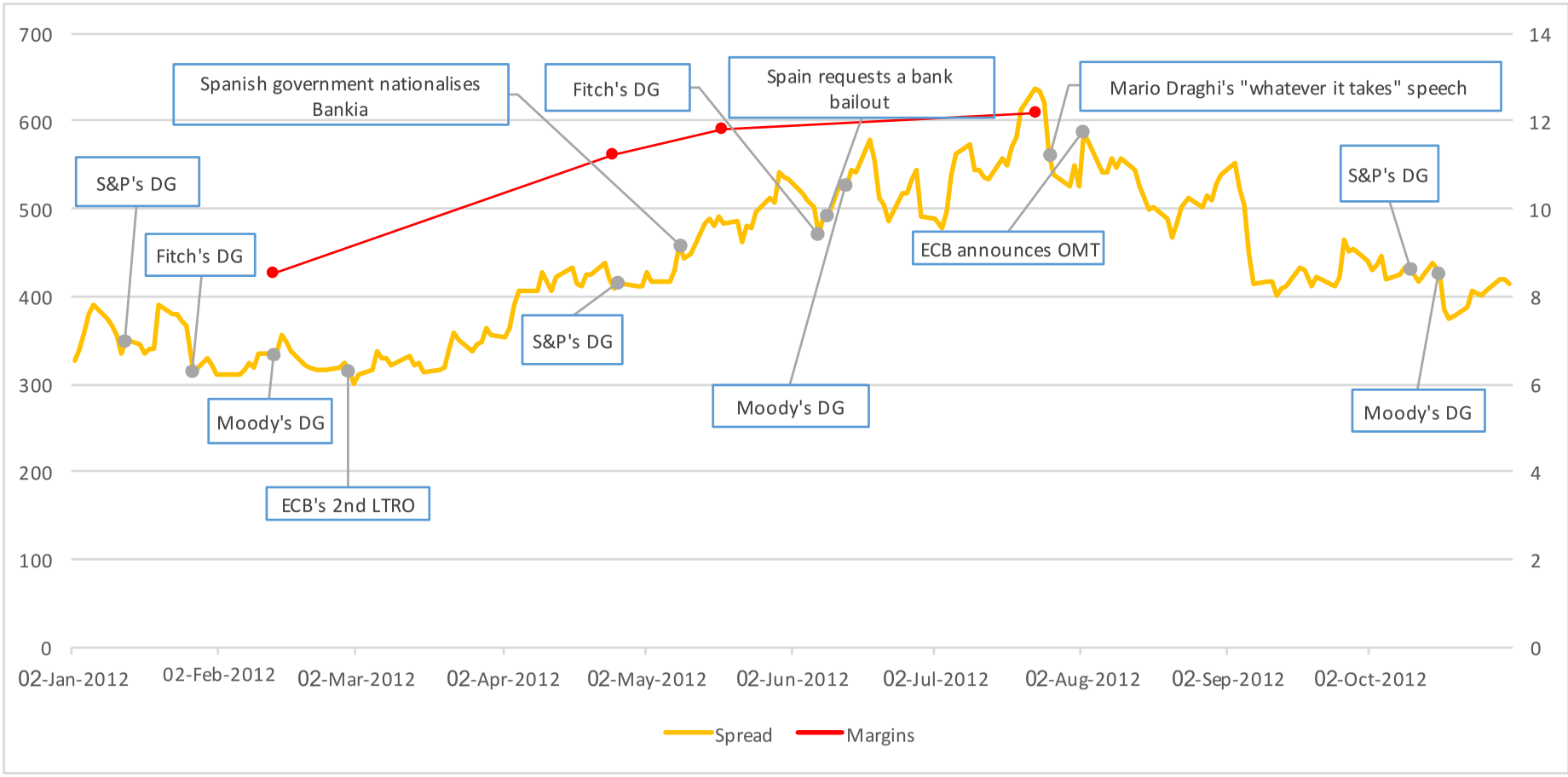
As the recession brought about by the GFC hit the country, the *cajas* became exposed to the collapse of the construction sector and the payment difficulties of mortgage holders, impairing their ability to meet debt repayments. In order to consolidate their books, some of Spain's largest and financially troubled *cajas* merged in December 2010 to form Bankia, which became the largest real estate lender in the country. Although the provision of liquidity by the ECB (via its two LTROs in December 2011 and February 2012) did ease the stress on Spanish sovereign debt markets between the end of 2011 and the beginning of 2012, it was not sufficient to fully recapitalise Spanish banks. That was particularly the case for Bankia, which had inherited the weaknesses from its founders *cajas*. In April 2012, an IMF report made warnings about the financial vulnerability of 10 Spanish banks, the majority of which received state aid (IMF, 2012). Although the report did not name any bank in particular, it became clear that Bankia was among those 10 banks, as it was the largest institution to have received state aid. As the profitability

and stock prices of Bankia began a massive decline from March 2012 onwards (ibid: 46), so did the price of Spanish sovereign bonds (because of the declining liquidity in the Spanish banking system) which led to a widening of the spread.

Amid rising spreads, this study finds that on 25 April LCH.Clearnet raised its margin requirement for using Spanish sovereign bonds as collateral in its repo operations to 11.20%, up from 8.35% (figure 19). Although the margin calls did cause a liquidity strain on the already struggling Spanish banking sector, there were no same-day reactions on sovereign bond markets in the aftermath of the increase (see appendix I), meaning that the margin call did not immediately lead to sell-offs. This raises an interesting question, particularly in light of the findings discussed in the previous three cases.

How is it that the margin calls, which reduced the value of Spanish sovereign bonds in repo transaction – thus exacerbating the already limited liquidity available in the Spanish banking system – did not lead to immediate sell-offs? As mentioned above, Spanish banks had one of the highest exposures to domestic sovereign debt in the euro area, at around 70% during the time of the first margin call.

(Fig. 19) Spanish 10-year sovereign bond yield spread (left-hand scale), LCH.Clearnet's margin requirements (right-hand scale)



Source: Thomson Reuters' Eikon and LCH.Clearnet's database, own elaboration.

DG=credit downgrade.

Spanish banks largely relied on Spanish sovereign bonds to access short-term funding via LCH.Clearnet, as commercial paper was no longer a feasible option. As mentioned above, the uselessness of commercial paper as collateral in the aftermath of the GFC was the reason why the *cajas* increased their reliance on Spanish sovereign bonds and the use of CCPs in the first place.

What that meant in practice was that, despite the margin requirement increases, Spanish banks did not have many other forms of collateral to sustain their funding liquidity needs, albeit it was becoming increasingly expensive for them to use Spanish government securities to access short-term funding. The strain on liquidity caused by the margin calls would also manifest on the country's spread, however at a later stage. Spread did continue to widen after the margin call, suggesting that Spanish sovereign bond-rich domestic banks were eventually forced to sell-off Spanish government bonds in order to meet the increase in collateral requirements by LCH.Clearnet. My argument can be corroborated with the following forms of evidence.

Financial analysts do suggest that the 'increase in margin calls makes it even less attractive to hold Spanish bonds and piles more pressure on Spanish banks who have been using the debt as collateral to raise funds (e.g. Reuters, 2012a). Among these, Spanish sovereign bond-rich domestic banks, Bankia, which joined LCH.Clearnet SA on October 2010 (see Bankia, 2011), was hit particularly badly by the margin call. Repos represented a very important source of short-term funding for Bankia, accounting for over 11% of the bank's total liabilities between 2010 and 2011, one of the highest in Europe (Armakola *et al*., 2016: 15). Given Bankia's reliance on repo funding, it does seem very plausible that the margin call exacerbated the bank's liquidity difficulties.

Indeed, just over two weeks following LCH.Clearnet's margin call, Bankia became partly nationalised by the Spanish government, which converted its previous €4.47bn state loan into a 45% stake in the institution. The Spanish government described the move as a 'necessary step to ensure its [Bankia's] solvency, the tranquillity of depositors and dispel doubts about the about the entity's capital needs…[and]...to guarantee the stability of the overall banking system' (in Johnson *et al.*, 2012). The announcement of the nationalisation was followed by massive sell-offs of Spanish sovereign bonds, amid the uncertainty of Bankia's future. The sell-offs widened the Spanish spreads, which, on 18 May 2012, triggered another margin call by LCH.Clearnet on Spanish sovereign debt to 11.80% (see appendix I). The increase in collateral further reduced the liquidity of Spanish sovereign debt, which worsened the strain on the funding needs of Spanish banks. However, this study finds that, just as in the previous increase, the margin call only caused sell-offs in the next few days, reinforcing my argument that Spanish banks could not easily get rid of domestic sovereign debt, given how much they relied on Spanish sovereign debt to access short-term funding.

This argument on the willingness by the *cajas* to maintain their sovereign debt holding can be corroborated by a recent study conducted at the ECB, which finds that during the euro crisis public domestic banks were much more likely than foreign banks to keep hold of sovereign debt (see Ongena *et al*., 2016). This was particularly evident in Spain, where 70% of all domestic sovereign bonds were held by public banks.

At that point, however, the prospect of external financial assistance became increasingly more likely, particularly after Bankia announced that it would need an additional €19bn in state aid on 25 May, bringing the total cost of its rescue to over €24bn (see Reuters, 2012b). Despite months of denial that its banking sector needed a bailout, on 9 June the

Spanish government formally made request for up to €100bn bank bailout to its European partners, just a couple days after Fitch downgraded Spanish sovereign debt to junk status.

The bailout request did not succeed in calming down turbulence on Spanish sovereign debt markets. The construction and mortgage credit boom developed in such a way whereby asset price growth in effect underpinned Spain's rising demand and economic growth, a phenomenon known as house price Keynesianism (see Watson, 2010; see also Norris and Michael, 2015). However, the inherent real estate-driven dimension of the Spanish crisis was not addressed in the financial assistance package. Thus, as house prices kept falling, Spanish banks, particularly the remaining *cajas* and Bankia, kept accumulating losses on their loan portfolios, whilst the availability of short-term funding was becoming increasingly expensive. In the meantime, unemployment began to reach historic heights and the whole economy slipped into recession.

Amid rising spreads, on 23 July LCH.Clearnet SA triggered a further margin call on Spanish sovereign debt to 12.20%. Although the increase in spread was not massive, this study finds that by the end of the trading day, when the margin call was issued, sovereign yield differentials reached a record high above 600bp (see appendix I). It should be noted that the announcement of the margin call that took place on 23 July also contained the increase in margins for Italian government securities to 11.65%. This means that two among the largest sovereign debt markets of the euro area were undergoing significant and comparable amounts of distress. This is important when it comes to understanding the events that followed. Indeed, Draghi's 'whatever it takes speech', and the launch of the ECB's OMTs programmes, need to be contextualised with respect to the risk that both Italy and Spain posed to the overall structural integrity of the euro area. The ECB acted in a moment whereby bank funding costs were becoming increasingly expensive for Italian and Spanish banks.

In conclusion, although the number of margin calls in the case of Spain were even more limited than those in the Italian case, the involvement of LCH.Clearnet during the Spanish crisis still underscores the crucial role of CCPs for our understanding of repos, funding liquidity and sovereign debt market instabilities during the euro crisis. Indeed, just like in Ireland, LCH.Clearnet's margin calls contributed to destabilising the Spanish domestic banking system, due to the impact its collateral requirement increases had in reducing the liquidity of Spanish sovereign bonds, and thus compromising the funding liquidity of Spanish banks.

This is also connected to a distinctive aspect of the Spanish story when compared to the other case examined: the unregulated, regional public savings banks, the *cajas*, had increased their reliance on Spanish sovereign debt as collateral to access CCP-based repo funding following the GFC. Once cheap credit (collateralised through commercial paper) suddenly stopped in 2008, the *cajas* became increasingly dependent on CCP-based repos for accessing affordable and reliable short-term funding, which was almost entirely built on the use of Spanish sovereign bonds as collateral. Thus, Spanish banks dramatically expanded their holdings of domestic sovereign debt. The huge prevalence of sovereign debt at home meant that, despite the increase in margins, the reduced liquidity of Spanish sovereign bonds did not compel Spanish banks to immediately get rid of government bonds, on which they heavily relied to access short-term funding after the GFC.

Yet, as the Spanish banks' liquidity deteriorated, sell-offs eventually took place in order to meet LCH.Clearnet's increases in collateral requirements, contributing to destabilising sovereign debt markets and eventually resulting in a widening of the spread. In other words, the analysis conducted above suggests that the LCH.Clearnet's margin calls contributed to the exacerbation of the funding pressures faced by of the Spanish domestic banking sector, even though they did not lead to an immediate sell-off. The absence of a

sustained short-term impact of margins on spread also excludes the presence of margin procyclicality in the case of Spain, as it was the case in Ireland and Portugal. Further, I should add that, as in the case of Italy, the much smaller increases in the collateral requirements for Spanish government securities (when compared to Ireland and Portugal) resulted in an absolute lower level of increase in the Spanish spreads when margin calls caused bond sell-offs.

Lastly, with respect to the involvement of CRAs, credit downgrades were matched by visible hikes of the Spanish spreads, especially on 13 February and 7 June. However, again due to the limited number of collateral requirement increases experienced by Spain, and to the complex dynamics between high domestic sovereign debt ownership and bond sell-offs, the comparison between the short-term impact of credit downgrades and margin calls is unfeasible.

Before moving on to the concluding remarks, I should also clarify that although this chapter emphasised the impact of LCH.Clearnet's actions on domestic banking systems, the CCPs' margin calls in some cases also worsened the position of those foreign banks who had increased their exposure to higher yielding government debt for carry-trade purposes, albeit in fewer cases than domestic banks. Carry-trade refers to the practice that involves borrowing at lower interest rates to purchase an asset with higher rates of returns, such as the euro area sovereign bonds with wider spreads during the euro crisis. The most striking case was the Belgium-based Dexia, who had increased their exposure to Greek, Portuguese, Italian and Spanish sovereign bonds, on the basis that they would profit from carry-trade with higher yielding sovereign bonds (see Acharya and Steffen, 2015). The increase in the margin requirements for clearing Portuguese and Italian and sovereign bonds, to which Dexia was highly exposed, greatly exacerbated its liquidity problems in 2011, due to both covering the increasingly expensive collateral that it had to post, as well

as to the general decline in the value of those securities caused by the margins-induced sell-offs. Indeed, on 8 October 2011 Dexia had to pay out additional €16bn in margin requirements (see ibid: 12). Due to its inability to meet its margin requirement increases and debt repayments, Dexia went bankrupt and had to be bailed out a few days later by the governments of Belgium, France and Luxembourg.

The concluding section will summarise the key findings, organise them into more concise tables, and discusses how we should be re-understanding the euro crisis in light of the analysis conducted above.

5.5 Conclusions

Despite the CCPs' well documented role in preserving the repo market as a whole, this chapter has shown that the CCPs' actions have nevertheless contributed to destabilising specific sovereign debt market in the euro area. This destabilising role has been fairly heterogeneous, both in relation to how LCH.Clearnet differently approached collateral management among the four case studies, as well as with respect to the impact that its actions had on the development of each country's crisis. That being said, the analysis conducted in this chapter allows us to make important comparative assessments.

First of all, the evidence gathered in this chapter suggests that most of LCH.Clearnet's margin calls directly contributed to a widening of the spreads in 3 out of the 4 case studies examined in this chapter. Table 2 summarises the number of times a margin call was matched by a widening of the spread on the day of the margin call itself and the following day, for each case study. With the exception of Spain, margin calls were followed by an immediate widening of the spread in most margin calls in Ireland, Portugal and Italy.

(Table 2) LCH.Clearnet's margin calls and spread hikes

Country	Number of occurrences	% of total
Ireland	9 (out of 10)	90%
Portugal	5 (out of 6)	83.33%
Italy	4 (out of 4)	100%
Spain	1 (out of 3)	33.3%

Thanks to the combination of the qualitative and quantitative evidence provided here, together to the analyses conducted in previous chapters, I argue that the widening spreads in the aftermath of the LCH.Clearnet's margin calls were likely caused by the reduction in the value of the affected securities as collateral in repo-based interbank funding operations. LCH.Clearnet's increases in margin requirements made it more expensive to employ Irish, Portuguese, Italian and Spanish sovereign bonds as collateral in repo operations. Hence, investors (particularly international sovereign bond holders) began large-scale sell-offs of the affected securities, which led to a decline in the prices of the affected securities, widening their spreads.

In short, the euro area witnessed a full blown CCP-induced collateral crisis (a term that I coined and described in Chapter 4), as LCH.Clearnet's margin calls established a hierarchy between good and bad collateral, compromising the liquidity of only a selected number of government bonds (i.e. Irish, Portuguese, Italian and Spanish), widening their spreads against the German bund.

These findings provide key empirical insights with respect to answering the research question posed by this project, namely: what factors contributed to destabilising sovereign debt markets during the height of the euro crisis from 2010 to 2012? In light of the analysis conducted in this thesis, I argue that it is the ways in which LCH.Clearnet

implemented its collateral policy within the crisis-prone structure of the European repo market that contributed to the destabilisation of sovereign debt markets from 2010 to 2012. The evidence gathered in this chapter point towards an understanding of spread movement that is deeply linked to the funding needs of banks in the euro area. Indeed, the widening of the spreads in the in the aftermath of margin calls suggests that investors were not only concerned with the sovereign default risk of the above-mentioned governments, as has often been assumed in the euro crisis literature and by policy makers. Rather, the widening of the spreads in the aftermath of LCH.Clearnet's margin calls were also (and indeed, in the case of Ireland and Portugal, were primarily) driven by the banks' concerns with funding liquidity risk.

While this applies to different degrees in all the 4 cases examined above, it is best exemplified in Ireland and Portugal. Despite having secured a state bailout, which guaranteed public-debt servicing for the coming three years, the Irish and Portuguese spreads kept widening as a result of LCH.Clearnet's margin calls. Hence, from the moment the bailouts were agreed, it is very plausible to assume that investors were no longer worried about the solvency of these two governments. This strongly suggests that the widening of the Irish and Portuguese spreads was taking place *primarily* as a result of how the margin calls impacted the liquidity of Irish and Portuguese sovereign bonds as collateral in repo transactions.

The analysis conducted in this chapter also allowed us to understand other ways in which LCH.Clearnet impacted upon the development of the sovereign debt crises of Ireland, Portugal Italy and Spain. These findings are summarised in Table 3, reflecting my contribution to the euro crisis literature with respect to the impact that CCP-induced collateral crises can have on the euro area. First, LCH.Clearnet's margin calls have led to an immediate widening in the spread three out of the four cases examined, suggesting that

the CCP's actions have caused significant financial shocks during the euro crisis, contributing to the large waves of bond sell-offs during the period examined.

(Table 3) Impact of LCH.Clearnet's margin calls during the euro crisis

	Ireland	Portugal	Italy	Spain
Immediately widened the spreads	Yes	Yes	Yes	No
Reduced sovereign bonds liquidity	Yes	Yes	Yes	Yes
Reduced banks' funding liquidity	Yes	Yes	Yes	Yes
Destabilised domestic banking systems	Yes	No	No	Yes
Margin procyclicality	Yes	Yes	No	No
Compromised public debt sustainability	Yes	No	No	No
Political impact	Yes	No	Yes	Yes*

*While there cannot be ascribed any short-term impact of margin calls on spreads in Spain, the increase of LCH.Clearnet's collateral requirements did worsen the funding liquidity of Spanish domestic banks, contributing to Spain's request of a bank bailout.

Second, LCH.Clearnet's margin calls are also highly likely to have reduced the liquidity of those sovereign bonds in repo markets that, in turn, increased the funding pressure of domestic banks in the euro area. Because repos represent the point of intersection between sovereign debt and bank funding, the increase in margin requirements on specific bonds made those securities more expensive to use as collateral and thus less liquid, which contributed to the increase in funding pressures on the banks of the euro area, particularly sovereign bond-rich domestic banks.

Third, LCH.Clearnet's margin policy did not destabilise the domestic banking system on every occasion, but only in Ireland and Spain. This reflects the much more distinctive banking dimension of the Irish and Spanish crises, which were rooted in housing and construction bubbles. In that respect, and fourth, another major difference is that whereas

Ireland and Portugal showed strong signs of margin procyclicality on their respective spreads, the same does not apply in the case of Italy and Spain. This is largely due to the much more frequent margin calls, and to the significantly higher overall increases in collateral requirements implemented by LCH.Clearnet Ltd *vis-à-vis* it's continental sister, LCH.Clearnet SA.

Fifth, LCH.Clearnet can also only be said to have contributed to compromising public debt sustainability in Ireland. That is because the procyclical element of its margin calls contributed to the widening of its spread to such a level that the Irish government also had to request a state bailout to finance its public spending, in addition to a financial assistance program for its ailing banks. When it comes to Portugal, Ireland's most similar case study in respect of how margin calls were implemented and the effect they had on spread, margin calls were only implemented after the Portuguese government had requested a state and bank bailout. Hence this excludes any possible link between LCH.Clearnet's margin policy and the public debt servicing sustainability in the Portuguese case. Italy did not ask for any form of financial aid to its European partners, while Spain only requested financial assistance programmes for its banking sector. Lastly, given the impact that its margin calls had on spreads, LCH.Clearnet's actions are likely to have contributed to influencing a variety of political processes, namely the bailout request in Ireland, the dismissal of Berlusconi and the appointment of technocrat Mario Monti in Italy, and the bank bailout in Spain.

In other words, LCH.Clearnet's triggering of a CCP-induced collateral crisis has had a variety of impacts, with some similar and some different impacts on each of the countries examined. This is largely because of the substantially different nature of the crises in each of the case studies, their sovereign debt market and banking structures, as well as the sizes

of the margin increases they received. Still, it can be concluded that LCH.Clearnet has retained a significant destabilising role in the sovereign debt markets of the euro area.

I will now turn to the concluding chapter of this project.

Conclusions

> My concern and expectation is that the coming weeks will show that the development of the markets, government bonds and the economy of Italy will be so far-reaching that this will be a possible signal to voters not to vote for populists on the right or left.
>
> (EU Commissioner for Budget and Human Resources Günther Oettinger, on the outcome of the Italian general elections, 2018).

Sovereign default risk perception remains, to this day, a key explanatory variable for market behaviour in the euro area. Shortly after the 2018 Italian general elections, resulting in a Eurosceptic and anti-establishment alliance between the *Movimento 5 Stelle* and the *Lega*, EU Commissioner Günther Oettinger made a statement during an interview with the German broadcaster *Deutsche Welle*. Oettinger suggested that such an electoral result would likely lead to financial market turbulence, which would push Italians not to vote for populist parties in the future (Anderson, 2018). Oettinger's statement, which was initially mis-translated in English from German as 'markets will teach Italy to vote for the right thing', claimed that the policy proposals put forward by the then potential government formation could breach the EU's fiscal rules, thus prompting a negative reaction on Italian sovereign bond prices. More specifically, Oettinger alluded to the fact that breaking the EU's fiscal rules could jeopardise Italy's public debt servicing sustainability, to the point where investors would lose confidence in the country's solvency. In turn, according to the Commissioner, this could lead to large-scale sell-offs in government bonds, severely damaging Italy's economy.

These comments sparked outrage among both Italian and EU authorities, on the basis that Oettinger's words disrespected Italy's democratic will. For instance, following those

comments, the *Movimento 5 Stelle*'s leader and Minister of Economic Development, Labour and Social Policies Luigi Di Maio replied in a tweet:

> "Markets will teach you how to vote". The words of European Commissioner #Oettinger are preposterous. These people treat Italy as a colony where they go on summer holidays. But in a few months the government of change will emerge, and it will finally make [Italy] respected Europe (Di Maio, 2018, my translation).

Most notably, as in the words of the *Lega*'s leader and Minister of Interior Matteo Salvini on a Facebook live stream:

> …and so the stock market crashes and the spread goes up. Markets will teach you to vote better next time. A European Commissioner, paid by you guys…who suddenly speaks as if democracy was worth zero, as if it will be the markets, *the people of the spread*, of finance, to teach…Italians to vote better…should resign this afternoon (Salvini, 2018, my translation).

Hence, while spread remains an important explanatory variable for market behaviour in the euro area, it has also taken on a more distinctive political connotation. As discussed in the introduction of the thesis, both pro-European and Eurosceptic forces in Italy keep employing spread as a proxy for market behaviour. However, it has now become a politically contested ground, in that the former sees it as a signal to maintain fiscal discipline in accordance to EU rules, whereas the latter sees it as a negative straitjacket that needs to be removed to free Italy from the markets' constraints and implement their electoral promises (see Petrini, 2018; Spezzaferro, 2018). The ongoing political significance of spread as a proxy for market behaviour made the analysis conducted in

this project a necessary step in achieving a better understanding of what drives investors to sell government bonds in the euro area.

The main conclusion drawn from this thesis is that spread can mean anything and nothing. There were numerous contextual factors that influenced investors' pricing of sovereign bonds during the euro crisis, with market sentiment towards sovereign default and funding liquidity risk just two of them. Nevertheless, my research has shown that sovereign default risk was not the only key concern for investors when trading sovereign bonds in the euro area during the crisis. In some instances, sovereign default was not even their main fear. As demonstrated in the case of Ireland and Portugal, spreads widened in the aftermath of LCH.Clearnet's margin calls even *after* these countries had secured a state bailout. This suggests that the sell-offs mainly took place because of the investors' concern with the funding liquidity risk posed by the reduced value of the affected sovereign bonds as collateral to access short-term funding via repo.

Thus, I argue that *spread movements alone* cannot be employed as a comprehensive indicator of market behaviour because of the variety of contextual factors that can influence bond price differentials in times of financial distress. Indeed, in order to explain how LCH.Clearnet contributed to widening the spreads, the analysis conducted in this thesis was built, on the one hand, on an in-depth understanding of the mechanisms underpinning the provision of funding liquidity in the euro area and, on the other, on a triangulation between quantitative and qualitative evidence.

Therefore, I conclude that looking employing spread movements as a heuristic tool to understand market behaviour *in its entirety* is redundant. This claim goes in stark contrast with the studies on the euro crisis that employ spread as an overarching proxy for market behaviour, which also explicitly understand investors as being largely driven by fear of

sovereign default (e.g. Arghyrou and Tsoukalas, 2011; Lane, 2012; De Grauwe and Ji, 2013; Pepino, 2015; Baldwin *et al*., 2015). Thus, I move beyond those studies by showing that sovereign bond yield spread movements also indicated fears regarding funding liquidity risk, which has not received nearly as much attention as sovereign default risk did.

Having deconstructed the significance of spread as proxy for market behaviour, this project has provided a number of key findings that are pertinent for this projects' research question, namely: what factors contributed to destabilising sovereign debt markets during the height of the euro crisis from 2010 to 2012?

CCPs, repos, and sovereign debt market (in)stability in the euro area

The main objective of this project was to put into question the uses of sovereign bond yield spread as an indicator of market perception of sovereign default risk during the euro crisis. The analysis developed throughout the previous five chapters demonstrated that the widening of the spreads from 2010 to 2012 was not only driven by considerations regarding public debt servicing sustainability, but also, and indeed, in some cases mostly, by concerns surrounding access to short-term funding.

The analysis was developed in the following steps. Chapter 1 examined the different approaches undertaken in the interdisciplinary field of enquiry that I labelled the euro crisis literature. This represented a first comprehensive attempt at connecting the dots between scholars from different subjects and theoretical strands who debate the origin and unfolding of the euro crisis. I argued that spread movements are recurrently employed to describe the markets changing perception of sovereign default risk, despite a number of important differences with respect to what factors are identified as the trigger to those

fears. It is remarkable that such an understanding of spread is not only shared among a variety of disciplines, namely political science, economics, political economy and financial economics, but also across different theoretical strands and approaches, including orthodox and heterodox (post-Keynesian and Marxist) economics, rational choice and comparative political economy, as well as political scientists and institutional economists working on varieties of capitalism. I also claim that the fixation with understanding market behaviour primarily in relation to sovereign default risk is linked to the literature's failure to examine the mechanisms underpinning the provision of short-term funding in the euro area, specifically with respect to CCPs and repo contracts.

Chapter 2 examined the functioning of CCPs and their relevance for financial stability. I showed that the role of central clearing in guaranteeing the performance of every contract has been a key feature in the development of financial markets since 18th century Japan. This has been retained by present-day CCPs, and also underpins the financial reform agenda for OTC derivatives put forward by G20 leaders in 2009. However, in Chapter 2 I also demonstrated that the ways in which CCPs interpose between traders through counterparty substitution allows them to unilaterally impose margin requirements. In turn, this can reduce the liquidity available in the financial system during a crisis. Indeed, I found that the use of margin requirements by CCPs has contributed to exacerbating instabilities during periods of financial distress, which lead me to conclude that these actors need further examination with respect to issues regarding systemic stability.

Chapter 3 examined the development of the modern repo market in order to show how repo contracts can become a crisis-transmission channel. I showed that repos have been closely linked to the provision of short-term funding since the New York Fed began using these instruments to refinance banks in the 1920s. I discussed how the development of repos after the end of World War II has been closely linked to the separation between

fiscal and monetary policy, whereby the central banks' use of high interest rates to combat inflation has made repos a much more affordable source of funding. I thus showed how expanding the use of sovereign bonds as collateral in repos has brought sovereign debt and bank funding ever closer together.

Yet, in light of the events surrounding the GFC, I showed that collateralised finance can also become a source of systemic instability. The sudden lack of repo collateral triggered margin calls that, in a procyclical way, further reduced the availability and value of collateral, which curtailed access to repo funding to the point that the US banking system became insolvent. Hence, I concluded that repos are particularly relevant for our understanding of the euro crisis, because of how they are connected to both the funding liquidity of banks, and to sovereign debt through their use as collateral.

Chapter 4 brought attention back to Europe by examining the architecture of the European repo market. The main argument I made here is that the politics surrounding the evolution of European financial integration has made the sovereign debt markets of the euro area prone to what I defined as CCP-induced collateral crises. I first examined how the political imperative of financial integration by the EC and the ECB has placed repos and sovereign bonds as the cornerstones for the creation of a single European financial space, which would greatly enhance cross-border lending and make government debt the dominant collateral. Specifically, the ways in which the EC and the ECB pushed for market-based practices when handling sovereign collateral has dramatically changed how collateral was previously managed by most European central banks, who did not employ these practices. Crucially, this shift retains an important political connotation, with regard to the direction taken by European economic integration between the 1990s and the early 2000s. Handling sovereign bonds according to market-based practices needs to be contextualised within the EC and ECB's political strategies to please Germany's

insistence with market discipline to move forward with monetary as well as financial integration. I argued that while these strategies succeeded in co-opting Germany in strengthening European economic integration, they also exposed sovereign collateral to price volatility in financial markets.

I thereafter assessed the different interests at stake in the consolidation of the European exchange industry, whose negotiations and compromises led to the creation of LCH.Clearnet. On the one hand, the insistence of the *Bourse de Paris* on retaining central clearing technologies against the vision of *Deutsche Börse* and, on the other hand, the compromises between users and exchanges in the LCH.Clearnet merger led to the creation of one of the world's largest CCPs by clearing volume, which ended up dominating the euro-denominated repo industry. Hence, I claim that such arrangements have exposed the sovereign debt markets of the euro area to the potential collateral shocks of LCH.Clearnet in repo transactions.

Chapter 5 brought all of the abovementioned findings together, assessing the involvement of LCH.Clearnet during the euro crisis. The main objective of this chapter was to assess the impact of LCH.Clearnet's margin calls on the Irish, Portuguese, Italian and Spanish crises. In order to triangulate my analysis, I contextualised daily movements of spread in relation to a variety of qualitative and quantitative evidence, that were specific to each case study. I found that the margin calls implemented by LCH.Clearnet likely contributed to an immediate widening in the spread of all of the case studies examined, with the exception of Spain, where bond sell-offs took place at a later stage because of the domestic banks' strong ownership of, and reliance on, Spanish sovereign debt. In light of what was discussed in previous chapters, I argue that LCH.Clearnet's margin calls contributed to destabilising sovereign bond markets in the euro area. This is because the increases in collateral requirements on government bonds directly reduced the value, and

thus the liquidity, of those securities as collateral in short-term funding operations via repos.

Original contributions

The euro crisis literature seeks to understand the roots and the dynamics of the euro crisis, largely by examining the factors that have contributed to eroding market confidence in public debt servicing sustainability. It is argued, in this literature, that sovereign solvency was one of the most important factors that influenced market sentiment towards government bonds during the euro crisis, which became reflected in the widening of the spreads. Despite the different positions on the issue, the literature is seemingly unable to escape from anchoring market behaviour to fear of sovereign default.

The main contribution of this project was to the euro crisis literature, where I provided a more nuanced conceptualisation of what drove investors to sell-government bonds, and thus widen the spreads, during the euro crisis. I contributed to the debate emphasising the dimension of short-term funding as another key driver for the large-scale sovereign bond sell-offs that affected the euro area. In answering the research question, this project suggested that the ways in which LCH.Clearnet implemented its collateral policy in the crisis-prone structure of the European repo market contributed to destabilising sovereign debt markets. This is because LCH.Clearnet compromised the use of specific sovereign bonds as collateral in repo funding operations. Hence, the widening of the spreads from 2010 to 2012 was not just an indication of market sentiment towards sovereign default risk, but also of their concerns with using sovereign bonds to meet their funding needs. This is a key contribution to the euro crisis literature, because it provides a more nuanced understanding of what investors feared during the unfolding of the euro crisis.

More generally, the analysis conducted in this project began unpacking the meaning of the 'markets' within the euro crisis literature. Firstly, I argue that the markets –understood as the actors that contributed to a widening of the spreads by purchasing and selling government bonds–were largely banks lending to each other in short-term repo funding operations. Secondly, as discussed in Chapter 5, there was a stark divide between the interests and necessities among the banks in the euro area.

On the one hand, the funding liquidity of domestic banks was impacted the hardest by LCH.Clearnet's increases in collateral requirements, because of their relatively higher ownership in the sovereign debt of the country they were headquartered in (the so-called home bias). In that respect, LCH.Clearnet – owned by large international financial conglomerates at the time – was acting on behalf of international banks who could sell the affected government bonds more freely, because they were not affected by the same home bias of domestic banks. On the other hand, the ways in which LCH.Clearnet's margin calls led to a widening of the spreads was different in Ireland, Portugal, Italy, and Spain, depending on the sovereign debt exposure and the funding status of each national banking system.

Therefore, I conclude that spread movements meant very different things in each country examined, which, in turn, provides a much more heterogenous understanding of 'the markets' and how they were behaving during the euro crisis. Recalling the words of Ian Hardie, who opposed an understanding of the market 'as a single entity, with common actions and policy preferences', I argue that the markets in the euro area 'is in reality made up of multiple, heterogeneous actors, often lacking any unity of opinion or purpose' (Hardie, 2006: 55).

A second contribution I made to the euro crisis literature is providing a review of the ways different disciplines and approaches discuss the origins and development of the euro crisis. This contribution is made in Chapter 1, which subdivides the literature into three macro groups: the domestic-level explanations, the European-level explanations, and the financial economics literature. I argue that both the domestic- and European-level explanations largely ascribe the sovereign debt market instabilities experienced in the euro area to the deterioration of macroeconomic fundamentals; however, they differ in either blaming primarily domestic or European weaknesses in economic governance.

The financial economics literature, in contrast, advances the debate by shedding light on a slightly more psychological element regarding the behaviour of financial market actors during the crisis. This scholarship shows that investors became more sensitive to deteriorating fundamentals after the GFC because they began to suddenly fear a higher possibility of sovereign default. Despite these differences, my categorisation spots a key commonality that is widely present in these varying approaches. Whatever the causes, I found that most scholars ascribe the widening of the spreads to the deteriorating market confidence in the sovereign solvency of countries in the euro area. Analysing the literature along those lines has not been conducted before, which makes understanding the euro crisis debate through the lens of market behaviour a novel approach in this interdisciplinary project.

A third contribution made to the euro crisis literature is my argument that the repo market is a source of systemic instability. The role played by repo contracts is largely overlooked in the literature, as most research simply limits itself to acknowledging the declining liquidity of repo markets during the crisis, without actually examining why that was the case. In Chapter 3, I contribute to our understanding of market instabilities during the euro crisis by showing that repos can act as a crisis transmission channel during times of

financial distress. That is because repo markets can be subjected to collateral crises, whereby the liquidity of specific assets used as guarantee gets greatly reduced, in turn exacerbating liquidity squeezes. While this contribution is developed theoretically in Chapter 3, it is demonstrated in Chapter 5, where I show that the reduced liquidity of certain sovereign bonds as collateral in repo transactions increased the funding pressures of banks in the euro area.

Fourth, this thesis contributed to the narrower scholarship on the political economy of global finance, as well as to the euro crisis and EU integrations literatures more broadly, by showing that the position of CCPs in financial markets can be detrimental to systemic stability in times of economic turbulence. Generally speaking, CCPs are severely understudied in these literatures, which is significant given the importance of these institutions for the development of markets since the 18th century. On the one hand, Chapter 2 shows that the position of CCPs as the buyers to all sellers and the sellers to all buyers allows them to exercise a significant amount of power over investors through the unilateral imposition of margin requirements, which contributed to the exacerbation of liquidity squeezes several times during the 20th century. On the other hand, Chapter 4 showed how the position of LCH.Clearnet in the European repo market has contributed to making the sovereign debt markets of the euro area particularly prone to systemic instabilities.

Fifth, this thesis contributed to the subgroup of the euro crisis literature that I labelled 'European-level explanations'. The main argument portrayed by scholars in this group is that the introduction of the euro has crystallised an asymmetric trade regime. Through bringing together different economies with different growth models, inflation rates, and wage setting mechanisms, the monetary union has polarised the euro area into a surplus and export-oriented core, and a deficit, bubble- and debt-oriented periphery. According

to this view, this asymmetric regime contributed to worsening macroeconomic fundamentals once credit halted in the aftermath of the GFC. This scholarship argues that the deterioration of macroeconomic fundamentals, as caused by the introduction of the euro, contributed to eroding market confidence in public debt servicing sustainability during the euro crisis. In short, a great deal of attention was paid to the imbalances generated by European monetary integration.

I contributed to this body of research by arguing that it was not just monetary integration that has exposed the sovereign debt market of the euro area to systemic instabilities, but also the ways in which European financial integration was conducted. In Chapter 4, I showed that the politics underpinning the creation of a single European financial space has exposed the sovereign debt markets of the euro area systemic vulnerabilities. On the one hand, the EC and ECB's political imperative of financial market integration through market-based practices has exposed sovereign collateral to sudden price shocks in financial markets. On the other hand, the different interests at stake in the consolidation of the European exchange industry has contributed to concentrating almost the entire repo industry in LCH.Clearnet, which allows for a single CCP to exert a significant amount of influence over the cost and availability of specific collateral markets. Hence, I argue that the specific way in which the European financial markets were integrated exposed the sovereign debt markets of the euro area to the potential collateral shocks by CCPs in repo markets, or what I called CCP-induced collateral crises.

Policy suggestions

In conclusion, I argue that the policy responses to the crisis have been unsuccessful in overcoming the vulnerabilities existing in European financial markets. While the reduction in public expenditure *may* have helped to restore confidence in public debt

servicing sustainability, spending cuts do not provide an effective guarantee the liquidity of sovereign bonds in repo markets. This is important in the light of this thesis' findings, as I demonstrated that it was not just sovereign solvency that drove investors to sell government bonds during the euro crisis, but also the reduced value of these securities in accessing short-term funding via repo. That is because spending cuts by governments did not, and indeed will not, ensure the liquidity of a country's sovereign debt in repo transactions in the middle of a collateral crisis.

Hence, I propose an understanding of the euro crisis that goes beyond ascribing sovereign debt market instabilities to the declining confidence of investors towards public debt servicing sustainability. Rather, this thesis emphasises the structural vulnerabilities that affect the provision of short-term funding in European financial markets. By suddenly reducing the liquidity of specific government bonds as collateral in repo operations, the vulnerability of European finance to CCP-induced collateral-crises can severely destabilise sovereign debt markets.

The post-crisis reforms, such as heighted bank deposit protection, strengthened financial supervision, and the framework for the recovery and resolution of banks in the euro area neither acknowledge, nor tackle, the collateral crisis-prone architecture of the European repo market. Therefore, policy proposals should instead aim at reducing the extent to which sovereign bonds in the euro area can be affected by the procyclical collateral practices of single systemic actors like, LCH.Clearnet. This could be achieved by, first, imposing a limit on the size and the frequencies of CCP's increases in collateral requirements, which would materially reduce the impact of such practise on the price of government debt. As a matter of fact, ESMA has recently called for strengthening regulatory efforts to limit the procyclicality of the CCPs' margins (ESMA, 2018).

Second, regulation could aim at reducing the concentration of repo exposure in single CCPs, by distribute a higher proportion of the market among institutionally-separate entities. As I discussed in Chapter 2, a similar issue was recognised by the FSB on a study on CCP interdependencies (FSB, 2017). A more equal and non-interconnected redistribution of repo exposures would significantly reduce the susceptibility of sovereign bonds' prices to the collateral practices of individual, large CCPs. Third, and perhaps more challenging, in order to properly break the link between sovereign debt and bank funding, the European repo markets need to slowly phase-out their dependence on sovereign bonds as collateral. This proposal is certainly ambitious and very difficult to implement. Issues would arise from finding another widely available, and most importantly, highly liquid source of collateral, to preventing capital flights from one sovereign debt market to another.

A solution, which could resolve both issues mentioned above, would be sovereign debt mutualisation with the introduction of a single government bond for the whole euro area, guaranteed by either the ECB or by the member states themselves (see Tilford, 2011). In order to overcome criticism, mainly by German authorities, that such a regime would weaken fiscal discipline, a quantitative limit could be introduced to the amount of mutualised bonds that a government in the euro area can issue, after which it would be the country alone liable for debt repayment (see Chrysoloras and Weber, 2018). A similar proposal was recently put forward by the EC, which proposed the introduction of sovereign bond-backed securities (SBBS), a type of low-risk liquid asset that would be backed by a pool of government bonds in the euro area. In the words of the EC:

> SBBS would be a new type of asset created by the private sector based on a pre-defined pool of sovereign bonds of the Euro area Member States. In practice, a private sector entity, created solely to issue and manage SBBS, would buy euro

> area sovereign bonds on the market and bundle them into higher or lower risk securities. Investors could buy higher or lower risk packages, according to their risk appetite (EC, 2018).

The EC proposed subdividing these securities into a so-called ‘senior’ tranche, making 70% of the whole issuance composed by the lower-yielding, more liquid bonds, with the remaining 30% to be divided among different ‘junior’ issuers, i.e. the higher yielding sovereign bonds. The EC’s initiative would be based upon a half-way type of debt mutualisation, whereby:

> the highest-risk securities (known as 'junior') would be first in line to bear any losses on the underlying pool should they arise, but would in exchange pay investors a higher return. Senior securities would be low-risk, as they would bear losses only in the (very unlikely) case that the junior tranche has to be fully written off to absorb the losses (ibid.)

In short, the senior issues would become the debt repayors of last resort. Perhaps unsurprisingly, these plans were quickly turned down in Germany. Markus Ferber, a German policymaker and vice-chairman of the European Parliament Committee on Economic and Monetary Affairs, worried that such a move would eventually lead to full joint liability; thus, he considered SBBS as the first step for the (unacceptable) proposal of debt mutualisation (see Guarascio, 2018).

Hence, considering what I discussed in Chapter 4, a question arises as to whether the weakness affecting European finance could ever be remedied. The imperative for financial market integration, which had to gather political support from both France and Germany, has led to a specific repo market architecture that is unable to reconcile cross-

border repo liquidity with sovereign debt market stability. In the absence of European-wide political support, particularly in Germany, for debt mutualisation, the prospect for a radical transformation of collateral policies in the euro area is very unlikely. This leaves changes in collateral management practices and repo exposure diversification among multiple CCPs discussed above the only viable options, to strengthen the stability of the European repo market and, in turn, of the sovereign debt markets of the euro area.

Proposals for further research

Finally, I would like to propose new avenues for further research. First, as this thesis is mainly focused on the involvement of LCH.Clearnet, further research could instead assess the impact on sovereign debt markets of other large CCPs in the euro area, such as Eurex clearing. Europe hosts a number of large CCPs, although comparatively smaller than LCH.Clearnet, which means that there is scope to compare the collateral management practices of different CCPs in the euro area, as well as to evaluate their own impact on sovereign debt markets and beyond. Second, more quantitative work should be conducted to quantify the exact impact of margin calls on sovereign bond prices. Indeed, one of the limitations of the analysis conducted in Chapter 5 was the lack of a precise quantification of the impact of LCH.Clearnet's margin calls on spread. As I mentioned at the beginning of the chapter, this limitation was in part dictated by the lack of a large enough sample size, which would allow estimation of the size of the effect of the margin calls. Yet, this could be overcome by aggregating the margin call data implemented by multiple CCPs in the euro area, on much longer time frames. This approach would make it possible to increase the sample size of the margin calls, which would permit the development of an auto-regressive time-series model that could quantify the impact of margin calls on spread.

To conclude, more research is also needed to understand the specific ways in which the uses of spread as a representation of market sentiment towards sovereign default risk mediates political processes. The anecdotes, that I presented in the introduction and conclusion chapters of this thesis, are merely a reflection of the more active discursive role played by spread and fear of default since the euro crisis. For instance, rising spread and perceived heightened sovereign default risk greatly contributed to adding pressure on Silvio Berlusconi to resign. Likewise, the ways in which Mario Monti thereafter employed spread targets as informal policy objectives provided legitimacy to his technocratic appointment.

Hence, more research could be conducted to understand the interconnections between the (perceived) functioning of market mechanisms, political authority and legitimacy. As a matter of fact, the research that I conducted in this thesis ended precisely where I originally expected to begin when I started my PhD programme four years ago. This thesis originally planned to understand and contextualise the discursive role played by references to spread in the political transition from Silvio Berlusconi to Mario Monti. Thus, while the planning of that project ended up evolving into the thesis presented here, the finding provided above calls for more scholarly efforts to better understand the interconnection between market mechanisms, politics, and our own assumptions about market behaviour.

Appendix I – margin calls and spread

Ireland		
Date	10-Year Spread (daily)	Margins
05-Oct-2010	421.0	
06-Oct-2010	431.6	
07-Oct-2010	434.5	
08-Oct-2010	427.5	
10-Oct-2010	427.5	
11-Oct-2010	415.0	
12-Oct-2010	433.0	
13-Oct-2010	426.1	
14-Oct-2010	399.5	
15-Oct-2010	382.3	
18-Oct-2010	369.5	
19-Oct-2010	392.6	
20-Oct-2010	396.4	
21-Oct-2010	414.9	
22-Oct-2010	413.6	
25-Oct-2010	409.4	
26-Oct-2010	399.5	
27-Oct-2010	428.8	
28-Oct-2010	436.1	
29-Oct-2010	447.7	
01-Nov-2010	476.3	
02-Nov-2010	491.3	
03-Nov-2010	513.2	
04-Nov-2010	538.3	
05-Nov-2010	534.0	
08-Nov-2010	562.6	
09-Nov-2010	566.3	
10-Nov-2010	650.1	15%
11-Nov-2010	682.1	
12-Nov-2010	587.3	
15-Nov-2010	552.4	
16-Nov-2010	594.9	
17-Nov-2010	580.2	30%
18-Nov-2010	558.2	
19-Nov-2010	560.1	
21-Nov-2010	560.1	
22-Nov-2010	566.7	
23-Nov-2010	602.8	
24-Nov-2010	640.7	
25-Nov-2010	652.3	45%
26-Nov-2010	662.2	
28-Nov-2010	662.2	
29-Nov-2010	669.6	
30-Nov-2010	689.5	
01-Dec-2010	647.5	
02-Dec-2010	591.5	
03-Dec-2010	561.9	
06-Dec-2010	557.8	30%
07-Dec-2010	540.0	
08-Dec-2010	523.9	
09-Dec-2010	521.7	
10-Dec-2010	532.0	
13-Dec-2010	530.5	
14-Dec-2010	537.9	
15-Dec-2010	531.1	
16-Dec-2010	538.7	
17-Dec-2010	556.8	
20-Dec-2010	576.8	
21-Dec-2010	611.1	
22-Dec-2010	620.9	
23-Dec-2010	624.7	
24-Dec-2010		
27-Dec-2010		
28-Dec-2010		
29-Dec-2010	631.1	
30-Dec-2010	631.0	
31-Dec-2010		

03-Jan-2011		
04-Jan-2011	633.7	
05-Jan-2011	630.1	
06-Jan-2011	628.7	
07-Jan-2011	643.2	
10-Jan-2011	624.4	
11-Jan-2011	596.3	
12-Jan-2011	553.9	
13-Jan-2011	548.0	
14-Jan-2011	549.7	
17-Jan-2011	552.7	
18-Jan-2011	579.8	
19-Jan-2011	585.8	
20-Jan-2011	575.0	
21-Jan-2011	572.7	
24-Jan-2011	571.5	
25-Jan-2011	572.2	
26-Jan-2011	576.7	
27-Jan-2011	591.3	
28-Jan-2011	596.8	
31-Jan-2011	599.5	
01-Feb-2011	583.8	
02-Feb-2011	556.3	
03-Feb-2011	567.1	
04-Feb-2011	563.2	
07-Feb-2011	563.8	
08-Feb-2011	567.0	
09-Feb-2011	569.7	
10-Feb-2011	579.0	
11-Feb-2011	579.9	
14-Feb-2011	584.3	
15-Feb-2011	593.5	
16-Feb-2011	592.0	
17-Feb-2011	604.5	
18-Feb-2011	592.0	
21-Feb-2011	594.5	
22-Feb-2011	594.9	
23-Feb-2011	598.6	
24-Feb-2011	617.3	
25-Feb-2011	620.0	
28-Feb-2011	619.5	
01-Mar-2011	628.2	
02-Mar-2011	616.8	
03-Mar-2011	606.1	
04-Mar-2011	612.7	
07-Mar-2011	614.5	
08-Mar-2011	626.1	
09-Mar-2011	627.7	
10-Mar-2011	628.6	
11-Mar-2011	650.5	
14-Mar-2011	626.2	
15-Mar-2011	640.4	
16-Mar-2011	656.3	
17-Mar-2011	649.2	
18-Mar-2011	645.6	
21-Mar-2011	643.6	
22-Mar-2011	658.7	
23-Mar-2011	655.9	
24-Mar-2011	684.6	35%
25-Mar-2011	688.1	
28-Mar-2011	681.5	
29-Mar-2011	682.7	
30-Mar-2011	682.5	
31-Mar-2011	689.1	
01-Apr-2011	690.8	45%
04-Apr-2011	669.9	
05-Apr-2011	657.9	
06-Apr-2011	610.1	
07-Apr-2011	593.7	
08-Apr-2011	591.8	
11-Apr-2011	575.6	
12-Apr-2011	581.6	35%
13-Apr-2011	577.4	
14-Apr-2011	587.2	
15-Apr-2011	630.8	
18-Apr-2011	658.0	
19-Apr-2011	662.4	

20-Apr-2011	717.2	
21-Apr-2011	723.4	
26-Apr-2011	744.1	45%
27-Apr-2011	746.7	
28-Apr-2011	747.2	
29-Apr-2011	748.0	
02-May-2011		
03-May-2011	731.6	
04-May-2011	720.6	
05-May-2011	735.6	55%
06-May-2011	755.4	
09-May-2011	797.2	
10-May-2011	756.8	
11-May-2011	757.0	
12-May-2011	764.8	
13-May-2011	777.6	
16-May-2011	732.9	
17-May-2011	732.6	
18-May-2011	729.0	
19-May-2011	732.6	
20-May-2011	764.2	
23-May-2011	808.9	
24-May-2011	815.7	
25-May-2011	823.9	65%
26-May-2011	845.2	
27-May-2011	810.4	
30-May-2011	834.3	
31-May-2011	807.2	
01-Jun-2011	804.0	
02-Jun-2011	802.6	
03-Jun-2011	770.6	
06-Jun-2011		
07-Jun-2011	759.5	
08-Jun-2011	797.0	
09-Jun-2011	803.3	
10-Jun-2011	837.3	
13-Jun-2011	845.5	75%
14-Jun-2011	858.8	
15-Jun-2011	868.6	
16-Jun-2011	889.9	
17-Jun-2011	883.8	
20-Jun-2011	877.4	
21-Jun-2011	861.9	
22-Jun-2011	886.0	
23-Jun-2011	909.9	
24-Jun-2011	926.0	
27-Jun-2011	950.5	
28-Jun-2011	960.5	80%
29-Jun-2911	972.5	

Portugal		
Date	10-Year Spread (daily)	Margins
05-Oct-2010	381.0	
06-Oct-2010	387.2	
07-Oct-2010	390.0	
08-Oct-2010	385.1	
11-Oct-2010	375.1	
10-Oct-2010	375.1	
12-Oct-2010	384.9	
13-Oct-2010	371.5	
14-Oct-2010	362.2	
15-Oct-2010	325.0	
18-Oct-2010	300.6	
19-Oct-2010	310.4	
20-Oct-2010	314.7	
21-Oct-2010	324.6	
22-Oct-2010	325.2	
25-Oct-2010	306.7	
26-Oct-2010	298.6	
27-Oct-2010	318.4	
28-Oct-2010	324.5	
29-Oct-2010	327.9	
01-Nov-2010	353.2	
02-Nov-2010	367.6	
03-Nov-2010	377.7	
04-Nov-2010	412.1	
05-Nov-2010	399.5	
08-Nov-2010	428.0	
09-Nov-2010	432.0	
10-Nov-2010	456.9	
11-Nov-2010	476.9	
12-Nov-2010	426.2	
15-Nov-2010	421.8	
16-Nov-2010	427.0	
17-Nov-2010	406.1	
18-Nov-2010	400.0	
19-Nov-2010	408.9	
21-Nov-2010	408.9	
22-Nov-2010	401.6	
23-Nov-2010	437.0	
24-Nov-2010	453.4	
25-Nov-2010	437.3	
26-Nov-2010	426.7	
28-Nov-2010	426.7	
29-Nov-2010	450.5	
30-Nov-2010	446.2	
01-Dec-2010	400.8	
02-Dec-2010	349.0	
03-Dec-2010	310.7	
06-Dec-2010	316.2	
07-Dec-2010	306.8	
08-Dec-2010	320.6	
09-Dec-2010	317.1	
10-Dec-2010	338.6	
13-Dec-2010	335.8	
14-Dec-2010	345.4	
15-Dec-2010	342.6	
16-Dec-2010	341.0	
17-Dec-2010	343.5	
20-Dec-2010	354.0	
21-Dec-2010	358.3	
22-Dec-2010	364.2	
23-Dec-2010	369.2	
24-Dec-2010	369.2	
27-Dec-2010	371.7	
28-Dec-2010	364.5	
29-Dec-2010	373.6	
30-Dec-2010	380.9	
31-Dec-2010	380.9	
03-Jan-2011	376.0	
04-Jan-2011	375.2	
05-Jan-2011	376.0	
06-Jan-2011	402.7	
07-Jan-2011	435.3	
10-Jan-2011	405.4	
11-Jan-2011	387.2	

12-Jan-2011	367.7	
13-Jan-2011	363.4	
14-Jan-2011	365.0	
17-Jan-2011	364.9	
18-Jan-2011	379.1	
19-Jan-2011	363.3	
20-Jan-2011	351.8	
21-Jan-2011	345.4	
24-Jan-2011	354.9	
25-Jan-2011	367.5	
26-Jan-2011	367.8	
27-Jan-2011	376.6	
28-Jan-2011	377.6	
31-Jan-2011	385.9	
01-Feb-2011	365.0	
02-Feb-2011	341.5	
03-Feb-2011	358.9	
04-Feb-2011	378.9	
07-Feb-2011	379.2	
08-Feb-2011	385.4	
09-Feb-2011	391.7	
10-Feb-2011	394.7	
11-Feb-2011	394.6	
14-Feb-2011	406.3	
15-Feb-2011	405.3	
16-Feb-2011	409.6	
17-Feb-2011	420.4	
18-Feb-2011	414.5	
21-Feb-2011	426.4	
22-Feb-2011	425.6	
23-Feb-2011	432.5	
24-Feb-2011	435.6	
25-Feb-2011	435.8	
28-Feb-2011	427.1	
01-Mar-2011	424.4	
02-Mar-2011	420.1	
03-Mar-2011	418.9	
04-Mar-2011	425.2	
07-Mar-2011	427.2	
08-Mar-2011	432.1	
09-Mar-2011	434.4	
10-Mar-2011	438.0	
11-Mar-2011	454.6	
14-Mar-2011	443.3	
15-Mar-2011	447.5	
16-Mar-2011	463.8	
17-Mar-2011	457.9	
18-Mar-2011	434.4	
21-Mar-2011	426.1	
22-Mar-2011	443.9	
23-Mar-2011	466.9	
24-Mar-2011	469.1	
25-Mar-2011	482.6	
28-Mar-2011	488.6	
29-Mar-2011	491.3	
30-Mar-2011	506.9	
31-Mar-2011	549.6	
01-Apr-2011	564.9	
04-Apr-2011	553.2	
05-Apr-2011	561.1	
06-Apr-2011	540.8	
07-Apr-2011	541.8	15%
08-Apr-2011	545.3	
11-Apr-2011	547.2	
12-Apr-2011	544.7	
13-Apr-2011	562.2	
14-Apr-2011	571.2	
15-Apr-2011	589.9	
18-Apr-2011	607.6	
19-Apr-2011	624.4	
20-Apr-2011	631.8	25%
21-Apr-2011	685.3	
26-Apr-2011	697.8	35%
27-Apr-2011	699.5	
28-Apr-2011	700.0	
29-Apr-2011	702.7	
02-May-2011	697.8	

03-May-2011	694.4	
04-May-2011	671.7	
05-May-2011	691.6	
06-May-2011	695.7	
09-May-2011	732.9	
10-May-2011	756.4	45%
11-May-2011	779.6	
12-May-2011	688.0	
13-May-2011	688.0	
16-May-2011	668.5	
17-May-2011	683.8	
18-May-2011	659.8	
19-May-2011	668.3	
20-May-2011	699.0	
23-May-2011	727.8	
24-May-2011	735.3	
25-May-2011	745.8	
26-May-2011	743.3	
27-May-2011	743.8	
30-May-2011	749.5	
31-May-2011	732.1	
01-Jun-2011	725.9	
02-Jun-2011	727.8	
03-Jun-2011	733.3	
06-Jun-2011	739.6	
07-Jun-2011	732.7	
08-Jun-2011	762.3	
09-Jun-2011	779.6	
10-Jun-2011	814.7	
13-Jun-2011	818.7	65%
14-Jun-2011	824.1	
15-Jun-2011	861.7	
16-Jun-2011	860.2	
17-Jun-2011	878.3	
20-Jun-2011	919.2	
21-Jun-2011	918.0	
22-Jun-2011	929.3	
23-Jun-2011	974.3	
24-Jun-2011	971.3	
27-Jun-2011	1,002.7	
28-Jun-2011	970.5	80%

Italy		
Date	10-Year Spread (daily)	Margins
03-Oct-2011	372.9	
04-Oct-2011	377.5	
05-Oct-2011	369.4	
06-Oct-2011	351.8	
07-Oct-2011	352.7	
10-Oct-2011	349.3	
11-Oct-2011	354.3	
12-Oct-2011	354.7	
13-Oct-2011	370.8	
14-Oct-2011	360.1	
17-Oct-2011	370.9	
18-Oct-2011	386.5	
19-Oct-2011	384.1	
20-Oct-2011	399.0	
21-Oct-2011	377.5	
24-Oct-2011	383.5	
25-Oct-2011	389.1	
26-Oct-2011	388.8	
27-Oct-2011	366.6	
28-Oct-2011	382.3	
31-Oct-2011	409.2	
01-Nov-2011	455.3	
02-Nov-2011	434.1	
03-Nov-2011	426.5	
04-Nov-2011	454.4	
07-Nov-2011	474.2	
08-Nov-2011	490.9	11.65%
09-Nov-2011	557.9	
10-Nov-2011	522.0	
11-Nov-2011	465.9	
12-Nov-2011	465.9	
14-Nov-2011	488.7	
15-Nov-2011	529.0	
16-Nov-2011	519.5	
17-Nov-2011	498.5	
18-Nov-2011	473.6	
21-Nov-2011	478.9	
22-Nov-2011	489.0	
23-Nov-2011	498.6	
24-Nov-2011	493.6	
25-Nov-2011	504.9	
28-Nov-2011	487.0	
29-Nov-2011	491.7	
30-Nov-2011	480.2	
01-Dec-2011	440.8	
02-Dec-2011	441.9	
04-Dec-2011	441.9	
05-Dec-2011	415.8	
06-Dec-2011	409.9	
07-Dec-2011	444.1	
08-Dec-2011	430.5	8.15%
09-Dec-2011	435.6	
12-Dec-2011	501.6	
13-Dec-2011	496.0	
14-Dec-2011	524.6	
15-Dec-2011	505.7	
16-Dec-2011	509.3	
19-Dec-2011	494.7	
20-Dec-2011	462.3	
21-Dec-2011	483.9	
22-Dec-2011	488.5	
23-Dec-2011	504.4	
27-Dec-2011	506.0	
28-Dec-2011	506.7	
29-Dec-2011	513.9	
30-Dec-2011	518.4	
02-Jan-2012	500.5	
03-Jan-2012	501.8	
04-Jan-2012	502.4	
05-Jan-2012	522.1	
06-Jan-2012	528.0	
09-Jan-2012	527.1	
10-Jan-2012	528.8	
11-Jan-2012	521.8	

12-Jan-2012	484.5	
13-Jan-2012	491.2	8.3%
16-Jan-2012	495.5	
17-Jan-2012	470.5	
18-Jan-2012	466.7	
19-Jan-2012	460.5	
20-Jan-2012	433.5	
23-Jan-2012	411.9	
24-Jan-2012	419.0	
25-Jan-2012	425.2	
26-Jan-2012	414.9	
27-Jan-2012	398.9	
30-Jan-2012	425.1	
31-Jan-2012	415.5	
01-Feb-2012	386.7	
02-Feb-2012	378.5	
03-Feb-2012	372.5	
06-Feb-2012	372.6	
07-Feb-2012	370.2	
08-Feb-2012	358.4	
09-Feb-2012	346.6	
10-Feb-2012	363.0	
13-Feb-2012	361.7	
14-Feb-2012	365.8	
15-Feb-2012	382.6	
16-Feb-2012	381.7	
17-Feb-2012	363.2	
20-Feb-2012	350.5	
21-Feb-2012	346.8	
22-Feb-2012	358.7	
23-Feb-2012	363.1	
24-Feb-2012	357.6	
27-Feb-2012	362.9	
28-Feb-2012	357.6	
29-Feb-2012	335.4	
01-Mar-2012	306.4	
02-Mar-2012	310.9	
05-Mar-2012	313.4	
06-Mar-2012	327.7	
07-Mar-2012	319.8	
08-Mar-2012	303.5	
09-Mar-2012	303.9	
12-Mar-2012	313.6	
13-Mar-2012	305.7	
14-Mar-2012	291.0	
15-Mar-2012	287.5	
16-Mar-2012	281.3	
19-Mar-2012	278.7	
20-Mar-2012	282.8	
21-Mar-2012	298.7	
22-Mar-2012	318.4	
23-Mar-2012	318.2	
26-Mar-2012	308.4	
27-Mar-2012	325.5	
28-Mar-2012	326.1	
29-Mar-2012	342.3	
30-Mar-2012	332.8	
02-Apr-2012	327.9	
03-Apr-2012	333.0	
04-Apr-2012	351.3	
05-Apr-2012	370.3	
10-Apr-2012	396.4	
11-Apr-2012	378.7	
12-Apr-2012	360.5	
13-Apr-2012	377.4	
16-Apr-2012	386.3	
17-Apr-2012	372.9	
18-Apr-2012	377.2	
19-Apr-2012	388.1	
20-Apr-2012	391.5	
23-Apr-2012	410.4	
24-Apr-2012	397.3	
25-Apr-2012	390.0	
26-Apr-2012	394.9	
27-Apr-2012	394.4	
30-Apr-2012	385.3	
02-May-2012	394.3	
03-May-2012	389.6	

04-May-2012	386.0	
07-May-2012	382.5	
08-May-2012	407.7	
09-May-2012	426.6	
10-May-2012	412.8	
11-May-2012	415.0	
14-May-2012	441.8	
15-May-2012	455.7	
16-May-2012	447.1	
17-May-2012	454.4	
18-May-2012	451.2	
21-May-2012	448.7	
22-May-2012	424.9	
23-May-2012	442.4	
24-May-2012	432.8	
25-May-2012	442.4	
28-May-2012	451.0	
29-May-2012	453.1	
30-May-2012	478.1	
31-May-2012	482.2	
01-Jun-2012	467.7	
04-Jun-2012	444.1	
05-Jun-2012	441.9	
06-Jun-2012	436.9	
07-Jun-2012	432.2	
08-Jun-2012	445.6	9.5%
11-Jun-2012	471.1	
12-Jun-2012	476.0	
13-Jun-2012	472.0	
14-Jun-2012	467.6	
15-Jun-2012	449.7	
18-Jun-2012	463.6	
19-Jun-2012	439.9	
20-Jun-2012	413.4	
21-Jun-2012	419.1	
22-Jun-2012	420.0	
25-Jun-2012	453.4	
26-Jun-2012	466.1	
27-Jun-2012	464.2	
28-Jun-2012	467.6	
29-Jun-2012	419.6	
02-Jul-2012	422.3	
03-Jul-2012	411.8	
04-Jul-2012	430.2	
05-Jul-2012	455.9	
06-Jul-2012	469.0	
09-Jul-2012	477.5	
10-Jul-2012	462.6	
11-Jul-2012	453.4	
12-Jul-2012	466.2	
13-Jul-2012	478.9	
16-Jul-2012	488.4	
17-Jul-2012	479.5	
18-Jul-2012	486.0	
19-Jul-2012	478.2	
20-Jul-2012	499.5	
23-Jul-2012	514.3	11.65%
24-Jul-2012	531.8	
25-Jul-2012	518.5	
26-Jul-2012	471.8	
27-Jul-2012	455.9	
30-Jul-2012	462.0	
31-Jul-2012	477.6	
01-Aug-2012	452.7	
02-Aug-2012	499.7	
03-Aug-2012	465.4	
06-Aug-2012	459.3	
07-Aug-2012	449.0	
08-Aug-2012	447.0	
09-Aug-2012	439.8	
10-Aug-2012	453.1	
13-Aug-2012	447.8	
14-Aug-2012	438.0	
15-Aug-2012	438.0	
16-Aug-2012	426.5	
17-Aug-2012	429.9	
20-Aug-2012	428.6	
21-Aug-2012	410.4	

22-Aug-2012	418.8	
23-Aug-2012	433.2	
24-Aug-2012	438.6	
27-Aug-2012	435.4	
28-Aug-2012	447.2	
29-Aug-2012	439.0	
30-Aug-2012	445.9	
31-Aug-2012	451.8	

Spain		
Date	10-Year Spread (daily)	Margins
02-Jan-2012	325.9	
03-Jan-2012	339.7	
04-Jan-2012	358.7	
05-Jan-2012	380.4	
06-Jan-2012	391.0	
09-Jan-2012	373.0	
10-Jan-2012	366.3	
11-Jan-2012	355.1	
12-Jan-2012	335.6	
13-Jan-2012	349.6	
16-Jan-2012	344.7	
17-Jan-2012	334.9	
18-Jan-2012	339.1	
19-Jan-2012	341.1	
20-Jan-2012	390.4	
23-Jan-2012	380.7	
24-Jan-2012	378.8	
25-Jan-2012	371.1	
26-Jan-2012	366.0	
27-Jan-2012	314.1	
30-Jan-2012	329.2	
31-Jan-2012	322.1	
01-Feb-2012	309.4	
02-Feb-2012	311.1	
03-Feb-2012	310.9	
06-Feb-2012	309.8	
07-Feb-2012	315.1	
08-Feb-2012	324.8	
09-Feb-2012	318.5	
10-Feb-2012	334.3	
13-Feb-2012	333.6	
14-Feb-2012	338.1	
15-Feb-2012	356.9	
16-Feb-2012	348.1	
17-Feb-2012	336.1	
20-Feb-2012	321.8	
21-Feb-2012	317.7	
22-Feb-2012	315.7	
23-Feb-2012	316.3	
24-Feb-2012	314.9	
27-Feb-2012	319.2	
28-Feb-2012	323.8	
29-Feb-2012	314.6	
01-Mar-2012	300.5	
02-Mar-2012	311.5	
05-Mar-2012	315.1	
06-Mar-2012	337.1	
07-Mar-2012	330.4	
08-Mar-2012	328.2	
09-Mar-2012	319.9	
12-Mar-2012	328.0	
13-Mar-2012	332.0	
14-Mar-2012	321.7	
15-Mar-2012	323.1	
16-Mar-2012	313.1	
19-Mar-2012	317.0	
20-Mar-2012	318.0	
21-Mar-2012	340.5	
22-Mar-2012	357.4	
23-Mar-2012	350.7	
26-Mar-2012	336.6	
27-Mar-2012	344.8	
28-Mar-2012	348.6	
29-Mar-2012	364.7	
30-Mar-2012	355.5	
02-Apr-2012	354.2	
03-Apr-2012	363.8	
04-Apr-2012	389.2	
05-Apr-2012	405.0	
06-Apr-2012	405.0	
09-Apr-2012	405.0	
10-Apr-2012	427.0	
11-Apr-2012	415.8	

12-Apr-2012	405.6	
13-Apr-2012	423.1	
16-Apr-2012	433.3	
17-Apr-2012	414.6	
18-Apr-2012	412.6	
19-Apr-2012	423.9	
20-Apr-2012	425.7	
23-Apr-2012	438.1	
24-Apr-2012	419.2	
25-Apr-2012	407.8	11.2%
26-Apr-2012	416.4	
27-Apr-2012	414.4	
30-Apr-2012	411.6	
01-May-2012	411.6	
02-May-2012	427.6	
03-May-2012	416.9	
04-May-2012	416.3	
07-May-2012	417.4	
08-May-2012	429.6	
09-May-2012	458.7	
10-May-2012	444.3	
11-May-2012	448.4	
14-May-2012	482.0	
15-May-2012	488.3	
16-May-2012	479.7	
17-May-2012	489.9	
18-May-2012	482.5	11.8%
21-May-2012	484.4	
22-May-2012	461.2	
23-May-2012	481.6	
24-May-2012	477.5	
25-May-2012	497.4	
28-May-2012	513.0	
29-May-2012	507.2	
30-May-2012	540.4	
31-May-2012	537.1	
01-Jun-2012	534.2	
04-Jun-2012	518.7	
05-Jun-2012	509.0	
06-Jun-2012	501.8	
07-Jun-2012	470.8	
08-Jun-2012	491.4	
09-Jun-2012	491.4	
11-Jun-2012	520.5	
12-Jun-2012	531.7	
13-Jun-2012	526.1	
14-Jun-2012	544.9	
15-Jun-2012	542.6	
18-Jun-2012	578.5	
19-Jun-2012	555.0	
20-Jun-2012	512.1	
21-Jun-2012	504.8	
22-Jun-2012	484.3	
25-Jun-2012	518.1	
26-Jun-2012	518.4	
27-Jun-2012	534.0	
28-Jun-2012	544.7	
29-Jun-2012	491.5	
02-Jul-2012	487.9	
03-Jul-2012	478.3	
04-Jul-2012	495.0	
05-Jul-2012	538.3	
06-Jul-2012	561.3	
09-Jul-2012	573.0	
10-Jul-2012	545.2	
11-Jul-2012	542.8	
12-Jul-2012	536.5	
13-Jul-2012	532.7	
16-Jul-2012	556.0	
17-Jul-2012	548.6	
18-Jul-2012	569.2	
19-Jul-2012	579.9	
20-Jul-2012	613.8	
23-Jul-2012	635.6	12.2%
24-Jul-2012	645.3	
25-Jul-2012	619.9	
26-Jul-2012	562.1	

27-Jul-2012	538.8	
30-Jul-2012	524.6	
31-Jul-2012	548.8	
01-Aug-2012	525.5	
02-Aug-2012	587.6	
03-Aug-2012	576.8	
06-Aug-2012	541.9	
07-Aug-2012	542.0	
08-Aug-2012	556.1	
09-Aug-2012	547.7	
10-Aug-2012	556.5	
13-Aug-2012	545.2	
14-Aug-2012	525.2	
15-Aug-2012	511.3	
16-Aug-2012	499.2	
17-Aug-2012	500.6	
20-Aug-2012	487.5	
21-Aug-2012	467.5	
22-Aug-2012	482.6	
23-Aug-2012	502.4	
24-Aug-2012	511.7	
27-Aug-2012	502.3	
28-Aug-2012	513.7	
29-Aug-2012	510.5	
30-Aug-2012	527.7	
31-Aug-2012	539.3	
03-Sep-2012	552.1	
04-Sep-2012	521.9	
05-Sep-2012	503.3	
06-Sep-2012	448.9	
07-Sep-2012	415.1	
10-Sep-2012	417.4	
11-Sep-2012	417.9	
12-Sep-2012	399.8	
13-Sep-2012	407.5	
14-Sep-2012	410.8	
17-Sep-2012	432.3	
18-Sep-2012	430.6	
19-Sep-2012	411.8	
20-Sep-2012	422.8	
21-Sep-2012	419.4	
24-Sep-2012	412.6	
25-Sep-2012	421.7	
26-Sep-2012	463.9	
27-Sep-2012	451.0	
28-Sep-2012	454.3	
01-Oct-2012	441.2	
02-Oct-2012	430.8	
03-Oct-2012	436.0	
04-Oct-2012	445.0	
05-Oct-2012	418.3	
08-Oct-2012	424.9	
09-Oct-2012	433.2	
10-Oct-2012	431.5	
11-Oct-2012	425.3	
12-Oct-2012	417.8	
15-Oct-2012	436.8	
16-Oct-2012	426.5	
17-Oct-2012	386.0	
18-Oct-2012	374.5	
19-Oct-2012	377.7	
22-Oct-2012	388.7	
23-Oct-2012	406.4	
24-Oct-2012	403.6	
25-Oct-2012	401.5	
26-Oct-2012	406.6	
29-Oct-2012	418.2	
30-Oct-2012	419.0	
31-Oct-2012	415.1	

Bibliography

Acharya, V. V, & Sabri, O. (2010). The Repurchase Agreement (Repo) Market. In *Regulating Wall Street: The Dodd-Frank Act and the New Architecture of Global Finance* (pp. 319–350). Courier Westford.

Acharya, V. V., & Steffen, S. (2015). The "greatest" carry trade ever? Understanding Eurozone Bank Risks. *Journal of Financial Economics*, *115*(2), 215–236.

Agresti, A., & Finlay, B. (2013). *Statistical methods for the social sciences* (4th ed.). Harlow: Pearson Education.

Aizenman, J., Hutchison, M., & Jinjarak, Y. (2013). What is the risk of European sovereign debt defaults? Fiscal space, CDS spreads and market pricing of risk. *Journal of International Money and Finance*, *34*, 37–59.

Albertazzi, U., Ropele, T., Sene, G., & Signoretti, F. M. (2014). The impact of the sovereign debt crisis on the activity of Italian banks. *Journal of Banking and Finance*, *46*, 387–402.

Alloway, T. (2010). Mi casa es su casa – Spanish clearing and collateral. Retrieved February 1, 2018, from https://ftalphaville.ft.com/2010/08/25/325491/mi-casa-es-su-casa-spanish-clearing-and-collateral.

Alloway, T. (2011). A glimpse at failed central counterparties. *Financial Times*. Retrieved May 2, 2017 from: https://ftalphaville.ft.com/2011/06/02/583116/a-glimpse-at-failed-central-counterparties/.

Amable, B. (2003). *The Diversity of Modern Capitalism*. Oxford University Press.

Anderson, E. (2018). Oettinger apologizes after Italy remarks spark storm. *Politico*. Retrieved September 4, 2018, from https://www.politico.eu/article/oettinger-italy-markets-will-give-signal-not-to-vote-for-populists/.

Arghyrou, M. G., & Kontonikas, A. (2012). The EMU sovereign-debt crisis: Fundamentals, expectations and contagion. *Journal of International Financial Markets, Institutions and Money*, *22*(4), 658–677.

Arghyrou, M. G., & Tsoukalas, J. D. (2011). The Greek Debt Crisis: Likely Causes, Mechanics and Outcomes. *World Economy*, *34*(2), 173–191.

Armakola, A., Douady, R., Laurent, J., & Molteni, F. (2016). *Repurchase agreements and systemic risk in the European sovereign debt crises: the role of European clearing houses* (Financial Regulation Lab Policy Paper No. 6). Retrieved July 21, 2017, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3010095.

Arora, V., & Cerisola, M. (2001). *How Does U.S. Monetary Policy Influence Sovereign Spreads in Emerging Markets?* (IMF Staff Papers No. 48–3).

Baker, A. (1999). Nébuleuse and the 'Internationalization of the State' in the UK? The case of HM Treasury and the Bank of England. *Review of International Political Economy*, *6*(1), 79–100.

Baker, M., & Wurgler, J. (2007). Investor Sentiment in the Stock Market. *Journal of Economic Perspectives*, *21*(2), 129–151.

Baldwin, R., Beck, T., Bénassy-quéré, A., Blanchard, O., Corsetti, G., Grauwe, P. De, … Weder, B. (2015). *Rebooting the Eurozone: Step I - Agreeing a Crisis Narrative* (CEPR Policy Insight No. 85). Retrieved October, 12, 2017, from https://voxeu.org/sites/default/files/file/Policy%20Insight%2085.pdf.

Ban, C., & Gabor, D. (2016). The political economy of shadow banking. *Review of International Political Economy*, *23*(6), 901–914.

Banco de Portugal. (2010). Financial Stability Report November 2010. Retrieved September 2, 2017, from https://www.bportugal.pt/en/comunicado/financial-stability-report-november-2010.

Bank of England. (1997). *The first year of the gilt repo market* (Bank of England Quarterly Bulletin May 1997). Retrieved 18 December, 2017, from https://www.bankofengland.co.uk/quarterly-bulletin/1997/q2/the-first-year-of-the-gilt-repo-market.

Bank of Italy. (2008). *Statistical Bulletin* (Statistical Bulletin No. quarter 4). Retrieved July 7, 2015, from https://www.bancaditalia.it/pubblicazioni/bollettino-statistico/2008-bolstat/index.html.

Bank of Italy. (2012). *Financial Stability Report* (No. 3, April). Retrieved June 21, 2016, from https://www.bancaditalia.it/pubblicazioni/rapporto-stabilita/index.html?com.dotmarketing.htmlpage.language=1.

Bankia. (2011). *Registration document*. Retrieved March 12, 2016, from https://www.bankia.com/recursos/doc/corporativo/20121002/ingles/registration-document-2011.pdf.

Banque de France. (2010). *Derivatives: Financial Innovation and Stability*. *Financial Stability Review*. Retrieved July 21, 2016, from https://publications.banque-france.fr/sites/default/files/medias/documents/financial-stability-review-14_2010-07.pdf.

Becker, J., & Jäger, J. (2012). Integration in Crisis: A Regulationist Perspective on the Interaction of European Varieties of Capitalism. *Competition & Change*, *16*(3), 169–187.

Beetsma, R., Giuliodori, M., de Jong, F., & Widijanto, D. (2013). Spread the news: The impact of news on the European sovereign bond markets during the crisis. *Journal of International Money and Finance*, *34*, 83–101.

Beirne, J., & Fratzscher, M. (2013). The pricing of sovereign risk and contagion during the European sovereign debt crisis. *Journal of International Money and Finance*, *34*, 60–82.

Bellofiore, R. (2013). "Two or three things I know about her": Europe in the global crisis and heterodox economics. *Cambridge Journal of Economics*, *37*(3), 497–512.

Bellofiore, R., & Halevi, J. (2010). "Could Be Raining." *International Journal of Political Economy*, *39*(4), 5–30.

Bernanke, B. (2011). *Clearinghouses, Financial Stability, and Financial Reform* (Speech given at the 2011 Financial Markets Conference, Stone Mountain, Georgia). Retrieved on July 1, 2018, from https://www.federalreserve.gov/newsevents/speech/bernanke20110404a.htm.

Bernanke, B. S. (1990). Clearing and Settlement during the Crash. *The Review of Financial Studies*, *3*(1), 133–151.

Bernoth, K., & Erdogan, B. (2012). Sovereign bond yield spreads: A time-varying coefficient approach. *Journal of International Money and Finance*, *31*(3), 639–656.

Bernoth, K., von Hagen, J., & Schuknecht, L. (2006). *Sovereign Risk Premiums in the European Government Bond Market* (University of Mannheim Discussion Paper No. 151).

Bibow, J. (2013). At the crossroads: The euro and its central bank guardian (and saviour?). *Cambridge Journal of Economics*, *37*(3), 609–626.

Bignon, V., & Vuillemey, G. (2017). *The Failure of a Clearinghouse: Empirical Evidence* (European Capital Market Institute Working Paper No. 6). Retrieved June 21, 2018, from https://static.norges-bank.no/contentassets/432aa1c401a243f9b08a3f3aecd4c71d/working_paper_3_17.pdf.

Bindseil, U., Corsi, M., Sahel, B., & Visser, A. (2017). *The Eurosystem collateral framework explained* (ECB's Occasional Paper Series No. 189). Retrieved January 21, 2018, from https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op189.en.pdf.

BIS. (2010). *Market structure developments in the clearing industry: implications for financial stability*. Retrieved October 3, 2017, from https://www.bis.org.

BIS. (2016). *Statistical release. OTC derivatives statistics at end-June 2016*. Retrieved October 21, 2017, from https://www.bis.org.

BIS. (2017). Global OTC derivatives market in billions of US dollars. Retrieved January 2, 2018, from https://www.bis.org.

Blanchard, O. (2007). Adjustment within the euro. The difficult case of Portugal. *Portuguese Economic Journal*, *6*(1), 1–21.

Blank, S. C., Colin, A. C., & Brian, H. S. (1991). *Futures and Option Markets*. Englewood Cliffs, NJ: Prentice-Hall.

Bloomberg. (2009). Greece Offers EU500 Million Farm Package, Roadblocks Continue. (23 January).

Boissel, C., Derrien, F., Ors, E., & Thesmar, D. (2017). Systemic risk in clearing houses: Evidence from the European repo market. *Journal of Financial Economics*, *125*(3), 511-536.

Borio, C., Furfine, C., & Lowe, P. (2001). Procyclicality of the financial system and financial stability: issues and policy options. In *Marrying the macro- and microprudential dimensions of financial stability* (BIS Papers Series No. 1).

Bottazzi, J.-M., Páscoa, M. R., & Ramírez, G. (2017). *Do security prices rise or fall when margins are raised?* (INOVA Working Paper No. 616). Retrieved January 12, 2018, from https://run.unl.pt/bitstream/10362/25470/1/wp616.pdf.

Brady, N. F. (1988). *Report of the Presidential Task Force on Market Mechanisms*. Retrieved 21 March, 2016, from https://archive.org/stream/reportofpresiden01unit#mode/2up.

Broner, F. A., Martin, A., & Ventura, J. (2010). Sovereign risk and secondary markets. *American Economic Review*, *100*(4), 1523–1555.

Brown, G. W., & Cliff, M. T. (2004). Investor sentiment and the near-term stock market. *Journal of Empirical Finance*, *11*(1), 1–27.

Brumm, J., Kubler, F., Grill, M., & Schmedders, K. (2012). *Margin Requirements and Asset Prices* (European Finance Association's 39th Annual Meeting, Copenhagen). Retrieved March 4, 2017, from http://johannesbrumm.com/wp-content/uploads/2014/12/bgks2-dec19-2014.pdf.

Brunnermeier, M. K., & Pedersen, L. H. (2009). Market liquidity and funding liquidity. *Review of Financial Studies*, *22*(6), 2201–2238.

Bryman, A. (2012). *Social research methods* (4th ed.). Oxford: Oxford University Press.

Büchel, K. (2013). Do words matter? The impact of communication on the PIIGS' CDS and bond yield spreads during Europe's sovereign debt crisis. *European Journal of Political Economy*, *32*, 412–431.

Buiter, W. H., & Sibert, A. (2005). *How the Eurosystem's Treatment of Collateral in its Open Market Operations Weakens Fiscal Discipline in the Eurozone (and What to Do About it)* (CEPR's Discussion Paper No. 5387). Retrieved 3 February, 2016, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=887541.

Buiter, W., & Rahbari, E. (2010). *Greece and the fiscal crisis in the Eurozone* (Centre for Economic Policy Research Policy Insight No. 51).

Bull, M., & Rhodes, M. (2007). Introduction - Italy: A contested polity. *West European Politics*, *30*(4), 657–669.

Bundesbank. (1996). *Annual Report 1996*. Retrieved January 25, 2017, from https://www.bundesbank.de/resource/blob/702930/7379f73102fcefc18692a7f8b2fee95f/mL/1996-annual-report-data.pdf.

Burke, J. (2011). *LCH.Clearnet Margining Approach. Presentation to: ECB Money Market Contact Group*. Retrieved 1 July 2018 from https://www.ecb.europa.eu/paym/groups/pdf/mmcg/Item_1_LCH_Margining.pdf?08c651031034a0ba9d02cc82b637d49e.

Byrne, E. (2012). *Political Corruption in Ireland 1922-2010: A Crooked Harp?* Manchester: Manchester University Press.

Caldas, J. (2017). Portugal's Austerity Bailout. In J. Bohoslavsky & K. Raffer (Eds.), *Sovereign Debt Crises: What Have We Learned?* (pp. 201–219). Cambridge: Cambridge University Press.

Cantor, R., & Packer, F. (1996). *Determinants and Impact of Sovereign Credit Ratings* (FRBNY Economic Policy Review No. 2).

Cargill, T. F., Hutchison, M. M., & Ito, T. (2003). *The Political Economy of Japanese Monetary Policy*. Cambridge, MA: MIT Press.

Carosso, V. P. (1970). *Investment Banking in America, A History*. Cambridge: Harvard University Press.

Casiraghi, M., Gaiotti, E., Rodano, L., & Secchi, A. (2016). The impact of unconventional monetary policy on the Italian economy during the sovereign debt crisis. *International Journal of Central Banking*, *12*(2), 269–315.

Cavalier, D. (2011). *The sovereign debt crisis puts Portuguese banks to the test* (BNP PARIBAS Economic Research). Retrieved August 12, 2015, from https://economic-research.bnpparibas.com/Views/DisplayPublication.aspx?type=document&IdPdf=19062

Cesaratto, S. (2013). Controversial and novel features of the Eurozone crisis as a balance of payment crisis. In Ó. Dejuán, E. Febrero, & G. Uxo (Eds.), *Post-Keynesian Views of the Crisis and its Remedies*. Routledge.

CESR. (2010). *Standardisation and exchange trading of OTC derivatives*. Retried 2 March 2, 2016, from https://www.cesr.eu.

CFTC and SEC. (2012). *Joint Report on International Swap Regulation*. Retrieved April 12, 2016, from https://www.sec.gov.

CGFS. (1999a). *Implications of repo markets for central banks*. Bank for International Settlements. Retrieved May 23, 2016, from https://www.bis.org.

CGFS. (1999b). *Market Liquidity: Research Finding and Selected Policy Implications*. Retrieved June 15, 2016, from https://www.bis.org.

Chalmin, P. (1990). *The Making of a Sugar Giant: Tate and Lyle, 1859-1989*. Chur: Harwood Academic Publishers.

Chamorro-Courtland, C. (2010). Counterparty Substitution in Central Counterparty (CCP) Systems. *Banking and Finance Law Review*, *26*(3), 519–542.

Chang, M., & Leblond, P. (2015). All in: Market expectations of eurozone integrity in the sovereign debt crisis. *Review of International Political Economy*, *22*(3), 626–655.

Chiodo, A. J., & Owyang, M. T. (2002). A Case Study of a Currency Crisis: The Russian Default of 1998. *The Federal Reserve Bank of St. Louis*, (November/December), 7–18.

Choudhry, M. (2002). *The REPO Handbook*. London: Butterworth-Heinemann.

Choudhry, M. (2006). *Bonds: a concise guide for investors*. Palgrave Macmillan.

Chrysoloras, B. N., & Weber, A. (2018). EU Unveils Pooled Sovereign-Debt Plan Amid German Resistance. *Reuters*. Retrieved May 1, 2018, from

https://www.bloomberg.com/news/articles/2018-05-24/eu-unveils-plan-for-pooled-sovereign-bonds-amid-italian-turmoil.

CME. (1988). Findings of the Committee of Inquiry: Examining the Events Surrounding October 19, 1987. Retrieved February 17, 2016, from http://3197d6d14b5f19f2f440-5e13d29c4c016cf96cbbfd197c579b45.r81.cf1.rackcdn.com/collection/papers/1980/1988_0331_MercantileReport.pdf.

Codogno, L., Favero, C., & Missale, A. (2003). Yield spreads on EMU government bonds. *Economic Policy*, (18), 503–532.

Cœuré, B. (2014). *Session 4 – Policy Panel Risks in (and of) CCPs*. Presentation to the OFR and FSOC Co-Host Third Annual Conference, 23 January, Washington DC.

Comotto, R. (2015). *European Repo Market Survey* (International Capital Market Association Survey No. 29). Retrieved 21 December, 2017, from http://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/short-term-markets/Repo-Markets/repo/.

Comotto, R. (2017). A primer on tri-party repo. Retrieved February 1, 2018, from www.esma.europa.eu

Comotto, R. (2018). *European Repo Market Survey* (International Capital Market Association Survey No. 34). Retrieved September 10, 2018, from https://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/repo-and-collateral-markets/icma-ercc-publications/repo-market-surveys/.

Consob. (2012). *Entrata in vigore del Regolamento UE n. 236/2012 in materia di vendite allo scoperto e taluni aspetti dei credit default swap* (Vol. 1998). Retrieved May 21, 2016, from

http://www.consob.it/documents/46180/46181/c12083249.pdf/89f67321-0180-4bef-924c-2b26ca1af5cf.

Constâncio, V. (2012). *Shadow banking – The ECB perspective Speech by Vítor Constâncio , Vice-President of the ECB , Towards better regulation of the shadow banking system , European Commission Conference ,* (Speech by Vítor Constâncio, Vice-President of the ECB, Towards better regulation of the shadow banking system, European Commission Conference, Brussels, 27 April). Retrieved July 1, 2016, from https://www.ecb.europa.eu/press/key/date/2012/html/sp120427.en.html.

Cont, R. (2017). *Central clearing and risk transformation* (Norges Bank Research No. 3). Retrieved January 12, 2018, from https://static.norges-bank.no/contentassets/432aa1c401a243f9b08a3f3aecd4c71d/working_paper_3_17.pdf.

Copeland, A., Davis, I., LeSeur, E., & Martin, A. (2012). Mapping and Sizing the U.S. Repo Market. Retrieved February 1, 2018, from http://libertystreeteconomics.newyorkfed.org/2012/06/mapping-and-sizing-the-us-repo-market.html.

Copeland, A., Martin, A., & Walker, M. (2014). Repo Runs: Evidence from the Tri-Party Repo Market. *Journal of Finance*, *69*(6), 2343–2380.

Corriere della Sera. (2012). Lo spread a un passo dalla «soglia Monti». Retrieved January 1, 2017, from https://www.corriere.it/economia/12_dicembre_19/spread-ribasso_6e21d76e-49b6-11e2-8f39-57d26b118e07.shtml.

Cotterill, J. (2011). LCH Clearnet SA raises margin on Italian bonds. *Financial Times*. Retrieved May 24, 2014, from http://ftalphaville.ft.com/2011/11/09/736051/lch-clearnet-sa-raises-margin-on-italian-bonds/.

Council Directive. (2002). Council Directive of 6 June 2002 on Financial Collateral Arrangements (2002/47/EC).

Culpepper, P. D. (2007). Eppure, non si muove: Legal change, institutional stability and Italian corporate governance. *West European Politics*, *30*(4), 784–802.

Culpepper, P. D. (2014). The Political Economy of Unmediated Democracy: Italian Austerity under Mario Monti. *West European Politics*, *37*(6), 1264–1281.

Currie, L. (1931). The Decline of the Commercial Loan. *Quarterly Journal of Economics*, *August*, 698–709.

Damiani, V. (2016). Italian prosecutor investigates Deutsche Bank over 2011 bond sale. Retrieved February 1, 2018, from https://uk.reuters.com/article/us-deutsche-bank-italy-probe/italian-prosecutor-investigates-deutsche-bank-over-2011-bond-sale-idUKKCN0XX0J5.

Davis, R., Maslar, D. A., & Roseman, B. (2017). Secondary Market Trading and the Cost of New Debt Issuance. *Ssrn*. https://doi.org/10.2139/ssrn.2954857.

De Cecco, M. (2007). Italy's dysfunctional political economy. *West European Politics*, *30*(4), 763–783.

De Grauwe, P. (1991). Is the European Monetary System a DM-Zone? In A. Steinherr & D. Weiserbs (Eds.), *Evolution of the International and Regional Monetary Systems*. London: Palgrave Macmillan.

De Grauwe, P., & Ji, Y. (2012). Mispricing of sovereign risk and macroeconomic stability in the eurozone. *Journal of Common Market Studies*, *50*(6), 866–880.

De Grauwe, P., & Ji, Y. (2013). Self-fulfilling crises in the Eurozone: An empirical test. *Journal of International Money and Finance*, *34*, 15–36.

De Santis. (2012). *The Euro Area Sovereign Debt Crisis: Safe Haven, Credit Rating Agencies and the Spread of the Fever From Greece, Ireland and Portugal* (ECB Working Paper Series No. 1419).

Deeg, R. (2005). Remaking Italian Capitalism? The Politics of Corporate Governance Reform. *West European Politics*, *28*(3), 521–548.

Dejuán, Ó., Febrero, E., & Uxó, J. (Eds.). (2013). *Post-Keynesian Views of the Crisis and its Remedies*. New York: Routledge.

Dellepiane, S., Hardiman, N., & Las Heras, J. (2013). *Building on easy money: the political economy of housing bubbles in Ireland and Spain* (UCD Geary Institute Discussion Paper Series No. WP2013/18).

Deloitte. (2014). *OTC Derivatives. The new cost of trading*.

Deutsche Bank. (2010). *Portugal's Difficulties Come From Afar* (Global Markets Research. Frankfurt am Main).

Dewachter, H., Iania, L., & Wijnandts, J.-C. (2016). *The response of euro area sovereign spreads to the ECB unconventional monetary policies* (National Bank of Belgium Working Paper Research No. 309).Retrieved January 21, 2017, from https://www.nbb.be/doc/oc/repec/reswpp/wp309en.pdf.

Di Maio, L. (2018). Twitter. Retrieved September 18, 2018, from https://twitter.com/luigidimaio/status/1001474208269045760.

Domanski, D., Gambacorta, L., & Picillo, C. (2015). Central clearing: trends and current issues. *BIS Quarterly Review*, (December), 59–76.

Dominguez, K. M. E. (2006). The European Central Bank, the euro, and global financial markets. *The Journal of Economic Perspectives*, *20*(4), 67–88.

Donovan, D., & Murphy, A. E. (2013). *The Fall of the Celtic Tiger: Ireland and the Euro Debt Crisis*. Oxford University Press.

Dooley, N. (2015). *Beyond Immaturity and Victimisation: The European Periphery and the Eurozone Crisis*. PhD thesis, University of Sussex.

Dow, S. (2009). The Psychology of Financial Markets: Keynes, Minsky and Emotional Finance. In D. B. Papadimitriou & L. R. Wray (Eds.), *The Elgar Companion to Hyman Minsky*. Cheltenham: Edward Elgar.

Dow, S. C. (2011). Cognition, market sentiment and financial instability. *Cambridge Journal of Economics*, *35*(2), 233–249. https://doi.org/10.1093/cje/beq029

Draghi, M. (2012). Verbatim of the remarks made by Mario Draghi. Retrieved February 1, 2018, from http://www.ecb.europa.eu/press/key/date/2012/html/sp120726.en.html.

Draghi, M. (2014). *Financial Integration and Banking Union* (Speech by Mario Draghi, President of the ECB, at the conference for the 20th anniversary of the establishment of the European Monetary Institute, Brussels, 12 February 2014). Retrieved on 1 May 2018 from https://www.ecb.europa.eu/press/key/date/2014/html/sp140212.en.html.

Draghi, M. (2018). *Risk-reducing and risk-sharing in our Monetary Union* (Speech by Mario Draghi, President of the ECB, at the European University Institute,

Florence, 11 May 2018). Retrieved from https://www.ecb.europa.eu/press/key/date/2018/html/ecb.sp180511.en.html.

Draghi, M., & Trichet, J.-C. (2011). Trichet e Draghi: un'azione pressante per ristabilire la fiducia degli investitori. *Corriere Della Sera*. Retrieved May, 5, 2017, from http://www.corriere.it/economia/11_settembre_29/trichet_draghi_inglese_304a5f1e-ea59-11e0-ae06-4da866778017.shtml.

Drehmann, M., & Nikolau, K. (2009). *FUNDING LIQUIDITY RISK. DEFINITION AND MEASUREMENT* (ECB's Working Paper Series No. 1024). Retrieved January 21, 2016, from https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1024.pdf.

Duffie, D. (1989). *Futures Markets*. Englewood Cliffs, NJ: Prentice-Hall.

Duffie, D., & Zhu, H. (2011). Does a Central Clearing Counterparty Reduce Counterparty Risk? *Review of Asset Pricing Studies*, *1*(1), 74–95.

Dyson, K., Featherstone, K., & Michalopoulos, G. (1995). Strapped to the mast: EC central bankers between global financial markets and regional integration. *Journal of European Public Policy*, *2*(3), 465–487.

EC, ECB, & IMF. (2011). *Statement by EC, ECB and IMF on the ninth review mission to Ireland* (IMF's Press Release No. 11/136). Retrieved March 2, 2017, from http://europa.eu/rapid/press-release_MEMO-13-75_en.htm?locale=en.

EC. (1999). *Commission welcomes report calling for more integrated EU repo markets* (European Commission's Press Release No. IP/99/794). Retrieved June 6, 2016, from http://europa.eu/rapid/press-release_IP-99-794_en.htm.

EC. (2010). *The Economic Adjustment Programme for Greece.* Retrieved August 19, 2016, from http://ec.europa.eu/economy_finance/publications/occasional_paper/2010/op61_en.htm.

EC. (2011a). *The Economic Adjustment Programme for Ireland.* Retrieved August 19, 2016, from http://ec.europa.eu/economy_finance/publications/occasional_paper/2011/op76_en.htm.

EC. (2011b). *The Economic Adjustment Programme for Portugal*. Retrieved August 19, 2016, from http://ec.europa.eu/economy_finance/publications/occasional_paper/2011/pdf/ocp79_en.pdf.

EC. (2012a). *The Financial Sector Adjustment Programme for Spain*. Retrieved August 19, 2016, from http://ec.europa.eu/economy_finance/publications/occasional_paper/2012/op118_en.htm.

EC. (2012b). Commission Decision on the State aid No SA.32504 (2011/N) and C 11/10 (ex N 667/09) implemented by Ireland for Anglo Irish Bank and Irish Nationwide Building Society. Retrieved April 8, 2016, from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012D0269&from=EN.

EC. (2017). *Commission Opinion on the Recommendation of the European Central Bank amending Article 22 of the Statute of the European System of Central Banks and the European Central Bank* (EC's Press Release). Retrieved January 17, 2018, from http://europa.eu/rapid/press-release_MEMO-17-3621_en.htm

EC. (2018). Frequently asked questions: Enabling framework for sovereign bond-backed securities. Retrieved September 3, 2018, from http://europa.eu/rapid/press-release_MEMO-18-3726_en.htm.

ECB and Federal Reserve. (2007). *The Role of Central Counterparties*. *Issues related to Central Counterparty Clearing. ECB-FED Chicago Conference 3-4 April 2006*.

ECB. (2002a). *Monthly Bulletin* (October). Retrieved 21 May, 2016, from https://www.ecb.europa.eu/pub/pdf/mobu/mb200210en.pdf.

ECB. (2002b). *Developments in banks' liquidity profile and management*. Retrieved July 1 2015, from, https://www.ecb.europa.eu/pub/pdf/other/banksliquidityprofile02en.pdf.

ECB. (2010). ECB introduces graduated valuation haircuts for lower-rated assets in its collateral framework as of 1 January 2011. Retrieved January 16, 2017, from http://www.ecb.int/press/pr/date/2010/html/pr100408_1.en.html.

ECB. (2011). *ECB announces measures to support bank lending and money market activity* (ECB's press release 8 December 2011). Retrieved April 2, 2016, from https://www.ecb.europa.eu/press/pr/date/2011/html/pr111208_1.en.html.

ECB. (2012). *Monthly Bulletin* (No. March 2012). Retrieved February 18, 2017, from https://www.ecb.europa.eu/pub/pdf/mobu/mb201203en.pdf.

ECB. (2015). Euro money market survey. (September). Retrieved January 12, 2016, from https://www.ecb.europa.eu/pub/pdf/other/euromoneymarketsurvey201509.en.pdf.

ECB. (2017). Financial Integration in Europe. *Annual Report on Financial Integration in Europe*. Retrieved January 7, 2018, from https://www.ecb.europa.eu.

ECB's Statistical Data Warehouse. (n.d.). Retrieved 15 September, 2016, from http://sdw.ecb.europa.eu.

Eichengreen, B. (2007). *The European economy since 1945: coordinated capitalism and beyond*. Princeton University Press.

Eichengreen, B. (2012). European Monetary Integration with Benefit of Hindsight. *Journal of Common Market Studies*, *50*(S1), 123–136.

Eichengreen, B., & Mody, A. (1998). *What Explains Changing Spreads on Emerging-Market Debt: Fundamentals or Market Sentiment?* (NBER Working Paper No. 6408).

Eijffinger, S. C. (2012). Rating agencies: Role and influence of their sovereign credit risk assessment in the eurozone. *Journal of Common Market Studies*, *50*(6), 912–921.

Eikon. (n.d.). Thomson Reuters Eikon. Retrieved 2 January, 2016, from https://eikon.thomsonreuters.com/index.html.

ERT. (1983). FOUNDATIONS FOR THE FUTURE OF EUROPEAN INDUSTRY. Retrieved May 10, 2017, from https://www.ert.eu.

ESMA. (2016). *Final Report: Possible systemic risk and cost implications of interoperability agreements*. Retrieved July 1, 2018, from https://www.esma.europa.eu.

ESMA. (2017). OTC DERIVATIVES AND CLEARING OBLIGATION. Retrieved on May 19, 2017, from https://www.esma.europa.eu/regulation/post-trading/otc-derivatives-and-clearing-obligation.

ESMA. (2018). *Final report: Guidelines on EMIR Anti-Procyclicality Margin Measures for Central Counterparties*.

ESRB. (2017). *The macroprudential use of margins and haircuts*. Retrieved January 12, 2016, from www.esrb.europa.eu.

Eurex Clearing. (2017). Default Waterfall. Retrieved May 19, 2017, from http://www.eurexclearing.com/clearing-en/risk-management/default-waterfall

Eurex. (2018). Milestones. Retrieved April 26, 2018, from http://www.eurexrepo.com/repo-en/about-us/milestones.

Euromoney. (1997). The Bund stops here. Retrieved February 1, 2018, from https://www.euromoney.com/article/b1320cvsjdsqpl/the-bund-stops-here.

Eurostat. (n.d.). Retrieved March 2, 2016, from https://ec.europa.eu/eurostat.

Faiola, A. (2011). Silvio Berlusconi resigns as prime minister amid Italian debt crisis. *The Washington Post*. Retrieved February 2, 2018, from https://www.washingtonpost.com/world/europe/berlusconi-poised-to…ep-down/2011/11/12/gIQAMJuZFN_story.html?utm_term=.91af7034ea8b.

Falagiarda, M., & Gregori, W. D. (2015). The impact of fiscal policy announcements by the Italian government on the sovereign spread: A comparative analysis. *European Journal of Political Economy*, *39*, 288–304.

Falagiarda, M., & Reitz, S. (2015). Announcements of ECB unconventional programs: Implications for the sovereign spreads of stressed euro area countries. *Journal of International Money and Finance*, *53*, 276–295.

Fan, J., & Zhang, W. (2008). Statistical Methods with Varying Coefficient Models. *Stat Interface*, *1*(1), 179–195.

FCA. (2016). Clearing obligation. Retrieved May 19, 2017, from https://www.fca.org.uk/print/markets/emir/clearing-obligation.

Featherstone, K. (2011). The Greek Sovereign Debt Crisis and EMU: A Failing State in a Skewed Regime. *Journal of Common Market Studies*, *49*(2), 193–217.

Fed. (1981). Federal Reserve Bulletin April 1981. Retrieved March 17, 2017, from https://fraser.stlouisfed.org/title/62/item/20476

Fed. (1982). Federal Reserve Bulletin April 1982. Retrieved April 14, 2017, from https://fraser.stlouisfed.org/title/62/item/20488.

Feldstein, M. (1997). The Political Economy of the European Economic and Monetary Union: Political Sources of an Economic Liability. *Journal of Economic Perspectives*, *11*(4), 23–42.

Fintech Futures. (2015). *London Stock Exchange launches major interest rate derivatives venture*. Retrieved April 12, 2018, from https://www.bankingtech.com/2015/10/london-stock-exchange-launches-major-interest-rate-derivatives-venture/.

FSB. (2012). *Securities Lending and Repos: Market Overview and Financial Stability Issues*. Retrieved 21 September, 2016, from http://www.fsb.org.

FSB. (2015). *OTC Derivatives Market Reforms. Ninth Progress Report on Implementation*. Retrieved 18 March, 2016, from http://www.fsb.org.

FSB. (2017). *Analysis of* Central *Clearing Interdependencies*. Retrieved February 12, 2018, from http://www.fsb.org/2017/07/analysis-of-central-clearing-interdependencies/.

G10. (2001). *Group of Ten Report on Consolidation In the Financial Sector*. Retrieved September 18, 2016, from https://www.imf.org/external/np/g10/2001/01/Eng/pdf/file1.pdf.

G20 Leaders Statement (2008). Declaration of the Summit on Financial Markets and the World Economy. Retrieved 10 July, 2017 from: http://www.un.org/ga/president/63/commission/declarationG20.pdf.

G20 Leaders Statement (2009). Leaders Statement: The Pittsburgh Summit. Retrieved 3 October, 2016 from: http://www.g20.utoronto.ca/2009/2009communique0925.html.

Gabor, D. (2016). The (impossible) repo trinity: the political economy of repo markets. *Review of International Political Economy*, *23*(6), 967–1000.

Gabor, D., & Ban, C. (2016). Banking on Bonds: The New Links Between States and Markets. *Journal of Common Market Studies*, *54*(3), 617–635.

Gabrisch, H., & Staehr, K. (2015). The Euro Plus Pact: Competitiveness and External Capital Flows in the EU Countries. *Journal of Common Market Studies*, *53*(3), 558–576.

Galati, G., & Tsatsaronis, K. (2003). The impact of the euro on Europe's financial markets. *Financial Markets, Institutions & Instruments*, *12*(3), 155–221.

Gambarotto, F., & Solari, S. (2015). The peripheralization of Southern European capitalism within the EMU. *Review of International Political Economy*, *22*(4), 788–812.

GAO. (1990). *Clearance and Settlement Reform. The Stock, Options, and Futures Markets Are Still at Risk*. Retrieved June 2, 2017, from https://www.gao.gov/assets/150/148885.pdf.

Garbade, K. D. (2006). *The Evolution of Repo Contracting Conventions in the 1980s*. (Federal Reserve Bank of New York Economic Policy Review).

Garfield, A. (1999). Cedel to link with Deutsche Borse. *The Independent*. Retrieved February 21, 2016, from https://www.independent.co.uk/news/business/cedel-to-link-with-deutsche-borse-1093693.html.

Garicano, L. (2012). Five lessons from the Spanish cajas debacle for a new euro-wide supervisor. Retrieved February 1, 2018, from http://www.voxeu.org/article/five-lessons-spanish-cajas-debacle-new-euro-wide-supervisor.

Gärtner, M., Griesbach, B., & Jung, F. (2011). PIGS or Lambs? The European Sovereign Debt Crisis and the Role of Rating Agencies. *International Advances in Economic Research*, *17*(3), 288–299.

Gaulier, G., & Vicard, V. (2013). *The signatures of euro-area imbalances: Export performance and the composition of ULC growth*. *ECB's COMPNET Policy Brief*.

Geithner, T. (2014). *Stress Test*: *Reflections on Financial Crises*, London, UK: Business Books.

Genito, L. (2013). *Towards the European Banking Union: The Single Supervisory Mechanism* (European Parliamentary Research Service). Retrieved April 26, 2018 from https://epthinktank.eu/2013/07/15/towards-the-european-banking-union-the-single-supervisory-mechanism/.

Giovannini Group. (1999). *EU Repo Markets: Opportunities for Change*. Retrieved March 2, 2017, from http://ec.europa.eu.

Gorton, G., & Metrick, A. (2012). Securitized banking and the run on repo. *Journal of Financial Economics*, *104*(3), 425–451.

Gorton, G., & Ordoñez, G. (2014). Collateral Crises. *The American Economic Review*, *104*(2), 343–378.

Gracie, A. (2015). *CCP resolution and the ending Too Big to Fail agenda*. Speech given by Andrew Gracie, Executive Director, Resolution, Bank of England, at the 21st Annual Risk USA Conference in New York on 22 October 2015.

Gregory, J. (2014). *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives*. Wiley.

Gros, D. (2012). *Macroeconomic Imbalances in the Euro Area: Symptom of cause of the crisis?* (CEPS Policy Brief No. 266). Retrieved May17, 2016, from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.394.9722&rep=rep1&type=pdf.

Guarascio, F. (2018). EU proposes new sovereign bond- backed securities, faces criticism. *Reuters.* Retrieved September 3, 2018, from https://www.reuters.com/article/us-eurozone-sovereign-sbbs/eu-pro…ew-sovereign-bond-backed-securities-faces-criticism-idUSKCN1IP1G2.

Hall, P. (2014). Varieties of Capitalism and the Euro Crisis. *West European Politics*, *37*(6), 1223–1243.

Hall, P. A. (2012). The Economics and Politics of the Euro Crisis. *German Politics*, *21*(4), 355–371.

Hancké, B. (2013). *Unions, Central Banks, and EMU: Labour Market Institutions and Monetary Integration in Europe*. Oxford University Press.

Hancock, C. (2015). Ireland was 'pushed quite hard' into bailout, says Cardiff. *Irish Times*. Retrieved March 5, 2016, from https://www.irishtimes.com/business/economy/ireland-was-pushed-quite-hard-into-bailout-says-cardiff-1.2254238.

Hardie, I. (2006). The power of the markets? The international bond markets and the 2002 elections in Brazil. *Review of International Political Economy*, *13*(1), 53–77.

Hardie, I., Howarth, D., Maxfield, S., & Verdun, A. (2013). Banks and the False Dichotomy in the Comparative Political Economy of Finance. *World Politics*, *65*(4), 691–728.

Hartmann, P., Maddaloni, A., & Manganelli, S. (2003). The Euro-area Financial System: Structure, Integration, and Policy Initiatives. *Oxford Review of Economic Policy*, *19*(1), 180–213.

Hasenpusch, T. A. (2009). *Clearing Services for Global Markets*. Cambridge University Press.

Heider, F., & Hoerova, M. (2009). *Interbank Lending, Credit Risk Premia and Collateral* (ECB Working Paper Series No. 1107).

Hein, E. (2013). The crisis of finance-dominated capitalism in the euro area, deficiencies in the economic policy architecture, and deflationary stagnation policies. *Journal of Post Keynesian Economics*, *36*(2), 325–354.

Helleiner, E. (1994). *States and the Re-emergence of Global Finance: From Bretton Woods to the 1990s*. Cornell University Press.

Helleiner, E. (1995). Explaining the Globalization of Financial Markets: Bringing States Back In. *Review of International Political Economy*, *2*(2), 315–341.

Helleiner, E. (2011). Understanding the 2007 – 2008 Global Financial Crisis: Lessons for Scholars of International Political Economy. *The Annual Review of Political Science*.

Helleiner, E. (2014). Out from the Shadows: Governing OTC Derivatives After the 2007-08 Financial Crisis. In J. Best & A. Gheciu (Eds.), *The Return of the Public in Global Governance*. Cambridge University Press.

Heller, D., & Vause, N. (2012). *Collateral Requirements for mandatory central clearing of over-the-counter derivatives* (BIS Working Paper Series No. 373).

Hendrikse, R. P. (2013). Entangled geographies of "Irish" finance. *Eurasian Geography and Economics*, *54*(2), 182–201.

Herrero, Á. M., & Mencía, J. (2015). *Credit and Liquidity Risk in Sovereign Bonds* (Banco de España's Estabilidad Financiera No. 28).

Hills, B., Rule, D., Parkinson, S., & Young, C. (1999). *Central counterparty clearing houses and financial stability* (Bank of England Financial Stability Review, June). Retrieved June 21, 2016, from https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/1999/june-1999.

Hilscher, J., & Nosbusch, Y. (2010). Determinants of Sovereign Risk: Macroeconomic Fundamentals and the Pricing of Sovereign Debt. *Review of Finance*, *14*(2), 235–262.

Hoeting, J. A., Madigan, D., Raftery, A. E., & Volinsky, C. T. (1999). Bayesian model averaging: A tutorial. *Statistical Science*, *14*(4), 382–401.

Holman, O. (2006). Trans-national Governance without Supra-national Government: The Case of the European Employment Strategy. *Perspectives on European Politics and Society*, *7*(1), 91–107.

Hopkin, J. (2012). A slow fuse: Italy and the EU debt crisis. *The Italian Spectator: Italian Journal of International Affairs*, *47*(4), 35–48.

ICMA. (2012). *Haircuts and initial margins in the repo market*. Retrieved January 21, 2018, from https://www.icmagroup.org.

ICMA. (2018a). How big is the repo market? Retrieved February 1, 2018, from https://www.icmagroup.org

ICMA. (2018b). Was a "run on repo" the cause of the financial crisis in 2007? Retrieved February 1, 2018, from https://www.icmagroup.org

IMF. (2001). *The Changing Structure of The Major Government Securities Markets: Implications for Private Financial Markets and Key Policy Issues (Chapter IV)*. Retrieved April, 21, 2017, from http://www.imf.org/external/pubs/ft/icm/2001/01/eng/index.htm.

IMF. (2002). *Selected Euro-Area Countries: The Determinants of Growth: The Experience in the Southern European Economies of Greece and Portugal* (IMF Country Report No. 02/91).

IMF. (2003). Global financial stability report. Chapter III: Financial Asset Price Volatility: A Source of Instability? (pp. 62–88). Retrieved March 12, 2016, from https://www.imf.org.

IMF. (2012). *Spain: Financial Stability Assessment* (IMF Country Report No. 12/137). Retrieved January 23, 2016, from https://www.imf.org/external/pubs/ft/scr/2012/cr12137.pdf.

In't Veld, J., Kollmann, R., Pataracchia, B., Ratto, M., & Roeger, W. (2014). International capital flows and the boom-bust cycle in Spain. *Journal of International Money and Finance*, *48*, 314–335.

ISDA. (2013). *Non-Cleared OTC Derivatives: Their Importance to the Global Economy*. Retrieved July 1, 2018, from https://www.isda.org.

ISDA. (2017). *SwapsInfo Second Quarter 2017 Review*. Retrieved July 1, 2018, from https://www.isda.org.

Issing, O. (2005). *One size fits all! A single monetary policy for the euro area* (Speech by Otmar Issing, Member of the Executive Board of the ECB at the International Research Forum, Frankfurt am Main, 20 May). Retrieved June 21, 2017, from https://www.ecb.europa.eu/press/key/date/2005/html/sp050520.en.html.

J.P.Morgan. (2015). *China's repo markets: The structure and safeguards of China's largest, most liquid money market instruments* (J.P.Morgan's Asset Management Report). Retrieved February 12, 2016, from https://am.jpmorgan.com/blob-gim/1383258499796/83456/WP-GL-China-repo-market.pdf.

Jabko, N. (1999). In the name of the Market: how the European Commission paved the way for monetary union. *Journal of European Public Policy*, *6*(3), 475–495.

Jabko, N. (2006). *Playing the market: A political strategy for uniting Europe, 1985-2005*. Ithaca, NY: Cornell University Press.

Jabko, N. (2015). The Elusive Economic Government and the Forgotten Fiscal Union. In M. Matthijs & M. Blyth (Eds.), *The Future of the Euro*. Oxford University Press.

Johnson, M., & Oakley, D. (2012). Spain takes 45 % stake in Bankia. *Financial Times*. Retrieved July 15, 2016, from https://www.ft.com/content/29595d88-99e8-11e1-accb-00144feabdc0.

Johnston, A., Hancké, B., & Pant, S. (2014). Comparative institutional advantage in the European sovereign debt crisis. *Comparative Political Studies*, *47*(13), 1771–1800.

Jones, E. (2012). The Berlusconi Government and the Sovereign Debt Crisis. *Italian Politics*, *27*(1), 172–190.

Jones, E. (2015). The Forgotten Financial Union: How You Can Have a Euro Crisis Without a Euro. In M. Matthijs & M. Blyth (Eds.), *The Future of the Euro*. Oxford University Press.

Jones, E. (2016). Competitiveness and the European Financial Crisis. In J. A. Caporaso & M. Rhodes (Eds.), *The Political and Economic Dynamics of the Eurozone Crisis*. Oxford University Press.

Jones, E., Kelemen, R. D., & Meunier, S. (2016). Failing Forward? The Euro Crisis and the Incomplete Nature of European Integration. *Comparative Political Studies*, *49*(7), 1010–1034.

Jones, S., Oakley, D., & Goff, S. (2010). Irish bond yields leap after selling wave. *Financial Times*. Retrieved February 5, 2015, from https://www.ft.com/content/5b1650c2-ecfd-11df-9912-00144feab49a.

Kalbaska, A., & Gątkowski, M. (2012). Eurozone sovereign contagion: Evidence from the CDS market (2005-2010). *Journal of Economic Behavior and Organization*, *83*(3), 657–673.

Kaltenthaler, K. (2005). The Bundesbank and the formation of the ECB's monetary policy strategy. *German Politics*, *14*(3), 297–314.

Kamin, S. B., & Kleist, K. Von. (1999). *The Evolution and Determinants of Emerging Market Credit Spreads in the 1990s* (BIS Working Papers No. 68).

Katsimi, M., & Moutos, T. (2010). EMU and the Greek crisis: The political-economy perspective. *European Journal of Political Economy*, *26*(4), 568–576.

Kelly, S. (2014). Light-Touch Regulation: The Rise and Fall of the Irish Banking Sector. In A. MacLaran & S. Kelly (Eds.), *Neoliberal Urban Policy and the transformation of the City*. Basingstoke: Palgrave Macmillan.

Kendall, R., & Lees, J. (2017). *The Chinese Interbank Repo Market* (Reserve Bank of Australia's Quarterly Bulletin, June). Retrieved December 27, 2017, from https://www.rba.gov.au/publications/bulletin/2017/jun/9.html.

Kenyon, C., & Green, A. (2013). Why CCPs are the new rating agencies – and pose the same risks. *Risk Magazine*. Retrieved January 21, 2017, from http://www.risk.net/infrastructure/clearing/2287734/why-ccps-are-new-rating-agencies-and-pose-same-risks.

Keohane, D. (2012). LCH SA has raised margins on Spanish government debt. Retrieved February 1, 2018, from https://ftalphaville.ft.com/2012/06/20/1052131/lch-has-raised-margins-on-spanish-government-debt/.

Kirby, P. (2010). *Celtic Tiger in Collapse: Explaining the Weaknesses of the Irish Model*. Palgrave Macmillan.

Konings, M. (2007). The institutional foundations of US structural power in international finance: From the re-emergence of global finance to the monetarist turn. *Review of International Political Economy*, *15*(1), 35–61.

Krauskopf, B. (1999). The Deutsche Bundesbank and its Legal Regime. In N. Horn (Ed.), *German Banking Law and Practice in International Perspective* (pp. 7–14). Berlin: Walter de Gruyter.

Krugman, P. (2011). Portugal ? O Nao ! *The New York Times*. Retrieved 5 June, 2018, from http://krugman.blogs.nytimes.com/2011/01/10/portugal-o-nao.

Krugman, P. (2017). Germany's Real Sin. *The New York Times*. Retrieved 1 May, 2018, from https://krugman.blogs.nytimes.com/2017/05/27/germanys-real-sin/.

Lacombe, R. (1939). *La Bourse de commerce du Havre (marchés de coton et de café)*. Paris: Sirey.

Lagna, A. (2013). *Deriving a normal country: Italian capitalism and the political economy of financial derivatives*. PhD thesis, University of Sussex.

Lagna, A. (2015). Italian municipalities and the politics of financial derivatives: Rethinking the Foucauldian perspective. *Competition & Change*, *19*(4), 283–300.

Lagoa, S., Leão, E., Mamede, R. P., & Barradas, R. (2014). *Financialisation and the Financial and Economic Crises: The Case of Portugal* (FESSUD - Studies in Financial Systems No. 24). Retrieved January, 21, 2016 from https://econpapers.repec.org/paper/fesfstudy/fstudy24.htm.

Lane, P. R. (2011). The Irish crisis. In M. Beblavý, D. P. Cobham, & L. Ódor (Eds.), *The Euro Area and the Financial Crisis* (pp. 59–80). Cambridge University Press.

Lane, P. R. (2012). The European Sovereign Debt Crisis. *Journal of Economic Perspectives*, *26*(3), 49–68.

Lapavitsas, C., Kaltenbrunner, G., Labrinidis, G., Lindo, D., Meadway, J., Michell, J., … Vatikiotis, L. (2012). *Crisis in the Eurozone*. Verso.

LCH.Clearnet Ltd. (2016). LCH LTD Default Waterfall. Retrieved 23 January, 2016, from http://www.lch.com/documents/731485/762506/2a-default-waterfall-ltd-0.35-161230-sig.pdf/aee1a93e-0974-404c-90ec-c0f8f7854414.

LCH.Clearnet. (2007). *LCH.Clearnet to Launch RepoClear EuroGC Clearing Service* (Communication No. 0048). Retrieved July 21, 2017, from http://secure-area.lchclearnet.com/Images/0048_tcm6-46155.pdf.

LCH.Clearnet. (2010a). Management of Sovereign Credit Risk for RepoClear Service (LCH.Clearnet Ltd Circular No. 2692). Retrieved May 1, 2015, from http://secure-area.lchclearnet.com/member_notices/circulars/2010-10-05.asp.

LCH.Clearnet. (2010b). Management of Sovereign Credit Risk for RepoClear Service (LCH.Clearnet Ltd Circular No 2720). Retrieved September 21, 2015, from http://secure-area.lchclearnet.com/risk_management/ltd/margin_rate_circulars/repoclear/2010-11-17.asp.

LCH.Clearnet. (2010c). Management of Sovereign Credit Risk for RepoClear Service (LCH.Clearnet Ltd Circular No 2749). Retrieved May 2, 2016, from http://secure-area.lchclearnet.com/member_notices/circulars/2010-12-09.asp.

LCH.Clearnet. (2010d). LCH.Clearnet SA to clear Spanish government bonds and repos. Retrieved February 1, 2015, from https://www.lch.com.

LCH.Clearnet. (2011a). Management of Sovereign Credit Risk for RepoClear Service (LCH.Clearnet Ltd Circular No. 2815). Retrieved December 23, 2015, from http://secure-area.lchclearnet.com/member_notices/circulars/2011-03-25_1.asp.

LCH.Clearnet. (2011b). Management of Sovereign Credit Risk for RepoClear Service (LCH.Clearnet Ltd Circular No. 2827). Retrieved December 23, 2015, from http://secure-area.lchclearnet.com/risk_management/ltd/margin_rate_circulars/repoclear/2011-04-07.asp.

LCH.Clearnet. (2015). *Net More*. Retrieved April 26, 2018, from http://ftp.lchclearnet.com/documents/731485/762478/netting_with_repoclear_v2.pdf/b8e48379-44e0-4072-b758-23b5758a9159.

LCH.Clearnet. (2018). Risk Management. Retrieved February 21, 2016, from https://www.lch.com/services/repoclear/repoclear-ltd/risk-management.

LCH.Clearnet. (n.d.). *RepoClear Margin Rate Circulars*. Retrieved 2 April, 2016, from http://secure-area.lchclearnet.com/risk_management/ltd/margin_rate_circulars/repoclear/default.asp.

Leao, P., & Palacio-Vera, A. (2011). *Can Portugal Escape Stagnation without Opting Out from the Eurozone?* (Levy Economics Institute's Working Paper No. 664).

Lee, R. (2010). Clearing houses are no panacea for market ills. *Financial Times*. Retrieved January 23, 2015, from https://www.ft.com/content/ee690e76-7243-11df-a0fd-00144feabdc0.

Lee, R. (2011). *Running the World's Markets*. Princeton University Press.

Levy-Garboua, V. (2016). *The organisation of market infrastructures in Europe* (Report to the Director-General of the French Ministry of the Treasury). Retrieved 21 April, 2017, from https://www.tresor.economie.gouv.fr/Ressources/File/431987.

Lockwood, E. (2018). The Politics and Practices of Central Clearing in OTC Derivatives Markets. In E. Helleiner, S. Pagliari, & I. Spagna (Eds.), *Governing the World's Biggest Market: The Politics of Derivatives Regulation After the 2008 Crisis*. Oxford University Press.

Loon, Y. C., & Zhong, Z. K. (2014). The impact of central clearing on counterparty risk, liquidity, and trading: Evidence from the credit default swap market. *Journal of Financial Economics*, *112*, 91–115.

Lops, V. (2012). Lo spread testa la «soglia Monti» di 287 punti. Fino a che punto può scendere ? Gli analisti: occhio alle prese di profitto per le festività natalizie. *Il Sole 24 Ore*. Retrieved August 23, 2018, from http://www.ilsole24ore.com/art/finanza-e-mercati/2012-12-19/spread-testa-soglia-monti-180036.shtml?uuid=AbTWCgDH.

LSEG. (2012). *London Stock Exchange Group plc to acquire majority stake in LCH.Clearnet Group Limited*. Retrieved April 26, 2018, from https://www.lseg.com/media-centre/news/corporate-press-releases/london-stock-exchange-group-plc-acquire-majority-stake.

Lucarelli, B. (2011). German neomercantilism and the European sovereign debt crisis. *Journal of Post Keynesian Economics*, *34*(2), 205–224.

Malliaris, A. G., & Ziemba, W. T. (2015). *The World Scientific Handbook of Futures Markets*. World Scientific.

Maltritz, D. (2012). Determinants of sovereign yield spreads in the Eurozone: A Bayesian approach. *Journal of International Money and Finance*, *31*, 657–672.

Mancini, L., Ranaldo, A., & Wrampelmeyer, J. (2015). The Euro Interbank Repo Market. *The Review of Financial Studies*, *29*(7), 1747–1779.

Manganelli, S., & Wolswijk, G. (2007). *Market discipline, financial integration and fiscal rules: what drives spreads in the Euro area government bond market?* (ECB Working Paper Series No. 745/April 2007).

Manna, M. (2011). *Home bias in interbank lending and banks' resolution regimes* (Bank of Italy's Temi di Discussione Working Papers No. 816). Retrieved November 21, 2016, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1960979.

Manning, M. E., & Schanz, J. (2009). *The Economics of Large-value Payments and Settlement: Theory and Policy Issues for Central Banks*. Oxford: Oxford University Press.

Manolopoulos, J. (2011). *Greece's "odious" debt: the looting of the Hellenic republic by the euro, the political elite and the investment community*. Athens: Anthem Press.

Markantonatou, M. (2012). The state and modes of regulation in Greece from the post-war period to the 2009 financial crisis. *Journal of Balkan and Near Eastern Studies*, *14*(4), 416–432.

Martin, A. (2015). *Why do CCP's play such a small role in the U.S. repo market and why that might change?* (Banque de France-Sciences Po Seminar in April, Paris). Retrieved March 15, 2017, http://econ.sciences-po.fr/sites/default/files/Slides%20for%20Science%20Po-BdF_8%20avril.pdf.

Martin, A., Skeie, D., & Thadden, E. L. Von. (2014). Repo runs. *Review of Financial Studies*, *27*(4), 957–989.

McCaffrey, U. (2011). Portuguese bonds fall while bank stocks increase. *Irish Times*. Retrieved March 2, 2015, from https://www.irishtimes.com/business/markets/portuguese-bonds-fall-while-bank-stocks-increase-1.566429.

McCauley, R. (1999). *The euro and the liquidity of European fixed income markets*. Retrieved 4 March, 2016, from http://www.bis.org/publ/cgfs11mccau.pdf.

McNamara, K. R. (1998). *The Currency of Ideas: Monetary Politics in the European Union*. Ithaca: Cornell University Press.

Meltzer, A. (2003). *A History of the Federal Reserve, Volume I: 1913-1951*. Chicago: Chicago University Press.

Merler, S., & Pisan-Ferry, J. (2012). "Who's afraid of sovereign bonds". *Bruegel Policy Contribution*. Retrieved August 2, 2016, from http://bruegel.org/wp-content/uploads/imported/publications/pc_2012_02_debt_.pdf.

Metcalfe, R., Serocold, J., & Huet, B. (2009). *ISDA, SIFMA and LIBA's response to the European Commission's proposals on OTC reform*. Retrieved 21 May, 2017, from https://www.isda.org/a/JsiDE/isda-liba-sifma-resp2009-eu-otc-derivs.pdf.

Miglietta, A., Picillo, C., & Pietrunti, M. (2015). *The impact of CCPs' margin policies on repo markets*. *Temi di Discussione (Bank of Italy's Working Papers* No. 1028*)*. Retrieved June 5, 2017, from https://www.bancaditalia.it/pubblicazioni/temi-discussione/2015/2015-1028/index.html?com.dotmarketing.htmlpage.language=1.

Milner, M. (1999). Clearing house merger prompts power struggle. *The Guardian*. Retrieved 21 January, 2017, from https://www.theguardian.com/business/1999/may/14/16.

Min, H. G. (1998). *Determinants of Emerging Market Bond Spread: Do Economic Fundamentals Matter?* (World Bank Policy Research Working Paper No. 1899).

Monti, M. (2012). Conférence de presse conjointe du Président de la République et de M. Mario Monti, Président du Conseil de la République d'Italie. Élysée, Présidence de la Republique. Retrieved March 11, 2015, from https://video-streaming.orange.fr/actu-politique/conference-de-presse-avec-m-mario-monti-a-l-occasion-du-sommet-franco-italien-VID0000000Wm5W.html?pid=SIl2WFC2AZWzJ7qSByljitF90Oyhq%2FuTijjNVTqW8eXHvld9E8Rs64WH95P3DwrNZrhnwO%2BL0t0%3D#plmAnchor.

Moody's. (2011). Rating Action: Moody's downgrades Irish bank ratings. Retrieved February 2, 2018, from https://www.moodys.com/research/Moodys-downgrades-Irish-bank-ratings--PR_217647.

Moro, B. (2014). Lessons from the European economic and financial great crisis: A survey. *European Journal of Political Economy*, *34*, S9–S24.

Moser, J. T. (1998). *Contracting Innovations and Evolution of Clearing and Settlement Methods at Futures Exchanges* (Federal Reserve Bank of Chicago Working Paper Series No. WP-98-26).

NASDAQ. (2011). Wrong-way risk. Retrieved February 27, 2018, from http://www.nasdaq.com/investing/glossary/w/wrong-way-risk.

Norman, P. (2011). *The Risk Controllers: Central Counterparty Clearing in Globalised Financial Markets*. Wiley.

Norris, M., & Byrne, M. (2015). *Asset price Keynesianism, regional imbalances and the Irish and Spanish housing booms and busts* (UCD Geary Institute For Public Policy Discussion Paper Series No. WP2015/14). Retrieved May 12, 2017, from https://researchrepository.ucd.ie/handle/10197/6872.

O'Hearn, D. (1998). *Inside the Celtic Tiger: The Irish Economy and the Asian Model*. London: Pluto Press.

Oakley, D. (2011). LCH.Clearnet lifts Ireland's debt trading costs. *Financial Times*. Retrieved January 1, 2015, from http://www.ft.com/cms/s/0/876a9bc4-5643-11e0-82aa-00144feab49a.html#axzz47hEuDfQP.

Oakley, D., & Jones, S. (2010). Bond sell-off takes Ireland closer to tipping point. *Financial Times*. Retrieved February 6, 2015, from http://www.ft.com/cms/s/0/41815768-ecfa-11df-9912-00144feab49a.html.

Obama, B. (2010). Statement from the President on Financial Reform. Retrieved May 19, 2017, from https://obamawhitehouse.archives.gov/the-press-office/statement-president-financial-reform.

OECD. (1994). *OECD Reviews of Foreign Direct Investment: Greece*. Retrieved on 5 May 2018 from http://www.oecd.org/greece/34383957.pdf.

OECD. (2003). Glossary of Statistical Terms. Retrieved May 19, 2017, from https://stats.oecd.org/glossary/detail.asp?ID=972.

OECD. (2011). *Regulatory Reform of OTC Derivatives and Its Implications for Sovereign Debt Management Practices* (OECD Working Papers on Sovereign Borrowing and Public Debt No. 1).

OECD. (2012). *Italy: Reviving Growth and Productivity* (Better Policies). Retrieved March 2, 2016, from https://read.oecd-ilibrary.org/economics/italy-reviving-growth-and-productivity_9789264201668-en#page1.

OFT. (2003). *Anticipated merger of Banque Centrale de Compensation SA and the London Clearing House Ltd* (UK's Office of Fair Trading decision on merger). Retrieved 21 July, 2017, from https://assets.publishing.service.gov.uk/media/555de46de5274a74ca00011d/lch.pdf.

Oliveira, L., Curto, J. D., & Nunes, J. P. (2012). The determinants of sovereign credit spread changes in the Euro-zone. *Journal of International Financial Markets, Institutions and Money*, *22*(2), 278–304.

Ongena, S., Popov, A., & Van Horen, N. (2016). *The invisible hand of the government: Moral suasion during the European sovereign debt crisis* (ECB Working Papaer Series No. No 1937). *ECB Working Paper Series*. Retrieved April 18, 2017, from https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1937.en.pdf.

Pagano, B. M., & Hoare, M. (2003). LCH and Clearnet merger talks in "good shape." Retrieved April 26, 2018, from https://www.fnlondon.com/articles/lch-and-clearnet-merger-talks-in-20030519.

Pagano, M. (2010). Fiscal crisis, contagion, and the future of euro. Retrieved February 1, 2018 from http://www.voxeu.org/index.php?q=node/5041.

Pagliari, S. (2012). Who Governs Finance? The Shifting Public-Private Divide in the Regulation of Derivatives, Rating Agencies and Hedge Funds. *European Law Journal*, *18*(1), 44–61.

Pagliari, S. (2013). *Public Salience and International Financial Regulation. Explaining the International Regulation of OTC Derivatives, Rating Agencies, and Hedge Funds*. PhD thesis, University of Waterloo.

Pagoulatos, G., & Quaglia, L. (2013). Turning the Crisis on Its Head: Sovereign Debt Crisis as Banking Crisis in Italy and Greece. In I. Hardie & D. Howarth (Eds.), *Market-Based Banking and the International Financial Crisis*. Oxford: Oxford University Press.

Panico, C., & Purificato, F. (2013). Policy coordination, conflicting national interests and the European debt crisis. *Cambridge Journal of Economics*, *37*, 585–608.

Pasquariello, P. (2014). Financial market dislocations. *Review of Financial Studies*, *27*(6), 1868–1914.

Pasquino, G., & Valbruzzi, M. (2012). Non-partisan governments Italian-style: decision-making and accountability. *Journal of Modern Italian Studies*, *17*(5), 612–629.

Pepino, S. (2015). *Sovereign Risk and Financial Crisis: The International Political Economy of the Eurozone*. Palgrave Macmillan.

Pereira, P. T., & Wemans, L. (2012). *Portugal and the Global Financial Crisis–short-sighted politics, deteriorating public finances and the bailout imperative* (Technical University of Lisbon, School of Economics and Management's Working Papers No. WP26/2012/DE/UECE). Retrieved March 6, 2015, from https://www.repository.utl.pt/bitstream/10400.5/4647/1/wp%20de26-12.pdf.

Petrini, R. (2018). Ecco perché il contratto M5S- Lega spaventa i mercati e fa risalire lo spread. *La Repubblica.* Retrieved August 23, 2018, from

https://rep.repubblica.it/pwa/generale/2018/05/16/news/il_contratto_spaventa_i_mercati_spread_oltre_quota_150_giu_la_borsa-196588478/.

Pettis, M. (2013). *The great rebalancing: trade, conflict, and the perilous road ahead for the world economy*. Princeton University Press.

PIMCO. (2017). Everything you need to know about bonds. *Understanding Investing*. Retrieved February 2, 2016, from https://global.pimco.com/en-gbl/resources/education/everything-you-need-to-know-about-bonds.

Pinto, B., & Ulatov, S. (2010). *Financial Globalization and the Russian Crisis of 1998* (World Bank's Policy Research Working Paper No. 5312).

Pirro, A. L. P., & van Kessel, S. (2018). Populist Eurosceptic trajectories in Italy and the Netherlands during the European crises. *Politics*, *38*(3), 327–343.

Polidori, E. (2012). Spread a un soffio dalla soglia Monti giù a quota 288, mai così basso dal 2010. *La Repubblica.* Retrieved August 25, 2018, from http://ricerca.repubblica.it/repubblica/archivio/repubblica/2012/12/20/spread-un-soffio-dalla-soglia-monti-giu.html.

Polychroniou, C. J. (2013). The Tragedy of Greece: A Case against Neoliberal Economics, the Domestic Political Elite, and the EU/IMF Duo College. *Levy Economics Institute of Bard College*, *1/2013*. Retrieved on 5 May 2018 from http://www.levyinstitute.org/pubs/pn_13_1.pdf.

Popov, V. (1999). FINANCIAL SYSTEM IN RUSSIA AS COMPARED TO OTHER TRANSITION ECONOMIES: ANGLO-AMERICAN VERSUS GERMAN-JAPANESE MODEL. *Comparative Economic Studies*, *41*(1), 1–42.

Prati, A., & Schinasi, G. J. (1997). EMU and International Capital Markets: Structural Implications and Risks. In P. R. Masson, T. H. Krueger, & B. G. Turtlebloom (Eds.), *EMU and the International Monetary System* (pp. 263–319). Washington: International Monetary Fund.

Protocol 4 (1998). *Treaty on the Functioning of the European Union.* Retrieved December 19, 2016, from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:12016E/PRO/04.

Quaglia, L., & Royo, S. (2015). Banks and the political economy of the sovereign debt crisis in Italy and Spain. *Review of International Political Economy*, *22*(3), 485–507.

Rahman, A. (2015). Over-the-counter (OTC) derivatives, central clearing and financial stability, Bank of England's Quarterly Bullettin (Q3), 283–295.

Rangone, M., & Solari, S. (2012). From the Southern-European model to nowhere: the evolution of Italian capitalism, 1976–2011. *Journal of European Public Policy*, *19*(8), 1188–1206.

Rees, G. L. (1981). The London Commodity Markets and Commonwealth Trade. *Journal of the Royal Society of Arts*, *129*(5294), 88–103.

Rehlon, A., & Nixon, D. (2013). *Central counterparties: what are they, why do they matter and how does the bank supervise them?* Bank of England's *Quarterly Bulletin* (Q2).

Reis, R. (2013). *The Portugese Slump and Crash and the Euro Crisis*. *Brookings Papers on Economic Activity*. Retrieved on 1 May 2018 from http://www.brookings.edu/~/media/Projects/BPEA/Spring 2013/2013a_reis.pdf.

Reuters. (2011). LCH.Clearnet raises margin call on Italian debt. Retrieved February 6, 2017, from http://www.reuters.com/article/us-markets-bonds-clearnet-idUSTRE7A82BK20111109.

Reuters. (2012a). LCH.Clearnet SA raise margin call on Spanish debt. Retrieved February 6, 2017, from http://www.reuters.com/article/markets-italy-margins-idUSL5E8GICGC20120518.

Reuters. (2012b). TIMELINE-Spain's banking crisis. Retrieved October 2, 2016, from https://www.reuters.com/article/spain-banks-timeline/timeline-spains-banking-crisis-idUSL5E8H88YV20120608.

Rixtel, A. Van, & Gasperini, G. (2013). *Financial crises and bank funding: recent experience in the euro area* (BIS Working Papers No. 406).

Rodrigues, J., & Reis, J. (2012). The Asymmetries of European Integration and the Crisis of Capitalism in Portugal. *Competition & Change*, *16*(3), 188–205.

Rommerskirchen, C. (2015). Debt and Punishment: Market Discipline in the Eurozone. *New Political Economy*, *20*(5), 752–782.

Royo, S. (2010). Portugal and Spain in the EU: Paths of economic divergence (2000-2007). *Analise Social*, *195*, 209–254.

Royo, S. (2013). How did the Spanish financial system survive the first stage of the global crisis? *Governance*, *26*(4), 631–656.

Salvini, M. (2018). *Italia sotto attacco, ma ce la faremo! #insiemesultetto*. Facebook. Retrieved 17 September, 2018, from https://www.facebook.com/salviniofficial/videos/10155801843233155/.

Santoni, G. J. (1987). The Great Bull Markets 1924-29 and 1982-87: Speculative Bubbles or Economic Fundamentals? *Federal Reserve Bank of St. Louis*, *November*. Retrieved May 12, 2017, from https://files.stlouisfed.org/files/htdocs/publications/review/87/11/Bull_Nov1987.pdf.

Schaede, U. (1989). Forwards and futures in Tokugawa-Period Japan, A New Perspective on the Dojima Rice Market. *Journal of Banking and Finance*, *13*, 487–513.

Schaede, U. (1991). The development of organized futures trading: The Osaka Rice Bill market of 1730. In W. T. Ziemba, W. Bailey, & Y. Hamao (Eds.), *Japanese Financial Market Research*. Amsterdam: Elsevier Science Publishers.

Schäfer, A., Schnabel, I., and di Mauro, B. W. (2016). Bail-in expectations for European banks: Actions speak louder than words. (*ESRB Working Paper Series* No. 7).

Scheinert, C. (2017). Servicing government debt: The impact of rising interest rates. Retrieved August 23, 2018, from http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/599317/EPRS_BRI(2017)599317_EN.pdf.

Seabrooke, L. (2001). *US power in international finance: The victory of dividends*. London: Palgrave Macmillan.

Segreto, L. (1998). Italian Capitalism between the Private and Public Sectors, 1933-1993. *Business and Economic History*, *27*(2), 455–468.

Shiller, R. J. (2000). *Irrational Exuberance*. Princeton, NJ: Princeton University Press.

Shu, H.-C., & Chang, J.-H. (2015). Investor Sentiment and Financial Market Volatility. *Journal of Behavioral Finance*, *16*(3), 206–219.

Siegel, J. J. (1992). Equity risk premia, corporate profit forecasts, and investor sentiment around the stock market crash of October 1987. *Journal of Business*, (65), 557–570.

SIFMA. (2017). *Repo Market Fact Sheet* (SIFMA's Fact Sheet Series). Retrieved December 8, 2017, from https://www.sifma.org/resources/research/us-repo-market-fact-sheet-2017/.

Singh, M. (2011). *Making OTC Derivatives Safe — A Fresh Look* (IMF Working Paper No. WP/11/66).

Single European Act. (1987). *Official Journal of the European Union*, *L 169*.

Sinn, H.-W. (2012). The European Balance of Payment Crisis. *CESifo*, *13*(Special Issue January).

Smiley, G., & Keehn, R. H. (1988). Margin Purchases, Brokers' Loans and the Bull Market of the Twenties. *Business and Economic History*, *17*, 129–142.

Spezzaferro, A. (2018). Torna lo "spauracchio" dello spread governo Lega-5 Stelle. *Il Primato Nazionale.* Retrieved August 23, 2018, from https://www.ilprimatonazionale.it/primo-piano/torna-lo-spauracchio-dello-spread-tutti-contro-il-governo-lega-5stelle-mattarella-in-testa-85445/.

Spörndli, E. (1998). *The Repurchase Agreement (Repo) as a Monetary Policy Instrument* (Swiss National Bank). Retrieved 17 August, 2016, from https://www.snb.ch/en/mmr/speeches/id/ref_19980417_es/source/ref_19980417_es.en.pdf.

Stafford, P. (2017). Clearing houses saddled with “too-big-to-fail” tag. *Financial Times*. Retrieved January 23, 2015, from https://www.ft.com/content/3460ff68-edf0-11e6-930f-061b01e23655.

Steigerwald, R. S. (2015). Central Counterparty Clearing and Systemic Risk Regulation. In A. G. Malliaris & W. T. Ziemba (Eds.), *The World Scientific Handbook of Futures Markets*. World Scientific.

Stevens, T. M. (2010). Listing and Delisting. In M. C. A. van den Nieuwenhuijzen (Ed.), *Financial Law in the Netherlands*. Kluwer Law International.

Stockhammer, E. (2016). Neoliberal growth models, monetary union and the Euro crisis. A post-Keynesian perspective. *New Political Economy*, *21*(4), 365–379.

Stockhammer, E., & Sotiropoulos, D. P. (2014). Rebalancing the Euro Area: The Costs of Internal Devaluation. *Review of Political Economy*, *26*(2), 210–233.

The New York Times. (2000). Stock Markets Of 3 Capitals In Europe Will Merge. *The New York Times*. Retrieved March 21, 2016, from https://www.nytimes.com/2000/03/20/world/stock-markets-of-3-capitals-in-europe-will-merge.html.

Thompson, H. (2015). Germany and the Euro-Zone Crisis: The European Reformation of the German Banking Crisis and the Future of the Euro. *New Political Economy*, *3467*(February), 1–20.

Thornton, D. L. (2009). *What the Libor-OIS Spread Says* (Federal Reserve Bank of St. Louis’ Economic Synopses Series No. 24).

Tilford, S. (2011). Why the eurozone needs debt mutualisation. *Centre for European Reform*. Retrieved February 2, 2017, from https://www.cer.eu/insights/why-eurozone-needs-debt-mutualisation.

Topik, S. (2004). *The World Coffee Market in the Eighteenth and Nineteenth Centuries, from Colonial to National Regimes* (GEHN Conference Working Paper Series No. 04/04). Retrieved August 12, 2016, from http://www.lse.ac.uk/Economic-History/Assets/Documents/Research/GEHN/GEHNWP04ST.pdf.

Trampusch, C. (2015). The Financialisation of Sovereign Debt: An Institutional Analysis of the Reforms in German Public Debt Management. *German Politics*, *24*(2), 119–136.

Treasury, SEC and Fed. (1992). *Joint Report on the Government Securities Market*. Retrieved November 21, 2017, from https://www.treasury.gov/resource-center/fin-mkts/documents/gsr92rpt.pdf.

UK Parliament. (1999). Memorandum by HM Treasury, UK Debt Management Office, National Savings, and National Investment and Loans Office. Retrieved March 16, 2018, from https://publications.parliament.uk/pa/cm199900/cmselect/cmtreasy/154/cor15402.htm

UNCTAD. (1998). *The Russian Crisis* (UNCTAD Working Paper No. d002). Retrieved February 19, 2017, from https://unctad.org/en/Docs/poirrsd002.en.pdf.

Underhill, G. R. D. (1997). The Making of the European Financial Area: Global Market Integration and the EU Single Market for Financial Service. In G. R. D. Underhill (Ed.), *The New World Order in International Finance* (pp. 101–123). Palgrave Macmillan.

Van Apeldoorn, B. (2002). *Transnational Capitalism and the Struggle over European Integration*. London: Routledge.

Van Duyn, A., & Gangahar, A. (2009). Exchanges sense bonanza in OTC overhaul. *Financial Times*. 15 May. Retrieved January 8, 2016, from https://www.ft.com/content/38fe6322-40b9-11de-8f18-00144feabdc0.

Van Rijckeghem, C., & Weder, B. (2001). Sources of contagion: Is it finance or trade? *Journal of International Economics*, *54*(2), 293–308.

Vartan, V. G. (1982). Drysdale Securities Out of Business. *The New York Times*. June 16.

Wakita, S. (2001). Efficiency of the Dojima rice futures market in Tokugawa-period Japan. *Journal of Banking and Finance*, *25*(3), 535–554.

Watson, M. (2005). *Foundations of International Political Economy*. Basingstoke: Palgrave Macmillan.

Watson, M. (2007). *The Political Economy of International Capital Mobility*. Basingstoke: Palgrave Macmillan.

Watson, M. (2010). House price Keynesianism and the contradictions of the modern investor subject. *Housing Studies*, *25*(3), 413–426.

Watson, M. (2018). *The Market.* New York: Columbia University Press.

Weatherford, J. (1997). *The History of Money*. New York: Crown Publishers.

Wells Fargo. (2017). *A primer on repurchase agreements*. Retrieved February 2, 2017, from https://www.wellsfargofunds.com/assets/pdf/fmg/icm/primer-repos.pdf.

Wendt, F. (2015). *Central Counterparties: Addressing their Too Important to Fail Nature* (IMF Working Paper No. WP/15/21).

West, M. D. (2000). Private Orderding at the World's First Futures Exchange. *Michigan Law Review*, *98*(8), 2574–2615.

White, E. N. (1984). Banking Innovation in the 1920s: The Growth of National Banks' Financial Services. *Business and Economic History*, *13*, 92–104.

White, E. N. (1990). The Stock Market Boom and Crash of 1929 Revisited. *Journal of Economic Perspectives*, *4*(2), 67–83.

World Bank. (2018). Financial Structures – Bank-based vs. market-based financial system. Retrieved February 1, 2018, from http://econ.worldbank.org/external/default/main?theSitePK=478060&contentMDK=20292122&menuPK=546160&pagePK=64168182&piPK=64168060.

Yang, J., & Bessler, D. A. (2008). Contagion around the October 1987 stock market crash. *European Journal of Operational Research*, *184*, 291–310.

Yonemoto, M. (2003). *Mapping Early Modern Japan: Space, Place, and Culture in the Tokugawa Period, 1603-1868*. Berkeley, CA: University of California Press.

Young, B., & Semmler, W. (2011). The European Sovereign Debt Crisis: Is Germany to Blame? *German Politics and Society*, *29*(1), 1–24.

Zoli, E. (2013). *Italian Sovereign Spreads: Their Determinants and Pass-through to Bank Funding Costs and Lending Conditions* (IMF Working Paper No. WP/13/84).

Zysman, J. (1983). *Government, Markets and Growth: Financial Systems and the Politics of Industrial Change.* Ithaca, NY: Cornell University Press.