Corporate Governance of Banks and Financial Stability*

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Abstract: We find that shareholder-friendly corporate governance is associated with higher stand-alone and systemic risk in the banking sector. Specifically, shareholder-friendly corporate governance results in higher risk for larger banks and for banks that are located in countries with generous financial safety nets as banks try to shift risk towards taxpayers. We confirm our findings by comparing banks to non-financial firms and examining changes in bank risk around an exogenous regulatory change in governance. Our results underline the importance of the financial safety net and too-big-to-fail guarantees in thinking about corporate governance reforms at banks.

Keywords: Corporate governance; Bank insolvency; Systemic risk

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1. Introduction

The global financial crisis has led to a re-examination of corporate governance practices at banks, with some policy makers questioning the extent to which managerial entrenchment and the failure of the boards to monitor executives may have led to excessive risk-taking and to financial instability. From a theoretical perspective, however, it is not at all clear that the implementation of good governance practices, such as having an independent board, should lead to less risk-taking. Corporate governance that aligns managerial incentives with shareholder interests can potentially result in more risk-taking as shareholders face pay-offs that are restricted on the downside by limited liability.[1]

Moreover, banks, especially those that are systemically important, tend to be supported by the financial safety net when they are in distress. Specifically, banks can benefit from explicit state guarantees in the form of risk-insensitive deposit insurance as well as potential implicit guarantees in the form of liquidity and capital support that prevent their failures. Banks' contingent access to the financial safety net represents a put option provided by public authorities. The value of this put option increases in the riskiness of bank activities and in bank leverage.[2] Furthermore, banks have incentives to herd and take on correlated (or systemic) risks if the state guarantees are more likely to be

[1] See, for instance, Jensen and Meckling (1976) and Holmstrom and Ricart i Costa (1986). John and Senbet (1998) argue that good governance that reduces agency costs of equity can increase risk-shifting agency costs with respect to debtholders and taxpayers. Empirically, John, Litov, and Yeung (2008) find that shareholder-friendly corporate governance in the form of stronger investor protection brings about increased risk-taking and higher growth for an international sample of non-financial firms. Acharya, Amihud, and Litov (2011) show evidence that stronger creditor rights in bankruptcy affect corporate investment choice by reducing corporate risk-taking. Kroszner and Strahan (2001) also provide supporting evidence of a shareholder–creditor conflict by showing that US non-financial firms tend to have bankers on their boards only when the conflict is less likely to be important.

[2] Merton (1977) shows that deposit insurance with a risk-insensitive insurance premium provides shareholders with a subsidy that increases in value with higher leverage and higher asset risk.

triggered in the event of multiple bank failures.[3] Bank shareholders can thus benefit from taking on more stand-alone as well as systemic risk, and the benefits of additional risk-taking increase with the strength of financial safety nets as shareholders try to shift risk to taxpayers.

Shareholder incentives to take on greater risks can be opposed by managers who tend to be more risk-averse compared to shareholders. Unlike shareholders who are likely to hold diversified stock portfolios, managers can have their jobs, reputations as well as a substantial portion of their personal wealth tied to the performance and health of their firm (Gilson and Vetsuypens, 1993). A bank's corporate governance is a key determinant of how this potential conflict between bank shareholders and managers to take on risk is resolved.

In this paper, we empirically examine the relations between banks' corporate governance and risks for a sample of US banks over the period 1990-2014, and for an international sample of banks over the period 2004-2008. Our main goal is to examine how the relation between corporate governance and bank risk is affected by the fact that banks tend to be covered by a financial safety net (see Laeven, 2013, for a discussion). In particular, we examine whether shareholder-friendly corporate governance results in greater risk-taking for banks compared to non-financial firms, since typically only financial firms benefit from financial safety nets provided by the state. We also examine whether shareholder-friendly corporate governance leads to greater risk-taking at larger

[3] Acharya and Yorulmazer (2007) show that regulators may find it ex-post optimal to bail out some or all failed banks if the number of failed banks is large. This provides banks with incentives to herd and increases the likelihood of systemic crises. Using options on individual banks and on a financial sector index, Kelly, Lustig, and Van Nieuwerburgh (2016) show evidence of a collective guarantee for the financial sector.

banks compared to their smaller counterparts, as larger banks generally benefit from greater protection by the financial safety net on account of their too-big-to-fail status (see Acharya, Anginer, and Warburton, 2016; Bertay, Demirguc-Kunt, and Huizinga, 2013). Finally, we consider whether shareholder-friendly corporate governance increases bank risks more in countries with more generous financial safety nets.

By examining a range of bank risk variables, corporate governance proxies and samples of US and international banks as well as non-financial firms, our analysis is able to provide a comprehensive picture of how the relation between corporate governance and bank risk is affected by the existence of the financial safety net. We examine three variables reflecting a bank's stand-alone risks (distance to default, leverage ratio, and asset volatility), and also three variables that capture a bank's contribution to financial-sector systemic risk. The systemic risk variables we consider are the marginal expected shortfall (MES), and systemic risk (SRISK) variables proposed by Acharya, Engle and Richardson (2012), and the COVAR variable proposed by Adrian and Brunnermeier (2016). Following Aggarwal, Erel, Stulz, and Williamson (2009), we use an overall index of shareholder-friendly corporate governance dealing with board composition, compensation, auditing and take-over related issues. In addition, following Bebchuk, Cohen and Ferrell (2008), we use an index of management entrenchment. Finally, we consider a variable that captures a board's independence vis-à-vis management.

Using US data, we find that there is a stronger relationship between shareholder-friendly corporate governance and stand-alone and systemic risks for banks compared to non-financial firms. This finding is consistent with banks being the main beneficiaries of a financial safety net compared to non-financial firms. We also find that the relation

between risk and shareholder-friendly corporate governance is stronger for larger banks, consistent with larger banks benefiting from a too-big-to-fail guarantee. Finally, we compare large banks to large non-financial firms through triple differencing. We show that the too-big-to-fail relation that we find between governance and risk-taking in the banking sector is not present in the non-financial sector.

The differences in the governance and risk-taking relation that we observe between large and small banks, as well as between banks and non-financial firms, could be driven by unobserved heterogeneity and omitted variables. Corporate governance can also, to some extent, be endogenously determined. For instance, a strong preference for risk on the part of a bank's shareholders could jointly give rise to both considerable bank risk-taking and shareholder-friendly corporate governance. We include bank fixed effects in all regressions in the paper, thereby controlling for any time-invariant unobservable bank characteristics that can affect both bank corporate governance and bank risks. To further address potential endogeneity concerns, we examine changes in risk-taking around an exogenous regulatory change that required increased board independence at some, but not all banks.

Specifically, in 2003 the NYSE and NASDAQ stock exchanges announced new regulations requiring at least 50% of board members at listed firms to be independent and not affiliated with the firm. Firms were required to comply with the new rules starting in 2004. We use the fact that some firms already had a majority of independent directors on their boards, and thus complied with the new rules when they were announced, while other firms had to increase the number of independent directors by the time the rules came into effect.

We find that banks that were affected by the reforms increased their stand-alone and systemic risk more (compared to banks that were already compliant) if they were larger. This result is consistent with our other findings and the notion that larger banks benefit more from financial safety net protection compared to smaller banks. Furthermore, we find that the tendency of larger affected banks to increase their risk was stronger compared to larger non-financial firms. This finding is again consistent with mainly banks benefiting from the financial safety net. These results strongly suggest a causal link between shareholder-friendly corporate governance and greater risk-taking for larger banks as well as larger banks compared to larger non-financial firms.

Our estimates of the differential effects of shareholder-friendly corporate governance on the riskiness of banks compared to non-banks, and of large banks compared to small banks, are economically significant. Relative to non-banks, a one-standard-deviation increase in the governance variable reduces the distance-to-default measure of banks by 0.35 (or 0.14 standard deviation), it reduces banks' MES by 41 basis points (or 0.21 standard deviation), and it increases banks' SRISK by 0.89 billion US dollars (or 0.1 standard deviation). With respect to bank size, a one-standard-deviation increase in the governance measure reduces distance-to-default by 0.36 and MES by 68 basis points for banks that have assets of $5 billion, while the corresponding decreases in distance-to-default and MES for banks with assets of $50 billion are substantially larger at 0.79 and 152 basis points respectively.

Going beyond the US setting, we use an international sample of banks to examine the impact of the strength of national financial safety nets. We find that shareholder-friendly corporate governance varies more positively with bank stand-alone and systemic

risks in countries with more generous financial safety nets. Specifically, our estimation implies that a one-standard-deviation increase in the corporate governance variable augments risk as measured by the distance to default, asset volatility, and MES variables by 2.3%, 1.7%, and 4.7% more in the country where the index of financial safety net strength is one standard deviation higher.[4] These findings are confirmed when we use an instrumental-variable estimation in which a bank's corporate governance is instrumented by the annual country-mean value of the corporate governance variable for all non-financial firms. The results based on international data provide additional evidence that the relations between a bank's corporate governance and risks reflect its incentives to exploit the financial safety net.

Our study fits in an emerging literature that has examined the impact of corporate governance on bank risk-taking.[5] Pathan (2009) finds that small boards and boards that are not controlled by the CEO lead to higher risk for a sample of US bank holding companies over the 1997-2004 period. Chen, Steiner, and Whyte (2006) find a positive relation between option-based executive compensation and market measures of risk for a sample of US commercial banks. DeYoung, Peng, and Yan (2013) find that CEO risk-taking incentives lead to riskier business policy decisions with respect to loans to businesses, non-interest based banking activities, and investment in mortgage-backed securities at US commercial banks. Calomiris and Carlson (2016) examine bank

[4] We do not find similarly significant differential effects for the SRISK and COVAR variables.
[5] Recent surveys are offered by Becht, Bolton, and Roell (2011) and Mehran, Morrison, and Shapiro (2012). Stulz (2016) discusses how corporate governance and risk management should be designed to ensure that banks only take good risks that add value.

ownership and risk-taking at US banks in the 1890s, and find that higher managerial ownership is associated with lower bank default risk.[6]

Several papers have examined how banks with different corporate governance regimes fared during the crisis. Berger, Imbierowicz, and Rauch (2016) find that high share ownership by lower-level management leads to a substantially higher probability of default for US commercial banks over the 2007-2010 period. Beltratti and Stulz (2012), and Fahlenbrach and Stulz (2011) find that banks with more shareholder-friendly boards and CEO compensation contracts that better align the interests of management and shareholders experienced worse stock market performance during the financial crisis. Ellul and Yerramilli (2013) show that US bank holding companies that had a strong and independent risk management function in place before the onset of the financial crisis fared better in terms of operating and stock performance during the crisis.

Multi-country studies of bank corporate governance and risk-taking are relatively scarce. Laeven and Levine (2009) examine the relation between bank ownership and bank risk-taking for an international sample of banks. They find that stronger cash flow rights of large owners are associated with higher bank risks, consistent with the hypothesis that bank shareholders favor greater risk-taking as compared to managers and creditors. These authors also consider the interaction between bank regulation and ownership, finding that deposit insurance is associated with an increase in risk only when the bank has a large equity holder. For a sample of international banks, Anginer,

[6] A few papers examine theoretically how executive compensation can be designed to reduce risk-shifting in banks. For example, John, Saunders, and Senbet (2000) suggest that fairly priced deposit insurance premium can induce shareholders to commit to writing executive compensation contracts that reduce risk-shifting. Bolton, Mehran, and Shapiro (2015) show that basing executive compensation on CDS spread can mitigate risk-shifting.

Demirguc-Kunt, Huizinga, and Ma (2016) find that shareholder-friendly corporate governance varies negatively with bank capitalization rates. Using international data, Erkens, Hung, and Matos (2012) find that financial institutions with more independent boards and higher institutional ownership experienced worse stock returns during the global financial crisis.

Our contribution to this literature is three-fold. First, this paper is the first to study the relation between a bank's corporate governance and its contribution to stand-alone as well as systemic risk. Second, we examine how the generosity and credibility of financial safety nets affect the relation between governance and bank risk. In particular, we compare banks to non-financial firms, compare larger banks to their smaller counterparts, and also consider cross-country differences in the strength of the safety net, adding to a literature that has mostly relied on US data. Third, we examine changes in risk-taking behavior around an exogenous regulatory change in governance and use non-financial firms in our analyses as a control group, which alleviates potential endogeneity concerns.

Our findings on the interaction of bank-level corporate governance variables and the financial safety net have important implications for corporate governance reforms in the financial sector. In particular, our results suggest that one has to be cautious to call for 'better' corporate governance at banks as long as generous financial safety nets and too-big-to-fail guarantees are in place. In fact, governance reforms designed to better align the incentives of managers and shareholders could fail to be in the interests of taxpayers who ultimately bear the cost of maintaining the financial safety net.

The rest of the paper is organized as follows. Section 2 discusses the data and variable construction. We present the empirical results in Section 3. We start with an

analysis of the relations between corporate governance and stand-alone and systemic risks for US banks as well as non-financial firms. Then we consider the impact of the NYSE and NASDAQ reforms towards greater board independence on measures of bank risk. Finally, we consider the relation between corporate governance and bank risk using international data so that we can bring cross-country variation in the strength of financial safety nets into the analysis. Section 4 concludes with policy implications.

2. Data and variable construction

In this study, we relate measures of firm stand-alone and systemic risks to indices of corporate governance for a sample of US banks and non-financial firms for the 1990-2014 period, and also for an international sample of banks for the 2004-2008 period. We describe the US and international samples in turn.

2.1. The sample of US banks and non-financial firms

We examine three measures of a bank's stand-alone risk and three measures of a bank's contribution to the financial sector's systemic risk. Accounting and market data used to construct risk measures for US banks are from Compustat North America and CRSP. Our first measure of bank stand-alone risk is Merton's (1974) distance-to-default measure, denoted as *DD*. This variable measures the difference between the asset value of the firm and the face value of its debt, scaled by the standard deviation of the firm's asset value (see Campbell, Hilscher and Szilagyi, 2008, p. 2914).

In particular, the market value of a company's equity, V_E, is modeled as a call option on the company's assets, V_A, by $V_E = V_A e^{-dT} N(d_1) - X e^{-rT} N(d_2) + (1 - e^{-dT}) V_A$, with $d_1 = \left[\log(V_A / X) + (r - d + s_A^2 / 2)T \right] \Big/ \left(s_A \sqrt{T} \right)$ and $d_2 = d_1 - s_A \sqrt{T}$. Here $N(\cdot)$ is the

cumulative normal probability function; X is the face value of debt maturing at time T; r is the risk-free rate; d is the dividend rate expressed in terms of V_A; and s_A is the volatility of the asset value that is related to equity volatility by $s_E = V_A e^{-dT} N(d_1) s_A / V_E$.

We simultaneously solve equations for V_E and s_E to find the values of V_A and s_A. We use the market value of equity for V_E and total liabilities to proxy for the face value of debt, X. In calculating standard deviations, we require the company to have at least 90 non-missing returns over the previous 12 months. T equals one year, and we use the one-year T-bill rate for the risk-free rate, r. The dividend rate, d, is the sum of the prior year's common and preferred dividends divided by the market value of assets. We use the Newton method to simultaneously solve for V_A and s_A.[7] After we determine asset values V_A, we follow Campbell, Hilscher, and Szilagyi (2008) and take the mean asset return, denoted by m, to be equal to the average equity premium set at 6%.[8] Merton's (1974) distance to default, *DD*, is finally computed as:

$$DD = \frac{\log(V_A/X) + (m - d - s_A^2/2)T}{s_A\sqrt{T}} \quad (1)$$

A higher value of DD implies a greater distance to default, and hence lower risk.

A bank's distance to default reflects both its leverage and the riskiness of its assets. These two aspects of bank risk are captured by the *Leverage* and *AVOL* variables, respectively. The Leverage variable is computed as the sum of the market value of equity

[7] For starting values of the unknown variables, we use $V_A = V_E + X$ and $s_A = s_E V_E / (V_E + X)$. We also winsorize s_E and $V_E / (V_E + X)$ at the 1st and 99th percentile levels to reduce the influence of outliers.

[8] We obtain similar distance to default values if we compute the asset return as $\max(V_{A,t} / V_{A,t-1} - 1, r)$, following Hillegeist, Keating, Cram, and Lundstedt (2004).

and the book value of liabilities divided by the market value of equity. The mean of the Leverage variable for US banks is 9.01 (see Panel A of Table 1 for summary statistics for the sample of US banks). The AVOL variable is constructed as the annualized standard deviation of the asset return computed from Merton's (1974) option pricing model. Leverage and AVOL are both negatively associated with distance to default, and higher values of these variables indicate greater bank risk. In the regression analysis, we consider as dependent variables Leverage and AVOL multiplied by -1 so that higher values of the dependent variables imply lower risk to be consistent with the DD measure. We denote the resulting negative Leverage and AVOL variables as -Leverage and -AVOL, respectively.

Shareholders of non-financial firms may be less interested in risk-taking compared to financial firms, as non-financial firms generally are not protected by a financial safety net. To test for a potentially different relation between corporate governance and risk at non-financial firms, we extend the sample to include non-financial US firms in some specifications. Panel B provides summary statistics for these non-financial firms in the US. Comparing Panels A and B, we see that non-financial firms have a slightly lower average distance to default of 5.22 (compared to 5.33 for banks), which reflects lower average Leverage of 2.07 (compared to 9.01) and higher average AVOL of 0.30 (compared to 0.10).

Following the recent literature, we use three variables to measure a bank's systemic risk. The first measure is the marginal expected shortfall (*MES*). Following Acharya, Engle, and Richardson (2012), we compute the MES as the average bank equity

return on days when the market as a whole is in the lower tail of its return distribution provided by:

$$MES_{i,t} = E\left(R_{i,t} \mid R_{m,t} < C\right) \tag{2}$$

in which $R_{i,t}$ is firm *i*'s equity return on day *t*, $R_{m,t}$ is the aggregate market index return, and *C* is the 5th percentile value of the market index returns over the past 12 months. We compute *MES* on an annual basis using daily stock market information from CRSP for US firms, and daily stock returns from Compustat Global for non-US firms. For the aggregate market index, we use the corresponding FTSE stock index of the country where the firm is incorporated. A lower MES variable indicates that a firm experiences lower returns during market distress. Hence, a lower MES variable indicates higher systemic risk.

Our second systemic risk measure, *SRISK*, represents a bank's expected capital shortfall when the market return is in the lowest 5% bracket in a given year (Acharya, Engle, and Richardson, 2012). Compared to MES, SRISK incorporates information on a bank's size and leverage. SRISK measures capital shortfall with respect to a prudential capital ratio and is computed as $SRISK = E\left[k(Debt + Equity) - Equity \mid Crisis\right]$. In this expression, *Debt* is the book value of debt, *Equity* is the market value of equity, and *k* is the prudential capital ratio set to 8%. SRISK is related to the expected shortfall for each firm *i* in year *t* as follows:

$$SRISK_{i,t} = k \cdot Debt_{i,t} + (1-k) \cdot (1 - LRMES_{i,t}) \cdot Equity_{i,t} \tag{3}$$

in which *LRMES* is the long-run marginal expected shortfall computed as $LRMES_{i,t} = 1 - \exp(18 \times MES_{i,t})$. Higher SRISK indicates greater risk. In the regression

analysis, we use as a dependent variable SRISK multiplied by -1 so that a higher dependent variable indicates lower risk to be consistent with the other risk measures. This negative value of SRISK is denoted by -SRISK.

Although capital shortfall as reflected by SRISK would not have the same implications for non-financial firms that are not subject to prudential capital requirements, one can still think of SRISK for non-financial firms as a systemic risk measure that combines information of their MES, size, and leverage. In Panels A and B of Table 1, we see that banks and non-financial firms have average values of SRISK of -0.42 and –3.22, respectively. Hence, banks as well as non-financial firms on average maintain a negative capital shortfall, i.e. a capital surplus, relative to the prudential capital ratio (of 8%) in case of a very low market return. There is, however, considerable time-series variation in SRISK for both banks and non-financial firms over our sample period. In 2008 during the financial crisis, for example, the average SRISK was 4.24 for banks and -0.87 for non-financial firms.

As our third systemic risk measure, we compute the conditional value-at-risk, *COVAR*, following Adrian and Brunnermeier (2016). This risk measure is the value-at-risk of the financial system conditional on a bank being in distress minus the value-at-risk of the financial system conditional on the bank being in a normal state. Following Adrian and Brunnermeier (2016), we compute the COVAR measure for each firm using quantile regressions and a set of macro state variables. In particular, we run the following two quantile regressions.

$$R_{i,t} = \alpha_i + \gamma_i M_{t-1} + \epsilon_{i,t} \tag{4}$$

$$R_{m,t} = \alpha_{system|i} + \beta_{system|i} R_{i,t} + \gamma_{system|i} M_{t-1} + \epsilon_{i,t} \tag{5}$$

in which $R_{i,t}$ is the equity return for firm *i* in week *t*, $R_{m,t}$ is the weekly return of country *m*'s stock index. M_{t-1} are lagged state variables: the change in the 3-months T-bill rate, the change in the term spread, the weekly country stock index return, and the volatility of the daily country stock index return over the past four weeks. We use weekly stock market information from CRSP for US firms, and weekly stock returns from Compustat Global for non-US firms. For the aggregate market index, we use the FTSE stock index corresponding to the country where the firm is incorporated.

The quantile regressions (4) and (5) are estimated at the end of each year using data from a rolling five-year window.[9] The COVAR variable is computed as the change in the value-at-risk of the system when the institution' return is at the 5th percentile (or when the institution is in distress) minus the value at risk of the system when the institution' return is at the 50% percentile given by:

$$COVAR_t^{5\%} = \hat{\beta}_{system|i}^{5\%}\left(\hat{R}_{i,t}^{5\%} - \hat{R}_{i,t}^{50\%}\right) \quad (6)$$

Since we use equity returns in the estimation, lower values of COVAR indicate a higher contribution to systemic risk.[10]

There are similarities as well as differences between the three measures of systemic risk. MES measures what happens to a firm's equity returns when the market is in distress, whereas COVAR complements MES by measuring what happens to the value-at-risk of the financial system when the firm is in distress. SRISK incorporates information on firm size and leverage, and hence addresses the too-big-to-fail dimension

[9] We require each firm to have at least 52 weeks of non-missing returns over the past 5 years to be included in the estimation.

[10] Some papers including Adrian and Brunnermeier (2016) use return losses (returns multiplied by -1) to compute conditional value-at-risk. With return losses, higher values indicate higher risk.

of systemic risk. Benoit, Colletaz, Hurlin, and Pérignon (2013) compare these three measures from a theoretical and empirical viewpoint, and show that these measures can be expressed as transformations of market risk measures such as Beta.

While our main focus is on examining the relations between corporate governance and ex-ante measures of bank risk-taking, for robustness we also consider how realized risk proxied by equity returns during the crisis vary with corporate governance. In particular, we compute average monthly stock returns (Return) over the crisis period from January to September 2008.

We use three alternative variables to represent the shareholder-friendliness of a firm's corporate governance. First, following Aggarwal, Erel, Stulz, and Williamson (2009), the Governance variable is based on 44 individual governance attributes related to board size and composition, compensation and ownership, external auditing, and anti-takeover measures, available from the Corporate Governance Quotient database assembled by Institutional Shareholder Services (ISS). Each attribute is a dummy variable that equals one if the characteristic is qualified as shareholder-friendly, and zero otherwise. A listing of the individual attributes is provided in Table A2 in the Appendix. The Governance variable reflects the values of the 44 attributes, and we scale it to a range between zero and one by dividing the number of qualifying attributes by the total number of attributes. This Governance variable is available for banks located in 22 countries for the years 2003-2007. The country coverage is provided in Table A3 in the Appendix. The mean value of the Governance variable for US banks is 0.62. This reflects an increase in this variable from 0.59 in 2003 to 0.66 in 2007, as overall corporate governance became more shareholder-friendly at US banks during this period.

Our second measure of corporate governance is the entrenchment index of Bebchuk, Cohen, and Ferrell (2008). This index represents six governance provisions, such as poison pills and golden parachutes, indicating management entrenchment and power vis-à-vis shareholders. We use data on these provisions from ISS (formerly Riskmetrics) over the 1990-2014 time period. We take the negative value of this measure to make it increasing in shareholder power vis-à-vis management in accordance with the other governance measures we use in the paper. The mean of the Entrenchment variable is -2.35 for US banks.

The third measure of governance is the Independence variable, which is the percentage of board members who are not affiliated with the firm. The board independence data are also from ISS (formerly Riskmetrics), and are available for the years 1995-2014. The mean corporate governance variables are very similar for the samples of banks and non-financial firms. The mean Independence variable, for instance, equals 0.70 for both banks and non-financial firms.

We use three additional firm-level control variables that are relevant and common to banks and non-financial firms. First, Return on assets is a profitability measure constructed as net income divided by total assets with a mean of 0.02. More profitable banks with a higher return on assets may have lower insolvency risk. Second, Market-to-book is the market value of total equity divided by the book value of total equity with a mean of 2.05. Banks with higher market-to-book ratios can be farther away from insolvency. Finally, Size is the log of total assets. Larger banks could pursue riskier strategies if they are deemed to be too big to fail, but they could also be less risky as a result of better diversification. The average Size variable is 8.27.

2.2. The sample of non-US banks

Banks can have higher incentives to take on risks if they operate in countries with stronger and more generous financial safety nets. To be able to take the strength of the financial safety net into account, we also examine an international sample of banks. Panel C of Table 1 provides summary statistics for the non-US banks in this sample.[11] The Governance variable is the only corporate governance variable available for the non-US sample of banks. Comparing Panels A and C, we see that the average Governance variable for non-US banks of 0.56 was lower than the average for US banks of 0.62, which suggests that corporate governance was on average less shareholder-friendly at non-US banks during 2004-2008.

Following Demirguc-Kunt and Detragiache (2002), we construct the Financial safety net variable as a country-level measure of the strength of the financial safety net through a principal components analysis of deposit insurance design features. Specifically, we collect data on deposit insurance characteristics in the year 2003 from Demirguc-Kunt, Karacaovali, and Laeven (2005), and construct Financial safety net as the sum of four principal components derived from eight deposit insurance characteristics: (1) existing coverage of foreign currency deposits, (2) existing coverage of interbank deposits, (3) an absence of coinsurance, (4) coverage per depositor per bank per account, (5) existence of funding ex ante, (6) existence of funding by the government, (7) existence of a risk-insensitive insurance premium, and (8) the ratio of insurance coverage and deposits per capita. In each case, a higher value for the deposit insurance

[11] Non-US banks have a relatively large average SRISK of 0.80 compared to an average SRISK of -0.42 for US banks, which reflects different sample periods and the relatively large average size of non-US banks.

feature is associated with a more generous financial safety net and a greater potential to induce bank risk taking.

The specifications that use the international sample include several macroeconomic and country-level institutional control variables. Inflation is the consumer price inflation rate. GDP growth is the rate of real GDP growth. GDP per capita is GDP per capita in thousands of constant U.S. dollars. As an index of bank regulation, Activity restriction is a composite index of regulatory restrictions on bank activities from Barth, Caprio, and Levine (2004). Specifically, it is an indicator of the degree to which banks face regulatory restrictions on their activities in securities markets, insurance, real estate, and their ownership of shares in non-financial firms. Capital stringency is an index of regulatory oversight of bank capital, summarizing information about the nature and the magnitude of bank capital requirements, with higher values indicating greater stringency. Supervisory power is an index of the power of bank supervisory authorities to undertake specific actions to prevent and correct problems at a bank, with higher values indicating greater power. Diversification is an index of loan diversification guidelines imposed on banks. Finally, Financial freedom is an index of financial market freedoms available from the Heritage Foundation.

3. Empirical results

In this section, we first discuss our methodology followed by a presentation of the empirical results based on the US and the international data.

3.1. Methodology

We begin our analysis by examining the relation between firm risks and corporate governance for a sample of US banks and non-financial firms:

$$Risk_{i,t} = \alpha + \beta_0 Gov_{i,t-1} + \beta_1 Gov_{i,t-1} \times Findum_i + \beta_2 X_{i,t-1} + \gamma_i + \delta_t + \epsilon_{i,t} \quad (7)$$

in which $Risk_{it}$ is a risk measure for firm *i* at year *t*. We use six different measures of risk. Specifically, DD, -Leverage and -AVOL measure firm-level risk, while MES, -SRISK and COVAR represent a firm's contribution to the systemic risk. In all cases, a lower value for the dependent variable denotes higher risk. $Gov_{i,t-1}$ is a corporate governance variable, in particular either Governance, Entrenchment, or Independence. As banks are generally protected by the financial safety net, we expect shareholder-friendly corporate governance to have a greater impact on risk for banks than for non-financial firms. To test this, we include an interaction term of the relevant corporate governance variable with the Findum variable which takes on a value of one for firms that are classified as financial firms, and takes on a value of zero otherwise.[12] $X_{i,t-1}$ is a set of firm-level controls. We include firm fixed effects γ_i and year fixed effects δ_t, to control for time-invariant firm-level heterogeneity and macro shocks that affect all firms in a given year. In the estimation, we cluster the errors at the firm level. All independent variables are lagged by one year to reduce endogeneity concerns.

For all three governance measures, a higher value of the $Gov_{i,t-1}$ variable indicates that corporate governance better serves the interests of shareholders. Shareholders of banks could gain more from higher risks compared to nonfinancial firms, as banks tend to be protected by the financial safety net. Consistent with a relatively strong relation

[12] A firm is classified as financial if it has a Standard Industrial Classification (SIC) code starting with 6.

between shareholder-friendly governance and risk for banks, we expect to find $\beta_1 < 0$ in Eq. (7).

On account of their too-big-to-fail status, larger banks are expected to benefit more from the financial safety net compared to smaller banks. This suggests that more shareholder-friendly corporate governance leads to higher bank risk especially in the case of large banks. To test this, we estimate the following regression model:

$$Risk_{i,t} = \alpha + \beta_0 Gov_{i,t-1} + \beta_1 Size_{i,t-1} + \beta_2 Gov_{i,t-1} \times Size_{i,t-1} + \beta_3 X_{i,t-1} + \gamma_i + \delta_t + \epsilon_{i,t} \quad (8)$$

We expect to find $\beta_2 < 0$ in Eq. (8), consistent with a stronger relation between shareholder-friendly governance and risk for larger banks.

Allowing for both bank vs. non-financial firm and size heterogeneity, we also estimate:

$$\begin{aligned} Risk_{i,t} = {} & \alpha + \beta_0 Gov_{i,t-1} + \beta_1 Size_{i,t-1} + \beta_2 Gov_{i,t-1} \times Size_{i,t-1} \\ & + \beta_3 Gov_{i,t-1} \times Findum_i + \beta_4 Size_{i,t-1} \times Findum_i \\ & + \beta_5 Gov_{i,t-1} \times Findum_i \times Size_{i,t-1} + \beta_6 X_{i,t-1} + \gamma_i + \delta_t + \epsilon_{i,t} \end{aligned} \quad (9)$$

In Eq. (9), the variable of interest is the triple interaction term $Gov_{i,t-1} \times Findum_i \times Size_{i,t-1}$ that captures the differential effect of governance on risks for large banks compared to large non-financial firms. We expect to find $\beta_5 < 0$, consistent with the notion that larger banks, but not larger non-financial firms, benefit from the financial safety net.

Finally, we use an international sample of banks to examine the impact of cross-country differences in the strength of the national financial safety nets. We estimate the following model:

$$\begin{aligned} Risk_{ij,t} = {} & \alpha + \beta_0 Gov_{ij,t-1} + \beta_1 Gov_{ij,t-1} \times Financial\ safety\ net_j + \beta_2 X_{ij,t-1} \\ & + \beta_3 Z_{j,t-1} + \gamma_i + \delta_t + \epsilon_{i,t} \end{aligned} \quad (10)$$

In Eq. (10), the variables that vary across countries are denoted by the subscript *j*. $Z_{j,t-1}$ is a set of country-level controls described in the previous section. We are interested in the interaction term $Gov_{ij,t-1} \times Financial\ safety\ net_j$ that measures the impact of financial safety nets on the governance-risk relation. We expect to find $\beta_1 < 0$, consistent with the notion that bank risks vary more positively with shareholder-friendly corporate governance in countries with more generous financial safety nets.

In subsection 3.2, we report the results from estimating models (7) to (9) for US banks and non-financial firms over the years 1990-2014. Subsection 3.3 provides results of the impact of an exogenous regulatory change in board independence on risk. We explain our approach in detail in that section. Analogous to models (7) to (9) and as an additional check, subsection 3.4 provides the results of regressions that relate equity returns during the financial crisis to corporate governance variables for the sample of US banks and non-financial firms. In subsection 3.5, we present the results of estimating model (10) for an international sample of banks. The international data also allow us to use an instrumental variable approach in which we instrument for bank-level governance using country-year average governance of non-financial firms. We explain this approach in detail in that section.

3.2. Corporate governance and risks at US banks and non-financial firms

In this subsection, we examine the relation between corporate governance and firm risk using data on US banks and non-financial firms. To start, Panels A, B and C of Table 2 provide the results of estimating Eq. (7) in which we relate the various risk measures to either Governance, Entrenchment, or Independence and the interaction of the included corporate governance variable with Findum. In Panel A, the interaction term

Governance × Findum has negative coefficients in all six risk regressions that are significant throughout except in the -AVOL regression. This provides evidence that shareholder-friendly corporate governance is more positively related to stand-alone as well as systemic risks for financial firms than for non-financial firms, as financial firms potentially benefit from financial safety nets. This effect is economically significant. Specifically, a one-standard-deviation increase in the governance variable reduces a bank's distance-to-default by 0.35 (or 0.14 standard deviation), reduces its MES by 0.0041 (41 basis points or 0.21 standard deviation), and increases its SRISK by 0.89 billion US dollars (or 0.1 standard deviation), compared to non-financial firms.

In terms of the control variables, the return on assets variable is positive and significant in the DD, -Leverage, and COVAR regressions, suggesting that more profitable banks have lower stand-alone and systemic risk. The market-to-book ratio has negative and significant coefficients in the DD, MES, and COVAR regressions, and a positive and significant coefficient in the –Leverage regression. A higher market-to-book ratio thus is associated with a lower distance to default despite a lower leverage. The estimated coefficient for the Size variable is negative and significant in the DD, MES, and COVAR regressions, while it is positive and significant in the -AVOL and -SRISK regressions. The ambiguous relation between bank size and risk could reflect that larger banks face greater incentives to take on risks on account of their too-big-to-fail status, while they may face lower risks due to better diversified asset portfolios.

In Panel B, the interaction term Entrenchment × Findum is estimated to be negative in all six risk regressions, and statistically significant except for the -AVOL regression. Similarly, in Panel C, the interaction term Independence × Findum has

negative and significant coefficients in the -Leverage, -AVOL, MES, and -SRISK regressions. Overall, Table 2 provides strong evidence of a more positive relation between shareholder-friendly corporate governance and risks at banks than at non-financial firms. This is consistent with banks having greater opportunities and incentives to shift risks to creditors and taxpayers.

Next, we consider how the relation between corporate governance and bank risk is affected by a bank's size. Bigger banks may be more aggressive in risk-taking, as in case of insolvency they may receive a more generous treatment by bank regulators due to their too-big-to-fail status. Hence, the relatively positive relation between governance and risk for banks compared to non-banks shown in Table 2 could be driven by the larger banks in the sample. To examine the role of bank size, we interact bank size with our measures of governance according to Eq. (8) described in the previous section, and report the results in Table 3.

In Panel A of this table, the interaction term Governance × Size has negative and significant coefficients in the DD, MES, -SRISK, and COVAR regressions. This suggests that shareholder-friendly corporate governance increases stand-alone and systemic risks especially for larger banks, consistent with a stronger financial safety net protection of larger banks. In Panel B, the interaction term Entrenchment × Size has negative coefficients in all six risk regressions that are significant in all cases except for the COVAR specification. Finally, in Panel C the interaction of Independence and Size has negative and significant coefficients in the DD, -Leverage, MES, and -SRISK regressions. Overall, for all three governance measures we find strong evidence that shareholder-friendly corporate governance is more positively related to riskiness for big

banks rather than small banks. These results are consistent with the notion that larger banks have greater incentives to take on additional risk due to their too-big-to-fail status. The results we report are economically significant. For instance, a one-standard-deviation increase in Governance reduces distance-to-default by 0.36 and MES by 0.0068 (or 68 basis points) for banks that have assets of $5 billion. The corresponding decreases in distance-to-default and MES for banks with assets of $50 billion are 0.79 and 0.0152 (or 152 basis points), respectively.

We expect the tendency of size to accentuate the positive relation between corporate governance and risk to be more pronounced in the case of banks compared to non-financial firms, as even very large non-financial firms are generally not deemed to be systemically important.[13] To test this, we estimate regression model (9) as described in the previous section in which we interact the pertinent corporate governance variable, the Size variable, and the Findum variable. The results are reported in Table 4.

In Panel A of this table, the triple interaction term of Governance × Size × Findum has negative coefficients that are significant in five risk regressions (of DD, -Leverage, MES, -SRISK, and COVAR). The triple interaction, however, has a positive and significant coefficient in the -AVOL regression. Hence, the triple interaction variable varies nonuniformly with leverage and asset risk (as reflected in the -Leverage and -AVOL regressions), while the overall effect on the distance to default variable – reflecting variation in both leverage and asset risk – is negative and significant. The evidence of Panel A thus suggests that larger firms with shareholder-friendly corporate

[13] Moreover, comparing banks to non-financial firms allows us to control for general advantages associated with firm size that may affect both the level of governance as well its impact on risk-taking across the two types of firms.

governance represent greater stand-alone risk (as measured by the distance to default) and greater systemic risk, especially if they are banks rather than non-financial firms.

In Panel B, the triple interaction of Entrenchment, Size and Findum is estimated with negative and significant coefficients in four risk regressions (of DD, -Leverage, MES, and COVAR), while in Panel C the interaction of Independence, Size and Findum is negative and significant in four risk regressions (of DD, -Leverage, MES, and -SRISK). Taken together, the results of Table 4 strongly suggest that larger firms with strong corporate governance are riskier especially if they are banks, consistent with a too-big-to-fail status of banks.

3.3. The impact of US reforms towards greater board independence on risk-taking

Corporate governance can, to some extent, be endogenously determined. For instance, a strong preference for risk on the part of a bank's shareholders may jointly give rise to both considerable bank risk-taking and shareholder-friendly corporate governance. As indicated before, to alleviate concerns about endogeneity we include bank fixed effects in all regressions with time-varying data, thereby controlling for any time-invariant unobservable bank characteristics that affect both bank corporate governance and bank risk.

To further address potential endogeneity, we examine the impact of new regulations announced by the NYSE and NASDAQ stock exchanges in 2003 requiring firms to have more than 50% independent directors on the risk-taking behavior of US banks and non-financial firms.[14] Listed firms were required to comply with these new

[14] Several papers have used the introduction of NYSE and NASDAQ rules requiring majority board independence, and the Sarbanes-Oxley regulations requiring majority independence in the audit committee as exogenous shocks to governance. See, for instance, Duchin, Matsusaka, and Ozbas (2010),

rules starting in 2004.[15] The reforms were, to a large extent, a response to fraudulent accounting practices at high-profile non-financial firms such as Enron, and were unlikely to be endogenous to the risk-taking behavior of financial institutions. The regulatory changes provide a quasi-experiment suitable for a difference-in-difference estimation, as some firms already had a majority of independent directors on their boards and thus complied with the new rules at the time they were announced (non-affected), while other firms had to increase the number of independent directors before the rules came into effect (affected).

Specifically, we examine the change in our six risk measures for the affected and non-affected firms after the implementation of the reforms. As before, we also examine whether risk-taking behavior changed more for larger banks compared to smaller banks. To do this, we estimate the following model over the time period from 2000 to 2005:

$$\begin{aligned} Risk_{i,t} = {} & \alpha + \beta_0 Size_{i,t-1} + \beta_1 Post_t + \beta_2 Post_t \times Affected_i + \beta_3 Post_t \times Size_{i,t-1} \\ & + \beta_4 Affected_i \times Size_{i,t-1} + \beta_5 Post_t \times Affected_i \times Size_{i,t-1} + \beta_6 X_{i,t-1} \\ & + \gamma_i + \tau + \tau \times Affected_i + \epsilon_{i,t} \end{aligned} \tag{11}$$

$Affected_i$ is a dummy variable that takes on a value of one for firms that were non-compliant with the rules prior to the implementation of the reforms. In our sample, about 12% of banks were affected by the new rules.[16] $Post_t$ is a dummy variable that takes on a value of one for the time period 2003-2005 comprising the announcement and

Chhaochharia and Grinstein (2009), Linck, Netter, and Yang (2008), and Armstrong, Core, and Guay (2014).

[15] NYSE-listed and NASDAQ-listed firms were required to implement the new requirement by their first annual meeting occurring after January 15, 2004, but no later than October 31, 2004 and October 15, 2004, respectively.

[16] Consistent with Armstrong, Core, and Guay (2014), we find that initially non-compliant firms had a significant increase in independent directors compared to initially compliant firms.

implementation of the reforms. We include firm fixed effects (γ_i) as well as time trend variables (τ and τ × Affected$_i$) to capture potentially differential pre-reform trends in the dependent variables for affected firms. [17]

The results of estimating Eq. (11) for the six risk measures are reported in Table 5 for the sample of US banks. The variable of interest is the triple interaction term, Post$_t$ × Affected$_i$ × Size$_{i,t-1}$.[18] The coefficients on the triple interaction term are negative and statistically significant in all six risk regressions except for the COVAR regression. This suggests that risk increased for larger affected banks after they were compelled by the new regulations to increase their share of independent board members. This provides evidence that an exogenously determined increase in board independence caused larger banks to increase their stand-alone and systemic risk, consistent with a more generous financial safety net treatment of larger banks.

Next, we consider two sets of additional tests of the impact of the NYSE and NASDAQ reforms towards greater board independence on firm risk. First, we expand the sample of US banks to include US non-financial firms. This enables us to test whether the reforms increased risk more at affected large banks than non-financial firms. We do this by including a quadruple interaction of Post, Affected, Size and Findum into regression model (11). The results are reported in Table 6. The regressions include all the interaction terms and control variables, but we report only the coefficients on the quadruple

[17] An alternative approach is to examine changes in board independence from 2000 (before there was any information about the impending change in regulations) to 2004 using the minimum change in board independence required to be compliant as an instrument following Duchin, Matsusaka, and Ozbas (2010). We find that the change in the share of independent board members had a positive impact on bank stand-alone and systemic risk using this approach.

[18] We have also estimated a baseline model examining the impact for all affected banks based on Post×Affected. This baseline impact of the regulatory change is not significant for the average bank.

interaction term for brevity. In Panel A of Table 6, we find that this quadruple interaction variable has negative and significant coefficients in all six risk variable regressions. This means that large affected banks increased their stand-alone and systemic risks more compared to large affected non-financial firms. These results are consistent with our earlier results and the notion that only large banks (and not large non-financial firms) are seen as benefiting from the financial safety net on account of their 'too-big-to-fail' status.

Second, in Panels B and C we show the results of regressions analogous to Table 5 in which we counterfactually construct the Affected variable on the assumption that the reforms were announced and implemented three years later and three years earlier, respectively. In Panel B, the quadruple interaction variable has positive coefficients (that are statistically significant in the DD and -SRISK regressions), suggesting that large (actually) affected large banks did not become riskier relative to large affected non-financial firms in the placebo reform period after 2005. Furthermore, in Panel C the quadruple interaction term is not statistically significant in any of the six risk variable regressions for a placebo reform period after 1999. The results of these placebo tests lend additional credence to our interpretation of the results in Panel A. Overall, our results provide evidence that greater board independence causes higher stand-alone and systemic risk especially at larger banks, consistent with stronger financial safety net protection of these banks.

3.4. Realized risk during the financial crisis

In this subsection, we examine the relation between corporate governance in 2007, and the equity returns of US banks and non-financial firms during the financial crisis in 2008. Whereas our prior analyses focused on ex-ante measures of risk, we use equity returns during the crisis as a measure of ex-post or realized risk. In particular, the return measure is the average monthly stock return from January to September 2008, before the implementation of various liquidity and capital support programs by the US Treasury and the Federal Reserve. We use the same regression specification provided in Eq. (7), (8) and (9), with returns as the dependent variable. Since we examine average returns during the crisis, the sample is only one cross-section. The results are reported in Table 7.

Analogous to Table 2, regressions (1)-(3) relate equity returns to a governance variable (either Governance, Entrenchment, or Independence) and its interaction with Findum. In regressions (2) and (3), the coefficients of the interaction terms Entrenchment × Findum and Independence × Findum are negative and significant, which suggest that banks with more shareholder-friendly corporate governance experienced lower equity returns during the financial crisis compared to non-banks. Analogous to Table 3, regressions (4)-(6) each include a distinct corporate governance variable and its interaction with Size; these regressions are estimated for the sample of banks only. The interaction variables Governance × Size and Independence × Size have negative and significant coefficient in regressions (4) and (6), providing evidence that banks with shareholder-friendly corporate governance had low stock returns during the crisis especially if they were large. Our finding that large US banks with more independent boards had low returns during the crisis is consistent with Fahlenbrach and Stulz (2011)

who show that equity returns during the crisis were negatively related to board independence for a sample of international banks. Finally, following Table 4 regressions (7)-(9) of Table 7 consider how the relationship between shareholder-friendly corporate governance and equity returns during the crisis jointly depends on Size and Findum. The triple interactions Governance × Findum × Size and Independence × Findum × Size enter with negative and significant coefficients in regressions (7) and (9), indicating that equity returns during the crisis varied negatively with shareholder-friendly corporate governance especially for firms that were large banks. The evidence that large banks with shareholder-friendly corporate governance realized relatively low equity returns during the financial crisis is consistent with our earlier findings in Tables 2-4 that these firms displayed relatively high ex-ante stand-alone and systemic risk measures.

3.5. Corporate governance and risk for international banks

In this subsection, we extend our analysis to an international sample of banks.[19] The international sample allows us to take into account cross-country variation in the strength of the financial safety net. The international data, in particular, enable us to examine whether shareholder-friendly corporate governance and bank risk are more positively related in countries that have stronger financial safety nets. We test this by estimating Eq. (10), which includes an interaction of the Governance variable with the Financial safety net variable, as applied to our measures of stand-alone and systemic risk. In Panel A of Table 8, this interaction variable is estimated with negative coefficients in

[19] In unreported regressions based on the international data, we confirm the results reported in section 3.2. In particular, shareholder-friendly corporate governance is more positively related to various stand-alone and systemic risks for banks than for non-financial firms, for big banks than for small banks, and for big banks than for big non-financial firms.

all six regressions, and it is significant in the DD, -AVOL, and MES regressions. These results are consistent with the hypothesis that more shareholder-friendly corporate governance increases stand-alone and systemic risks in banks located in countries with stronger financial safety nets, since it is in these countries that distressed banks are more likely to obtain generous support and bailouts.[20]

To ascertain the economic significance of the results, we can compare the impact of a one-standard-deviation increase in the corporate governance variable on risk variables in two countries for which the financial safety net variables differ by one standard deviation. The estimated coefficients then imply that the increase in the corporate governance variable reduces the DD, -AVOL, and MES variables by 2.3%, 1.7%, and 4.7% more in a country with a relatively strong financial safety net.

In terms of the control variables, the inflation variable is positive and significant in the DD and MES regressions, but negative and significant in the COVAR regression. The ambiguous relationship between inflation and risk may reflect that inflation provides banks with additional profit opportunities in a more uncertain macroeconomic environment. The coefficient for GDP growth is positive and significant in several of the risk variable regressions, as bank risks are likely to be reduced by economic growth. The GDP per capita variable has negative and significant coefficients in some of risk variable regressions. This result could reflect that banks in wealthier countries are protected by a more credible financial safety net, which induces them to take on more risk. The Activity restriction variable has negative and significant coefficients in the DD and COVAR regressions, perhaps due to the fact that activity restrictions reduce risk diversification

[20] In unreported results, we also find that the positive relation between Governance and bank risk is stronger for banks that are larger and located in countries with stronger financial safety nets.

options for banks. Furthermore, stronger diversification guidelines imposed on banks are associated with higher bank risks in several instances, while the relation between supervisory power and financial freedom on the one hand and bank risks on the other appear to be ambiguous.

To alleviate the concern for potential endogeneity, we have included firm fixed effects as well as considered an exogenous shock to board independence in the US. While we do not have a comparable exogenous shock in corporate governance for the international sample, we use an instrumental-variable approach to confirm the robustness of the results reported in Panel A of Table 8. In particular, we instrument a bank's Governance variable by using the average of this variable for all non-financial firms in the same country and in the same year. We consider such country-year averages a valid instrument, as a shock to a bank's risk is unlikely to affect the corporate governance of non-financial firms. Similar IV approaches were previously used by John, Litov, and Yeung (2008), Aggarwal, Erel, Stulz, and Williamson (2009), and Laeven and Levine (2009).

Panel B of Table 8 reports IV results for regressions that are analogous to those seen in Panel A. Columns 1 and 2 show the 1st stage regressions of the Governance and Governance × Financial safety net variables, respectively. In these two regressions, the instruments Governance non-financials, and Governance non-financials × Financial safety net have coefficients 0.955 and 0.927, respectively, and they are significant at 1%. In the 2nd stage regressions reported in columns 3-8, the instrumented Governance × Financial safety net variable has negative coefficients which are significant in all regressions except the -SRISK and COVAR regressions. Based on these results, we conclude that the

negative relations between the stand-alone and systemic risk variables and the interaction of Governance and Financial safety net we reported in Panel A of Table 8 are robust to using an instrumental-variable approach.[21] This cross-country evidence supports the hypothesis that more shareholder-friendly corporate governance leads to more stand-alone and systemic risk if the financial safety net is stronger.

4. Conclusion

This paper provides evidence that more shareholder-friendly corporate governance is associated with greater stand-alone and systemic risks for financial institutions compared to non-financial firms, consistent with the notion that banks benefit more from financial safety nets. Furthermore, shareholder-friendly corporate governance is associated with greater risk-taking by large banks compared to small banks, consistent with larger banks benefiting from too-big-to-fail guarantees. For the sample of international banks, we also find that the relations between shareholder-friendly governance and bank risks are stronger in countries with more generous financial safety nets. This is again consistent with the notion that banks try to shift risk onto the financial safety net to increase equity value.

To alleviate endogeneity concerns, we examine changes in risk-taking around an exogenous regulatory change that increased board independence for some banks but not others. We find that regulatory reform towards greater board independence approved in 2003 by US exchanges increased stand-alone and systemic risks more at larger banks that were affected by this reform as compared to non-financial firms. For the sample of

[21] In equity return regressions for the international sample of banks analogous to Table 8, we did not find a significant impact of the interaction of Governance and Financial safety net (unreported).

international banks, we use an instrumental-variable approach to confirm our findings. These results strongly suggest a causal link between shareholder-friendly corporate governance and bank risk-taking.

The interaction between corporate governance and the financial safety net in determining bank insolvency and systemic risks has important implications for public policies towards corporate governance at banks. In particular, the case for more shareholder-friendly corporate governance at banks is much weaker than in the case of non-financial firms. In the case of banks, particularly large ones, corporate governance that better aligns managerial incentives with shareholder interests may exacerbate the excessive risk-taking resulting from bank shareholders' incentives to exploit the financial safety. This paper's finding that regulations towards greater board independence in the US increased the riskiness of the affected banks relative to non-financial firms provides suggestive evidence of this. In the second-best world in which mispriced financial safety nets and too-big-to-fail policies exist, 'better' corporate governance could produce worse outcomes. To prevent this, a first priority should be regulatory and safety net reforms to address too-big-to-fail issues and to reduce moral hazard leading to excess risk-taking of banks. After such reforms, the case for 'better' corporate governance at banks would become much stronger.

Appendix. Variable definitions, data sources, governance attributes, and country coverage

Table A1. Variable definitions and data sources

Variable name	Definition	Data source
Risk and return variables		
DD	Merton's (1974) distance-to-default measure computed as the difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value	Authors' calculations
Leverage	Market leverage computed by dividing the sum of the market value of equity and the book value of liabilities by the market value of equity	Authors' calculations
AVOL	Asset volatility computed using the Merton (1974) model	Authors' calculations
MES	Average bank stock return when market return is in the lowest 5% bracket in a given year	
SRISK	Expected capital shortfall in billions of US dollars when the market return is in the lowest 5% bracket in a given year	Authors' calculations
COVAR	Conditional value at risk measure as the change in the value at risk (VaR) of the system when the firm is at the 5^{th} percentile minus the VaR of the system when the institution is at the 50^{th} percentile in terms of its stock returns	Authors' calculations
Return	Average monthly stock return during the financial crisis from January to September 2008	Author's calculations
Governance variables		
Governance	Corporate governance index based on 44 attributes listed in Table A2	ISS/CGQ
Entrenchment	Entrenchment index of executive entrenchment based on six governance provisions: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments with higher values indicating better governance	ISS/Riskmetrics
Independence	Share of board members who are not affiliated with the firm	ISS/Riskmetrics
Affected	Dummy variable set to one for firms that were not compliant with the exchange rules requiring firms to have at least 50% of their board members to independent in 2003.	ISS/Riskmetrics
Firm control variables		
Size	Logarithm of total assets	CRSP and Compustat Global
Market-to-book	Market to book ratio computed as market capitalization divided by the book value of equity	CRSP, Compustat North America, and Compustat Global

Return on assets	Net income divided by total assets	CRSP, Compustat North America, and Compustat Global
Macro and institutional control variables		
Financial safety net	Sum of first four principal components with an eigenvalue exceeding one based on 8 deposit insurance scheme design features as follows: (1) coverage of foreign currency deposits, (2) coverage of interbank deposits, (3) an absence of coinsurance, (4) coverage per depositor per bank per account, (5) funded ex ante, (6) funded by government, (7) risk-insensitive insurance premium, (8) the ratio of insurance coverage and deposits per capita, with a higher value for each feature suggesting a more generous financial safety net and more severe moral hazard	Authors' calculations based on deposit insurance data in year 2003 from Demirguc-Kunt, Karacaovali, and Laeven (2005)
Inflation	Consumer price inflation rate	World Development Indicators
GDP growth	Rate of real GDP growth	World Development Indicators
GDP per capita	GDP per capita in thousands of constant 2005 U.S. dollars	World Development Indicators
Activity restrictions	Index of regulatory restrictions on bank activities	Barth, Caprio, and Levine (2004)
Capital stringency	Index of regulatory oversight of bank capital with higher values indicate greater stringency	Barth, Caprio, and Levine (2004)
Supervisory power	Index of power of bank supervisory authorities to take specific actions to prevent and correct problems with higher values indicating greater power	Barth, Caprio, and Levine (2004)
Diversification	Index of diversification guidelines imposed on banks with higher values indicating more diversification	Barth, Caprio, and Levine (2004)
Financial freedom	Index of financial freedom with higher values indicating greater freedom	Heritage Foundation

Table A2. Corporate governance attributes

Board attributes
1. All directors attended 75% of board meetings or had a valid excuse
2. CEO serves on the boards of two or fewer public companies
3. Board is controlled by more than 50% independent outside directors
4. Board size is greater than 5 but less than 16
5. CEO is not listed as having a related-party transaction
6. No former CEO on the board
7. Compensation committee composed solely of independent outsiders
8. Chairman and CEO are separated or there is a lead director
9.Nominating committee composed solely of independent outsiders
10.Governance committee exists and met in the past year
11.Shareholders vote on directors selected to fill vacancies
12.Governance guidelines are publicly disclosed
13.Annually elected board (no staggered board)
14.Policy exists on outside directorships (four or fewer boards is the limit)
15.Shareholders have cumulative voting rights
16.Shareholder approval is required to increase/decrease board size
17.Majority vote requirement to amend charter/bylaws
18.Board has the express authority to hire its own advisors
19.Performance of the board is reviewed regularly
20.Board-approved succession plan in place for the CEO
21.Outside directors meet without CEO and disclose number of times met
22.Directors are required to submit resignation upon a change in job
23.Board cannot amend bylaws without shareholder approval or can do so only under limited circumstances
24.Does not ignore shareholder proposal
25.Qualifies for proxy contest defenses combination points
Compensation and ownership attributes
26.Directors are subject to stock ownership requirements
27.Executives are subject to stock ownership guidelines
28.No interlocks among compensation committee members
29.Directors receive all or a portion of their fees in stock
30.All stock-incentive plans adopted with shareholder approval
31.Options grants align with company performance and reasonable burn rate
32.Company expenses stock options
33.All directors with more than one year of service own stock
34.Officers' and directors' stock ownership is at least 1% but not over 30% of total shares outstanding
35.Repricing is prohibited
Auditing attributes
36.Board independence: Audit committee
37.Consulting fees paid to auditors are less than audit fees paid to auditors
38.Auditors ratified at most recent annual meeting
Antitakeover attributes
39.Single class, common
40.Majority vote requirement to approve mergers (not supermajority)
41.Shareholders may call special meetings
42.Shareholder may act by written consent
43.Company either has no poison pill or a pill that was shareholder approved
44.Company is not authorized to issue blank check preferred

Source: Aggarwal, Erel, Stulz, and Williamson (2009)

Table A3. Country coverage

Country name	Frequency	Percentage of the sample
Australia	83	1.88
Austria	15	0.34
Belgium	20	0.45
Canada	33	0.75
Denmark	9	0.2
Finland	8	0.18
France	21	0.48
Germany	42	0.95
Greece	14	0.32
Hong Kong	122	2.76
Ireland	9	0.2
Italy	31	0.7
Japan	294	6.66
Netherlands	18	0.41
Norway	10	0.23
Portugal	12	0.27
Singapore	71	1.61
Spain	10	0.23
Sweden	29	0.66
Switzerland	30	0.68
United Kingdom	167	3.78
United States	3,367	76.25

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Table 1. Summary statistics

Panel A reports summary statistics for the sample of US banks, Panel B for the sample of US non-financial firms, and Panel C for the sample of international banks. DD is Merton's (1974) distance-to-default measure computed as the difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value. Leverage is market leverage computed by dividing the sum of the market value of equity and the book value of liabilities by the market value of equity. AVOL is asset volatility computed using the Merton (1974) model. MES is marginal expected shortfall computed as the average stock return of a firm when the market return is in the bottom 5th percentile in a given year. SRISK is expected capital shortfall when the market return is in the lowest 5% bracket in a given year. COVAR is conditional value at risk measure computed as the change in the value at risk (VaR) of the system when the firm is at the 5th percentile minus the VaR of the system when the institution is at the 50th percentile in terms of its stock returns. Return is the average monthly stock return during the financial crisis from January to September 2008. Governance is an overall governance index. Entrenchment is an index of executive entrenchment with higher values indicating better governance. Independence is the share of board members not affiliated with the firm. Return on asset is net income divided by total assets. Market-to-book is the market to book ratio computed as market capitalization divided by the book value of equity. Size is the log of total assets. Financial safety net is an index based on 8 deposit insurance design features with higher values indicating a more generous safety net. Inflation is the percentage annual change in the consumer price index. GDP growth is the real rate of GDP growth. GDP per capita is the GDP per capita in thousands of constant 2005 U.S. dollars. Activity restriction is an index of regulatory restrictions on bank activities. Capital stringency is an index of regulatory oversight of bank capital with higher values indicating greater stringency. Supervisory power is an index of the power of bank supervisory authorities to take specific actions to prevent and correct problems with higher values indicating greater supervisory power. Diversification is an index of diversification guidelines imposed on banks with higher values indicating greater diversification. Financial freedom is an index of government regulations and controls on the financial sector with higher values indicating greater freedom. Data in Panels A and B are for the period 1990-2014, while data in Panel C is for the period 2004-2008.

Panel A: US banks	Obs	Mean	Std	P25	P50	P75
DD	6,664	5.33	2.50	3.74	5.18	6.72
Leverage	6,638	9.01	16.41	3.40	6.24	9.42
AVOL	6,664	0.10	0.12	0.03	0.06	0.12
MES	6,855	-0.02	0.02	-0.03	-0.02	-0.01
SRISK	6,642	-0.42	8.77	-0.81	-0.11	0.01
COVAR	6,732	-0.01	0.01	-0.02	-0.01	-0.01
Return	712	-0.02	0.05	-0.04	-0.01	0.01
Governance	3,700	0.62	0.09	0.56	0.62	0.68
Entrenchment	4,416	-2.35	1.45	-3.00	-2.00	-1.00
Independence	3,107	0.70	0.17	0.60	0.73	0.82
Return on assets	7,264	0.02	0.05	0.01	0.01	0.02
Market-to-book	7,264	2.05	1.93	1.16	1.63	2.31
Size	7,264	8.27	2.02	6.80	8.21	9.54

Panel B: US non-financials	Obs.	Mean	Std	P25	P50	P75
DD	32,374	5.22	2.87	3.17	4.78	6.77
Leverage	32,065	2.07	4.04	1.21	1.50	2.10
AVOL	32,374	0.30	0.21	0.16	0.26	0.39
MES	33,310	-0.02	0.02	-0.03	-0.02	-0.01
SRISK	32,158	-3.22	12.65	-1.67	-0.47	-0.13
COVAR	32,786	-0.01	0.01	-0.02	-0.01	-0.01
Return	2,744	-0.02	0.06	-0.05	-0.02	0.01
Governance	14,311	0.63	0.09	0.57	0.64	0.70
Entrenchment	25,629	-2.31	1.40	-3.00	-2.00	-1.00
Independence	19,212	0.69	0.17	0.57	0.71	0.83
Return on assets	34,930	0.01	0.17	0.01	0.04	0.08
Market-to-book	34,930	3.08	3.59	1.28	2.02	3.40
Size	34,930	6.69	1.86	5.50	6.66	7.87

Panel C: Non-US banks	Obs	Mean	Std	P25	P50	P75
DD	1,049	5.93	2.98	3.78	5.31	7.58
Leverage	1,041	9.58	10.31	2.10	5.47	13.68
AVOL	1,049	0.11	0.11	0.02	0.07	0.17
MES	1,046	-0.03	0.03	-0.04	-0.03	-0.01
SRISK	1,025	0.800	17.02	1.73	-0.30	1.31
COVAR	917	-0.02	0.01	-0.02	-0.01	-0.01
Return	935	-0.02	0.05	-0.05	-0.02	0.01
Return on assets	1,049	0.03	0.05	0.00	0.01	0.03
Market-to-book	1,049	2.08	2.12	1.06	1.50	2.36
Size	1,049	9.76	1.86	8.37	9.84	11.04
Governance	1,049	0.56	0.07	0.50	0.55	0.61
Country level variables						
Financial safety net	566	-0.52	1.69	-0.38	-0.31	-0.30
Inflation	1,049	0.01	0.01	0.00	0.02	0.02
GDP growth	1,049	0.03	0.02	0.02	0.03	0.04
GDP per capita	1,049	35.30	6.70	31.87	35.78	37.72
Activity restriction	1,049	6.09	2.11	4.00	7.00	8.00
Capital stringency	1,049	4.99	1.20	4.00	5.00	6.00
Supervisory power	1,049	10.62	2.18	8.00	11.00	12.00
Diversification	1,049	1.51	0.53	1.00	2.00	2.00
Financial freedom	1,049	67.95	21.66	50.00	70.00	90.00

Table 2. Corporate governance and risk at banks vs. non-financial firms

The dependent variables in the 6 columns are DD, -Leverage, -AVOL, MES, -SRISK and COVAR. DD is Merton's (1974) distance-to-default measure computed as the difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value. Leverage is market leverage computed by dividing the sum of the market value of equity and the book value of liabilities by the market value of equity. AVOL is asset volatility computed using the Merton (1974) model. MES is marginal expected shortfall computed as the average stock return of a firm when the market return is in the bottom 5th percentile in a given year. SRISK is expected capital shortfall when the market return is in the lowest 5% bracket in a given year. COVAR is conditional value at risk measure computed as the change in the value at risk (VaR) of the system when the firm is at the 5th percentile minus the VaR of the system when the institution is at the 50th percentile in terms of its stock returns. We multiply Leverage, AVOL and SRISK by -1 so that higher values indicate lower risk consistent with the other risk measures. Return on assets is net income divided by total assets. Market-to-book is the market to book ratio computed as market capitalization divided by the book value of equity. Size is the log of total assets. Findum is a dummy variable that takes on a value of one if the firm is a financial firm. In Panel A Governance is an overall governance index. In Panel B Entrenchment is an index of executive entrenchment with higher values indicating better governance. In Panel C Independence is the share of board members not affiliated with the firm. Return on assets, Market-to-book, and Size are included in the regressions but not reported in Panels B and C. All regressions include firm and year fixed effects. T-statistics based on errors clustered at the firm level are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A: Governance	DD	-Leverage	-AVOL	MES	-SRISK	COVAR
	(1)	(2)	(3)	(4)	(5)	(6)
Return on assets	1.594***	2.289***	0.048	-0.000	-0.076	0.002***
	(9.657)	(3.646)	(1.591)	(-0.112)	(-0.272)	(3.616)
Market-to-book	-0.015*	0.088***	0.001	-0.001***	-0.008	-0.000***
	(-1.850)	(4.168)	(1.318)	(-6.018)	(-0.410)	(-3.884)
Size	-0.526***	0.079	0.081***	-0.008***	0.351*	-0.001***
	(-6.717)	(0.216)	(10.204)	(-8.071)	(1.806)	(-3.961)
Governance	-0.158	7.684***	-0.011	-0.007	1.317	0.002
	(-0.359)	(3.826)	(-0.303)	(-1.550)	(1.211)	(1.284)
Governance × Findum	-3.876***	-47.991***	-0.032	-0.046***	-9.858**	-0.016***
	(-4.446)	(-4.036)	(-0.714)	(-4.718)	(-2.149)	(-4.129)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	16,723	16,194	16,723	16,888	16,194	16,463
R-squared	0.820	0.497	0.809	0.708	0.819	0.654
Panel B: Entrenchment						
Entrenchment	0.011	0.276***	0.005***	0.084***	-0.343	0.000***
	(0.364)	(3.500)	(3.261)	(3.810)	(-1.472)	(6.804)
Entrenchment × Findum	-0.155***	-1.037**	-0.003	-0.361***	-0.848*	-0.001***
	(-3.261)	(-2.052)	(-1.435)	(-6.802)	(-1.853)	(-7.685)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	27,879	27,974	27,879	28,883	28,071	28,656
R-squared	0.744	0.523	0.805	0.702	0.695	0.553

Panel C: Board independence						
Independence	0.168	1.450***	0.022*	0.217	0.992	0.000
	(0.909)	(4.884)	(1.857)	(1.540)	(1.222)	(1.222)
Independence × Findum	-0.451	-12.074***	-0.075***	-1.196***	-16.003***	-0.000
	(-1.131)	(-3.954)	(-3.252)	(-3.233)	(-2.807)	(-0.410)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	20,435	20,704	20,435	21,390	20,801	21,169
R-squared	0.762	0.507	0.807	0.683	0.788	0.515

Table 3. Corporate governance, risk and bank size

The dependent variables in the 6 columns are DD, -Leverage, -AVOL, MES, -SRISK and COVAR. DD is Merton's (1974) distance-to-default measure computed as the difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value. Leverage is market leverage computed by dividing the sum of the market value of equity and the book value of liabilities by the market value of equity. AVOL is asset volatility computed using the Merton (1974) model. MES is marginal expected shortfall computed as the average stock return of a firm when the market return is in the bottom 5th percentile in a given year. SRISK is expected capital shortfall when the market return is in the lowest 5% bracket in a given year. COVAR is conditional value at risk measure computed as the change in the value at risk (VaR) of the system when the firm is at the 5th percentile minus the VaR of the system when the institution is at the 50th percentile in terms of its stock returns. We multiply Leverage, AVOL and SRISK by -1 so that higher values indicate lower risk consistent with the other risk measures. Return on assets is net income divided by total assets. Market-to-book is the market to book ratio computed as market capitalization divided by the book value of equity. Size is the log of total assets. In Panel A Governance is an overall governance index. In Panel B Entrenchment is an index of executive entrenchment with higher values indicating better governance. In Panel C Independence is the share of board members not affiliated with the firm. Return on assets and Market-to-book are included in the regressions but not reported. All regressions include firm and year fixed effects. T-statistics based on errors clustered at the firm level are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A: Governance	DD	-Leverage	-AVOL	MES	-SRISK	COVAR
	(1)	(2)	(3)	(4)	(5)	(6)
Size	0.797*	3.318	0.035**	0.017***	10.134***	0.002
	(1.858)	(0.898)	(2.179)	(4.280)	(2.696)	(1.338)
Governance	13.607***	25.886	-0.036	0.264***	143.332***	0.045***
	(3.244)	(0.896)	(-0.223)	(6.645)	(2.699)	(3.373)
Governance × Size	-2.066***	-4.988	-0.008	-0.040***	-19.471***	-0.006***
	(-4.114)	(-1.043)	(-0.407)	(-7.891)	(-2.692)	(-3.979)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	3,414	3,334	3,414	3,449	3,334	3,356
R-squared	0.808	0.505	0.869	0.726	0.356	0.651
Panel B: Entrenchment						
Size	0.406***	-1.323***	-0.013**	0.000	-0.021	-0.001*
	(2.908)	(-3.575)	(-2.243)	(0.194)	(-0.014)	(-1.874)
Entrenchment	1.170***	2.131***	0.032**	0.016***	8.322**	0.000
	(4.595)	(3.068)	(2.035)	(6.561)	(2.193)	(0.106)
Entrenchment × Size	-0.113***	-0.159**	-0.003*	-0.001***	-0.857**	-0.001
	(-4.674)	(-2.143)	(-1.956)	(-6.385)	(-2.025)	(-0.423)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	4,054	4,097	4,054	4,215	4,101	4,189
R-squared	0.767	0.502	0.858	0.823	0.360	0.581

Panel C: Board independence						
Size	0.347	0.284	-0.049***	-0.000	7.999**	-0.001***
	(1.481)	(0.580)	(-4.815)	(-0.077)	(2.517)	(-2.940)
Independence	5.031*	27.904***	0.156	0.037***	124.680***	0.001
	(1.902)	(6.264)	(1.594)	(2.590)	(3.172)	(0.015)
Independence × Size	-0.459*	-3.042***	-0.014	-0.004**	-14.035***	-0.002
	(-1.740)	(-6.161)	(-1.437)	(-2.390)	(-3.131)	(-0.085)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	2,809	2,880	2,809	2,952	2,884	2,922
R-squared	0.785	0.497	0.864	0.806	0.451	0.516

Table 4. Corporate governance, risk and size at banks vs. non-financial firms

The dependent variables in the 6 columns are DD, -Leverage, -AVOL, MES, -SRISK and COVAR. DD is Merton's (1974) distance-to-default measure computed as the difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value. Leverage is market leverage computed by dividing the sum of the market value of equity and the book value of liabilities by the market value of equity. AVOL is asset volatility computed using the Merton (1974) model. MES is marginal expected shortfall computed as the average stock return of a firm when the market return is in the bottom 5th percentile in a given year. SRISK is expected capital shortfall when the market return is in the lowest 5% bracket in a given year. COVAR is conditional value at risk measure computed as the change in the value at risk (VaR) of the system when the firm is at the 5th percentile minus the VaR of the system when the institution is at the 50th percentile in terms of its stock returns. We multiply Leverage, AVOL and SRISK by -1 so that higher values indicate lower risk consistent with the other risk measures. Return on assets is net income divided by total assets. Market-to-book is the market to book ratio computed as market capitalization divided by the book value of equity. Size is the log of total assets. Findum is a dummy variable that takes on a value of one if the firm is a financial firm. In Panel A, Governance is an overall governance index. In Panel B Entrenchment is an index of executive entrenchment with higher values indicating better governance. In Panel C Independence is the share of board members not affiliated with the firm. Return on assets and Market-to-book are included in the regressions but not reported. All regressions include firm and year fixed effects. T-statistics based on errors clustered at the firm level are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A: Governance	DD	-Leverage	-AVOL	MES	-SRISK	COVAR
	(1)	(2)	(3)	(4)	(5)	(6)
Size	0.491***	1.198**	0.112***	0.002	3.285***	0.004***
	(3.848)	(2.171)	(8.020)	(1.583)	(5.364)	(6.390)
Governance	5.837***	4.881*	0.289**	0.093***	27.520***	0.046***
	(5.232)	(1.757)	(2.046)	(6.946)	(5.594)	(9.085)
Governance × Size	-0.983***	-0.108	-0.050***	-0.017***	-4.540***	-0.007***
	(-5.877)	(-0.160)	(-2.614)	(-8.413)	(-5.128)	(-8.990)
Governance × Findum	5.782*	29.967	-0.391*	0.179***	116.015**	0.033*
	(1.822)	(1.005)	(-1.842)	(4.373)	(2.183)	(1.927)
Findum × Size	0.039	-3.879	-0.047**	0.012***	6.880*	-0.002
	(0.122)	(-1.034)	(-2.170)	(3.065)	(1.812)	(-1.048)
Governance × Findum × Size	-0.835**	-8.304*	0.059**	-0.025***	-14.873**	-0.004**
	(-2.103)	(-1.711)	(2.222)	(-4.637)	(-2.055)	(-1.976)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	16,723	16,194	16,723	16,888	16,194	16,463
R-squared	0.822	0.504	0.809	0.714	0.825	0.640

Panel B: Entrenchment						
Size	0.189***	-0.321***	-0.044***	-0.046	5.933***	0.001***
	(2.807)	(-4.924)	(-12.442)	(-1.189)	(4.974)	(4.239)
Entrenchment	0.317***	0.029	-0.008	0.053	5.576***	0.001***
	(3.562)	(0.478)	(-1.297)	(0.721)	(3.732)	(10.723)
Entrenchment × Size	-0.040***	0.015*	0.000	0.003	-0.810***	-0.000***
	(-3.583)	(1.920)	(0.693)	(0.320)	(-3.666)	(-9.182)
Entrenchment × Findum	0.392	1.496*	0.016	0.987***	1.645	0.000
	(1.633)	(1.931)	(1.257)	(3.647)	(0.405)	(0.953)
Findum × Size	0.165	-0.367	0.024***	-0.067	-6.357***	-0.001
	(1.395)	(-1.475)	(5.355)	(-0.875)	(-3.822)	(-0.550)
Entrenchment × Findum × Size	-0.051**	-0.171*	-0.002	-0.136***	-0.018	-0.000*
	(-2.002)	(-1.946)	(-1.398)	(-4.633)	(-0.037)	(-1.759)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	27,879	27,974	27,879	28,883	28,071	29,848
R-squared	0.745	0.525	0.805	0.705	0.708	0.921

Panel C: Board independence						
Size	-0.223**	-0.081	-0.054***	-0.216***	2.439***	-0.001***
	(-2.105)	(-0.735)	(-7.883)	(-3.086)	(2.650)	(-4.419)
Independence	-1.408	0.400	0.034	-1.979***	-11.171	-0.001
	(-1.606)	(0.760)	(0.631)	(-3.504)	(-1.055)	(-1.065)
Independence × Size	0.222*	-0.004	-0.003	0.287***	1.448	0.000
	(1.909)	(-0.049)	(-0.390)	(3.834)	(0.973)	(1.468)
Independence × Findum	4.153*	27.063***	0.064	5.282***	136.611***	0.001
	(1.899)	(6.333)	(0.578)	(3.288)	(3.346)	(0.328)
Findum × Size	0.348	0.357	0.030***	0.100	5.279*	0.000
	(1.566)	(0.369)	(2.757)	(0.654)	(1.700)	(1.409)
Independence × Findum × Size	-0.523**	-3.193***	-0.008	-0.687***	-15.743***	-0.000
	(-2.193)	(-6.486)	(-0.686)	(-3.750)	(-3.289)	(-0.535)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
Observations	20,435	20,704	20,435	21,390	20,801	22,115
R-squared	0.762	0.514	0.808	0.685	0.795	0.923

Table 5. Regulatory changes in board independence at banks

This table reports regression results examining the impact of the 2003 NYSE/NASDAQ rules requiring firms to have at least 50% of their board members to be independent. The sample period includes three years before and after the introduction of the new rules from 2000 to 2005. The dependent variables in the 6 columns are DD, -Leverage, -AVOL, MES, -SRISK and COVAR. DD is Merton's (1974) distance-to-default measure computed as the difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value. AVOL is asset volatility computed using the Merton (1974) model. Leverage is market leverage computed by dividing the sum of the market value of equity and the book value of liabilities by the market value of equity. MES is marginal expected shortfall computed as the average stock return of a firm when the market return is in the bottom 5th percentile in a given year. SRISK is expected capital shortfall when the market return is in the lowest 5% bracket in a given year. COVAR is conditional value at risk measure computed as the change in the value at risk (VaR) of the system when the firm is at the 5th percentile minus the VaR of the system when the institution is at the 50th percentile in terms of its stock returns. We multiply Leverage, AVOL and SRISK by -1 so that higher values indicate lower risk consistent with the other risk measures. Return on assets is net income divided by total assets. Market-to-book is the market to book ratio computed as market capitalization divided by the book value of equity. Size is the log of total assets. Post is a dummy variable that takes on a value of one for the time period 2003 to 2005 when the new rules had been introduced. Affected is a dummy variable set to one for firms that were not compliant with the new requirements in 2002. The regressions include firm fixed effects. An included time variable and its interaction with the Affected variable are unreported. T-statistics based on errors clustered at the firm level are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	DD	-Leverage	-AVOL	MES	-SRISK	COVAR
	(1)	(2)	(3)	(4)	(5)	(6)
Return on assets	6.376**	-9.346	-0.157*	-0.015	6.939	-0.022*
	(2.370)	(-0.683)	(-1.698)	(-0.979)	(1.272)	(-1.747)
Market-to-book	-0.152***	-0.163	-0.010***	-0.002***	0.161	-0.000*
	(-3.022)	(-0.564)	(-4.725)	(-4.631)	(0.944)	(-1.802)
Size	-0.917***	-1.815**	0.037***	-0.005***	-0.683	-0.002
	(-2.654)	(-2.051)	(4.160)	(-2.702)	(-0.411)	(-1.425)
Post	-1.996**	0.197	0.060***	-0.015***	-22.907***	0.004
	(-2.372)	(0.176)	(3.057)	(-3.646)	(-2.860)	(0.914)
Post × Affected	7.138***	9.032***	0.189**	0.030**	29.642***	0.004
	(2.989)	(3.204)	(2.240)	(2.477)	(2.620)	(0.481)
Post × Size	0.311***	0.024	-0.005***	0.002***	2.593***	0.000
	(3.904)	(0.217)	(-2.852)	(4.831)	(3.008)	(0.012)
Affected × Size	0.046	-0.088	0.009	-0.007*	-0.183	-0.000
	(0.069)	(-0.061)	(0.202)	(-1.733)	(-0.093)	(-0.054)
Post × Affected × Size	-0.701***	-0.858***	-0.020**	-0.003**	-3.222***	-0.001
	(-2.865)	(-3.232)	(-2.051)	(-2.160)	(-2.685)	(-0.671)
Firm FE & Time trend	Y	Y	Y	Y	Y	Y
Observations	926	919	926	932	919	921
R-squared	0.798	0.841	0.934	0.621	0.806	0.485

Table 6. Regulatory changes in board independence at banks vs. non-financial firms

This table reports regression results examining the impact of the 2003 NYSE/NASDAQ rules requiring firms to have at least 50% of their board members to be independent (not affiliated with the firm). The sample period includes three years before and after the introduction of the new rules from 2000 to 2005. The dependent variables in the 6 columns are DD, -Leverage, -AVOL, MES, -SRISK and COVAR. DD is Merton's (1974) distance-to-default measure computed as the difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value. Leverage is market leverage computed by dividing the sum of the market value of equity and the book value of liabilities by the market value of equity. AVOL is asset volatility computed using the Merton (1974) model. MES is marginal expected shortfall computed as the average stock return of a firm when the market return is in the bottom 5th percentile in a given year. SRISK is expected capital shortfall when the market return is in the lowest 5% bracket in a given year. COVAR is conditional value at risk measure computed as the change in the value at risk (VaR) of the system when the firm is at the 5th percentile minus the VaR of the system when the institution is at the 50th percentile in terms of its stock returns. We multiply Leverage, AVOL and SRISK by -1 so that higher values indicate lower risk consistent with the other risk measures. Size is the log of total assets. Post is a dummy variable that takes on a value of one for the time period 2003 to 2005 when the new rules had been introduced. Affected is a dummy variable set to one for firms that were not compliant with the new requirements in 2002. Findum is a dummy variable that takes on a value of one if the firm is a financial firm. Return on assets and Market-to-book are unreported. Panel A includes an interaction term of the Post, Affected, Size and Findum variables. The uninteracted variables, double and triple interactions, a time variable, and an interaction of the time variable with the Affected variable and firm fixed effects are unreported. In Panels B and C, we report results from placebo tests in which we assume that the rule introduction took place three years later in Panel B and three years earlier in Panel C than the actual rule introduction in 2003. Accordingly, we set the Post dummy variable to one for the period after 2005 in regressions reported in Panel B, and to one for the period after 1999 in Panel C. T-statistics based on errors clustered at the firm level are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A: Banks vs. non-financials	DD	-Leverage	-AVOL	MES	-SRISK	COVAR
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Affected × Size × Findum	-0.861***	-0.859***	-0.037***	-0.005***	-5.237*	-0.002**
	(-3.220)	(-4.412)	(-3.021)	(-3.864)	(-1.791)	(-2.556)
Firm FE & Time trend	Y	Y	Y	Y	Y	Y
Observations	7,334	7,060	7,155	7,185	7,060	7,150
R-squared	0.852	0.860	0.831	0.511	0.925	0.498
Panel B: Post 2005 placebo						
Post × Affected × Size × Findum	0.503*	1.505	0.017	0.002	12.880**	0.000
	(1.665)	(0.903)	(1.237)	(0.757)	(2.440)	(0.360)
Firm FE & Time trend	Y	Y	Y	Y	Y	Y
Observations	6,193	6,069	6,193	6,240	6,069	6,197
R-squared	0.766	0.419	0.744	0.602	0.836	0.471
Panel C: Post 1999 placebo						
Post × Affected × Size × Findum	-0.061	-0.168	0.002	-0.008	1.722	-0.000
	(-0.356)	(-0.686)	(0.938)	(-0.635)	(0.696)	(-0.009)
Firm FE & Time trend	Y	Y	Y	Y	Y	Y
Observations	7,400	7,341	7,400	7,448	7,341	7,388
R-squared	0.647	0.842	0.861	0.884	0.877	0.504

Table 7. Corporate governance and equity returns of US banks during the financial crisis

The dependent variable is Return, which is the average monthly stock return during the financial crisis period from January to September 2008. Return on assets is net income divided by total assets. Market-to-book is the market to book ratio computed as the market capitalization divided by book equity. Size is the log of total assets. Findum is a dummy variable that takes on a value of one if the firm is a financial firm. Governance is an overall governance index. Entrenchment is an index of executive entrenchment with higher values indicating better governance. Independence is the share of board members not affiliated with the firm. All explanatory variables are for 2007. T-statistics based on robust standard errors are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	Return	Return	Return	Return	Return	Return	Return	Return	Return
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Return on assets	0.045***	0.018	0.038**	0.131***	0.005	0.119	0.042***	0.012	0.035**
	(8.990)	(1.019)	(2.242)	(3.224)	(0.049)	(1.193)	(8.298)	(0.679)	(2.101)
Market-to-book	-0.000	-0.000	-0.001*	-0.000	-0.001	-0.001	-0.000	-0.001	-0.001*
	(-1.618)	(-1.186)	(-1.815)	(-0.476)	(-0.506)	(-0.904)	(-1.597)	(-1.346)	(-1.795)
Size	0.001	-0.003***	-0.003***	0.032***	-0.014*	0.024	0.007	-0.004	-0.008
	(0.952)	(-4.397)	(-3.413)	(3.563)	(-1.879)	(1.155)	(1.562)	(-1.289)	(-1.321)
Findum	0.020	-0.024*	0.055**				-0.195***	0.087	-0.218
	(1.142)	(-1.823)	(2.293)				(-2.582)	(1.406)	(-1.498)
Findum × Size							0.025**	-0.010	0.030*
							(2.434)	(-1.631)	(1.830)
Governance	0.011			0.363***			0.055		
	(0.850)			(3.605)			(1.369)		
Governance × Size				-0.049***			-0.008		
				(-3.780)			(-1.303)		
Entrenchment		-0.000			0.005			0.004	
		(-0.216)			(0.268)			(0.737)	
Entrenchment × Size					-0.001			-0.001	
					(-0.430)			(-0.823)	
Independence			0.001			0.994**			-0.060
			(0.061)			(2.112)			(-0.986)
Independence × Size						-0.117**			0.008
						(-2.315)			(0.987)
Governance × Findum	-0.032						0.322***		
	(-1.194)						(2.861)		
Entrenchment × Findum		-0.005*						0.001	
		(-1.798)						(0.075)	
Independence × Findum			-0.070**						0.329*
			(-2.235)						(1.747)
Governance × Findum × Size							-0.041***		
							(-2.772)		
Entrenchment × Findum × Size								-0.000	
								(-0.152)	
Independence × Findum × Size									-0.044**
									(-2.085)
Observations	3,430	1,229	1,090	704	190	150	3,430	1,229	1,090
R-squared	0.031	0.026	0.024	0.041	0.119	0.083	0.037	0.045	0.031

Table 8. Corporate governance and risk at international banks

The dependent variables in the 6 columns are DD, -Leverage, -AVOL, MES, -SRISK and COVAR. DD is Merton's (1974) distance-to-default measure computed as the difference between the asset value of a firm and the face value of its debt scaled by the standard deviation of the firm's asset value. Leverage is market leverage computed by dividing the sum of the market value of equity and the book value of liabilities by the market value of equity. AVOL is asset volatility computed using the Merton (1974) model. MES is marginal expected shortfall computed as the average stock return of a firm when the market return is in the bottom 5^{th} percentile in a given year. SRISK is expected capital shortfall when the market return is in the lowest 5% bracket in a given year. COVAR is conditional value at risk measure computed as the change in the value at risk (VaR) of the system when the firm is at the 5^{th} percentile minus the VaR of the system when the institution is at the 50^{th} percentile in terms of its stock returns. We multiply Leverage, AVOL and SRISK by -1 so that higher values indicate lower risk consistent with the other risk measures. Market-to-book is the market to book ratio computed as market capitalization divided by the book value of equity. Size is the log of total assets. Inflation is the percentage annual change in the consumer price index. GDP growth is the real rate of GDP growth. GDP per capita is the GDP per capita in thousands of constant 2005 U.S. dollars. Activity restriction is an index of regulatory restrictions on bank activities is an index of regulatory oversight of financial institutions with higher values indicating greater stringency. Supervisory power is an index of the power of bank supervisory authorities to take specific actions to prevent and correct problems with higher values indicating greater supervisory power. Diversification is an index of diversification guidelines imposed on banks with higher values indicating greater diversification. Financial freedom is an index of government regulations and controls on the financial sector with higher values indicating greater freedom. Governance is an overall governance index. Financial safety net is an index based on 8 deposit insurance design features with higher values indicating a more generous safety net. In Panel B, we instrument for the Governance variable using the average Governance measure for non-financial firms in a given country and year named Governance non-financials. We instrument for the interaction of Governance and Financial safety net using the interaction of average Governance of non-financial firms in a given country and year with Financial safety net, i.e. Governance non-financials x Financial safety net. The first stage regression results are reported in columns 1 and 2. Regressions in Panel B include unreported control variables. All regressions include firm and year fixed effects. T-statistics based on errors clustered at the firm level are provided in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A: Financial safety net interaction						
	DD	-Leverage	-AVOL	MES	-SRISK	COVAR
	(1)	(2)	(3)	(4)	(5)	(6)
Return on assets	2.615***	6.772*	-0.037	-0.004	-1.304	0.001
	(2.706)	(1.759)	(-0.592)	(-0.319)	(-0.550)	(0.257)
Market-to-book	-0.105**	0.612***	-0.008***	-0.001	-0.082	-0.000
	(-2.051)	(3.994)	(-3.436)	(-1.357)	(-0.787)	(-0.879)
Size	-0.587***	-1.401*	0.030***	-0.009***	-1.775**	-0.003***
	(-2.842)	(-1.850)	(3.148)	(-4.433)	(-2.382)	(-2.897)
Inflation	90.934***	-126.745	0.804	0.732*	448.546	-0.432*
	(2.835)	(-1.112)	(1.242)	(1.734)	(1.080)	(-1.933)
GDP growth	33.289***	135.947***	0.587***	0.449***	-62.029	0.086
	(2.884)	(3.091)	(2.594)	(3.935)	(-0.731)	(0.972)
GDP per capita	-0.546**	-2.957**	0.007	-0.012***	-2.713**	-0.006***
	(-2.576)	(-2.280)	(1.313)	(-4.414)	(-2.411)	(-3.474)
Activity restriction	-0.995***	0.161	-0.001	-0.005	-0.308	-0.005**
	(-2.753)	(0.166)	(-0.078)	(-1.464)	(-0.094)	(-2.467)
Capital stringency	0.419	0.020	0.006	0.002	-0.019	0.001
	(1.606)	(0.033)	(1.279)	(1.000)	(-0.015)	(0.845)
Supervisory power	-0.279	1.112*	-0.004	-0.002*	0.480	0.003**
	(-1.552)	(1.768)	(-1.235)	(-1.934)	(0.551)	(1.986)
Diversification	-0.567**	-2.056**	0.004	-0.005	2.000	-0.006***
	(-2.268)	(-2.069)	(0.587)	(-1.071)	(0.441)	(-3.447)
Financial freedom	0.009	-0.006	0.001***	-0.000**	-0.163*	0.000
	(1.068)	(-0.200)	(4.365)	(-2.061)	(-1.811)	(0.429)
Governance	0.270	6.772	-0.032	0.009	-0.426	0.002
	(0.166)	(1.272)	(-0.925)	(0.641)	(-0.075)	(0.200)
Governance × Financial safety net	-0.586*	-0.998	-0.016**	-0.012***	-1.365	-0.002
	(-1.756)	(-0.893)	(-2.053)	(-4.089)	(-1.203)	(-0.961)
Firm & Year FE	Y	Y	Y	Y	Y	Y
Observations	3924	3888	3924	3927	3886	3747
R-squared	0.644	0.397	0.256	0.580	0.053	0.358

Panel B: Financial safety net interaction – IV regression								
	1st Stage		**2nd Stage**					
	Governance	Governance x Financial safety net	DD	-Leverage	-AVOL	MES	-SRISK	COVAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Governance non-financials	0.955***	-0.024						
	(7.189)	(-0.059)						
Governance non-financials × Financial safety net	0.027	0.927***						
	(0.987)	(8.902)						
Instrumented Governance			-2.549	30.843*	-0.202*	-0.035	13.239	0.019
			(-0.453)	(1.701)	(-1.704)	(-0.945)	(0.576)	(0.567)
Instrumented Governance × Financial safety net			-3.664***	-11.014***	-0.062***	-0.047***	-4.993	-0.000
			(-5.180)	(-3.109)	(-3.671)	(-6.293)	(-1.509)	(-0.020)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Firm & Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	3,937	3,937	3,790	3,748	3,790	3,785	3745	3,617
R-squared	0.307	0.268	0.547	0.419	0.169	0.461	0.052	0.348