

Inside Debt and Bank Risk*

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Abstract

Inside debt compensation held by top officers of U.S. banks is negatively related to risk and risk-taking. The evidence reveals a robust and strongly negative relation between end-of-2006 inside debt and 2007-2009 bank-specific risk exposures in terms of lost stock market value, volatility, tail risk, and the probability of financial distress. Banks with managers having large inside debt holdings are characterized by better-quality assets, more conservative balance sheet management, and a stronger tendency towards traditional banking activities. The results suggest that debt-based compensation limits bank risk and risk-taking by encouraging more conservative decision-making.

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1 Introduction

The poor incentives from executive compensation are frequently named as a cause for the near collapse of the U.S. banking industry between July 2007 and March 2009. As a result, new legislation has expanded the rights of shareholders in approving compensation practices, appointing directors on compensation committees, and designing compensation proposals.¹ However, notwithstanding increased scrutiny by media, regulators, and legislators, the academic evidence on whether shareholder governance actually limits bank risk is not convincing.

Leading examples of this literature are Beltratti and Stulz (2012) who actually show that banks with more shareholder-friendly boards performed worse during the crisis than other banks, and Fahlenbrach and Stulz (2011) who find no evidence that better-aligned equity incentives are related to better shareholder performance for banks during the financial crisis. If anything, Fahlenbrach and Stulz find the contrary.

These results are not surprising from a theoretical perspective since bank shareholders worry about executives taking too *little* risk. By preventing underinvestment, contingent stock-based and options-based compensation create shareholder value by encouraging managers to increase volatility (Guay (1999)). Therefore, bank executives may have suffered great losses during the crisis *and* acted in the best interest of their shareholders (see Cheng et al. (2012) for empirical evidence in support of this view).

What has received much less attention in previous literature are agency problems between managers and other investors such as debtholders. Equity-based incentives encourage the shifting of risk to debtholders, so that shareholders do not bear the full losses from the “downside” of the corporation’s risk-taking (Jensen and Meckling (1976); Bolton et al.

¹For instance, the Corporate and Financial Institution Compensation Fairness Act of 2009 expanded the rights of shareholders in approving compensation practices and appointing directors on compensation committees. One year later, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 mandates shareholders to vote on executive compensation and empowers shareholders to design their own compensation proposals. Similar international initiatives also adopt a shareholder-friendly governance perspective such as the “Principles and Implementations Standards for Sound Compensation Practices” by the Financial Stability Forum, which represents the G-20 finance ministries and central bankers.

(2010)). These risk-inducing effects are reduced by debt-based compensation such as defined benefit pensions and deferred compensation (inside debt), which consists of the promise of fixed sums of cash in the future. Because such commitments are unsecured and unfunded liabilities of the firm, executives would stand in line with other unsecured creditors in the event of default (Sundaram and Yermack (2007)). The idea that managers with debt-based incentives manage their firms more conservatively is formalized by Edmans and Liu (2011).

Using a sample of CEOs and CFOs from small and large U.S.-listed banks, this study examines whether variations in inside debt are associated with meaningful differences in bank risk during the 2007-2009 financial crisis. While risk is typically defined from the perspective of shareholders, this paper takes the perspective of both shareholders and debtholders. This seems useful for banks that are funded primarily by depositors and other debtholders and much less by shareholder capital, and build their business around debt and credit. The importance of leverage in banks causes debt agency problems to be particularly severe within banks. Since market assessments of debtholder risk can only be observed directly for about twenty of the very largest banks that have publicly traded debt instruments, this study describes bank shareholder and debtholder risk using tail risk. The idea is that the lower tail of the stock returns distribution represents problems that are shared by both shareholders and debtholders. The paper also investigates the link between inside debt and several policy mechanisms that are unique to banks and generally considered important in the recent financial crisis.

Consistent with theoretical predictions, the results indicate that banks with larger inside debt holdings at the end of 2006 have lower risk exposures from July 1, 2007, to March 31, 2009, in terms of lost stock market value, return volatility, and tail risk. Furthermore, inside debt is associated with more conservative investment decisions (i.e., a smaller fraction of nonperforming real estate and asset writedowns), more conservative financing decisions (i.e., less short-term market borrowing to fund bank assets in the run-up to the crisis), and more conservative business decisions (i.e., a smaller fraction of nontraditional banking

activities). Collectively, the results indicate that inside debt holdings limit bank risk by encouraging more conservative decision-making. The negative relation between inside debt and bank risk remains strong after controlling for survivorship bias and a series of variables. Throughout the paper, untabulated analyses verify that the negative relation is robust to several definitions of inside debt and bank risk; at the executive level and the firm level; across bank risk definitions in levels or first differences; across several tail risk thresholds; before and after winsorizing; and either with or without systemically important banks. Although the sample has relatively few observations, the results are confirmed by an instrumental variable analysis and extend to a sample of CEOs and CFOs with and without any inside debt.

An illustration of the main result can be seen in Figure 1, which represents bank risk conventionally in terms of lost equity market value. Banks are sorted into three portfolios according to their relative inside debt holdings in 2006, and the graph shows how stock market losses evolve for portfolios 1 and 3.² The notable features in the figure are that banks with low levels of inside debt gained significantly more market value before the crisis, but also lost significantly more during the crisis. It can also be seen that low-inside debt banks lost ground both faster and earlier over the crisis period examined in this study. Banks with high levels of inside debt seem to have retained much of their market value until the Lehman collapse caused problems to spread across the entire financial sector. Figure 1 illustrates the central claim of this paper that large inside debt holdings encourage managers to act conservatively, resulting in lower risk and smaller losses during the crisis.

This paper's focus on debt-based compensation adds to recent work that studies the role of non-debt incentives and risk-taking in the financial sector's problems (e.g., Cheng et al. (2012); Balachandran et al. (2010); Bennett et al. (2012); Chesney et al. (2012); DeYoung et al. (2013); Fahlenbrach and Stulz (2011)), in particular when it comes to risk-shifting

²Specifically, the portfolios are constructed by cutting the sample at the 30th and 70th percentile according to the earliest available inside debt ratio in December 2006. Next, bank stocks are sorted into the first and third quantiles to create a High inside debt portfolio and a Low inside debt portfolio. Figure 1 plots each portfolio's cumulative returns from 2002 onwards.

problems (e.g., Chesney et al. (2012)). Furthermore, several contributions are made to the literature on inside debt. First, most previous work has only examined the impact of inside debt within *non*-financial firms³, and this study on the financial sector examines a particularly clear and important case of risk-taking by identifying several risk-taking mechanisms unique to the financial sector. Second, this paper contributes to currently existing working papers on inside debt and bank risk (e.g., Tung and Wang (2010); Bennett et al. (2012)) by its attempts to address empirical issues related to attrition bias, selection bias, and identification problems arising from the endogenous nature of compensation, and by examining CEO and CFO incentives. CFO incentives are arguably more important in specialized decision-making such as bank risk management (Chava and Purnanandam (2010); Anantharaman and Lee (2013)). Third, exploring the market implications of debt-based pay during the recent financial crisis leads to new insights. While previous studies demonstrate that debt-based pay generally leads to lower equity returns under normal economic conditions (Wei and Yermack (2011)), the results in this paper suggest that it also moderates losses under adverse economic conditions.

Finally, the results presented in this study have strong implications for the broader issue of how to best regulate compensation within financial institutions. Specifically, it adds to previous work that offers several solutions to shift compensation away from equity-based incentives (e.g., John et al. (2000); Bebchuk and Spamann (2010); Bolton et al. (2010); Carpenter et al. (2011)). It is true that the results do not say anything about whether banks should limit risks or pursue high returns from a societal point of view, and do not justify any welfare claims. However, if the purpose is to limit risk, then the public discussion about aligning managerial incentives could benefit from considering debt-based compensa-

³After the Securities and Exchange Commission (SEC) adopted new rules in 2007 that required disclosure about defined benefit pensions and deferred compensation, several studies found that inside debt reduces the agency problem of debt. For instance, inside debt has been associated with more favorable debt contracts (Anantharaman et al. (2010); Wang et al. (2010)), more conservative financial and investment policies (Cassell et al. (2012)), less restrictive covenants in debt contracting (Chen et al. (2010); Anantharaman et al. (2010); Wang et al. (2010); Chava et al. (2010)), more prudent accounting (Chen et al. (2010); Wang et al. (2010)), diversifying acquisitions (Liu and Mauer (2012)), and higher bond prices (Wei and Yermack (2011)).

tion. More specifically, the reforms mentioned in Footnote 1 indicate that a widespread assumption gained ground that risks will be more effectively monitored once more power is assigned to shareholders. However, the results in this paper suggest that, for the purpose of limiting risk, power should be shifted to debtholders rather than shareholders.

The remainder of this paper is organized as follows. Section 2 explains how the data and variables in this study are constructed and describes the empirical model. Section 3 describes how inside debt contracts in 2006 affect bank risk in 2007-2009. Section 4 examines the several risk-taking policies through which bank managers can manage their firms more conservatively. Section 5 presents attempts to alleviate concerns about endogeneity and selection bias. Section 6 concludes.

2 Data and variables

The construction of the data starts with collecting information on all financial institutions (i.e., firms with Standard Industry Classification (SIC) codes between 6000 and 6300) among the largest 3000 U.S. companies, which represent approximately 98% of the investable U.S. equity market. The compensation data of these companies are obtained from Equilar, an executive compensation data firm, and hand-collected whenever necessary. Compared to 129 of the very largest banks that are S&P 1500 member and analyzed in most studies, this number almost quadruples to an initial list of 542 eligible financial institutions.⁴

In 2006, the Securities and Exchange Commission (SEC) adopted new disclosure guidelines that require mandatory disclosure of the accumulated present value of pension benefits and the fiscal year-end balance of deferred compensation. Since firms had to comply with the new rules if their fiscal year ended on or after December 15, 2006, the analysis excludes all banks that end the 2006 fiscal year before that date. I collect compensation data and other explanatory variables only for the year 2006 since the crisis induced a discrete, exoge-

⁴It is verified that Equilar data are equivalent to Compustat's Execucomp data except for the broader coverage.

nous, and unanticipated increase in bank risk in August 2007.⁵ Bank stocks lost substantial ground until the first quarter of 2009, after which a partial recovery set in (see also Figure 1). Because of these structural breaks, I calculate the main dependent variables over a period from July 2007 to March 2009.

I exclude banks that, as of December 31, 2006, are listed abroad, privately held, or traded on an over-the-counter listing service such as Pink Sheets or OTC Bulletin Board. Next, by browsing through each company’s public website, I determine whether a firm (or a substantial part of it) is in the lending business. This includes lending institutions such as consumer finance companies (e.g., cars, boats, credit cards, and mortgages) and partial banks, but excludes firms specializing in non-lending services such as pure brokerage houses, investment management services, and trading platforms. Finally, following the existing literature on inside debt, this paper initially focuses on CEOs and CFOs that have nonzero inside debt. Collectively, these requirements result in a sample of 319 banks that have a CEO and/or CFO that holds inside debt as of December 2006. Section 5.2 also discusses results after considering banks that do not award any inside debt, which increases the sample size to 429 banks. Using CUSIP/ticker/name combinations, the compensation data are matched to pricing data from the Center for Research in Security Prices (CRSP) and accounting data from Compustat. Duplicate matches are combined or removed, and non-matches are verified manually.

2.1 Measuring inside debt

Jensen and Meckling (1976) argue that when an executive’s D/E ratio is similar to that of the firm, she would have no incentives to transfer wealth from debtholders to equityholders because the reallocation would have no effect on the value of her holdings in the firm. More recently, Edmans and Liu (2011) show that increases in the value of a CEO’s inside debt

⁵On August 9, 2007, BNP Paribas announced the suspension of three investment funds because “the complete evaporation of liquidity in [the subprime segment] of the US securitization market has made it impossible to value certain assets [...] regardless of their quality or credit rating.” (BBC News, August 9, 2007).

lead to conservative investment choices, which in turn lead to increases (decreases) in the value of the firm’s debt (equity). Therefore, inside debt holdings are generally measured by the debt-to-equity (D/E) ratio of CEO wealth that is invested in the firm, relative to that of the firm. I follow Edmans and Liu (2011) who derive the following inside debt ratio:

$$k = \frac{D^I/E^I}{D^F/E^F} = \frac{(Pension + NQDC) / (Stock + Options)}{(LTDebt + CDebt) / (P * CSHO)}, \quad (1)$$

where inside debt (D^I) comprises the present value from accumulated pension benefits (*Pension*) and the fiscal year-end balance non-qualified deferred compensation (*NQDC*), respectively, both from the firm’s proxy statements. Inside equity (E^I) is defined as the value of stock and option holdings, with stock ownership value (*Stock*) calculated by multiplying shares held times the stock price on December 29, 2006. These shares include unvested stock and equity incentive plan awards. I deduct options that become exercisable within 60 days after the proxy statement to avoid double counting the options in the outstanding equity table. The value of stock options (*Options*) is calculated from the Black-Scholes value of each individual tranche of outstanding options and summing the tranche values to a grand total for each executive, described in more detail in the Appendix. Firm debt (D^F) is long-term debt (*LTDEBT*) plus current debt (*CDebt*), and firm equity (E^F) the numbers of shares outstanding times the stock price on December 29, 2006.⁶

2.2 Measuring total shareholder and debtholder risk

In contrast to bank shareholders whose levered equity might increase with volatility, unsecured debtholders have no upside potential other than the periodic interest payments and the payout of face value when the debt matures. Since debtholders only lose a portion of their principal when daily stock returns are sufficiently negative, the lower tail of the returns distribution represents severe problems for both shareholders *and* equityhold-

⁶It is verified that the results in this paper are robust to alternative measures such as the k^* -ratio proposed by Wei and Yermack (2011), or the measures in Section 5.2.

ers. Hence, a bank risk measure that matters for shareholder and debtholders alike needs to capture downside risk. In addition, since the empirical distribution of such gains and losses is probably skewed and has fat tails, an appropriate risk measure does not assume normality. The measure should also minimize the role of managerial discretion and account for off-balance sheet items that may distort many important financial performance measures (Altman (2000)). These items include the structured finance instruments that played a key role during the 2007-2008 crisis including asset-backed securities, mortgage-backed securities, and many credit derivative products. Therefore, I represent shareholder and debtholder risk by value-at-risk (VaR), expected shortfall (ES), and CoVaR. All these measures are designed for measuring and managing risk within financial institutions.

VaR (Guldimann et al. (1994)) is a widely used quantity for corporate control as it focuses on the largest likely loss. Given a probability level α that indicates the difference between “likely” and “extreme” loss, VaR is defined as the maximum (firm-wide) loss in $100(1 - \alpha)\%$ of the time:

$$\text{VaR}_{it}^{1-\alpha}(R_{it}) = -\sup \{z \mid \Pr [R_{it} < z] < \alpha\},$$

where R_{it} is firm i 's return at time t , and z is a percentile corresponding to the pre-specified parameter α . Since risk is calculated *ex post*, it is straightforward to obtain $100(1 - \alpha)\%$ daily VaR by selecting the lowest $100\alpha\%$ of daily observations for each firm for a given time period. Assuming that realized returns are an accurate description of the underlying data generating process, VaR is simply the largest (i.e., least negative) of these observations. Bali et al. (2009) demonstrate that this straightforward non-parametric definition of VaR yields results very similar to more sophisticated definitions.

VaR represents the largest likely loss and is fully uninformative about the size of the actual loss if extreme, unlikely events occur, such as the mortgage crisis starting in 2007. In that respect, ES (Artzner et al. (1999)) gives a better impression of the worst $100\alpha\%$ of the

cases by describing the mean of the lower tail of the returns distribution:

$$ES_{it}^{\alpha}(R_{it}) = -\mathbb{E} [R_{it} \mid R_{it} \leq \text{VaR}_{it}^{1-\alpha}(R_{it})].$$

This definition can be interpreted as the average loss suffered in the worst $100\alpha\%$ of the time.

Shleifer and Vishny (1992) demonstrate that losses might also occur because other institutions face similar constraints at the same time. This is important to the 2007-2009 crisis: many banks could no longer roll over their short-term debt in 2008, which is considered a direct consequence of sector-wide increased margin and collateral requirements and a general tightening of lending (Brunnermeier and Pedersen, 2008). To capture risk spillovers, CoVaR (Brunnermeier and Adrian (2009)) measures how financial institutions are exposed to problems at their industry peers. Specifically, define R_t^* as the return on the MSCI U.S. Financial Services index. Next, an institution's vulnerability to the spreading of industry problems is captured by:

$$\text{CoVaR}_{it}^{\alpha}(R_{it}) = -\text{VaR}_{it}^{1-\alpha}(R_{it} \mid R_{it}^* \leq \text{VaR}_t^{1-\alpha}(R_{it}^*)).$$

In words, CoVaR measures the sensitivity of overall exposure to losses from other financial firms by calculating the value-at-risk of a stock, given that the industry return is below its 100α -th percentile.⁷ CoVaR represents the largest likely loss when losses of industry peers become quite large, measuring exposure to severe industry problems. Therefore, it captures risk spillovers and an institution's vulnerability to the spreading of losses such as the credit and liquidity freezes in 2008.

Since all returns in the lower tail are negative, VaR, ES, and CoVaR are multiplied with minus one in the equations above. This facilitates interpretation with a positive coefficient

⁷Note that the CoVaR definition is different from Brunnermeier and Adrian (2009) who are interested in the VaR of the financial system given the distress of a particular financial institution.

indicating a positive effect on bank shareholder and debtholder risk. I examine within-firm Var, ES, and CoVaR over the crisis period from July 2007 to March 2009. In the results below, a threshold level of $\alpha = 0.05$ is assumed. It is verified that assigning different values to α yields similar results.

Survivorship bias Since market assessments of debtholder risk can only be observed directly for about twenty of the very largest banks that have publicly traded debt instruments, bank shareholder and debtholder risk is measured using stock returns. However, of the 319 banks in the sample, about 17% was acquired by other firms, or delisted due to a violation of listing requirements or bankruptcy. Table A1 shows how many banks survived, entered bankruptcy, merged, or were acquired during the sample period. Consequently, the possibility exists that banks with large inside debt holdings may seemingly fare better during the crisis, simply because I ignore other banks that got into trouble and disappeared from the sample.

To alleviate this concern, I make use of CRSP's delisting prices. If a security is removed from the exchange, CRSP calculates its price after delisting from an off-exchange price or bid-ask spread (i.e., the average of the bid and ask quotes), and the sum of a series of distribution payments. Hence, returns from delisted firms can be calculated using the share price on December 29, 2006, and the delisting price on the date of delisting. If banks are near bankruptcy when they delist or are taken over, returns are near -100% and are captured by VaR, ES, CoVaR, and volatility. However, if healthy banks are taken over, the delisting return includes the takeover premium paid by the acquirer. Thus, bank risk only increases when banks delist or are taken over due to bankruptcy.

2.3 Empirical model

To test whether variations in inside debt holdings of CEOs and CFOs at bank i at the end of 2006 (*Dec06*) are associated with meaningful differences in bank risk during the crisis ending

in March 2009 (*Mar09*), a simple cross-sectional regression model is estimated:

$$Y_{i,Mar09} = \beta_0 + \beta_1 D_{i,Dec06} + \beta_2 X_{i,Dec06} + \varepsilon_{i,Mar09}, \quad (2)$$

where $Y_{i,Mar09}$ is bank risk represented by stock market losses, volatility, VaR, ES, CoVaR, and the probability of financial distress⁸; $D_{i,Dec06}$ is inside debt as measured by the k -ratio; $X_{i,Dec06}$ is a collection of control variables measured at the end of 2006, and $\varepsilon_{i,Mar09}$ is an error term that is adjusted for heteroskedasticity. Since prior work suggests that CFO incentives are arguably more important for decisions that require specialized knowledge such as bank risk management (Chava and Purnanandam (2010); Anantharaman and Lee (2013)), I report results on both CEO and CFO incentives.⁹ I follow the previous literature on inside debt (e.g., Cassell et al. (2012)) and report p -values that are two-tailed except for the variables of interest, $D_{i,Dec06}$. I discuss the endogeneity issues related to this empirical setup in Section 5.

Since bank risk during the crisis can be affected by many factors, a variety of control variables is included (see Table 1 for their definitions). First, I include *equity delta* and *equity vega* since equity incentives and debt incentives are likely to be set simultaneously, and shareholders implement compensation policies that have a positive effect on firm risk (e.g., Jensen and Murphy (1990); Guay (1999)). Second, I include *total annual compensation* since riskier firms may need to pay their managers more if managerial effort is more difficult to monitor (Prendergast (2002)), managers have a stronger influence in riskier firms (Cheng et al. (2012)), and it is more difficult for riskier firms to attract optimal talent (Edmans and Gabaix (2011)). At the same time, high levels of pay may also indicate entrenchment problems as in Bebchuk et al. (2002), and indicate weak corporate governance. Third, *firm size* and *market-to-book* are canonical determinants of future returns that also affect risk

⁸I find similar, somewhat stronger results when measuring volatility, VaR, ES, and CoVaR in first-differences. These findings are not reported to conserve space.

⁹Results are similar when incentives are combined at the firm level, e.g., after firm-averaging all top-5 executives.

(Coles et al. (2006)) and compensation (Gabaix and Landier (2008)). Fourth, *return on assets* may be indicative of risk-taking before the crisis. Fifth, (market) *leverage* controls for the amount of balance sheet expansion that allows banks to increase profitability by taking more risk. Finally, *depository banks* are more strictly regulated than non-depository institutions and protected from a bank run by deposit insurance, which provides them with different incentives for taking risk. Hence, I also include an indicator variable relative to whether Tier 1 capital is reported; this item is reported only by depository banks.

3 Main results

3.1 Inside debt at the end of 2006

Panel A of Table 1 presents summary statistics for the sample at the bank level. The banks have a total sum of assets of \$14 trillion and consist of some very large institutions.¹⁰ The mean leverage ratio equals 0.83, but varies between 0.55 and 0.95. The average Tier-1 capital ratio of 11% indicates that the banks are well-capitalized, although the sample contains four banks with a Tier-1 capital ratio below the regulatory minimum of 4%. Mean (median) survivorship-adjusted buy-and-hold returns around the crisis period are -53% (-57%) and vary widely from -100% to +67%. Average annualized volatility over 2006 is 23% and increases dramatically to 80% during the crisis.

Panel B of Table 1 presents summary statistics at the executive level and describes CEOs and CFOs in terms of personal characteristics and several compensation statistics at the end of 2006. Some CEOs hold large amounts of shares, options, and inside debt, and median CEO ownership is about three times median CFO ownership. However, CEO and CFO incentives as measured by equity delta, equity vega, and the *k*-ratio are similar. Importantly, the median value of inside debt for bank CEOs (CFOs) is \$0.94 million (\$0.23 million), which is

¹⁰For all results presented in this paper, it is verified that results are very similar after excluding financial institutions that are systemically important (as designated by the Bank of International Settlements).

similar to the median value of executive stock options of \$0.83 million (\$0.27 million). Hence, in terms of dollar value, inside debt is of similar importance to stock option holdings and more important than executive cash bonuses. Since the risk-taking incentives from executive stock options are positive while those from inside debt are negative, and shares have a vega of zero, one may expect that inside debt has an economically important impact on bank risk.

The median “inside” CEO (CFO) D/E ratio is 0.12 (0.10), but the incentives from inside debt vary widely across executives. For example, several banks have *outside* debt amounting to less than 0.3% of equity value, which leads to very large *inside* debt ratios. Following conventions in the literature, I apply a log transformation to the k -ratio and winsorize at the 2.5th and 97.5th percentile.¹¹ The median k -ratio for CEOs (for CFOs) is $e^{-1.07} = 0.34$ ($e^{-1.20} = 0.30$). This number is comparable to studies for large non-financial firms (the median k -ratio is 0.51 in Wei and Yermack (2011) and 0.47 in Cassell et al. (2012)).

Panel C of Table 1 presents correlations between inside debt and control variables to check for collinearity issues. For instance, leverage is a key variable in banking but also implicitly captured by the k -ratio, and total annual compensation correlates strongly with bank size (Gabaix and Landier (2008)). The correlation between inside debt and leverage is around 0.3, and correlations are quite high between book-to-market and leverage (0.62), and firm size and total annual compensation (0.84). Hence, I repeat the analyses below after excluding leverage and total annual compensation from the regressions, which further improves results (see the online appendix). However, even though collinearity problems results in larger standard errors, the coefficients on total annual compensation and leverage are highly significant in the regressions below. Furthermore, leverage is a key variable in any study on banks. Therefore, I include these variables in the main text.

¹¹The results that follow are similar without log-transformations and winsorizing.

3.2 Inside debt and bank shareholders in 2007-2009

The majority of studies examining firm risk focus on shareholder risk. Therefore, I first examine the impact of inside debt on shareholder losses and shareholder risk before turning to an examination of total (i.e., shareholder and debtholder) bank risk.

Inside debt and shareholder losses Columns 1 and 2 of Table 2 re-examine Figure 1 in a multivariate context. Shareholder losses are represented by average (rather than cumulative) buy-and-hold stock returns, multiplied with minus one to facilitate an interpretation in the context of bank risk.

The coefficient on inside debt is negative and statistically significant for CEOs and CFOs ($p < 0.01$), indicating that banks with larger inside debt holdings suffered smaller stock market losses during the crisis after controlling for other return drivers. The coefficient on log total compensation is significant for CEOs ($p < 0.05$) but not for CFOs, in favor of stories on CEO entrenchment (as in Bebchuk et al. (2002)) or stories that higher CEO pay is optimal for riskier financial firms (as in Cheng et al. (2012)). The coefficient on log equity market value is significant only for the larger sample of CEOs, which has more variation in market capitalizations. The negative coefficient on CEO equity delta appears in contrast with Fahlenbrach and Stulz (2011) who find a negative relation between stock performance and the CEO's shares and options owned as a fraction of shares outstanding. Unreported results confirm the negative relation in Fahlenbrach and Stulz (2011) when using their measure. Other important control variables are ROA ($p < 0.10$) and market leverage ($p < 0.01$).

The economic importance of inside debt can be assessed using Panel B of Table 1, which shows that the standard deviation of the k -ratio equals 2.19 for CEOs (2.08 for CFOs). Therefore, a one-standard deviation increase in the k -ratio is associated with a loss that is $2.19 \times 3.650 = 8.0$ percent ($2.08 \times 3.745 = 7.8$ percent) lower during the 21-month crisis period. This is equivalent to an average annualized difference of $8.0^{12/21} = 3.3$ percent

($7.8^{12/21} = 3.2$ percent) per crisis year.

These wealth losses by bank shareholders complement previous empirical findings that more inside debt is generally associated with lower returns. For instance, Wei and Yermack (2011) find that more inside debt is generally associated with lower stock returns during non-crisis times, whereas the negative coefficients on inside debt in Table 2 indicate that inside debt has also limited stock market losses during crisis times.

Inside debt and shareholder risk It is difficult to discuss bank risk without looking at volatility. One reason for this is that, strictly speaking, VaR, ES, and CoVaR do not measure risk: If the full distribution of returns moves to the left, then both expected returns and returns in the tails will be lower. Therefore, I investigate whether idiosyncratic, systematic, and total volatility are lower for banks that issue more inside debt. Idiosyncratic risk is the standard deviation of daily residuals from the Fama-French three-factor model. Systematic risk is the standard deviation of the fitted values from the three-factor model.

In Columns 3-8 of Table 2, the coefficients on CEO and CFO inside debt suggest a negative and highly significant effect on total volatility and idiosyncratic volatility. CEO equity delta is negatively related to total volatility (as in, e.g., Lambert and Larcker (1987) and Aggarwal and Samwick (2003)) and idiosyncratic volatility (as in, e.g., Jin (2002)). Coefficients on CEO and CFO equity vega are insignificant as in Fahlenbrach and Stulz (2011). As before, the coefficients on total annual compensation are significant for CEOs but less so for CFOs. As expected, shareholder risk for banks with larger inside debt holdings was lower during the crisis.¹²

3.3 Inside debt and total bank risk in 2007-2009

The results above demonstrate that inside debt is significantly associated with shareholder losses and limits risk when economic conditions deteriorate. However, it is not clear how

¹²Results on shareholder losses or shareholder risk using a sample that excludes (non-)depository institutions or systemically important banks are very similar, but omitted to conserve space.

these results relate to the interests of depositors, bondholders, and other creditors of the bank. Therefore, I measure total bank risk using the lower tail of the returns distribution, since debt repayment is only jeopardized when daily stock returns are sufficiently negative.

Inside debt and VaR, ES, and CoVaR Columns 1 and 2 of Table 3 present estimation results with VaR as the dependent variable. Again, the coefficients on inside debt are negative and significant for both CEOs and CFOs ($p < 0.03$). The coefficients on total compensation are significant as well, in line with either Bebchuk et al. (2002) or Cheng et al. (2012). In terms of firm-level controls, the results are not very different from Table 2 with significant coefficients on ROA and leverage.

VaR estimates are disclosed by financial institutions in external reports, used as an internal control standard for audit ratings or self-assessment, and required by law in regulatory reporting. Therefore, while financial firms have some discretion in calculating VaR and use *ex ante* calculations of expected VaR (this number is not reported publicly for all firms and could be subject to differences in estimation methodology), realized VaR is an *ex post* measure of a financial institution's willingness to absorb losses. Hence, the results on VaR suggest that inside debt encourages more conservative internal, external and regulatory risk governance. This idea is further investigated in Section 4 below.

Columns 3 and 4 of Table 3 present results showing the impact of 2006 inside debt holdings on ES from 2007-2009. The results are roughly similar to those on VaR. Most importantly, coefficients on inside debt are negative and significant ($p < 0.03$). The results on ES complement those on VaR by suggesting that, given that an extremely negative shock materializes, the average exposure is lower for banks with higher levels of inside debt.

Columns 5 and 6 of Table 3 show the impact of inside debt on banks' vulnerability to the spreading of losses captured by CoVaR. The coefficients on log equity market value are significantly positive suggesting that being "too-interconnected-to-fail" (e.g., Brunnermeier and Adrian (2009)) is a moral hazard problem related to larger banks. The results on inside

debt are not as strong as in the columns on VaR or ES ($p < 0.13$ for CFOs). However, the online appendix shows that coefficients on inside debt become significant once potentially collinear variables are removed ($p < 0.05$ for CEOs, $p < 0.07$ for CFOs).

The economic significance of inside debt is substantial as before, with a one-standard deviation increase in the k -ratio for CEOs limiting VaR and ES during the crisis by $2.19 \times 0.216 = 0.5$ percent and $2.19 \times 0.293 = 0.6$ percent, respectively. Similarly, VaR and ES for CFOs are limited by $2.08 \times 0.192 = 0.4$ percent and $2.08 \times 0.319 = 0.7$ percent, respectively.

Inside debt and the probability of financial distress Bank tail risk is estimated at the $\alpha = 0.05$ risk threshold so that about 30 daily returns are used to calculate ES and CoVaR from July 2007 to March 2009. Therefore, one may be concerned as to whether the lower tail is reliably described by VaR, ES and CoVaR. For instance, since ES is an average, it can be distorted by a long lower tail leading to overstated results. Another possible concern is that these statistics might not reflect risks far enough down the lower tail to be relevant for debtholders. Hence, it may not be immediately clear to what extent VaR, ES, and CoVaR actually relate to the total return on equity and debt and, consequently, whether inside debt is an important determinant of total bank risk.

To tackle these concerns, I use a probit model that captures the probability of financial distress which is relevant to shareholders as well as debtholders and other creditors, but does not require an estimate of the lower tail. The binary dependent variable equals one if financial institutions have a survivorship-adjusted buy-and-hold return of -80% or worse, and zero otherwise. With returns adjusted for survivorship bias, the variable distinguishes surviving banks and banks delisted after a value-increasing takeover from distressed banks and banks delisted after a government-backed takeover or a bankruptcy. Results after re-estimating Eq. (2) in a probit framework are presented in Columns 7 and 8 of Table 3.

The coefficients on CEO and CFO inside debt are negative and significant suggesting a negative impact on the probability of shareholder and debtholder distress. Unreported

estimates after excluding systemically important banks or (non-)depository banks are very similar. This result confirms previous findings and alleviates concerns about the validity of the VaR, ES, and CoVaR measures, suggesting that banks with higher 2006 inside debt holdings are associated with lower bank risk exposures in 2007-2009.

4 Inside debt and bank risk-taking policies

The results above are consistent with the theoretical predictions of Jensen and Meckling (1976) and Edmans and Liu (2011) who predict more conservative policy when inside debt holdings are larger. However, the positive impact of inside debt on bank risk says little about the specific policy mechanisms through which bank managers with large inside debt holdings manage their firms more conservatively. Hence, I consider several mechanisms that are specific to banks and are generally regarded important in the recent financial crisis.

4.1 Investment policy: Real estate lending and writedowns

First, on the asset side of the bank's balance sheet, banks built substantial exposure to the subprime loans that set off the crisis. Subprime mortgages are risky assets as they continue to have a balance remaining after all the scheduled payments are paid, and need refinancing at an appreciated home price to avoid a jump in the mortgage rate. Therefore, when house prices fall, subprime borrowers may no longer be able to refinance and risk foreclosure. This deteriorates the quality of a bank's real estate portfolio that increasingly consists of nonperforming assets, i.e., non-accrual loans in which payment of interest or principal is unlikely or the borrower has fallen behind in interest payments, as well as foreclosed and repossessed properties.

Hence, if inside debt induces bank managers to preserve firm value, I expect a significant relation between inside debt holdings and the quality of the bank's real estate portfolio during the crisis. The fraction of low-quality real estate is proxied by "nonperforming assets on real

estate” which consists of non-accrual loans that are considered impaired as the payment of interest or principal is doubtful, plus “other real estate owned assets” which represents properties acquired through foreclosure and repossession that serve as a total or partial repayment of a loan.¹³

Columns 1 and 2 of Table 4 present regression results on the quality of banks’ asset portfolios at the end of 2008. The estimation model is equivalent to Eq. (2) with the fraction of low-quality real estate in a bank’s asset portfolio as the dependent variable. The inside debt coefficient is highly significant for CEOs and CFOs ($p < 0.01$).

An alternative way of examining investment policy is through the income statement, with writedowns proxying for the extent of risk-taking as in Chesney et al. (2012). Although banks have some discretion over writedowns, they are required to take writedowns on investments that could *ex ante* be considered risky even if the assets do not actually result in realized losses. Furthermore, writedowns summarize a wide range of investment policy decisions that go beyond real estate lending alone. Therefore, similar to Chesney et al. (2012), I measure writedowns by summing 2007 and 2008 provisions for credit losses and other provisions, pretax writedowns, losses on investment securities, and allowances or reserves for other losses, all scaled by total assets.

Columns 3 and 4 of Table 4 show that CEO and CFO inside debt holdings are negatively correlated to writedowns scaled by total assets ($p < 0.03$ for CEOs, $p < 0.01$ for CFOs). The statistical significance of inside debt further increases when writedowns are expressed in dollar terms (unreported to conserve space). Hence, the evidence on the fraction of low-quality real estate and writedowns is consistent with the assertion that inside debt encourages managers to invest more conservatively.

¹³See, for instance, Northern Trust’s 2010 annual report, page 56.

4.2 Financing policy: Pre-crisis borrowing

On the liability side of the bank's balance sheet, additional risk was taken by funding assets mostly by short-term market borrowing (Acharya et al. (2009)). Since a bank's balance sheet is continuously marked to market, increases (decreases) in the value of the asset portfolio appear immediately as increases (decreases) in net worth of the bank, allowing (requiring) financial intermediaries to increase (decrease) the dollar value of debt (Adrian and Shin (2010)). Several papers argue that the active management of banks' balance sheets increases aggregate volatility, the price of risk, and the probability of financial distress during the financial crisis (e.g., Brunnermeier and Pedersen (2008); Fostel and Geanakoplos (2008); Kashyap et al. (2008); Brunnermeier (2009); He et al. (2010); Adrian and Shin (2010)).¹⁴

Hence, if higher leverage increases the probability of default and inside debt encourages managers to avoid default, I expect that a negative relation exists between inside debt holdings and growth in bank debt. A straightforward measure for growth in bank debt would be the increase in market leverage. However, because leverage appears in the denominator of the inside debt measures, any documented association between inside debt and financial leverage could be driven by a mechanical relationship. Therefore, I examine proportional growth in repurchase agreements (repos) to proxy for balance sheet expansion, which is arguably a more important channel for banks to raise debt (e.g., see Adrian and Shin (2010)). In a repurchase agreement, a bank sells a security in order to buy it back at a pre-agreed price on a fixed future date. Hence, a repo is equivalent to a collateralized loan with interest being the excess of the repurchase price over the sale price. I measure balance sheet expansion by the proportional change in repurchase agreements from December 2006 to alleviate concerns about endogeneity between inside debt and leverage policy, and until July 2007 to isolate

¹⁴An important explanation is that, when mortgage values eroded in 2007 and 2008, banks needed to de-leverage their positions by selling part of the assets. The sales occurred when the prices of these assets were low, and led to even lower prices. This raised concerns with other banks about the solvency and liquidity of the banking system, and margin and collateral requirements were increased. Due to these tightened lending standards, banks could no longer roll over their short-term debt leading to further assets sales and deeper losses.

balance sheet expansion from changes in bank borrowing due to the crisis.

Columns 5 and 6 of Table 4 present coefficient estimates of Eq. (2) with pre-crisis growth in repurchase agreements as the dependent variable. Even though the sample contains 100 observations or less, larger holdings of 2006 inside debt are significantly associated with less growth in repos during the first half of 2007. Consistent with the negative association between inside debt holdings and bank risk during the crisis, CEOs and CFOs with larger inside debt holdings conduct balance sheet policy that is less risky. Notably, pre-crisis repo growth quantifies the impact of inside debt on firm policies *before* the start of the crisis.

Another possible policy implication is that the effect of inside debt is the strongest when the potential for risk-shifting towards debtholders is the largest, i.e., when leverage is high. To examine this, I split the sample at the median leverage ratio and re-run the key regressions in Tables 2 and 3. In unreported results, the impact of CEO inside debt on stock market losses, volatility, VaR, ES, and CoVaR (CFO inside debt on volatility, VaR, ES, and CoVaR) is indeed larger for banks with above-median leverage.

4.3 Business Policy: Noninterest-based banking

Finally, in the years leading up to the crisis, large banking companies have increasingly departed from the traditional, interest-based “originate-and-hold” banking model (in which banks use deposits to fund illiquid loans that are held on-balance sheet) towards fee-based investment banking, brokerage, insurance sales and underwriting, as well as a fee-based “originate-to-distribute” lending model (in which banks securitize their loans, sell them to various third-party investors, and use the proceeds to fund new loans).

Previous studies find that banks more involved into such fee-based, non-interest income are associated with increased operating leverage, revenue volatility, and earnings volatility (DeYoung and Roland (2001)). In addition, DeYoung et al. (2013) find that *equity*-based risk incentives have encouraged CEOs at U.S. commercial banks to generate *more* income from non-interest banking activities. Hence, it seems plausible that a negative relation

exists between inside debt holdings and noninterest-based banking activities. To examine this, I follow DeYoung et al. (2013) and measure the fraction of total noninterest income as total noninterest income scaled by net operating income (noninterest income + interest income – interest expense). I log-transform the resulting variable since it is strongly skewed. The Compustat items are taken at the first available date after 2006 inside debt, which is December 2007.

Columns 7 and 8 of Table 4 present the coefficient estimates on total non-interest income. As expected, larger holdings of 2006 inside debt are significantly associated with a lower percentage of income from non-traditional banking activities, with each of the coefficients significant at better than the 5% level.¹⁵ This evidence is consistent with the idea that CEOs and CFOs with larger inside debt holdings stick to traditional lines of business, and are less involved in fee-based banking.

5 Endogenous choice of inside debt compensation

Any form of managerial compensation is likely to be influenced by a bank’s business environment, its riskiness, and the nature of the agency problems that compensation is to address.

In the context of this paper, banks could set inside debt remuneration while simultaneously having future bank risk in mind, which may result in a negative relation between inside debt and bank risk that is spurious rather than causal. Another alternative explanation for the negative relation between inside debt and bank risk is that more inside debt is awarded by banks that are less vulnerable to crises or operate in a more stable business environment. This seems especially valid in this cross-sectional study, which does not purge fixed effects as in a panel data setup.

¹⁵This result remains significant when the dependent variable is $\log(|\text{noninterest income}|)$, where $|\cdot|$ stands for the absolute value, and an indicator variable for observations with negative noninterest income is added to Eq. (2). This setup allows for taking logs without discarding banks that have negative total noninterest income.

Such concerns are partially addressed by measuring changes in share prices (i.e., returns), as in Table 2 and Figure 1. Unreported results show that 2006 inside debt also significantly affects *changes* in volatility, VaR, ES, and CoVaR from the start to the end of the financial crisis. This setup creates an appealing quasi-experimental setting as the crisis induced a discrete and exogenous increase in bank risk that was largely unanticipated by managers.¹⁶ In addition, examining the impact of 2006 inside debt on 2007-2009 risk helps to ensure that the managers’ inside debt holdings are predetermined. Finally, accumulated pension benefits are a “stock” rather than “flow” quantity, and are not easily manipulated from one year to another. These features reduce the endogeneity problem that arises from a simultaneous determination of inside debt and bank risk.

5.1 Instrumental variables

To alleviate endogeneity concerns more directly, I re-estimate the various instances of Eq. (2) using a two-stage least squares (2SLS) regression model. One previously used instrument (see, for instance, Cassell et al. (2012)) that seems reasonably exogenous is executive age since pension value mechanically increases with age, and it is relatively difficult to argue that the exclusion restriction is violated.

First, following the line of argument in Yim (2013), even though changes in personal characteristics that occur with age may also affect a bank executive’s risk-taking propensity, this holds for *any* physiological, psychological, or mental characteristic. As a result, older bank CEOs and CFOs may either *increase* bank risk if they, e.g., have lower energy levels to monitor risk, lack sufficient training in modern risk-management techniques, etc., or *decrease* bank risk if they, e.g., have more wisdom from experience, are more even-tempered and conservative, etc. It is difficult to exhaustively distinguish among these stories. Furthermore, there exists considerable ambiguity over how personal characteristics change with age. For instance, while some management and psychology studies of non-executives suggest that

¹⁶For example, Fahlenbrach and Stulz (2011) find that bank CEOs did not reduce their stock holdings in anticipation of the crisis, and subsequently suffered large wealth losses.

older people are less overconfident (Taylor (1975); Kovalchik et al. (2005); Forbes (2005)), Yim (2013) finds that CEO age does not proxy for overconfidence. Furthermore, older bank CEOs and CFOs may actually be *more* overconfident due to survival and self-attribution bias (Doukas and Petmezas (2007); Billett and Qian (2008)).

Next, empirical findings that document a positive correlation between age and risk aversion are plagued by various identification problems as risk-aversion is generally affected by time-specific developments (e.g., current and past recessions). Ameriks and Zeldes (2004) identify these problems and find that the correlation between age and risk aversion disappears once these issues are addressed: older individuals do not gradually allocate lower fractions of their wealth into (risky) equities.

Finally, in studies that focus specifically on bank executives, age has no significant effect on a variety of bank performance measures (Tung and Wang (2010); Bennett et al. (2012)), and CEOs with experience of earlier crises do not manage more conservatively in (pre-) crisis years (Fahlenbrach et al. (2012)).

The first-stage and second-stage results are presented in panels A and B of Table 5, respectively. In the relatively small sample of banks, the impact of inside debt on volatility, VaR, and ES is predominantly significant around conventional levels for CFOs ($p < 0.14$), but not for CEOs ($p < 0.41$). This holds to a lesser extent for the impact of inside debt on buy-and-hold returns for CEOs ($p < 0.08$) and CFOs ($p < 0.03$). The online appendix shows that once possibly collinear variables are removed, the standard errors decrease further to conventional significance levels for CFOs ($p < 0.10$ across all dependent variables in Table 5), but again not for CEOs ($p < 0.48$ across all dependent variables in Table 5). This difference in coefficients between CEOs and CFOs is noteworthy: if some omitted variable is responsible for the results in panel B even after instrumenting inside debt, then it must affect CEOs' and CFOs' incentives in different ways to produce these different results. This rules out many omitted variables. For instance, a more stable business environment is unlikely to affect compensation to CFOs but not to CEOs.

While most estimated coefficients in panel B of Table 5 have the expected signs and significance levels, the 2SLS-estimated coefficients on CFO inside debt are insignificant for CoVaR ($p < 0.27$ in the main text and the online appendix). For that reason, even though the high p -values may reflect the innately less precise 2SLS estimator rather than a spurious, endogenously driven effect of inside debt, I interpret the result on CoVaR with more care. Nevertheless, the bits of evidence presented so far increase confidence in the consistency and validity of the OLS results.

5.2 CEOs and CFOs with and without inside debt

Finally, one may be concerned that pension benefits and deferred compensation are not always awarded: Panel B of Table 1 indicates that within the 319 banks that have nonzero inside debt, around 20% and 40% of the CEOs and CFOs does not receive any accumulated pension benefits or *NQDC*, respectively.¹⁷ These observations might introduce a sample selection bias in favor of the main hypotheses if the omissions are non-random in some way.

Simply replacing the missing values by zeros would censor the inside debt variable and generate new statistical bias in favor of the main hypotheses (e.g., Rigobon and Stoker (2009)). In addition, statistical procedures that address selection bias do so for selection in outcome variables rather than explanatory variables (e.g., Tobin (1958), Heckman (1979), or the partial identification methods in Manski (1990)). Therefore, to alleviate concerns about the observations that have no valid k -ratio, I create a between-groups “treatment” indicator variable that equals one if *any* inside debt is held by an CEO or CFO and zero otherwise, and use this instead of the k -ratio to estimate Eq. (2) on the full sample of banks with and without inside debt. This substantially increases the sample size from 319 banks to 422 banks: 24% of the banks does not award any inside debt to the CEO or CFO. Since at least

¹⁷Closer inspection of these observations reveals that CEOs and CFOs without inside debt do not have equity holdings, debt holdings, or both, because they (i) have joined the company within or around the 2006 fiscal year, and had not been granted inside debt or equity yet; (ii) have resigned or were about to resign within or around the 2006 fiscal year, and their equity was forfeited or accelerated in vesting; or (iii) did not have outstanding inside debt or equity because their bank has not granted any in a long time or has never granted inside debt or equity.

some of the inside debt that an executive builds up from *NQDC* is discretionary, it could be that the *NQDC* part of inside debt depends on the executive's view of future default risk. Therefore, I also create an indicator variable for whether CEOs and CFOs hold any pensions as there is less discretion for accumulating pensions than for annually awarding *NQDC*.

Table 6 presents results after re-running the main regressions on the extended sample. Panels A-D present results that are in line with the main claim of the paper and relieve concerns about sample selection issues. While important information is lost by dichotomizing, holding any CEO or CFO inside debt is negatively and significantly associated with the various measures for bank risk. Results are similar for CEOs and CFOs without any accumulated pensions, which alleviates concerns that the inside debt measures reflect the CEO's, CFO's, or bank's view of default risk. Hence, the negative link between inside debt and bank risk extends to a sample of CEOs and CFOs with and without inside debt, which relieves concerns about selection bias.

6 Conclusion

In order to discourage risk-taking behavior fueled by executive compensation, legislators amended the Securities Exchange Act of 1934 to address moral hazard between managers and shareholders. This presumes that the monitoring of risk will be more effective once more power is assigned to shareholders.

This paper examines incentives that address the debtholder rather than shareholder agency problem. It discusses how bank risk is affected by awarding executives with debt-based executive pay, which consists of defined benefit pensions and deferred compensation (inside debt). Using a sample of CEOs and CFOs in small and large U.S.-listed banks, the results in this paper demonstrate that higher inside debt holdings are associated with systematically less bank risk during the crisis. In addition, inside debt holdings are negatively correlated to several bank-specific risk-taking channels. This suggests that inside debt limits

bank losses incurred in crisis times by encouraging more conservative decision-making.

The results have clear implications for the evaluation of current regulatory reforms and the broader public policy issue of how to limit the risks surrounding financial institutions. For example, the documented link between inside debt and bank risk suggests that creditors are more inclined to monitor bank risk than shareholders. As a consequence, the strengthening of shareholder governance that is now implemented in many countries may not necessarily be the most effective tool for limiting risk.

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Table 1: Summary statistics

Summary statistics of key variables for the sample of banks, taken from Compustat and Equilar after applying the sample selection criteria described in Section 2. Unless stated otherwise, data items are collected for December 2006. Panel A presents summary statistics at the bank level with variables taken directly from Compustat or defined as follows (Compustat item codes in square brackets): “Market-to-book” is equity market value [CSHO \times PRCC_F] divided by equity book value [CEQ]. “Return on assets” is operating income before depreciation [OIBDP] divided by total assets [AT]. “Market leverage” is total assets minus equity book value, divided by total assets plus equity market value minus equity book value. The various measures “Buy-and-hold returns,” “Annualized volatility,” “Value-at-risk,” “Expected shortfall,” and “CoVaR” are calculated using daily stock price data over 21 months and defined in Section 2.2. “Low quality real estate” is nonperforming assets on real estate [NPAORE] plus other real estate owned assets [OREO] in December 2008, relative to total assets. “Writedowns” is provisions for credit losses [PCL] and other provisions [PVON], pretax writedowns [WDP], losses on investment securities [INVSGL], and allowances or reserves for other losses [AROL], all summed over 2007 and 2008 and scaled by total assets. “Pre-crisis growth in repo” is the proportional change in repurchase agreements [RPAGQ] from December 2006 to July 2007. “Non-interest income” is total noninterest income [NIINT] divided by net operating income (noninterest income + interest income [TNII]– interest expense [XINT]). Panel B presents summary statistics at the CEO/CFO level with variables taken directly from Equilar or defined as follows: “Value of shares” is the total value of shares owned plus the total value of unvested shares. “Value of options” is the total value of exercisable options plus the total value of unexercisable options, with option values based upon Black-Scholes estimates using data for each individual option tranche outstanding. “Cash bonus” is the annual bonus plus non-equity incentive plan payouts. “Equity delta” (“Equity vega”) is the percentage change in value of each executive’s stock portfolio and all her individual tranches of options held, summed to an aggregate total, for a \$1 increase in the stock price (1% increase in stock volatility). Awarded stock is assumed to have a vega of zero and a delta of one and equals the number of (unearned or unvested) shares, plus those that are owned or have been awarded through an equity incentive plan. The Black-Scholes value of each option tranche is estimated using the exercise price and remaining option life from Equilar, the stock price from Compustat, the risk-free rate that best corresponds to the option’s time to maturity from CRSP, annualized daily volatility estimated over three years, and the dividend yield defined as annual cash dividends divided by share price. The value of inside debt is accumulated pensions plus the balance of non-qualified deferred compensation (“Balance NQDC”). The executives’ inside debt-equity (D/E) ratio (“Executive D/E ratio”) equals the value of inside debt divided by the total value of shares and options owned. The k -ratio equals the personal debt-equity ratio divided by the firm’s external debt-equity ratio. Panel C presents correlations amongst inside debt and all control variables.

Panel A: Bank data summary statistics

	N	Mean	S.D.	p25	p50	p75
Total assets (bln \$)	319	44.7	209.4	1.0	2.1	6.7
Log(total assets (mln \$))	319	8.1	1.8	6.9	7.6	8.8
Total liabilities (bln \$)	319	41.5	196.7	0.9	1.9	6.0
Log(total liabilities (mln \$))	319	8.0	1.8	6.8	7.5	8.7
Equity market value (bln \$)	319	6.2	26.0	0.1	0.4	1.4
Log(equity market value (mln \$))	319	6.4	1.8	5.0	6.0	7.2
Total debt (bln \$)	319	17.1	91.0	0.1	0.3	1.0
Log(total debt (mln \$))	318	6.0	2.2	4.7	5.5	6.9
Net income / total assets	319	0.01	0.00	0.01	0.01	0.01
Net income / book equity	319	0.11	0.05	0.08	0.12	0.14

(Continued on next page)

Table 1: Summary statistics (Continued)

Panel A: Bank data summary statistics (Continued)

	N	Mean	S.D.	p25	p50	p75
<i>Control variables</i>						
Market-to-book	319	1.97	0.71	1.46	1.86	2.28
Return on assets	319	0.02	0.01	0.02	0.02	0.03
Market leverage (%)	319	83.14	5.53	80.26	83.73	86.65
Tier-1 capital ratio	281	0.11	0.03	0.09	0.11	0.12
<i>Bank risk (in percentages)</i>						
Buy-and-hold return 2006	314	5.0	18.5	-4.0	4.6	15.5
Buy-and-hold return 2007-9	319	-52.6	31.9	-77.7	-57.0	-29.3
Annualized volatility 2006	319	23.1	6.8	18.0	22.3	27.5
Annualized volatility 2007-9	319	79.6	32.9	58.3	72.3	94.7
Value-at-risk 2006	319	2.5	0.7	1.9	2.5	3.0
Value-at-risk 2007-9	319	7.3	2.7	5.5	6.9	8.6
Expected shortfall 2006	319	3.6	1.0	2.9	3.5	4.1
Expected shortfall 2007-9	319	11.1	4.5	8.1	10.2	13.2
CoVaR 2006	319	4.0	1.6	2.8	3.9	4.9
CoVaR 2007-9	319	14.2	6.9	9.2	13.9	17.9
Low-quality real estate	155	0.55	0.86	0.07	0.31	0.66
Writedowns	282	3.3	3.6	1.0	2.1	4.4
Pre-crisis growth in repos	103	11.2	67.2	-10.6	4.7	27.5
Log(Non-interest income)	232	-11.4	81.4	-61.2	-21.6	29.3

Table 1: Summary statistics (Continued)

Panel B: Executive data summary statistics

	N		Mean		S.D.		p25		p50		p75	
	CEO	CFO	CEO	CFO	CEO	CFO	CEO	CFO	CEO	CFO	CEO	CFO
Age	284	226	54	48	7	7	49	43	55	48	59	53
Value of shares (mln \$)	286	228	58.50	6.50	280.00	14.40	2.80	0.84	5.99	1.86	31.50	5.45
Value of options (mln \$)	286	228	8.09	1.37	25.60	3.38	0.17	0.07	0.83	0.27	4.02	1.07
Cash bonus (mln \$)	286	228	0.79	0.28	2.24	0.74	0.05	0.02	0.14	0.07	0.47	0.17
<i>Control variables</i>												
Equity delta (%)	286	228	5.0	5.0	2.6	2.7	3.2	3.2	4.5	4.6	6.1	6.1
Equity vega (%)	286	228	0.3	0.4	1.0	0.9	0.1	0.1	0.2	0.3	0.3	0.4
Total annual compensation (mln \$)	286	228	3.33	1.05	8.36	2.40	0.54	0.27	0.86	0.38	2.21	0.79
<i>Inside debt</i>												
Accumulated pensions (mln \$)	234	183	2.80	0.52	5.70	1.23	0.33	0.06	0.81	0.15	2.62	0.39
Balance NQDC (mln \$)	177	131	3.22	0.65	8.71	1.68	0.19	0.05	0.47	0.17	1.73	0.46
Value of inside debt (mln \$)	286	228	4.28	0.79	10.80	1.98	0.41	0.07	0.94	0.23	3.24	0.62
Inside debt / salary	285	228	5.89	2.39	10.10	4.39	1.08	0.38	2.63	1.09	6.42	2.33
Executive D/E ratio	286	228	0.25	0.27	0.64	0.84	0.04	0.04	0.12	0.10	0.27	0.20
Log of inside debt ratio	286	228	-1.01	-1.16	2.19	2.08	-2.35	-2.37	-1.07	-1.20	0.01	-0.07

Panel C: correlations table for the main explanatory variables

	Log of inside debt ratio	Equity vega	Equity delta	Log of total annual compensation	Log of equity market value	Market-to-book ratio	Return on assets	Market leverage
Equity vega	0.02							
Equity delta	0.06	0.24						
Log of total annual compensation	-0.17	-0.01	-0.35					
Log of equity market value	-0.19	0.11	-0.44	0.84				
Market-to-book ratio	0.22	-0.13	-0.28	0.24	0.29			
Return on assets	0.08	-0.10	-0.37	0.44	0.45	0.51		
Market leverage	-0.36	0.10	0.14	-0.20	-0.23	-0.62	-0.41	
Depository bank (0/1)	0.22	0.04	0.14	-0.40	-0.30	-0.18	-0.50	0.06

Table 2: End-of-2006 inside debt and bank shareholder risk during the crisis

Robust regression analysis of stock market losses, total return volatility, idiosyncratic volatility, and systematic volatility, all calculated from July 2007 - March 2009 and regressed against CEO or CFO inside debt and control variables. Equity market losses are represented by buy-and-hold returns multiplied with minus one, and constructed as described in Section 2.2. Idiosyncratic volatility (systematic volatility) is defined as the standard deviation from residuals (fitted values) of the Fama-French three-factor model. All dependent variables are in percentages and all independent variables are measured at the end of 2006 and defined in Table 1. Reported in parentheses are p -values (two-tailed except for the variable of interest, in italics) based on standard errors that are adjusted for heteroskedasticity. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	Stock market losses		Total volatility		Idiosyncratic volatility		Systematic volatility	
	CEO	CFO	CEO	CFO	CEO	CFO	CEO	CFO
<i>Log of inside debt ratio</i>	-3.650*** (0.000)	-3.745*** (0.001)	-0.150*** (0.007)	-0.139** (0.042)	-0.158*** (0.003)	-0.147** (0.023)	-0.028 (0.226)	-0.009 (0.43)
Equity vega	0.988 (0.255)	1.484 (0.346)	-0.020 (0.779)	0.021 (0.851)	-0.033 (0.666)	-0.020 (0.852)	0.036 (0.223)	0.053 (0.295)
Equity delta	-1.936*** (0.007)	-0.894 (0.294)	-0.134*** (0.004)	-0.045 (0.369)	-0.091** (0.045)	-0.011 (0.803)	-0.117*** (0.000)	-0.083** (0.027)
Log of total annual compensation	11.624*** (0.000)	5.927 (0.190)	0.498** (0.010)	0.257 (0.479)	0.508** (0.011)	0.326 (0.406)	0.040 (0.737)	-0.228** (0.042)
Log of equity market value	-6.136*** (0.001)	-1.900 (0.404)	-0.156 (0.216)	0.058 (0.786)	-0.505*** (0.000)	-0.310 (0.176)	0.570*** (0.000)	0.683*** (0.000)
Market-to-book ratio	-0.394 (0.890)	-0.309 (0.925)	0.078 (0.604)	0.142 (0.434)	0.094 (0.528)	0.081 (0.637)	0.005 (0.964)	0.133 (0.341)
Return on assets	4.210* (0.074)	6.657** (0.016)	0.050 (0.790)	0.226 (0.218)	0.118 (0.528)	0.333* (0.062)	-0.100 (0.349)	-0.124 (0.314)
Market leverage	1.298*** (0.000)	1.273*** (0.002)	0.105*** (0.000)	0.112*** (0.000)	0.123*** (0.000)	0.129*** (0.000)	-0.010 (0.553)	-0.004 (0.841)
Depository bank (0/1)	8.650 (0.216)	9.458 (0.300)	-0.047 (0.932)	0.220 (0.720)	-0.534 (0.383)	-0.247 (0.704)	0.699** (0.035)	0.545 (0.185)
Intercept	-188.946*** (0.000)	-142.544** (0.038)	-9.319*** (0.005)	-8.936* (0.078)	-9.697*** (0.004)	-9.799* (0.069)	-0.710 (0.722)	1.461 (0.548)
Observations	286	228	286	228	286	228	286	228
Adj. R-squared	0.212	0.137	0.165	0.120	0.182	0.135	0.555	0.536

Table 3: End-of-2006 inside debt and total bank risk during the crisis

Robust regression analysis of value-at-risk (VaR), expected shortfall (ES), CoVaR, and financial distress, all calculated from July 2007 - March 2009 and regressed against CEO or CFO inside debt and control variables. VaR, ES, and CoVaR are defined as described in Section 2.2. "Financial distress" is a dummy variable equal to one if financial institutions have a survivorship-adjusted buy-and-hold return of -80% or worse, and zero otherwise. All dependent variables are in percentages and all independent variables are measured at the end of 2006 and defined in Table 1. Reported in parentheses are p -values (two-tailed except for the variable of interest, in italics) based on standard errors that are adjusted for heteroskedasticity. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	VaR		ES		CoVaR		Financial distress (0/1)	
	CEO	CFO	CEO	CFO	CEO	CFO	CEO	CFO
<i>Log of inside debt ratio</i>	-0.216*** (0.004)	-0.192** (0.026)	-0.293** (0.014)	-0.319** (0.030)	-0.191 (0.162)	-0.287 (0.125)	-0.191*** (0.000)	-0.145** (0.015)
Equity vega	-0.018 (0.851)	0.086 (0.553)	-0.027 (0.858)	0.177 (0.495)	-0.077 (0.669)	0.335 (0.398)	-0.428 (0.358)	-0.055 (0.549)
Equity delta	-0.172*** (0.004)	-0.033 (0.623)	-0.266*** (0.007)	-0.074 (0.478)	-0.513*** (0.001)	-0.290* (0.079)	-0.126*** (0.007)	-0.124** (0.011)
Log of total annual compensation	0.596** (0.031)	0.647** (0.035)	1.050** (0.015)	0.977 (0.175)	0.953 (0.150)	0.778 (0.342)	0.380** (0.033)	0.179 (0.369)
Log of equity market value	-0.275 (0.106)	-0.188 (0.254)	-0.293 (0.289)	-0.042 (0.917)	0.978** (0.017)	1.121** (0.022)	-0.114 (0.310)	0.017 (0.876)
Market-to-book ratio	0.115 (0.573)	0.240 (0.294)	0.124 (0.704)	0.274 (0.460)	0.031 (0.954)	0.368 (0.551)	-0.219 (0.211)	-0.248 (0.168)
Return on assets	0.210 (0.420)	0.486* (0.058)	0.249 (0.540)	0.596 (0.155)	-0.345 (0.493)	-0.137 (0.801)	-0.030 (0.849)	0.042 (0.818)
Market leverage	0.137*** (0.000)	0.144*** (0.000)	0.262*** (0.000)	0.257*** (0.000)	0.156** (0.043)	0.120 (0.172)	0.041 (0.104)	0.040 (0.136)
Depository bank (0/1)	-0.264 (0.725)	0.348 (0.661)	-0.284 (0.797)	0.594 (0.640)	1.664 (0.229)	2.644 (0.128)	0.157 (0.748)	-0.057 (0.920)
Intercept	-10.487** (0.020)	-13.981** (0.012)	-22.925*** (0.001)	-25.331** (0.014)	-16.406* (0.092)	-14.677 (0.252)	-7.919** (0.015)	-5.653 (0.120)
Observations	286	228	286	228	286	228	286	228
Adj. / Pseudo R-squared	0.166	0.132	0.186	0.157	0.228	0.188	0.201	0.160

Table 4: End-of-2006 inside debt and bank risk-taking policies around the crisis

Robust regression analysis of low-quality real estate, writedowns, repo growth, and non-interest income, regressed against CEO or CFO inside debt and control variables. “Low quality real estate” is nonperforming assets on real estate [NPAORE] plus other real estate owned assets [OREO] in December 2008, relative to total assets and the resulting variable multiplied by 100. “Writedowns” is provisions for credit losses [PCL] and other provisions [PVON], pretax writedowns [WDP], losses on investment securities [INVSGL], and allowances or reserves for other losses [AROL], all summed over 2007 and 2008 and scaled by total assets. “Repo growth” is the proportional change in repurchase agreements [RPAGQ] from December 2006 to July 2007. “Non-interest income” is total noninterest income [NINT] divided by net operating income (noninterest income + interest income [TNI]) – interest expense [XINT], with the resulting variable log-transformed. All dependent variables are in percentages and all independent variables are measured at the end of 2006 and defined in Table 1. Reported in parentheses are p -values (two-tailed except for the variable of interest, in italics) based on standard errors that are adjusted for heteroskedasticity. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	Low-quality real estate		Writedowns		Repo growth		Non-interest income	
	CEO	CFO	CEO	CFO	CEO	CFO	CEO	CFO
<i>Log of inside debt ratio</i>	-0.119*** (0.002)	-0.110*** (0.006)	-0.357*** (0.000)	-0.262*** (0.008)	-8.403*** (0.002)	-7.367*** (0.020)	-6.589** (0.015)	-5.850** (0.037)
Equity vega	-0.230 (0.306)	0.095 (0.530)	-2.544*** (0.001)	-0.353 (0.626)	-15.679 (0.541)	-30.582 (0.247)	-6.253 (0.819)	32.769 (0.160)
Equity delta	-0.058** (0.025)	-0.031 (0.262)	-0.206*** (0.004)	-0.144* (0.063)	4.577 (0.338)	1.413 (0.672)	3.675 (0.153)	0.408 (0.883)
Log of total annual compensation	0.224* (0.078)	0.001 (0.992)	0.773** (0.039)	-0.252 (0.640)	17.336 (0.274)	-11.222 (0.436)	-2.844 (0.777)	-4.204 (0.727)
Log of equity market value	-0.285*** (0.008)	-0.172** (0.043)	-0.385 (0.127)	0.151 (0.596)	-19.452 (0.149)	1.357 (0.886)	15.854** (0.020)	16.534** (0.011)
Market-to-book ratio	-0.038 (0.815)	-0.004 (0.979)	-0.630 (0.102)	-0.451 (0.256)	-6.080 (0.535)	2.805 (0.731)	5.407 (0.587)	15.290 (0.166)
Return on assets	0.100 (0.302)	0.110 (0.297)	0.534 (0.119)	0.825** (0.024)	47.690* (0.052)	18.156 (0.247)	-48.409*** (0.000)	-50.919*** (0.000)
Market leverage	-0.030 (0.174)	-0.042 (0.187)	0.036 (0.443)	0.077 (0.132)	-1.498 (0.461)	-1.389 (0.191)	3.308** (0.044)	5.065*** (0.001)
Depository bank (0/1)	0.825*** (0.001)	0.750*** (0.000)	2.014*** (0.009)	2.845*** (0.000)			-23.943 (0.784)	88.420*** (0.000)
Intercept	0.961 (0.629)	4.145 (0.180)	-8.792 (0.177)	-4.071 (0.601)	-106.288 (0.641)	210.799 (0.206)	-229.002 (0.182)	-489.853** (0.011)
Observations	146	116	256	201	100	67	214	168
Adj. R-squared	0.117	0.0524	0.156	0.0555	0.126	0.0421	0.312	0.348

Table 5: End-of-2006 inside debt and bank risk during the crisis: Two-stage least squares

Two-stage least squares (2SLS) analysis of bank risk regressed against CEO or CFO inside debt and control variables. Inside debt is instrumented by the executive's age, measured at the end of 2006. Panel A reports the results from 1st-stage regressions of CEO or CFO inside debt on age and the exogenous control variables included previously. The partial R -squared is the fraction of the variation in inside debt explained by age, net of its effect through the other explanatory variables. The Kleibergen-Paap F -statistic and LM statistic are heteroskedasticity-robust tests for weak identification and underidentification problems, respectively. Panel B reports the results from the 2nd-stage regressions of stock market losses, total volatility, value-at-risk ("VaR"), expected shortfall ("ES"), and CoVaR, all calculated from July 2007 - March 2009 and regressed against inside debt and all control variables from the main regressions, with inside debt as the endogenous variable. Reported in parentheses are p -values (two-tailed except for the variable of interest, in italics) based on standard errors that are adjusted for heteroskedasticity. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

Panel A: First-stage results

	CEO	CFO
Executive age	0.082*** (0.000)	0.057*** (0.001)
All variables from main regressions	YES	YES
Observations	284	226
Adj. R -squared	0.270	0.239
Partial R -squared	0.079	0.045
Kleibergen-Paap F -statistic (H_0 : weakly identified)	20.16	12.43
Kleibergen-Paap LM statistic (H_0 : underidentified)	19.46 (0.000)	11.08 (0.000)

Table 5: End-of-2006 inside debt and bank risk during the crisis: Two-stage least squares (continued)

Panel B: Second-stage results

	Stock market losses		Total volatility		VaR		ES		CoVaR	
	CEO	CFO	CEO	CFO	CEO	CFO	CEO	CFO	CEO	CFO
<i>Log of inside debt ratio</i>	-4.047*	-9.467**	0.058	-0.418	-0.058	-0.639*	0.145	-0.867	-0.162	-0.628
	(0.078)	(0.033)	(0.393)	(0.133)	(0.407)	(0.090)	(0.368)	(0.134)	(0.405)	(0.272)
Equity vega	1.345	3.127	-0.077	0.109	-0.026	0.243	-0.120	0.379	-0.068	0.341
	(0.242)	(0.148)	(0.410)	(0.434)	(0.830)	(0.188)	(0.559)	(0.239)	(0.809)	(0.434)
Equity delta	-2.004***	-1.124	-0.136***	-0.054	-0.168***	-0.051	-0.264***	-0.095	-0.527***	-0.308*
	(0.003)	(0.207)	(0.003)	(0.297)	(0.003)	(0.461)	(0.006)	(0.364)	(0.001)	(0.050)
Log of total annual compensation	12.664***	5.725	0.487***	0.237	0.706***	0.658**	1.115***	0.994	1.036*	0.638
	(0.000)	(0.244)	(0.009)	(0.481)	(0.004)	(0.040)	(0.007)	(0.170)	(0.094)	(0.427)
Log of equity market value	-6.259***	-2.986	-0.089	-0.052	-0.232	-0.304	-0.153	-0.240	0.998**	1.112**
	(0.001)	(0.303)	(0.537)	(0.818)	(0.206)	(0.186)	(0.617)	(0.598)	(0.018)	(0.043)
Market-to-book ratio	0.469	-0.109	0.090	0.173	0.148	0.260	0.148	0.316	0.138	0.381
	(0.860)	(0.976)	(0.546)	(0.408)	(0.467)	(0.296)	(0.656)	(0.419)	(0.786)	(0.550)
Return on assets	4.494**	7.598***	-0.014	0.152	0.312	0.536**	0.258	0.547	-0.390	-0.190
	(0.038)	(0.002)	(0.947)	(0.439)	(0.215)	(0.019)	(0.560)	(0.185)	(0.501)	(0.732)
Market leverage	1.382***	0.512	0.137***	0.053	0.177***	0.075	0.342***	0.157	0.177	0.084
	(0.010)	(0.554)	(0.000)	(0.395)	(0.000)	(0.349)	(0.000)	(0.229)	(0.137)	(0.627)
Depository bank (0/1)	17.120**	24.989**	-0.502	0.025	0.965	1.643**	0.146	1.325	2.048	1.905
	(0.031)	(0.017)	(0.542)	(0.976)	(0.243)	(0.025)	(0.929)	(0.398)	(0.477)	(0.487)
Intercept	-219.144***	-91.539	-11.487***	-3.062	-16.864***	-9.450	-31.370***	-17.186	-19.688*	-9.169
	(0.000)	(0.308)	(0.003)	(0.660)	(0.001)	(0.250)	(0.000)	(0.234)	(0.061)	(0.616)
Observations	284	226	284	226	284	226	284	226	284	226

Table 6: Additional evidence from CEOs and CFOs with and without inside debt holdings

Robust regression analysis of stock market losses, volatility, value-at-risk (“VaR”), expected shortfall (“ES”), and CoVaR, regressed against inside debt and all control variables from the main regressions. The previously used inside debt measure is replaced by indicator variables. In Panels A and C, the indicator is equal to one if positive inside debt holdings are reported in the proxy statements, and zero otherwise. In Panel B and D, the indicator is equal to one if positive accumulated pensions are reported in the proxy statements, and zero otherwise. All other variables are as defined previously. Reported in parentheses are one-tailed p -values based on standard errors that are adjusted for heteroskedasticity. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

Panel A: CEOs with and without inside debt

	Stock market losses	Volatility	VaR	ES	CoVaR
<i>CEO with inside debt (0/1)</i>	-8.632*** (0.007)	-0.757*** (0.003)	-0.937*** (0.004)	-1.602*** (0.002)	-1.904*** (0.004)
Variables from main regressions	YES	YES	YES	YES	YES
Observations	429	429	429	429	429
Adj. R-squared	0.098	0.124	0.134	0.130	0.175

Panel B: CEOs with and without pensions

	Stock market losses	Volatility	VaR	ES	CoVaR
<i>CEO with pension (0/1)</i>	-9.541*** (0.001)	-0.441** (0.028)	-0.605** (0.023)	-0.919** (0.028)	-1.517** (0.011)
Variables from main regressions	YES	YES	YES	YES	YES
Observations	429	429	429	429	429
Adj. R-squared	0.105	0.112	0.125	0.118	0.172

Panel C: CFOs with and without inside debt

	Stock market losses	Volatility	VaR	ES	CoVaR
<i>CFO with inside debt (0/1)</i>	-7.987*** (0.006)	-0.528*** (0.009)	-0.738*** (0.005)	-1.240*** (0.004)	-1.160** (0.038)
Variables from main regressions	YES	YES	YES	YES	YES
Observations	423	423	423	423	423
Adj. R-squared	0.082	0.088	0.113	0.117	0.187

Panel D: CFOs with and without pensions

	Stock market losses	Volatility	VaR	ES	CoVaR
<i>CFO with pension (0/1)</i>	-9.738*** (0.001)	-0.504*** (0.010)	-0.741*** (0.004)	-1.146*** (0.006)	-1.325** (0.022)
Variables from main regressions	YES	YES	YES	YES	YES
Observations	423	423	423	423	423
Adj. R-squared	0.091	0.086	0.111	0.114	0.185

Table A1: Attrition of banks included in sample

The main sample includes 319 lending institutions in fiscal year 2006. “Merged or acquired” signifies that the institution left the sample due to an acquisition or merger during the sample period, and “Delisted by exchange” signifies a delisting of the institution due to a violation of listing requirements or bankruptcy. “Remaining in sample” signifies that the institution is still listed on a major US exchange by March 2009.

	With inside debt	
	Freq.	Percent
Merged or acquired	23	7.21
Delisted by exchange	32	10.03
Remaining in sample	264	82.76
Total	319	100.00

Figure 1: Evolution of lost equity market value for varying inside debt holdings

The figure demonstrates how stock market losses accumulate for two portfolios constructed by sorting banks according to their inside debt holdings. In December 2006, banks are sorted into three portfolios according to the average inside debt ratio of their top-5 executives. Each executive's ratio is weighted by the size of debt holdings of each executive. Tercile portfolios are constructed by cutting the sample at the 30th and 70th percentile. Next, the figure plots the evolution of cumulative value-weighted returns on portfolios 1 ("Low inside debt") and 3 ("High inside debt") in a 21-month moving window from mid-2002 up to end-of-2012. Returns are normalized to 100 percent at the start of the sample. The light-shaded area corresponds to this study's sample period. The dark-shaded areas represent 95% confidence intervals.

