Inside Debt and Bank Performance During the Financial Crisis

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May 2, 2012

Abstract

This paper examines how holdings of defined benefit pensions and deferred compensation (inside debt) influence bank performance during the recent financial crisis. Using a proprietary sample of executives from 319 small and large U.S. banks, I find that banks with larger end-of-2006 inside debt holdings generate higher returns, display a smaller increase in downside risk, and have a smaller probability of distress from July 2007 to March 2009. Inside debt is also positively associated with conservative balance sheet management pre-crisis, and a better-quality asset portfolio in December 2008. The findings suggest that debtholder governance moderates bank risk-taking, with important implications for the stability and governance of financial institutions.

Keywords: Executive Compensation, Risk Management, Financial Institutions

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1 Introduction

The poor incentives from bank executives' compensation are frequently named as a cause for the near collapse of the U.S. banking industry that initiated the recent global credit crisis. 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, not withstanding increased scrutiny by journalists, regulators, and lawmakers, the academic evidence on whether compensation affected performance during the crisis is mixed. A leading example of this literature is Fahlenbrach and Stulz (2011) who find no evidence that the equity pay structure has affected 2007-2008 shareholder performance for banks. If anything, their evidence is to the contrary.

Their result is actually not surprising from a theoretical perspective as bank shareholders worry about executives taking too *little* risk. To prevent underinvestment, firms pay contingent stock-based and options-based compensation in order to increase shareholder value by encouraging risk-taking (Guay (1999); Coles et al. (2006)). Therefore, bank executives may have acted in the best interest of their shareholders. However, other agency problems have received only little attention in the public, political, and academic discourse on the financial crisis. This study fills this gap by considering the interests of bank executives and those of debtholders during the financial crisis.

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

[1] For instance, specifically targeting the U.S. financial sector, 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. More recently, 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 exist such as the Financial Stability Forum's "Principles for Sound Compensation Practices."

Meckling (1976)). Debt-based incentives (or "inside debt" such as defined benefit pensions and deferred compensation) ameliorate such risk-shifting problems since they consist 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)). Therefore, theory predicts that managers with debt-based incentives manage their firms more conservatively, a result that has recently been confirmed empirically for industrial firms (Cassell et al. (2012)).[2]

Using a proprietary sample of executives from 319 U.S. banks, this paper examines whether variations in inside debt are associated with meaningful differences in bank performance during the crisis. I investigate "performance" from the perspective of shareholders as well as debtholders by measuring both survivorship-adjusted shareholder returns and downside risk. Since downside risk can only be observed directly for about twenty of the very largest banks that have publicly traded debt instruments, I proxy downside risk using the lower tail of the stock returns distribution.[3] The paper also investigates the association between inside debt and two mechanisms through which bank riskiness was increased or reduced. Both are specific to banks and generally considered direct causes of the current financial crisis: the fraction of risky assets in a bank's asset portfolio and the short-term market borrowing to fund these assets.

[2]Interestingly, a current working paper by Tung and Wang (2010) discusses the impact of inside debt on returns from shareholders and bondholders for the largest 20 to 83 U.S. banks. As explained in the next section, my paper is different in that it primarily focuses on shareholders' and creditors' risk implications.

[3]Specifically, downside risk is proxied by value-at-risk (VaR) and expected shortfall (ES). VaR (Guldimann et al. (1994)) represents the loss that could occur over a given period of time with a given probability. Since it is the main statistic used in external reports, internal audit ratings, and regulatory reporting, a change in VaR represents an *ex post* assessment of an institution's willingness to absorb losses. ES (Artzner et al. (1999)) is the average capital loss when losses exceed the VaR threshold. Therefore, a change in ES summarizes the exposure to excessive, rare events like the mortgage crisis starting in 2007. VaR and ES incorporate skewed and fat-tailed returns distributions that characterize crisis periods, as well as the risk of off-balance sheet items that have played a key role in the crisis.

Consistent with theoretical predictions, I find that banks with larger inside debt holdings (i.e., defined benefit pensions and deferred compensation) at the end of 2006 have higher returns and smaller exposures to downside risk between July 1, 2007, and March 31, 2009. Furthermore, inside debt is associated with a smaller fraction of nonperforming real estate assets in December 2008 as well as less balance sheet expansion before the crisis, indicating that inside debt holdings moderate risk-taking within banks. The results continue to hold after controlling for a series of variables and for several definitions of inside debt and performance. The results are further corroborated using instrumental variables.

Several contributions are made to the literature. For instance, this paper is the first to establish a link between debt-based executive compensation and the downside risks borne by shareholders and creditors. It also links inside debt to oft-cited risk-taking mechanisms that proved important in explaining the recent financial crisis. Second, exploring the market implications of debt-based pay during a period of economic turmoil leads to new insights. While previous findings suggest that debt-based pay generally leads to lower equity prices (Wei and Yermack (2011)), the results in this paper suggest that it also moderates losses under adverse economic conditions. Third, this study offers guidelines for the broader public policy issue of how to best regulate compensation within financial institutions. Since the near collapse of the financial system in 2007-2008, a widespread assumption gained ground that managerial risk-taking within financial institutions will be more effectively monitored once more power is assigned to shareholders (see footnote 1). However, for the purpose of limiting bank risk, the results in this paper suggest that power should be shifted to debtholders rather than shareholders.

The remainder of this paper is organized as follows. Section 2 describes the relevant literature and presents hypotheses. Section 3 describes the empirical model, and how the data

and variables in this study are constructed. Section 4 examines how inside debt contracts in 2006 affect risk, performance, and banks' risk-taking policies during the financial crisis. Section 5 concludes.

2 Empirical expectations

Equity-based compensation can lead to excessive risk-taking in companies with unsecured debt, since shareholders have unlimited upside potential if risky strategies work out favorably but share the losses with debtholders if strategies work out unfavorably (Jensen and Meckling (1976)). The shifting of risk toward debtholders is exacerbated in the financial sector as banks are highly leveraged (Bebchuk and Spamann (2010)). Furthermore, banks also have incentives to shift risk toward taxpayers. This results from several public institutions intended to safeguard an uninterrupted supply of credit and capital, including a "lender of last resort" (Bagehot (1873)), federal deposit insurance (Diamond and Dybvig (1983)) and implicit government guarantees for banks that are "too inter-connected to fail" (O'Hara and Shaw (1990); Veronesi and Zingales (2010)).[4] Bolton et al. (2010) formalize this by showing that if an executive's actions are unobservable, she will shift risks toward debtholders and taxpayers by undertaking excessive risk. Furthermore, it follows from their model that shareholders actually prefer the excessive risk-taking over compensation that is tied to the default riskiness of the firm.

To remediate risk-shifting problems, several studies argue that incentives for bank managers should be shifted away from shareholder interests, and towards the long-term solvency of the firm. To this end, previous research argues that management compensation should be

[4]Without these institutions, banks would be facing bank runs (Diamond and Dybvig (1983)) and asset price spirals (Brunnermeier (2009)) that can have grave economic consequences.

incorporated in the federal deposit insurance premium (John et al. (2000)), tied to the value of debt-like instruments (Bebchuk and Spamann (2010)), or linked to a bank's credit default swap (CDS) spread (Bolton et al. (2010)). Shareholder interests could also be re-aligned via the pricing of government guarantees and capital charges (Carpenter et al. (2011)). However, the potential role of inside debt in aligning bankers' incentives has received only little attention.

An exception is a current working paper by Tung and Wang (2010) that examines the impact of inside debt on shareholder returns for the largest 83 banks, and bond returns for the largest 20 banks. Recent updates of this paper describe bank risk-taking using investments in mortgage-backed securities and loan loss provisions, and now have become more similar to my paper. Their main finding is that stock and bond returns are lower for banks with more inside debt. While these results are consistent with my claim that more inside debt has led to better bank performance during the crisis, they could also indicate that shareholder and bondholder risk is simply lower for banks with more inside debt. Furthermore, bondholders constitute only a relatively small part of most banks' creditors, which also include depositors and taxpayers. My study complements theirs by investigating 319 large and small U.S. banks, and focusing on the implications of inside debt for shareholder and creditor risk. Furthermore, I attempt to address issues related to sample selection (e.g., the largest banks have very different risk-taking incentives due to too-big-to-fail guarantees), survivorship bias (see Section 3.2 below), and several sources of endogeneity (see Section 4.4 below).

The theoretical argument for inside debt is appealing. First, when debt-based compensation is large compared to equity-based compensation, the incentive effects of equity-based holdings will be reduced (Cassell et al. (2012)). Second, since pension benefits and deferred compensation are unsecured and unfunded, executives would stand in line with other unse-

cured creditors in the event of default (Sundaram and Yermack (2007)). Indeed, theory predicts that the value of inside debt holdings is sensitive to both the probability of bankruptcy and the liquidation value of the firm in the event of bankruptcy or reorganization (Edmans and Liu (2011)). It can therefore be expected that inside debt holdings encourage more conservative management decisions. Since managerial conservatism is particularly valuable when economic conditions deteriorate, I expect to find two empirical results.

First, if inside debt discourages managers to take decisions that involve more risk, this should positively affect enterprise value after the crisis sets in. It follows that inside debt holdings are associated with better shareholder performance when a negative shock occurs. Thus, I expect that larger pre-crisis inside debt holdings are associated with a smaller decrease in banks' market capitalization during the crisis.

Second, as discussed just above, shareholder interests may differ from the interests of debtholders. While shareholders receive all the remaining cash flows after debt repayment, debtholders have no upside potential other than the periodic interest payments and the payout of face value when the debt matures. At the same time, unsecured debtholders face significant downside risk as they may loose a portion of their principal. Hence, since the value of debt claims increases with the likelihood that debtholders will be paid in full, I expect that larger pre-crisis inside debt holdings are associated with a smaller increase in downside risk during the crisis.

Up to 2006, limited public data about defined benefit pensions and deferred compensation permitted little empirical confirmation of this idea. However, after the Securities and Exchange Commission (SEC) adopted new disclosure requirements in 2007, several studies found that inside debt encourages more conservative investment and financial decisions that avoid risk and preserve liquidity, thereby reducing the agency problem of debt. Specifically,

inside debt has been associated with a lower cost of debt (Anantharaman et al. (2010); Wang et al. (2010)), 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)), more conservative financial and investment policies (Cassell et al. (2012)), and higher bond prices (Wei and Yermack (2011)). This paper builds on this literature by examining the link between inside debt and shareholder and debtholder performance for banks during the financial crisis.

3 Data and variables

Data for this study come from financial institutions drawn from the Russell 3000 index in 2006, which measures the performance of the largest 3000 U.S. companies representing approximately 98% of the investable U.S. equity market. The compensation data of Russell 3000 companies is obtained from Equilar, an executive compensation data firm. Compared to 129 of the very largest banks that are S&P 1500 member, this number almost quadruples for Russell 3000 members to an initial list of 542 eligible financial institutions.

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. Further, firms are selected with Standard Industry Classification (SIC) codes between 6000 and 6300 for the fiscal year 2006. 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, for each

firm, I determine whether it (or a substantial part) 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, this paper focuses on firms that have nonzero inside debt. Using CUSIP/ticker/name combinations, the Equilar compensation data is matched to pricing data from the Center for Research in Security Prices (CRSP), and accounting data from Standard and Poor's Compustat. Duplicate matches are combined or removed, and non-matches are verified manually. This results in a final sample of 319 banks.

3.1 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 debt to equity holders 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 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 k-ratio defined as the D/E ratio of the manager relative to that of the owner:

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

where inside debt (D^I) comprises of 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 (excluding unvested stock and equity incentive plan awards) and summing the tranche values to a grand total for each executive. 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.

Notwithstanding the theory behind the k-ratio, Wei and Yermack (2011) argue that "managers tend to hold much of their equity in stock options that have finite expirations and convex slopes with respect to firm value, while much of the firm's equity takes the form of shares that have unlimited lives and linear slopes with respect to firm value. Moreover, the manager's inside debt may have a different duration than the debt securities issued externally by the firm." To address this problem, Wei and Yermack introduce a measure that is based on changes in the value of debt and equity, rather than their levels.

They define the "relative incentive ratio" as

$$k^* = \frac{\Delta D^I / \Delta D^F}{\Delta E^I / \Delta E^F}, \tag{2}$$

with "total delta" $\Delta E^I = S \times \Delta^S + N \times \Delta^N$, where S and N are the number of shares and options held by the executive, Δ^N is the option sensitivity with respect to the stock price,

and Δ^S is assumed to be 1. Next, ΔE^I is approximated by calculating the delta of a "representative" company option from the total number of employee stock options outstanding and their average exercise price, available from Equilar, and an assumed time-to-maturity of four years. Wei and Yermack (2011) further assume that $\Delta D^I/\Delta D^F \approx D^I/D^F$.

3.2 Performance

Buy-and-hold returns On 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." Other funds with sub-prime investments were also suspended and bank stocks lost substantial ground until the first quarter of 2009. Therefore, to explain the cross-sectional variation in long-run shareholder performance, I calculate buy-and-hold returns from July 2007 to March 2009.

Table A1 shows how many sample banks survived, entered bankruptcy, merged or were acquired from fiscal year-end 2006 to March 2009. Of the 319 banks in the sample with available stock data on December 2006, almost 1 in 5 banks were acquired by other firms, or delisted due to a violation of listing requirements or bankruptcy. The banks that disappear from the initial sample cloud the positive relation between inside debt and bank performance by the potential for survivorship bias. Specifically, 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, buy-and-hold 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%. However, if healthy banks are taken over, the buy-and-hold return includes the takeover premium paid by the acquirer.

Tail risk In contrast to shareholders whose aim is to increase upside risk, debtholders worry primarily about limiting downside risk. Hence, an appropriate measure for creditor risk needs to distinguish gains from losses. In addition, since the empirical distribution of stock returns from 2007 to 2010 is skewed and has fat tails, the risk measure should not assume normality and can be estimated non-parametrically. 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.[5]

Therefore, I represent debtholder performance by changes in value-at-risk (VaR) and expected shortfall (ES). VaR and ES examine the lower tail of the returns distribution and are designed for measuring and managing risk within financial institutions. Given a probability level α that indicates the difference between "likely" and "extreme" loss, VaR

[5]These requirements reject the measures previously used to analyze executive compensation including (idiosyncratic) stock price volatility as in Saunders et al. (1990), DeFusco et al. (1990), Cohen et al. (2000), Balachandran et al. (2010), and Tung and Wang (2010) (who don't distinguish between upside risk and downside risk); distance-to-default as in Barth and Levine (2001), Sundaram and Yermack (2007), and Beltratti et al. (2010) (that assumes normality) and the Roy (1952) z-score as in Laeven and Levine (2009) (that relies on balance sheet items). Furthermore, since only the very largest companies are able to issue debt instruments, the use of bonds or credit default swaps as in Daniel et al. (2004), Billett et al. (2010), Tung and Wang (2010), and Wei and Yermack (2011) would be impractical for the purpose of this study.

and ES describe different aspects of downside risk. VaR resembles the maximum loss in the majority of "likely" events, whereas ES measures the average loss for a minority of "extremely" negative events.

The value that is "at risk" can be interpreted as a threshold value, such that the probability of the mark-to-market loss exceeding this value within a given time frame is α (Jorion (2007)). For example, if a bank has a one-day 99% VaR of 0.08, there is an $\alpha = 0.01$ probability that the bank's equity will fall in value by more than 8% over a one day period. VaR is a useful quantity for corporate control as it focuses on the largest likely loss. Consequently, VaR is disclosed by financial institutions in external reports, the main statistic employed 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, higher VaR represents more lenient internal, external and regulatory risk governance. VaR (Guldimann et al. (1994)(is defined as the maximum (firm-wide) loss in $100(1-\alpha)\%$ of the time:

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

in which R_{it} is firm i's return at time t, and z is a percentile corresponding to the pre-specified parameter α. Because I am calculating risk *ex post,* it is straightforward to obtain $100(1-\alpha)\%$ daily VaR by selecting the lowest $100\alpha\%$ of daily observations for each firm in a given fiscal year. Assuming that realized returns are an accurate description of the underlying data generating process, value-at-risk 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 elaborate definitions.

Actual losses may not be captured by VaR, which represents the largest likely loss. Therefore, it is fully uninformative about the size of the actual loss if an extreme, unlikely event occurs. To get a better impression of the returns distribution when losses exceed VaR, I also measure the expected loss for the worst $100\alpha\%$ of the cases, i.e., expected shortfall (ES; Artzner et al. (1999)). ES represents the average capital loss when losses exceed the VaR threshold. While VaR focuses on the maximum loss near the center of the returns distribution, ES provides information about losses given a rare event (e.g., the mortgage crisis starting in 2007) by describing the mean of the left tail of the returns distribution.

$$\mathrm{ES}_{it}^{\alpha}\left(R_{it}\right) = -\mathbb{E}\left[R_{it} \mid R_{it} \leq \mathrm{VaR}_{it}^{1-\alpha}\left(R_{it}\right)\right].$$

This definition describes the mean return from the $100\alpha\%$ of observations that are excluded to calculate $100(1-\alpha)\%$ daily VaR, and can be interpreted as the average loss suffered in the worst $100\alpha\%$ of the time.

Since all returns in the left tail are negative, I multiply VaR and ES with minus one in the equations above. This facilitates an interpretation in terms of performance with a positive coefficient indicating a positive effect on risk. Next, I examine within-firm changes in Var and ES over the same period as the buy-and-hold returns, from July 2007 to March 2009. Furthermore, when banks delist, I include CRSP's delisting return on the date of delisting, which is calculated by comparing the security's value after it delists with its price on the last day of trading. This increases ES when banks delist or are taken over due to bankruptcy. Finally, in the results below, a threshold level of $\alpha = 0.05$ is assumed. It is verified that

different values for α yield similar results. For instance, in unreported results, coefficient estimates for $\alpha = 0.01$ are larger and of higher significance.

3.3 Empirical model

To test whether variations in inside debt holdings of executive i at the end of 2006 ($Dec06$) are associated with meaningful differences in bank performance during the crisis ending in March 2009 ($Mar09$), a conventional two-period regression model is estimated using ordinary least squares (OLS):

$$\Delta R_{i,Mar09} = \beta_0 + \beta_1 D_{i,Dec06} + \beta_2 X_{i,Dec06} + \varepsilon_{i,Mar09}, \tag{3}$$

where, $\Delta R_{i,Mar09}$ is July 2007-March 2009 bank performance represented by changes in share price (i.e., buy-and-hold returns), changes in VaR, and changes in ES[6]; $D_{i,Dec06}$ is inside debt represented by Eqs. (1) and (2); $X_{i,Dec06}$ is a collection of control variables, and $\varepsilon_{i,Mar09}$ is an error term that is assumed to be normally distributed with mean zero, adjusted for heteroskedasticity, and clustered by firm to control for within-firm dependence. Following previous literature on inside debt (e.g., Cassell et al. (2012)), I report p-values that are two-tailed except for the variables of interest, $D_{i,Dec06}$. Since bank performance during the crisis can be affected by many factors, the following set of control variables are included (with Compustat item codes in square parentheses).

- A large literature on compensation contracts shows that shareholders implement compensation policies that have a positive effect on firm performance and firm risk (e.g., Jensen and Murphy (1990); Guay (1999)). Furthermore, equity incentives and debt

[6] I find similar or stronger (but unreported) results when measuring VaR and ES in levels.

incentives are likely to be set simultaneously. The structure of equity-based incentives is represented by risk incentives and price incentives, and both are calculated in four steps. Risk incentives are calculated as 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 stock volatility. Price incentives are the percentage change in value for a $1 increase in the stock price. Awarded stock is assumed to have a vega of zero and a delta of one. It equals the number of (unearned or unvested) shares, plus those that are owned or have been awarded through an equity incentive plan. Restricted stock, as well as unexercised and unearned options, are treated as if owned unconditionally.

The value of each option tranche is estimated using Black-Scholes, which requires the following items. The stock price is fixed on December 29, 2006. The exercise price and remaining option life are taken from the Equilar database. The dividend yield is calculated from COMPUSTAT as annual cash dividends divided by the share price on December 29, 2006. Annualized daily volatility is estimated over three years from January 1, 2004 to December 29, 2006. I obtain estimates for the risk-free rate on December 29, 2006, from CRSP's U.S. Treasury and Inflation index that correspond as closely as possible to the remaining years before option maturity.

- Current cash compensation (the log of salary plus bonus compensation) proxies for the level of the CEO's outside wealth and degree of diversification (Guay (1999); Cassell et al. (2012)).

- Firm size (log of equity market value [CSHO*PRCC_F]) and the market-to-book ratio (equity market value divided by equity book value [CEQ]) are canonical determinants

of future return performance (Fama and French (1993)) that also affect risk (Coles et al. (2006)) and compensation (Gabaix and Landier (2008)).

- Sales growth (the log of end-of-2006 sales [SALE] divided by beginning-of-2006 sales) controls for investment and growth opportunities because high-growth firms may indicate lower returns (Fama and French (1993)) and might take on more risk (Coles et al. (2006); Cassell et al. (2012)). In addition, problems in the financial sector began with sub-prime mortgage sales, which could have been value-reducing *ex ante* and might have increased risk exposures.

- Return volatility is included since compensation, performance, and risk are all affected by uncertainty, and because compensation may partially be determined by volatility expectations. Furthermore, the value of inside debt (risk incentives) decreases (increases) when volatility increases, altering the optimal structure of compensation. Volatility is calculated for the year 2006.

- The previous year's return on assets (operating income before depreciation [OIBDP] divided by total assets) controls for bank performance over 2006, which may be indicative of performance and risk during the crisis.

- Cash surplus (net cash flow from operations [OANCF] less depreciation expense [DPC] divided by total assets) controls for available funds to invest in new projects (Coles et al. (2006); Cassell et al. (2012)).

- Tier 1 capital [CAPR1; available only for depositary institutions] and market leverage control for the amount of balance sheet expansion, which allows banks to increase profitability at higher risk. Since balance sheets of financial institutions are continuously

marked to market, I use market leverage (rather than book leverage) as the measure for leverage policy. Bank leverage is total assets minus equity book value, divided by the quasi-market value of assets. The quasi-market value of assets equals total assets plus equity market value, minus equity book value.

I discuss the endogeneity issues related to this empirical setup in Section 4.4, where I re-estimate Eq. (3) using instrumental variables.

4 Results

4.1 Inside debt at the end of 2006

Panel A of Table I 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. On December 29, 2006, the sample median market capitalization is $400 million and the mean market capitalization $6.2 billion. The mean (median) total asset value is $44.7 billion ($2.1 billion), whereas mean (median) total liabilities amount $41.5 billion ($1.9 billion). The average net income over assets (over equity) is 1.0% (11%). Given the largely skewed distribution of bank size, I also report the summary statistics after applying a log transformation to dollar-denominated variables.

The distribution of the remaining variables is fairly symmetric. 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%. This number is significantly lower than buy-and-hold returns over 2006

that average +5%. Average annualized volatility over 2006 is 23%, and increases dramatically to 80% during the crisis. Mean VaR equals 7% during the crisis, an average increase of 5 percentage points relative to the VaR calculated immediately before the financial crisis. Mean ES equals 11% during the crisis, which is an increase of 7 percentage points relative to ES before the crisis.

Panel B of Table I presents summary statistics at the executive level and describes executive age, elements of compensation, and several compensation statistics at the end of 2006. Pension benefits and deferred compensation are not always awarded jointly, indicating that one form of inside debt may be substituted for another. Unreported results show that about 20% of the executives are not awarded any pension benefits but receive deferred compensation, and about 40% is not awarded deferred compensation but receives pension benefits.

The mean (median) value of inside debt for bank executives is $1.86 million ($0.37 million), which is somewhat higher (lower) than the value of executive stock options. Hence, in terms of dollar value, inside debt holdings are of similar importance to stock option holdings, less important than the total amount of shares held, and more important than executive cash bonuses. Inside debt holdings comprise an average (median) of 3.8 (1.6) times base salary. This number is smaller than the value of shares relative to salary, but larger than the cash bonus relative to salary.

The median executive ("inside") D/E ratio is 0.12, but this ratio varies widely across executives. Several banks hold small amounts of outside debt accounting for less 0.3% of equity value, which leads to very large inside D/E ratios. Following the convention in the literature, I apply a log transformation to the k-ratio and k^*-ratio. It is verified that winsorizing the ratios does not materially affect any of the results reported below. The

bottom rows of panel B show that the k-ratio and k^*-ratio cannot be calculated for some executives.[7] The median k-ratio is $e^{-1.11} = 0.3$ indicating that the median executive's D/E ratio is smaller than the bank's D/E-ratio. This number is comparable to studies for large nonfinancial firms (the median k-ratio is 0.51 in Wei and Yermack (2011) and 0.47 in Cassell et al. (2012)). The median k^*-ratio is $e^{0.72} = 2.1$ is larger than the median k^*-ratio of 0.37 in Wei and Yermack (2011) and 0.41 in Cassell et al. (2012), which can be attributed to the highly levered nature of banks.

4.2 Bank performance during the crisis

A natural point of departure is comparing the performance during the crisis between banks with high or low inside debt holdings. A first indication of the main result can be seen in Figure 1, which shows the future evolution of bank performance for two portfolios constructed by sorting banks according to their inside debt holdings.[8] The portfolios are constructed as follows. Per December 2006, I sort banks into three portfolios according to their level of inside debt. The portfolios are constructed by cutting the sample at the 30th and 70th percentile, and Figure 1 plots the High inside debt and Low inside debt (i.e., first and third) quantiles. I then compute each portfolio's equal-weighted cumulative returns from July 2007 to March 2009 (panel A), and a 21-month moving window of median VaR (panel B) and median ES (panel C). This window is of the same length as the July 2007-March 2009 crisis period.

The notable feature in the figures is that performance during the crisis is less negative

[7] Closer inspection of these observations reveals that the executives have joined the company within or around the 2006 fiscal year, and have not been granted equity yet; resigned or are about to resign within or around the 2006 fiscal year, and their equity was forfeited or accelerated in vesting; or do not have outstanding equity because their bank has not granted any in a long time or has never granted equity.

[8] I thank David Yermack for this suggestion.

for banks with high levels of inside debt. For instance, when plotting survivorship-adjusted cumulative returns in panel A, it can be seen that banks with low inside debt perform worse during the financial crisis with increasingly more negative cumulative returns up to March 2009, the depth of the crisis.[9] However, banks partially make up for the shareholder losses after the crisis, and the difference in cumulative returns has become substantially smaller at the end of the sample period. Hence, profits are higher and losses are deeper for banks that award low inside debt remuneration. This complements Wei and Yermack (2011) who show that inside debt is associated with lower equity prices in non-crisis times. Similarly, the plots in panels B and C show that banks with low inside debt incurred median losses (i.e., VaR and ES) that are higher during the crisis. This suggests that inside debt holdings have limited losses during the crisis.

I now turn to investigating the relation between debt incentives as of the end of fiscal year 2006 and bank performance during the crisis. Table II describes the impact of 2006 inside debt on bank performance during the crisis for four alternative specifications. First, the columns differ in terms of the measures used to proxy for inside debt (k from Eq. (1) or k^* from Eq. (2)). Second, odd-numbered columns differ from even-numbered columns in that information on the Tier-1 capital ratio is not available for nondepository banks.

In columns (1) and (2) of Table II, the coefficient on inside debt is positive and statistically significant ($p < 0.01$) suggesting that larger inside debt holdings have led to less negative returns during the crisis. Results in Columns (3) and (4), with the alternative measure for inside debt, are quite similar to those in Column (1) and (2). The results complement previous empirical findings that more inside debt is generally associated with lower prices. For instance, while Wei and Yermack (2011) find that more inside debt is associated with

[9]The difference in returns becomes more pronounced when returns are value-weighted.

lower equity prices, the positive inside debt coefficients in Table II indicate that inside debt has dampened negative returns during the financial crisis.

Coefficients on percentage gain from +1$, current compensation, and size are significant in some specifications, but not in others. The effects of cash surplus and leverage are absorbed by the impact of Tier-1 capital. Coefficients on Tier-1 capital are positive and significant ($p < 0.01$) emphasizing the importance of capital reserves. The coefficient on proportional sales growth over 2006 is also highly significant ($p < 0.01$) suggesting that banks sales increased risk exposures during the crisis that led to more negative returns. In addition, return on assets in 2006 is significantly associated with lower returns during the crisis. Interestingly, volatility in 2006 does not significantly explain returns nor losses during the financial crisis, indicating that banks in a more risky environment during 2006 did not perform worse during the crisis.

The economic importance of inside debt can be assessed using Table I, which shows that the standard deviation of the k-ratio (k^*-ratio) equals 2.44 (2.74). Therefore, a one-standard deviation increase in the k-ratio (k^*-ratio) implies a return that is $2.44 \times 2.913 = 7.1$ percent ($2.74 \times 2.875 = 7.9$ percent) higher over the 21-month crisis period. This is equivalent to an average annualized return differential of $7.1^{12/21} = 3.1$ percent ($7.9^{12/21} = 3.3$ percent) per crisis year.

Table III presents estimation results for Eq. (3) where the dependent variable is growth in VaR. The coefficients on inside debt are negative and significant for both measures of inside debt ($p < 0.01$). Hardly any of the coefficients on other elements of compensation are significant. Other than that, the results are similar to Table II. Bank leverage and cash surplus are associated with higher VaR during the crisis, but again this effect is absorbed by the impact of Tier-1 capitalization on VaR. The coefficients on Tier-1 capital are highly

significant ($p < 0.01$), as are the coefficients on sales growth ($p < 0.01$).

In terms of economic significance, a one-standard deviation increase in the k-ratio (k^*-ratio) is associated with a change in VaR that is $2.44 \times -0.198 = -0.5$ percent ($2.74 \times -0.187 = -0.5$ percent) from the start to the end of the crisis period. This amounts to about 10% of the sample-average change in VaR. These results indicate that inside debt encourages more conservative risk policy, leading to a lower loss threshold that financial institutions have been willing to absorb *ex ante*. I note that estimates of VaR in levels rather than differences (unreported) show similar or stronger results.

Table IV presents results showing the impact of 2006 inside debt holdings on growth in ES during the financial crisis. The results compared are very similar to those in in Tables II and III. Most importantly, coefficients on inside debt are negative and significant ($p < 0.01$). Coefficients on sales growth and the Tier-1 capital ratio are also significant in each specification. Most coefficients on the remaining control variables are indistinguishable from zero. A one-standard deviation increase in the k-ratio (k^*-ratio) is associated with an increase in ES of $2.44 \times -0.265 = 0.6$ percent ($2.74 \times -0.249 = 0.7$ percent) from the start until the end of the crisis period. This amounts to about 6% of the sample-average change in ES. Unreported estimates of ES in levels rather than differences show similar or stronger results. I conclude that inside debt holdings are associated negatively with banks' losses incurred under dire market conditions (i.e., when returns were extremely negative).

Downside risk is estimated at the $\alpha = 0.05$ risk threshold so that about 30 daily returns are used to calculate ES from July 2007 to March 2009. Therefore, one may be concerned as to whether the lower tail is reliably described by ES. Since ES is an average, it can be distorted by a long lower tail leading to overstated results. Another possible concern is that, although debt repayment is jeopardized when daily stock returns are sufficiently negative, the

downside risk statistics might not reflect risks far enough down the lower tail to be relevant for creditors. Hence, it is not clear to what extent VaR and ES relate to the *total* return on equity and debt and, consequently, whether inside debt is an important determinant of downside risk that is enterprise-wide.

To tackle this concern, I use a probit model to capture downside risk that does not require estimation of the tail. Instead, the binary dependent variable equals one if financial institutions have a survivorship-adjusted buy-and-hold return of -80% or worse, and zero otherwise. The indicator variable measures the probability of financial distress which is relevant to shareholders as well as debtholders and other creditors, and is not sensitive to potential issues in estimating tail risk. Since survivorship-adjusted returns are calculated, 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. The coefficients from re-estimating Eq. (3) in a probit framework are presented in Table V. As before, the coefficients on inside debt are negative and significant, suggesting a negative impact on the probability of enterprise-wide distress. This result is consistent with the previous estimates, and alleviates concerns about the validity of the downside risk measures.

4.3 Inside debt and bank risk-taking

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 (shareholder and debtholder) performance says little about the specific mechanisms through which bank managers with large inside debt holdings manage their firms more conservatively. Therefore, I consider

two mechanisms that are specific to banks and are generally considered direct causes of the current financial crisis.

Investing policy: Quality of loans First, on the asset side of the bank's balance sheet, the coefficient on 2006 sales growth is highly significant in Tables II-V suggesting that bank sales have increased bank risk during the crisis. Sub-prime lending could drive this result since banks had substantial exposure to subprime loans on their balance sheets. 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, many subprime borrowers can no longer refinance and risk foreclosure. This deteriorates the quality of a bank's asset 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 asset portfolio during the crisis. The fraction of low-quality assets is nonperforming assets on real estate [NPAORE] plus other real estate owned assets [OREO] in December 2008, relative to total assets [AT]. NPAORE consists of non-accrual loans that are considered impaired because the payment of interest or principal is doubtful. OREO represents properties acquired through foreclosure and repossession that serve as a (total or partial) repayment of a loan.[10]

Table VI presents regression results on the quality of banks' asset portfolios at the end of 2008. As previously, the variables of interest are the k-ratio and the k^*-ratio. The estimation model is very similar to Eq. (3), except that the dependent variable is the fraction of low-

[10]See, for instance, Northern Trust's 2010 annual report, page 56.

quality assets in a bank's asset portfolio. The models explain 23% to 27% of the variation in low-quality assets. As before, the coefficient on Tier-1 capital is significantly negative indicating that well-capitalized banks held a smaller fraction of low-quality assets at 2008 year-end. Also, sales growth over 2006 is positively associated with the fraction of low-quality assets ($p < 0.05$), potentially because managers took risks to increase market share. Moreover, it can be seen that each of the inside debt measures is highly significant at better than the 5% significance level. Hence, the evidence is consistent with the assertion that inside debt encourages managers to act more conservatively. Furthermore, a one-standard deviation increase in inside debt is associated with a increase in low-quality assets of 0.2 percent, equivalent to about 40% of the sample-average fraction of low-quality assets.

Financing policy: Pre-crisis borrowing Second, on the bank's liability side of the balance sheet, additional risk was taken by funding the 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)). Specifically, 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.

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 an (often subprime mortgage-backed) 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. This *ex ante* variable is measured after December 2006 to alleviate concerns about endogeneity between inside debt and leverage policy, and before July 2007 to isolate balance sheet expansion from changes in leverage due to the crisis.

Table VII presents coefficient estimates of Eq. (3) with pre-crisis repurchase agreements as the dependent variable. The models explain 19% to 23% of the variation in balance sheet expansion. Regardless of the inside debt measure used, larger holdings of 2006 inside debt are significantly associated with less growth in repos during the first half of 2007 ($p < 0.01$). In terms of economic significance, a one-standard deviation increase in the k-ratio (k^*-ratio) is associated with a proportional growth in repos of $2.44 \times 6.283 = 15$ percent ($2.74 \times 7.503 = 21$ percent), or about 1-2 times the sample average of growth in repos.

However, one should not read too much into this since the standard deviation is quite high relatively to the mean. Nevertheless, consistent with the negative association between inside debt holdings and performance during the crisis, Table VII suggests that executives with larger inside debt holdings conduct balance sheet policy that is less risky. Notably, pre-crisis repurchase agreements quantify the impact of inside debt on firm policies before the start of the crisis.

4.4 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. If bank performance or bank risk-taking is influenced by variables that affect managerial incentives and are also omitted from the empirical model in Eq. (3), the estimation results may be inconsistent and biased. Empirical endogeneity issues between managerial incentives and corporate decisions are discussed in detail in Core and Guay (1999), Palia (2001), and Coles et al. (2006), among others. A discussion on the endogeneity issues between corporate governance and corporate performance is presented in Wintoki et al. (2012).

In the context of this paper, banks could set inside debt remuneration while simultaneously having bank performance in mind, which may result in a positive relation between inside debt and bank performance that is spurious, not causal. In the results so far, such concerns are partially addressed by measuring performance by changes around the financial crisis in terms of share price (i.e., returns), VaR, and ES. This provides an appealing quasi-experimental setting as the crisis induced a discrete, exogenous, and unanticipated increase in bank risk. In addition, examining the impact of inside debt on *future* performance helps to ensure that the managers' inside debt holdings are predetermined. Finally, accumulated pen-

sion benefits and deferred compensation are stock variables rather than flow variables, and are not easily manipulated from one year to another. These features reduce the endogeneity problem that arises from simultaneous determination of inside debt and bank performance.

Another explanation for a positive relation between inside debt and bank performance is that more inside debt is awarded by banks that are less vulnerable to crises or operate in a more stable business environment. However, volatility in 2006 does not significantly explain buy-and-hold returns, value-at-risk, or expected shortfall during the financial crisis. This indicates that banks operating in a more volatile environment in 2006 did not perform worse during the crisis. Also, inside debt holdings are negatively associated with pre-crisis growth in repurchase agreements. This suggests that inside debt discourages managerial risk-taking regardless of the crisis period, and alleviates concerns about endogeneity that arises from omitting the bank's business environment as a variable in Eq. (3).

To alleviate endogeneity concerns more directly, I re-estimate the various instances of Eq. (3) using a two-stage least squares (2SLS) regression model. To find instruments that are economically related to inside debt but uncorrelated to the error term of the 2nd-stage regressions, I follow Cassell et al. (2012) who consider several variables from the literature on inside debt. The instruments are (1) executive age, (2) an indicator variable equal to one if the bank's executive is new and zero otherwise, (3) log total assets, (4) an indicator equal to one if the bank is liquidity constrained (measured by negative operating cash flow before depreciation [OIBDP]) and zero otherwise, (5) an indicator variable equal to one if the bank faces a favorable tax status (measured by nonzero tax-loss carry forward [TLCF]) and zero otherwise, all based on Sundaram and Yermack (2007); (6) the maximum state tax rate on individual income based on Anantharaman et al. (2010); and (7) the industry median of inside debt (by 4-digit Standard Industry Classification (SIC) code) based on Murphy

(1999).[11]

The instruments have substantial predictive power. The 1st-stage results in panel A of Table VIII show that the k-ratio and k^*-ratio are positively, and highly significantly, related to executive age and industry-median inside debt. The k^*-ratio is negatively, but more weakly, related to log total assets, and to the indicator variables related to tax status and newly hired executives. The F-statistics in both models reject the null hypothesis that the coefficients on the instruments are jointly zero. Furthermore, the F-statistics are larger than 10, which is the "rule of thumb" critical value suggested by Staiger and Stock (1997) for assessing instrument strength. Further support for the instruments selected by Cassell et al. can be found in panel B. For all 2nd-stage models, the partial R^2 indicates that the instruments explain a substantial part of the variation in inside debt. This is net of any effect through the other explanatory variables. Finally, the instruments seem to be satisfactorily exogenous: the test of overidentifying restrictions cannot reject the joint null hypothesis that the instruments are uncorrelated with the error term and are correctly excluded from the 2nd-stage regression. Collectively, these tests indicate that each of the 2SLS models is correctly specified.

In my relatively small sample of banks, inside debt continues to have a significant impact on value-at-risk ($p < 0.10$), the fraction of low-quality assets ($p < 0.05$), and buy-and-hold returns ($p < 0.05$ for the k-ratio). However, 2SLS-estimated coefficients on inside debt are borderline insignificant for expected shortfall ($p < 0.12$ for the k-ratio and $p < 0.14$ for the

[11] Using the maximum state tax rate as an instrument is motivated by the observation that executives could enjoy a significant tax benefit if they defer current compensation in a high state tax rate jurisdiction (e.g., California) and move to a low state tax rate jurisdiction (e.g., Texas) after retirement. In comparison to Cassell et al. (2012), I do not include tenure which is available for CEOs only, or 2-digit SIC-based fixed effects since these are not jointly significant and lead to nearly identical results in unreported results. Market-to-book is not an instrument because I also include all exogenous variables in the first stage, in addition to the assumed instruments.

k^*-ratio) and buy-and-hold returns ($p < 0.14$ for the k^*-ratio). In fact, the relation between inside debt and pre-crisis growth in repurchase agreements is no longer significant at all ($p < 0.26$). Nevertheless, the 2SLS results do not contradict or negate the evidence in Tables II to VI. Compared to the coefficients obtained earlier using OLS, the estimated coefficients in panel B have the correct signs and are not significantly different in magnitude. Stated more precisely in terms of the difference-in-Hansen test reported in panel B, I cannot reject the null hypothesis that the 2SLS and OLS coefficients on bank performance or bank risk-taking are identical. Therefore, the high p-values for some of the 2nd-stage results could reflect the innately less precise 2SLS estimator rather than a spurious, endogenously driven effect of inside debt. This result implies that less efficient 2SLS methods are not required to estimate Eq. (3). In other words, the 2SLS estimates suggest that the OLS results in Tables II to VI are consistent and valid.

5 Conclusion

In the wake of the financial crisis, and in order to enhance the monitoring of risk, the "Corporate and Financial Institution Compensation Fairness Act 2009" and the comprehensive "Dodd-Frank Wall Street Reform and Consumer Protection Act 2010" have amended the Securities Exchange Act of 1934 to expand the rights of shareholders in approving compensation, appointing directors on compensation committees, and proposing compensation plans. These requirements build on the assumption that the monitoring of risk will be more effective once more power is assigned to shareholders, and address moral hazard between managers and shareholders. However, the manager-shareholder agency problem is generally not confirmed by empirical research studying the 2007-2009 financial crisis. This paper

examines the conflict of interest between managers and debtholders instead.

Suggesting the presence of a manager-debtholder agency problem, the results in this paper demonstrate that higher inside debt holdings are associated with systematically better performance of banks during the crisis. Using a proprietary sample of 319 U.S. banks, I document a significantly positive association between 2006 inside debt and 2007-2009 stock returns, and a significantly negative relation between 2006 inside debt and 2007-2009 growth in downside risk. In addition, inside debt holdings are negative correlated to the future probability of financial distress, to the fraction of low-quality loans by 2008, and to pre-crisis growth in short-term borrowings. The results suggest that inside debt dampens the losses incurred by banks during crisis times by encouraging more conservative financing and investment decisions.

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 performance suggests that creditors are better in bank risk monitoring than shareholders, and that the strengthening of shareholder governance is not necessarily the most effective tool for risk management.

I emphasize that the social trade-off between risk monitoring by debtholders and generating returns for shareholders is beyond the scope of this paper. That is, the results do not imply that debtholder monitoring is socially optimal and shareholder monitoring is not, nor that a "remedy" exists to prevent crises that represents a pure Pareto-improving change. Nevertheless, when the purpose is the limiting and monitoring of risk, this paper makes a case for shifting power from shareholders to debtholders. In line with theoretical predictions, the empirical results indicate that inside debt contracts might be an effective channel to do this.

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Table I: Summary statistics

Summary statistics of key variables for the sample of 319 banks, taken from Compustat and Equilar after applying the sample selection criteria described in Section 3. Unless stated otherwise, the data pertain to December 2006. Panel A presents summary statistics at the bank level with Compustat item codes in square brackets: "Market-to-book" is equity market value [CSHO×PRCC_F] divided by equity book value [CEQ]. "Market leverage" is total assets [AT] minus equity book value, divided by total assets plus equity market value minus equity book value. "Sales growth" is sales [SALE] divided by beginning-of-2006 sales. "Annualized volatility," "Buy-and-hold returns," "Value-at-risk," and "Expected shortfall" are calculated using daily data from January 2006–December 2006, or from July 2007–July 2009, and are defined in more detail in Section 3. "Return on assets" is operating income before depreciation [OIBDP] divided by total assets. "Cash surplus" equals net cash flow from operations [OANCF] less depreciation expense [DPC] divided by total assets. All remaining variables in panel A are taken directly from Compustat. Panel B presents summary statistics at the executive level. "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. "Inside equity" is the total value of shares and options. "Cash bonus" is the annual bonus plus non-equity incentive plan payouts. "Percentage gain from 1$" ("Percentage gain from 1%") is the dollar change in value of each executive's stock portfolio and all her individual tranches of options held for a $1 increase in the stock price (1% increase in stock volatility), as a fraction of total compensation. "Log(Current compensation)" is the log of salary plus bonus compensation. 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 value of inside equity. The k-ratio equals the personal debt-equity ratio divided by the firm's external debt-equity ratio. The k^*-ratio is a similar statistic based upon the CEO's and firm's changes in debt and equity value for a unit change in the value of the firm. All remaining variables in panel B are taken directly from Equilar.

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
Market value (bln $)	319	6.2	26.0	0.1	0.4	1.4
Log(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 I: Summary statistics (Continued)

Panel A: Bank data summary statistics (Continued)

	N	Mean	S.D.	p25	p50	p75
Control variables						
Market-to-book	319	0.19	0.07	0.14	0.18	0.22
Return on assets	319	0.02	0.01	0.02	0.02	0.03
Market leverage	319	0.83	0.06	0.80	0.84	0.87
Sales growth	319	0.20	0.12	0.12	0.19	0.26
Cash surplus	310	0.01	0.02	0.01	0.01	0.01
Tier-1 capital ratio	281	0.11	0.03	0.09	0.11	0.12
Bank performance and risk-taking						
Growth in repos	103	0.11	0.67	-0.11	0.05	0.28
Buy-and-hold return 2006	314	0.05	0.19	-0.04	0.05	0.15
Buy-and-hold return 2007-9	319	-0.53	0.32	-0.78	-0.57	-0.29
Annualized volatility 2006	319	0.23	0.07	0.18	0.22	0.27
Annualized volatility 2007-9	319	0.80	0.33	0.58	0.72	0.95
Value-at-risk 2007-9	319	0.07	0.03	0.05	0.07	0.09
Change in value-at-risk	319	0.05	0.03	0.03	0.04	0.06
Expected shortfall 2007-9	319	0.11	0.04	0.08	0.10	0.13
Change in expected shortfall	319	0.07	0.04	0.05	0.07	0.09

Table I: Summary statistics (Continued)

Panel B: Executive data summary statistics

	N	Mean	S.D.	p25	p50	p75
Age	1,273	52	7	46	52	57
Tenure (CEO only)	292	8.93	6.76	4.05	7.25	12.05
Value of shares (mln $)	1,293	22.2	138.0	0.80	2.32	8.69
Value of options (mln $)	1,293	3.5	15.8	0.03	0.29	1.30
Inside equity / salary	1,292	48	264	4.88	11.84	30.28
Cash bonus (mln $)	1,293	0.50	1.69	0.02	0.08	0.23
Cash bonus / salary	1,292	0.99	3.09	0.14	0.34	0.70
Control variables						
Percentage gain from 1$	1270	0.36	0.95	0.08	0.21	0.39
Percentage gain from 1%	1270	4.15	5.34	0.00	0.00	10.00
Log(Current compensation)	1028	12.69	0.81	12.13	12.57	13.08
Inside debt						
Accumulated pensions (mln $)	1,015	1.21	3.24	0.10	0.30	0.92
Balance NQDC (mln $)	782	1.51	5.35	0.06	0.21	0.73
Value of inside debt (mln $)	1,293	1.86	6.16	0.12	0.37	1.11
Inside debt / salary	1,292	3.8	10.4	0.58	1.60	3.79
Executive D/E ratio	1,270	523	6490	0.05	0.12	0.29
Log(k-ratio)	1,185	-1.01	2.44	-2.35	-1.11	-0.01
Log (k^*-ratio)	1,135	0.74	2.74	-0.80	0.72	2.15

Table II: End-of-2006 inside debt and buy-and-hold returns during the crisis
Ordinary least squares regressions of buy-and-hold returns calculated between July 2007 - March 2009, regressed against inside debt and control variables. Buy-and-hold returns are constructed as described in Section 3.2. 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 variables of interest, in italics) based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	2007-2009 buy-and-hold returns			
Log of k^*-ratio	2.875***	2.768***		
	(0.000)	(0.000)		
Log of k-ratio			2.913***	2.366***
			(0.001)	(0.001)
Percentage gain from +1%	-330.193	-188.551	-74.175	-328.904
	(0.223)	(0.497)	(0.443)	(0.265)
Percentage gain from +1$	66.889*	72.347*	42.088	69.156*
	(0.076)	(0.057)	(0.188)	(0.068)
Current compensation	-4.517*	-6.547**	-0.609	-2.678
	(0.091)	(0.015)	(0.801)	(0.252)
Market value	1.655	3.970**	-1.328	1.208
	(0.410)	(0.047)	(0.422)	(0.521)
Market-to-book ratio	-106.827	207.512	-106.671	288.339
	(0.352)	(0.452)	(0.377)	(0.264)
Annualized volatility	-11.280	2.720	-21.149	-6.701
	(0.717)	(0.923)	(0.488)	(0.805)
Return on assets	-4.841**	-7.262**	-4.057**	-7.065**
	(0.019)	(0.029)	(0.047)	(0.032)
Market leverage	-276.863*	163.404	-286.113*	242.694
	(0.082)	(0.635)	(0.082)	(0.453)
Sales growth	-94.727***	-77.083***	-92.077***	-76.776***
	(0.000)	(0.000)	(0.000)	(0.000)
Cash surplus	-437.316***	-233.771	-413.002***	-210.481
	(0.001)	(0.142)	(0.002)	(0.189)
Tier-1 capital ratio		3.083***		2.990***
		(0.000)		(0.000)
Constant	278.550**	-173.959	260.741*	-278.800
	(0.049)	(0.599)	(0.082)	(0.368)
Observations	868	774	910	802
Adj. R-squared	0.276	0.323	0.282	0.323

Table III: End-of-2006 inside debt and growth value-at-risk during the crisis
Ordinary least squares regressions of growth in value-at-risk calculated from July 2007 - March 2009, regressed against inside debt and control variables. Value-at-risk is defined as described in Section 3.2. 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 variables of interest, in italics) based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	2007-2009 growth in value-at-risk			
Log of k-ratio*	-0.187***	-0.144***		
	(0.003)	(0.002)		
Log of k-ratio			-0.198***	-0.123**
			(0.002)	(0.007)
Percentage gain from +1%	10.286	-0.244	-2.721	4.423
	(0.587)	(0.990)	(0.770)	(0.813)
Percentage gain from +1$	-1.309	-1.877	-0.399	-1.848
	(0.634)	(0.473)	(0.878)	(0.487)
Current compensation	0.247	0.454**	-0.054	0.215
	(0.253)	(0.030)	(0.800)	(0.244)
Market value	0.049	-0.023	0.269*	0.155
	(0.762)	(0.882)	(0.050)	(0.264)
Market-to-book ratio	7.984	-1.991	6.855	-15.582
	(0.372)	(0.913)	(0.455)	(0.419)
Annualized volatility	-0.206	-0.844	0.984	0.383
	(0.925)	(0.693)	(0.671)	(0.863)
Return on assets	0.298	0.313	0.252	0.327
	(0.181)	(0.217)	(0.275)	(0.239)
Market leverage	22.230*	5.288	22.430*	-10.290
	(0.071)	(0.817)	(0.084)	(0.663)
Sales growth	5.051***	4.152***	5.367***	4.416***
	(0.002)	(0.008)	(0.002)	(0.006)
Cash surplus	26.413**	7.751	26.143**	5.334
	(0.019)	(0.540)	(0.026)	(0.682)
Tier-1 capital ratio		-0.190***		-0.196***
		(0.000)		(0.000)
Constant	-20.525*	-4.021	-18.589	12.861
	(0.072)	(0.855)	(0.118)	(0.572)
Observations	868	774	910	802
Adj. R-squared	0.216	0.238	0.228	0.248

Table IV: End-of-2006 inside debt and growth in expected shortfall during the crisis
Ordinary least squares regressions of growth in expected shortfall calculated from July 2007 - March 2009, regressed against inside debt and control variables. Expected shortfall is defined as described in Section 3.2. 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 variables of interest, in italics) based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	2007-2009 growth in expected shortfall			
Log of k-ratio*	-0.249**	-0.176***		
	(0.020)	(0.009)		
Log of k-ratio			-0.265**	-0.151**
			(0.011)	(0.021)
Percentage gain from +1%	49.927	16.719	0.211	23.118
	(0.213)	(0.604)	(0.991)	(0.465)
Percentage gain from +1$	-6.656	-4.593	-3.656	-4.599
	(0.210)	(0.262)	(0.423)	(0.265)
Current compensation	0.219	0.601*	-0.189	0.305
	(0.519)	(0.069)	(0.574)	(0.294)
Market value	0.280	0.076	0.613***	0.310
	(0.329)	(0.733)	(0.009)	(0.138)
Market-to-book ratio	7.044	-7.815	6.046	-24.417
	(0.651)	(0.782)	(0.683)	(0.381)
Annualized volatility	-0.292	-1.317	1.163	0.136
	(0.934)	(0.692)	(0.752)	(0.969)
Return on assets	0.297	0.531	0.222	0.534
	(0.438)	(0.186)	(0.577)	(0.220)
Market leverage	31.909	5.058	33.105	-13.684
	(0.137)	(0.887)	(0.109)	(0.689)
Sales growth	9.683***	8.032***	9.748***	8.420***
	(0.001)	(0.005)	(0.001)	(0.004)
Cash surplus	48.464**	1.829	48.648**	-1.689
	(0.023)	(0.935)	(0.029)	(0.942)
Tier-1 capital ratio		-0.250***		-0.258***
		(0.002)		(0.002)
Constant	-27.750	-2.918	-26.081	17.439
	(0.163)	(0.932)	(0.172)	(0.595)
Observations	868	774	910	802
Adj. R-squared	0.224	0.237	0.237	0.249

Table V: End-of-2006 inside debt and the probability of distress during the crisis
Ordinary least squares regressions of a dummy variable indicating financial distress, regressed against inside debt and control variables. The distress indicator variable equals one if a bank's return is -80% or worse, and zero otherwise. 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 variables of interest, in italics) based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	Probability of financial distress (0/1)			
Log of k-ratio*	-0.139***	-0.124***		
	(0.001)	(0.004)		
Log of k-ratio			-0.137***	-0.104**
			(0.005)	(0.033)
Percentage gain from +1%	1.640	-0.020	-9.565	10.855
	(0.936)	(0.999)	(0.307)	(0.650)
Percentage gain from +1$	-4.941**	-5.368*	-4.119*	-5.088*
	(0.047)	(0.052)	(0.072)	(0.054)
Current compensation	0.019	0.087	-0.174	-0.067
	(0.914)	(0.664)	(0.276)	(0.707)
Market value	0.100	0.024	0.248**	0.150
	(0.384)	(0.869)	(0.017)	(0.273)
Market-to-book ratio	-6.462	-4.992	-2.844	-1.289
	(0.456)	(0.791)	(0.743)	(0.940)
Annualized volatility	1.655	0.939	1.837	0.951
	(0.376)	(0.617)	(0.323)	(0.606)
Return on assets	0.024	0.172	-0.023	0.138
	(0.875)	(0.480)	(0.883)	(0.573)
Market leverage	-1.962	-1.306	3.951	5.064
	(0.867)	(0.957)	(0.735)	(0.817)
Sales growth	4.555***	4.011***	4.255***	3.761***
	(0.000)	(0.000)	(0.000)	(0.001)
Cash surplus	15.901	10.144	14.238	9.436
	(0.103)	(0.380)	(0.142)	(0.418)
Tier-1 capital ratio		-0.213***		-0.211***
		(0.000)		(0.000)
Constant	-0.111	0.932	-4.328	-4.055
	(0.992)	(0.968)	(0.683)	(0.845)
Observations	868	774	910	802
Pseudo R-squared	0.219	0.241	0.228	0.243

Table VI: End-of-2006 inside debt and asset portfolio quality at 2008 year-end
Ordinary least squares regressions of low-quality assets as a fraction of total assets per 2008 year-end, regressed against inside debt and control variables. The fraction of low-quality assets is the fraction of nonperforming assets on real estate [NPAORE] plus other real estate owned assets [OREO] in December 2008, relative to total assets [AT]. 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 variables of interest, in italics) based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	End-of 2008 low-quality assets (%)			
Log of k-ratio*	-0.076***	-0.074**		
	(0.009)	(0.015)		
Log of k-ratio			-0.092***	-0.085***
			(0.004)	(0.008)
Percentage gain from +1%	-0.749	-2.637	14.115	12.027
	(0.953)	(0.827)	(0.251)	(0.318)
Percentage gain from +1$	-1.619	-1.716	-1.244	-1.328
	(0.181)	(0.148)	(0.293)	(0.251)
Current compensation	0.090	0.110	0.012	0.032
	(0.402)	(0.307)	(0.890)	(0.710)
Market value	-0.165*	-0.179*	-0.128	-0.140*
	(0.088)	(0.059)	(0.109)	(0.076)
Market-to-book ratio	21.953	22.330	19.713	20.399
	(0.356)	(0.354)	(0.276)	(0.266)
Annualized volatility	1.613	1.295	1.693	1.361
	(0.150)	(0.255)	(0.111)	(0.217)
Return on assets	0.177*	0.133	0.195**	0.158
	(0.096)	(0.218)	(0.049)	(0.118)
Market leverage	28.258	28.046	25.070	25.453
	(0.315)	(0.328)	(0.226)	(0.228)
Sales growth	2.603**	2.182**	2.363**	2.004**
	(0.017)	(0.020)	(0.018)	(0.022)
Cash surplus	5.764	6.650	5.154	5.973
	(0.380)	(0.323)	(0.419)	(0.362)
Tier-1 capital ratio		-0.062*		-0.055*
		(0.058)		(0.085)
Constant	-28.408	-27.497	-24.821	-24.576
	(0.304)	(0.330)	(0.224)	(0.238)
Observations	421	421	438	438
Adj. R-squared	0.231	0.265	0.245	0.271

Table VII: End-of-2006 inside debt and pre-crisis growth in repurchase agreements
Ordinary least squares regressions of growth in repurchase agreements from January 2007 until June 2007, regressed against inside debt and control variables. Growth in repurchase agreements is defined in Section 4.3. 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 variables of interest, in italics) based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

	Pre-crisis growth in repurchase agreements			
Log of k-ratio*	-6.283***	-6.004***		
	(0.004)	(0.004)		
Log of k-ratio			-7.503***	-6.524***
			(0.001)	(0.004)
Percentage gain from +1%	-1,211.209	-864.536	169.196	289.781
	(0.383)	(0.589)	(0.907)	(0.855)
Percentage gain from +1$	49.682	21.253	22.013	-1.837
	(0.772)	(0.903)	(0.897)	(0.992)
Current compensation	-3.137	-0.391	-11.413	-8.875
	(0.709)	(0.966)	(0.163)	(0.309)
Market value	-4.804	-6.913	-2.220	-3.773
	(0.549)	(0.479)	(0.775)	(0.685)
Market-to-book ratio	-785.206	-955.349	-803.596	-991.745
	(0.318)	(0.251)	(0.283)	(0.223)
Annualized volatility	181.172	177.956	200.835	199.296
	(0.195)	(0.236)	(0.143)	(0.177)
Return on assets	32.172*	26.598	29.923*	24.610
	(0.057)	(0.106)	(0.085)	(0.151)
Market leverage	-1,033.832	-1,354.874	-1,115.167	-1,429.660
	(0.266)	(0.197)	(0.212)	(0.166)
Sales growth	92.775*	86.629*	102.811*	97.393*
	(0.068)	(0.081)	(0.057)	(0.058)
Cash surplus	779.089	778.823	813.125	801.951
	(0.159)	(0.138)	(0.152)	(0.138)
Tier-1 capital ratio		-3.483		-3.125
		(0.184)		(0.236)
Constant	951.664	1,281.614	1,093.566	1,417.022
	(0.277)	(0.206)	(0.190)	(0.153)
Observations	304	284	307	287
Adj. R-squared	0.198	0.216	0.216	0.227

Table VIII: End-of-2006 inside debt, 2007-2009 bank performance, and bank risk-taking: Two-stage least squares

Two-stage least squares (2SLS) analysis of bank performance and bank risk-taking, regressed against inside debt and control variables. Panel A reports the results from the 1st-stage regressions of inside debt on instrumental variables and the exogenous control variables included in the 2nd-stage regression. Instrumental variables are measured at the end of 2006, and taken directly from Compustat or defined as follows (Compustat item codes in square brackets): executive age ("Executive Age"), an indicator variable equal to one if the bank's executive is new and zero otherwise ("Newly hired executive"), the natural logarithm of total assets ("Log (total assets)"), an indicator equal to one if the bank is liquidity constrained (measured by negative operating cash flow before depreciation [OIBDP]) and zero otherwise ("Liquidity constrained"), an indicator variable equal to one if the bank faces a favorable tax status (measured by nonzero tax-loss carry forward [TLCF]) and zero otherwise ("Tax status"), the maximum state tax rate on individual income ("Maximum state tax rate"); and the industry median of inside debt (by 4-digit Standard Industry Classification (SIC) code). The F-statistic tests the joint statistical significance of the instruments. Panel B reports the results from the 2nd-stage regressions of buy-and hold returns, growth in value-at-risk ("Growth in VaR"), and growth in expected shortfall ("Growth in ES"), all calculated between July 2007 - March 2009; low-quality assets as a fraction of total assets per 2008 year-end ("Low-quality assets (%)"); and growth in repurchase agreements from January 2007 until June 2007 ("Repo Growth"), regressed against inside debt ("Log of k^*-ratio*";* "Log of k-ratio") and control variables, with inside debt as the endogenous variable. The partial R-squared is the fraction of the variation in inside debt explained by the instruments, net of their effect through the other explanatory variables. The test of overidentifying restrictions tests the joint null hypothesis that the instruments are uncorrelated with the error term and are correctly excluded from the 2nd-stage equation. The difference in Hansen statistic examines whether the OLS and 2SLS coefficients on inside debt are statistically different from each other. Reported in parentheses are p-values (two-tailed except for the variables of interest in panel B, in italics) based on robust standard errors that are adjusted for heteroskedasticity and clustered by firm. *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.

(*Tables start on next page*)

Table VIII: End-of-2006 inside debt, 2007-2009 bank performance, and bank risk-taking: Two-stage least squares (Continued)

Panel A: First-stage results

	Log of k^*-ratio	Log of k-ratio
Executive age	0.085***	0.055***
	(0.000)	(0.000)
Log (total assets)	-3.620*	-2.122
	(0.054)	(0.265)
Liquidity constrained	-0.294	0.214
	(0.662)	(0.685)
Tax status	-2.056*	-0.807
	(0.051)	(0.218)
Maximum state tax rate	-0.076	-0.071
	(0.125)	(0.183)
Newly hired executive	-0.903*	0.238
	(0.064)	(0.578)
Industry median of Log of k^*-ratio	0.413**	
	(0.036)	
Industry median of Log of k-ratio		0.747***
		(0.004)
All variables from main regressions	YES	YES
Constant	-17.284	0.502
	(0.262)	(0.974)
Observations	847	886
Adj. R-squared	0.442	0.271
Robust F-statistic	20.73	35.39
p-value	0.000	0.000

Table VIII: End-of-2006 inside debt, 2007-2009 bank performance, and bank risk-taking: Two-stage least squares (Continued)

Panel B: Second-stage results

	Buy-and-hold returns		Growth in VaR		Growth in ES		Low-quality assets (%)		Repo growth	
Log of k^*-ratio	1.691		-0.182*		-0.300		-0.156**		-2.671	
	(0.137)		(0.101)		(0.120)		(0.035)		(0.253)	
Log of k-ratio		4.172**		-0.324*		-0.402		-0.223**		-4.553
		(0.036)		(0.071)		(0.136)		(0.018)		(0.197)
All variables from main regressions	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	276.187*	206.754	-21.031*	-16.587	-26.083	-23.415	-28.514	-23.498	506.499	523.119
	(0.060)	(0.143)	(0.072)	(0.183)	(0.205)	(0.240)	(0.277)	(0.179)	(0.475)	(0.425)
Observations	847	886	847	886	847	886	410	427	296	299
Adj. R-squared	0.274	0.285	0.218	0.221	0.228	0.238	0.187	0.129	0.137	0.158
Predictive power of instruments										
Partial R-squared	0.148	0.093	0.148	0.093	0.148	0.093	0.071	0.055	0.107	0.089
Test of overidentifying restrictions										
Hansen's J-statistic	6.858	8.78	3.085	6.737	3.354	5.776	2.765	1.311	9.151	7.422
p-value	0.334	0.186	0.798	0.346	0.763	0.449	0.736	0.934	0.103	0.191
Cluster-robust endogeneity test for inside debt (OLS coefficient = 2SLS coefficient)										
Difference-in-Hansen statistic	1.442	0.0587	0.405	0.0265	0.401	0.356	1.055	2.162	1.048	0.157
p-value	0.230	0.809	0.524	0.871	0.526	0.551	0.304	0.141	0.306	0.692

Table A1: Attrition of banks included in sample

The sample includes 319 commercial and investment banks covered by Equilar in fiscal year 2006. ''Remaining in sample'' signifies that the bank is still listed on a major US exchange by March 2009. ''Merged or acquired'' signifies that the bank left the sample due to an acquisition or merger during the sample period, and ''Delisted by exchange'' signifies a delisting of the bank due to a violation of listing requirements or bankruptcy.

	Freq.	Percent
Merged or acquired	23	7.21
Delisted by exchange	32	10.03
Remaining in sample	264	82.76
Total	319	100

Figure 1: Evolution of bank performance for varying inside debt holdings
The figures plot the evolution of bank performance for two portfolios constructed by sorting banks according to their inside debt holdings. At December 2006, banks are sorted into three portfolios according to their k^*-ratio, which captures inside debt holdings based upon the executive's and bank's changes in debt and equity value for a unit change in the value of the bank. Quantile portfolios are constructed by cutting the sample at the 30th and 70th percentile, and the figures plot the evolution of performance over the months that constitute the financial crisis. Panel A presents cumulative equal-weighted median returns on the High inside debt and Low inside debt (i.e., first and third) quantiles. Panels B and C present median VaR and ES for the quantiles, respectively, in a 21-month moving window.

Panel A: Cumulative Returns

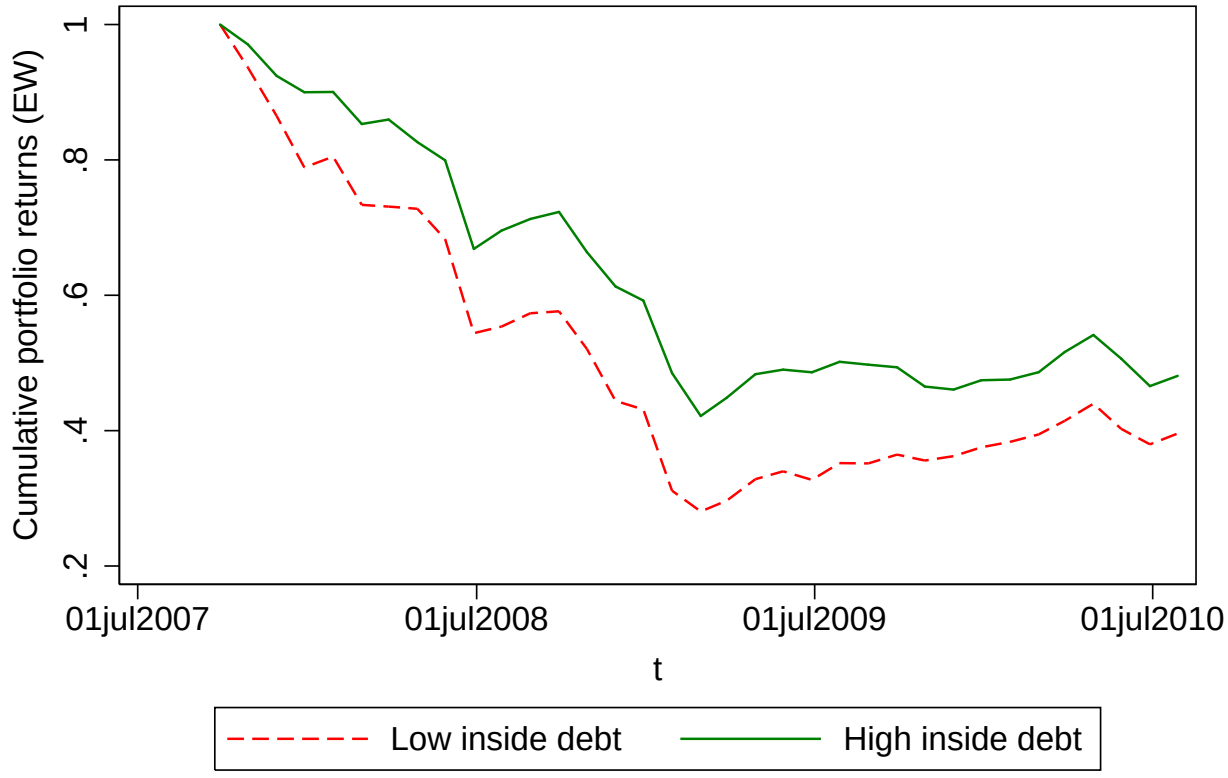
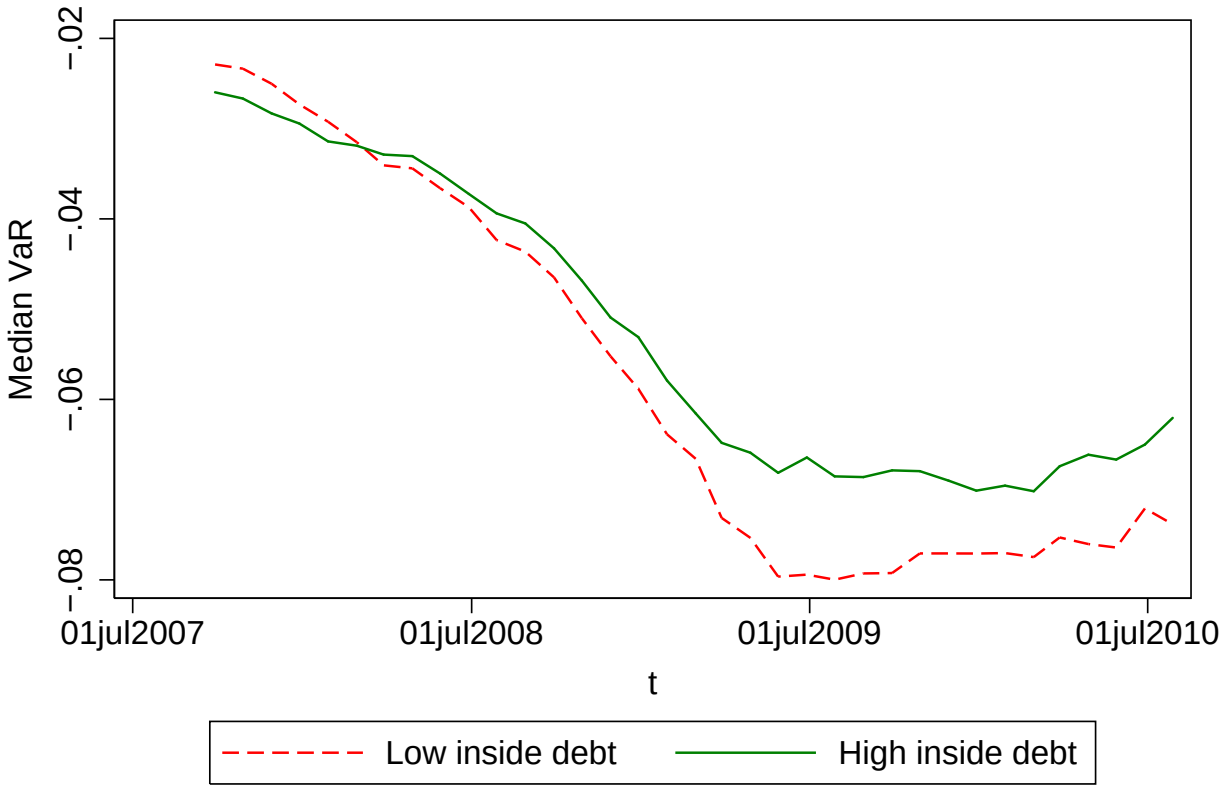


Figure 1: Evolution of bank performance for varying inside debt holdings (Continued)

Panel B: Value-at-risk



Panel C: Expected shortfall