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Inside Debt, Bank Default Risk, and Performance during the Crisis

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ABSTRACT

In this paper, we examine whether the structure of the chief executive officer's (CEO) compensation package can explain default risk and performance in bank holding companies (BHCs) during the recent credit crisis. Using a sample of 371 BHCs, we show that in 2006 higher holdings of inside debt relative to inside equity by a CEO after controlling for firm leverage is associated with lower default risk and better performance during the crisis period. We present evidence that before the crisis banks with higher inside debt ratios also have supervisory ratings that indicate stronger capital positions, better management, stronger earnings, and being in a better position to withstand market shocks in the future. Such ex ante evidence can explain the observed relationship between inside debt, default risk, and performance during the crisis.

JEL classification: G01, G21, G28, G32

Keywords: Executive compensation, financial crises, bank risk

Opinions expressed in this paper are those of the authors and not necessarily those of the FDIC.

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I. Introduction

The possible role that executive compensation played as a cause of the credit crisis that began in 2007 has attracted significant attention from the public, policy makers, and researchers. The Dodd-Frank Wall Street Reform and Consumer Protection Act (the Dodd Frank Act), which was signed into law on July 21, 2010, requires the regulatory agencies to prohibit the incentive-based compensation practices that encourage inappropriate risk-taking activities at financial institutions.

One question that emerged from this attention and the subsequent legislative action is whether there is an association between executive compensation and excessive risk taking at banks. The core of this debate goes back to Jensen and Meckling (1976). They argued that a higher level of CEO wealth in the form of inside equity (restricted stock and stock options) aligns the interests of the CEO with the shareholders and thereby solves incentive-based agency problems. However, a higher level of CEO inside equity leads to more risk taking. In contrast, when the CEO's wealth is in the form of inside debt (pensions and deferred compensation) then the CEO cares more about the long-term solvency of the firm. This concern reduces the CEO's risk appetite.

The credit crisis provides an opportunity to examine this hypothesized relation between CEO compensation and either risk taking or the firm's performance. In a recent paper, Fahlenbrach and Stulz (2011) provide evidence that inside equity and the BHCs' performance were negatively related during the credit crisis. Furthermore, they argue that the CEOs were maximizing shareholder wealth and that the poor performance was merely an unexpected outcome. Given this arguments, one can argue that if the CEOs

were focused on shareholder maximization, then their risk-taking activities were not optimal for the other stakeholders of the bank (i.e., the debt holders and the deposit insurer). Therefore, higher inside debt compensation can lead the CEOs to choose investments that have a risk-return profile that is more favorable to the interests of the debt holders and the deposit insurer. Thus, BHCs that compensate their CEOs with a higher share of inside debt should face a lower risk of default and perform better during a crisis period. In this paper we test this hypothesis.

Our results support this argument. Specifically, we show that there is a significant association between the CEO's inside debt in 2006 and the cross-sectional variation in the BHCs' default risk at the end of 2008 and their performance during the crisis period of 2007 to 2008.

Our paper sheds light on the use of inside debt in the banking industry by constructing one of the largest samples assembled for bank governance research. The sample consists of 371 BHCs in the U.S. at the end of 2006.[1] Assets at the insured subsidiaries of these companies make up about 72 percent of the assets for all insured depositories in the U.S. at that time.

Our multivariate analysis indicates that the CEO's inside debt is a statistically significant predictor of the future default risk of the BHC, after controlling for the BHC leverage ratio, asset and liability characteristics of the BHC, and CEO characteristics, such as age, tenure, and total compensation. We measure default risk using Moody's KMV expected default frequency (EDF), our estimates of distance-to-default at the end of 2008, the stock return volatility during 2007 and 2008, risk ratings assigned by bank

[1] We have 57 stand-alone banks and thrifts in our sample and 314 bank holding companies. For simplicity, we refer to the institutions in our sample as BHCs throughout the paper.

supervisors and actual bank default frequency between 2007 and 2011. Our findings show that higher inside debt in 2006 is associated with a lower default risk regardless of the risk measures that we use.

We augment this finding by examining how well the CEO's inside debt explains cross-sectional variation in performance measures, such as return on equity, return on assets, and excess stock returns during the crisis. We find that the BHCs performed significantly better during the crisis if they compensated their CEOs with more inside debt relative to inside equity. We also show that the increase in net income is due to lower interest expenses, lower provisions, and higher non-interest income.

Furthermore, we compare the explanatory power of equity-based compensation measures, with the explanatory power of the CEO's inside debt when the dependent variables are proxies for either the default risk or the performance. The equity-based compensation measures are the CEO compensation in response to a percentage change in stock price (delta) and to the volatility of stock returns (vega). We show that the delta and vega have explanatory power, but they lose significance when inside debt is added to the same regression. This finding implies that inside debt is a critical signal for the default risk and the performance of the BHC.

The analysis presented thus far focuses on the relation between default risk and performance and CEO compensation controlling for bank and CEO characteristics. However, this analysis does not address why performance in 2007 and 2008 was worse for banks with little CEO inside debt in 2006.

To analyze this link, we examine the cross-sectional relation between bank supervisory ratings and the CEOs' inside debt at the end of 2006. In contrast to

nonfinancial corporations, banks are rated by bank supervisors, whose interests are closely aligned with the creditors (depositors). These ratings represent the ex-ante supervisory expectations of future default risk and performance. Furthermore, the six component ratings—capital adequacy, asset quality, management, earnings, and sensitivity to market risk—allow us to investigate why performance was worse for banks with little CEO inside debt.

We find that there is a significant positive association before the crisis between inside debt and favorable supervisory ratings in terms of capital adequacy, earnings, and sensitivity to market risk in 2006. Also, the relation between the supervisory rating of management quality and inside debt is positive and significant. This finding is especially interesting because in 2006 examiners were not required to consider components of the CEO's compensation such as inside debt and equity when determining a supervisory rating. Thus, the BHCs that had higher inside debt in 2006 also received better ratings of capital strength, earnings power, and risk management from examiners. These factors can explain why ex post bank performance is related to inside debt.

Collectively, the negative association between inside debt and bank risk and performance is consistent with either a signaling interpretation or a causal interpretation. Under a signaling interpretation, CEOs that accept compensation packages with a higher inside debt are less prone to risk taking as an equilibrium outcome of a contracting problem with asymmetric information. In this case, the structure of compensation is a signal for the propensity of managers to take risk, as suggested by John, Saunders, and Senbet (2000). Consistent with this view we show that we can infer the BHCs' default-risk exposure and performance by looking at the inside debt of the CEO. On the other

hand, the finding that 2006 inside debt is associated with the default risk and performance during 2007 to 2008 also can have a causal interpretation—higher inside debt causes managers to take less risk—that gives support to the provisions in the Dodd-Frank Act that regulators prohibit compensation practices that encourage risk taking. However, a caveat applies. It is possible that BHCs that did not want to face high default probability in a crisis environment, made low-risk investment decisions, which caused them to appoint more risk averse CEOs, and compensate them with high inside debt. To address this possible endogeneity concern we used the instrumental variables estimator with CEO age, squared term for CEO age, and state income tax rate as instruments for the inside debt ratio. Inside debt remains a significant determinant of risk taking and the instruments are significant and pass tests for over-identifying restrictions. This finding gives some support for the hypothesis that the inside debt is driving the expected default frequencies.

Our paper is organized as follows. Section II reviews the related literature and outlines the hypothesis. Section III describes the data sources, variables, and the summary statistics. Section IV presents the empirical results from the analysis of the relation between the inside debt, default risk and performance. Section V shows whether supervisory ratings reflect better performance for those BHCs that have compensated their CEOs with a higher inside debt. Section VI concludes.

II. Literature

There is considerable research that investigates how the structure of CEO compensation is associated with bank risk-taking incentives. Houston and James (1995) investigate the earlier period of 1982 to 1988 and find no evidence that equity-based

incentives of CEO's are associated with higher risk, measured by stock price volatility. However, during this period, the equity incentive compensation was a smaller portion of the compensation package than in later periods. Indeed, Harjoto and Mullineaux (2003) and Chen, Steiner, and Whyte (2006) show that the equity and option components of compensation at BHCs increased significantly in the 1992 to 2000 period. Chen, Steiner, and Whyte (2006) examine the association between option-based compensation and four types of market measures of risk: total, systematic, idiosyncratic, and interest-rate risk. They conclude that the use of stock-option compensation induces risk taking in the banking industry. Mehran and Rosenberg (2008) use data from 1993 to 2002 and find that the dollar change in CEO compensation in response to a percentage change in stock price (delta) and to the volatility of stock returns (vega) are positively related to measures of stock price and asset volatility in the following year. They attribute this relation to banks undertaking more risky investments.

A growing number of studies investigate the association between CEO compensation and bank risk taking during the credit crisis. A strand of the literature argues that compensation policies contributed to the credit crisis. Bebchuk, Cohen, and Spamann (2010) analyze the cases of Bear Stearns Companies Inc. and Lehman Brothers Holdings Inc. and conclude that their compensation structures provided executives with the incentives for excessive risk taking. Cheng, Hong, and Scheinkman (2010) find a strong positive correlation between executive compensation (average total compensation of the top five executives adjusted for firm size) and price-based bank risk measures (beta, return volatility, tail cumulative return) over the 1992 to 2008 period. They also show that total residual compensation over the 1998 to 2000 period is related to higher

exposure to subprime mortgages at banks in 2006 to 2008. DeYoung, Peng, and Yan (2013) examine the 1994 to 2006 period and find that CEO compensation contracts influenced excessively risky business decisions. Cornett, McNutt, and Tehranian (2009) find that the delta of CEO compensation decreased over the 2006 to 2008 period. They argue that lower levels of delta are associated with a decrease in management monitoring and the subsequent decline in market values associated with the financial crisis.

Another strand of the literature argues that CEOs did not take excessive risks in their own interest at the expense of shareholder interests. Instead, the risks that CEOs took were consistent with shareholder interests and CEOs took those risks to maximize shareholder wealth. In other words, these risks looked profitable for the shareholders ex ante, but the ex post poor performance during the crisis was an unexpected outcome. In support for this argument, Fahlenbrach and Stulz (2011) find that those banks in which CEOs have more shares of equity and executive stock options as a percent of total shares have lower stock returns, ROA, and ROE over the period from July 1, 2007, to December 31, 2008. Support for this view also comes from Gropp and Koehler (2010) who use a large dataset of OECD banks and show that, before the crisis, owner-controlled banks reported higher profits than manager-controlled banks, but during the crisis owner-controlled banks incurred larger losses and were more likely to receive government support.

These papers provide valuable evidence about the association between CEO compensation and risk taking. However, one common shortcoming in this literature is that they typically use inside equity based compensation measures, namely delta and vega. The insight of Jensen and Meckling (1976) provides an opportunity to examine

another component of compensation. They hypothesize that there is an optimal ratio of the CEO's inside debt-to-equity ratio deflated by the firm's debt-to-equity ratio. When this relative measure equals unity the CEO's incentives are equally aligned with shareholders and debt holders, mitigating the incentives to shift risk to debt holders. If the CEO's inside debt-to-equity ratio is less than the BHC's debt-to-equity ratio, then the CEO has an incentive to redistribute wealth from debt holders to shareholders. In a recent paper, Edmans and Liu (2011) show how inside debt mitigates the incentive to risk-shift. Unlike the payoff to equity, the payoff to inside debt in a bankruptcy state is positive, which makes the managers more sensitive to the value of the firm when they have more inside debt. This structure aligns the incentives of the managers with debt holders deterring managers from risk-shifting decisions.

Sundaram and Yermack (2007) and Gerakos (2010) are the first to test the Jensen and Meckling (1976) predictions. They use pension benefits as a proxy for inside debt and show that higher levels of CEO pension benefits are associated with lower levels of default risk as indicated by lower distance-to-default and better ratings for non-financial firms. Wei and Yermack (forthcoming) examine the stock and bond market response in non-financial firms to disclosure announcements of inside debt in 2006. They find that when the firm discloses that its CEO has a sizable wealth in defined pension plan or deferred compensation there were negative stock and positive bond returns. Bolton, Mehran, and Shapiro (2011) show that a sample of 27 BHCs had on average lower credit default swap (CDS) spreads after the 2006 disclosure. Anantharaman, Fang, Gong (forthcoming) find that the cost of debt, both private loans and public debt issues, is higher when the CEO inside debt-to-equity ratio relative to the firm leverage ratio is

higher. Cassell et al. (2012) show that there is a negative association between inside debt holding and future stock returns, R&D expenditures and financial leverage and a positive association with diversification and asset liquidity in a sample of financial and non-financial firms. They conclude that firms with higher inside debt prefer less risky investment and financial policies.

We follow this literature and investigate how the CEO's inside debt in 2006 is associated with the default risk and performance of BHCs during the crisis period.

III. Data

Our sample includes 371 institutions. We construct this sample from a number of sources. We start with 7,538 U.S. financial institutions (5,085 BHCs and 2,453 stand-alone banks) that filed regulatory reports in the fourth quarter of 2006. Our analysis starts in 2006 because the Securities and Exchange Commission (SEC) increased the disclosure requirements for retirement plans and post-employment benefits of the executives and directors on January 17, 2006, which allows us to construct measures of inside debt and equity. Appendix A describes our data sources and variable definitions in more detail.

Data for BHC characteristics are from Y9C filings. For stand-alone banks we use the bank-level Call Reports. We exclude 18 BHCs because the sum of assets in the insured US depository institutions in the holding company are less than 20 percent of the BHC's total assets. This filter removes firms with relatively insignificant banking activity and the subsidiaries of foreign BHCs. In our robustness checks, we use a threshold of 90

percent, which requires almost all our sample BHC assets to be in the hands of insured depository institutions. Our results remain robust to this change in the threshold.

To obtain a CRSP identifier for each BHC in our sample we use the dataset prepared by the Federal Reserve Bank of New York (FRBNY) that links the BHC, bank identifier (RSSDID), and the CRSP identifier (PERMCO).[2] We supplement this dataset with matches that we collect by hand and end up with 415 BHCs that have CRSP identifiers.

We match this sample to COMPUSTAT's Execucomp database[3] that provides CEO compensation information for 108 of the 415 BHCs. The Execucomp sample is biased toward large BHCs. To remedy this problem, we use the proxy statements (DEF14A filings) from the SEC EDGAR database and hand-collect the executive compensation data for the remaining 307 BHCs. Of the 307 BHCs, the proxy statements we need to calculate the CEO inside debt and equity are available for only 263 BHCs. This sample plus the sample from Execucomp forms our sample of 371 institutions. We should note that only four of our sample institutions do not file in December.[4] To check whether there is a systematic bias in BHCs that file in December we rerun our baseline specification by excluding these four institutions and our results remain unchanged.

Table 1 provides summary statistics for default risk, performance measures, CEO and BHC characteristics.

INSERT TABLE 1 HERE

[2] The CRSP-FRB link data can be downloaded from http://www.newyorkfed.org/research/banking_research/datasets.html. We use the file dated March 18, 2008.

[3] The Standard and Poor's Execucomp dataset compiles information from the Security and Exchange Commission DEF 14A (proxy) filings and covers information on S&P 1500 firms.

[4] The four institutions are : (1) WVS Financial Corp, (2) Southern Missouri Bancorp Inc., (3) Harleysville Savings Financial Corp, and (4) Anchor Bancorp Inc.

Default Risk Measures. We use a number of measures of default risk. Our primary measure is Moody's KMV Expected Default Frequency (EDF). Specifically, we use the one-year horizon EDF measure from December 31, 2008. If the BHC did not survive between the end of 2006 and 2008 because of a failure or merger, we use the last reported EDF. There is evidence that the EDF provides explanatory power for default risk. Sellers and Arora (2004) show that EDFs are more powerful at predicting default events than agency ratings. They find that over the 1996 to 2004 period the accuracy ratio for EDF is 0.83, which is higher than the 0.73 ratio for agency ratings.

We observe in Table 1 that, on average, the one-year EDF at the end of 2006 is 13 basis points. In contrast, the average one-year EDF at the end of 2008 jumps to 3.21 percent. By construction, the maximum value an EDF can take is 35 percent, which indicates the default state. We also use the one-year EDF from May and September of 2008. Table 1 shows that, on average, the EDF increased from 78 basis points in May to 1.42 percent in September and then to the 3.21 percent in December of 2008. For robustness, we also use the December 2008 EDF over a 5-year horizon. Table 1 shows that the average of the 5-year EDF at the end of 2008 is 3.13 percent.

Our second default risk measure is the distance-to-default, which we calculate as the market value of assets less adjusted liabilities (equal to short term debt plus one half of long term debt) divided by asset volatility in dollars. To estimate the market value of assets and asset volatility we use an iterative approach that is similar to the one that Moody's KMV uses. First, we construct a weekly series of the market value of equity using equity prices between 2007 and 2008. Merton (1974) expresses equity as a call option written on the assets of the firm. We invert this equation to arrive at an expression

for the market value of assets as a function of the market value of equity and adjusted liabilities. We use the sum of market value of equity and adjusted liabilities to obtain an initial estimate for the weekly series of market value of assets. We estimate asset volatility as the annualized standard deviation of weekly logarithmic asset returns. These initial set of estimates together with adjusted liabilities and market value of equity are used to calculate the next iteration of estimates for the market values of assets and asset volatility. We continue the iterative estimation until the change in volatility estimate is within a small tolerance level. Our estimation approach differs from that of Moody's KMV because Moody's makes additional adjustments on the adjusted liabilities and the volatility estimates that we do not make.[5] Furthermore, we calculate December 2008 distance to default using data from 2007 to 2008, whereas Moody's KMV estimates it using data from 2006 to 2008.

We also use stock return volatility as a proxy for default risk. We define the total stock return volatility as the annualized standard deviation of the weekly logarithmic returns over the 2007 to 2008 period. The use of volatility as a proxy for default risk is plausible because both default probability and stock return volatility are positively related to the firm's operational risk (asset volatility) and financial risk (leverage). Furthermore, a firm with a higher standard deviation of equity returns has a higher probability of falling below the default threshold. Consistent with these insights, Campbell and Taksler (2003) report a strong positive relation between corporate bond credit spreads and equity volatility.

[5] For further explanation of the method used to calculate EDFs see Moody's KMV (2009).

Another proxy for default risk that we use is the confidential supervisory information, namely the CAMELS composite ratings at the end of 2008.[6] In contrast to ratings that are issued by a credit-ratings agency, confidential supervisory ratings are issued by a non-equity stakeholder because the deposit insurance fund is exposed to default risk. This measure is unique to the banking industry.

Supervisory authorities assign each federally insured bank a composite ratings and component CAMELS ratings to six aspects of the bank. These components are capital, asset quality, management, earnings, liquidity and sensitivity to market risk. The ratings are measured on a numerical scale from 1 to 5, where a rating of 1 indicates the strongest performance, risk management practices and lowest degree of supervisory concern, and a rating of 5 is the lowest rating and indicates the weakest performance, inadequate risk management practices and the highest degree of supervisory concern.

The last proxy for default risk is actual failures that occurred during 2007 to 2011. We examine how well inside debt of the CEO predicts the actual default frequency.

Performance Measures. We use three measures of bank performance: return on assets (ROA), and return on equity (ROE), and cumulative excess stock return. We define ROA as the BHC's annualized cumulative quarterly net income over the 2007 to 2008 period divided by the total assets at the end 2006. For ROE, we define the numerator in the same way and deflate it by total shareholder's equity. In addition, we use interest income, interest expense, provisions for loan losses, non-interest income and expense variables (all as a percent of total assets) to demonstrate the channel through which compensation structure affects ROA. The bank's cumulative excess stock return is the

[6] The CAMELS rating is part of the Uniform Financial Institutions Rating System (UFIRS), which was adopted by the Federal Financial Institutions Examination Council (FFIEC) on November 13, 1979. Additional information can be found in FDIC (2012).

annualized cumulative monthly logarithmic return in excess of the S&P 500 logarithmic return over the 2007 to 2008 period.

Inside Debt and Inside Equity. We define the inside debt of the CEO as the sum of the balance in the CEO's pension fund and non-qualified deferred compensation.[7] Pension benefits are reported in proxy filings as the actuarial present value of accumulated benefits determined in accordance with SEC rules. Our measure of pensions includes both qualified plans and non-qualified plans. CEOs typically hold most of their pensions in non-qualified plan. The Pension Benefit Guaranty Corporation (PBGC) guarantees qualified pension plans up to a limit in the case of insolvency of the firm. However, for CEOs most of the pension plan amount is not covered by PBGC (Sundaram and Yermack, 2007). Non-qualified deferred compensation is a "Top Hat" plan offered only to employees in the top 10 percent salary bracket. The plan allows the deferral of long-term incentive bonuses into retirement.

We do not directly calculate the pension holdings and deferred compensation variables. Instead, we use the values reported by the companies. Firms that file the proxy statements (DEF 14A filing) follow the methodology spelled out in the prevailing SEC rules[8] to estimate the value of pensions and deferred compensation. The proxy statement is the standard source for both ExecuComp and our hand collected database.

Inside debt is at risk when a firm fails. The 314 BHCs in our sample are subject to bankruptcy rules under which both pension and deferred compensation are treated as

[7] Qualified pension plans or deferred compensation are considered compensation under the tax code. Non-qualified pension plans or deferred compensation are not considered compensation under the tax code.
[8] See *Federal Register* v. 71, n. 174, pp. 53158-53266; September 8, 2006.

unsecured liabilities.[9] On the other hand, in the case of failure, the 57 stand-alone banks in our sample would undergo a bank resolution process and the FDIC would act as the receiver. As the receiver, the FDIC has the authority to disaffirm any contract that it deems burdensome if it will promote the order resolution of the failed bank.[10] Furthermore, the FDIC has the power to prohibit golden parachute payments or indemnification payments to parties that are affiliated with failed banks. Therefore, if the FDIC determines that it is burdensome to pay the amount of the inside debt that the CEO holds, the FDIC can repudiate the contract. The CEO then has the right to file a claim for actual direct damages and this claim would have the same priority as a general trade claimant. FDIC's authority to repudiate contracts was upheld in court.[11]

Table 1 shows that 72 percent of the CEOs in our sample hold some form of inside debt. CEOs who hold pensions constitute 60 percent and those that hold deferred compensation constitute 44 percent of the total sample in 2006.

We define inside equity as the sum of the value of equity holdings and the value of stock options. We calculate the value of equity holdings by the product of the number of shares held by the CEO and the stock price at the end of 2006. We construct a value for the stock options by using the detailed data on the option grants, which was first required in the 2006 SEC filings. The maturity, exercise price, and stock price for each of the options holdings are reported in Execucomp and DEF 14A filings. We value the options using the standard Black-Scholes (1973) option pricing formula. We use the one-

[9] The orderly liquidation authority under Title II of the Dodd-Frank Act institutions could be invoked for institutions in our sample, but the treatment of deferred compensation claims would receive the same treatment as they would under bankruptcy.
[10] See Federal Deposit Insurance Act 12 USC 1821 (e)(1).
[11] *Westport Bank & Trust Company v M. James Geraghty and Normand M. Steere v Federal Deposit Insurance Corporation*, 593 US (2d Cir 1996).

year constant maturity Treasury bond yield, which was 5.0 percent at the end of 2006, as the risk-free rate.[12] We calculate the six month, one, two, three, five, seven, and ten year volatilities for each stock using monthly returns from CRSP files. Out of these we pick the volatility over a horizon that is the closest to the stated maturity of the option. On average, the CEOs in our sample have $41 million in inside equity holdings.

Our focal independent variable is the CEO inside debt ratio, which is the ratio of inside debt to inside equity. We construct this ratio to measure the importance of inside debt relative to inside equity holdings. This ratio provides information about the extent to which the CEO incentives are aligned with both the debt holders and the shareholders of the firm. On average, the CEO inside debt ratio is 0.37 in our sample. In Sundaram and Yermack (2007) and Wei and Yermack (forthcoming) the sample averages of the inside debt ratio are 0.17 and 0.22, respectively.[13] In our regressions we use the natural logarithm of the CEO inside debt ratio.[14] We use the logarithmic transformation for two reasons. First, the variable is highly skewed. Second, a kernel regression between the inside-debt to inside-equity ratio in 2006 and EDFs in in 2008 demonstrates a strong negative convex relation. However, for robustness check we use various forms of inside debt ratio in addition to the logarithmic transformation.

INSERT FIGURE 1 HERE

CEO Characteristics. To control for the characteristics that could affect the CEO's risk incentives and thus the default risk of the BHC, we use the CEO's age and

[12] We obtained this interest rate from the H.15 release of the Board of Governors for December 29, 2006.
[13] We should note two key differences between our sample and the Sundaram and Yermack and Wei and Yermack samples. First, their samples are based on primarily non-financials. Second, Wei and Yermack sample consists only of firms with a positive amount of inside debt.
[14] Because the ratio is zero for some CEOs with no inside debt holdings, we add a constant to the ratio to define the logarithm. We set the constant to the average of ratio's minimum (0) and non-zero minimum value over the sample. Our empirical results remain robust to using different constants in the logarithmic transformation.

tenure with the BHC. In a cross-sectional regression, age can control for the unobservable characteristics of the CEO including the CEO's risk aversion or confidence. The CEO's tenure has similar characteristics, but as Sundaram and Yermack (2007) point out, the size of the pension can mechanically increase based on the CEO's years of service to the firm. Age can also affect the value of pensions because the calculation uses an actuarial estimate of the CEO's remaining lifespan. Therefore, controlling for both the CEO's age and tenure can isolate the impact of the inside debt ratio on risk taking.

At the end of 2006, the average age of CEOs in our sample is 57 years and the average tenure of CEOs is ten years. The CEOs range in age from 34 to 81 and range in tenure from recently appointed to 50 years of experience.

In our regressions, we also control for the level of the CEO's pay. When a CEO's total pay exceeds a certain threshold, the CEO may not be responsive to incentive clauses in his contract. Penas and Unal (2003) and Minnick, Unal, and Yang (2011) find evidence that incentive responsiveness decreases as the BHC size, and therefore total pay, increases.

We term the level of the CEO's pay as total compensation, which includes salary, bonus, equity awards, option awards, non-equity incentive compensation, and other compensation. We observe that, on average, the CEOs in our sample received $2.3 million in total compensation in 2006. The amount ranges from $120,400 to approximately $52 million.

BHC Characteristics. In our regressions with the inside debt ratio, we control for BHC leverage. To calculate BHC leverage, we define debt as the total liabilities and

equity as the market value of equity as of the end of 2006. On average the BHC debt-to-equity ratio is 5.34 in our sample.

Furthermore include asset and liability variables and size to control for BHC characteristics that can influence the default probability. In terms of asset characteristics, from the end of 2006, we include loan loss reserves, non-performing assets, securities, and cash and items due from other banks, as a percentage of total assets. We also include brokered deposits and firm leverage from the liability side of the balance sheet. Cole and White (2012) show that these variables exhibit significant explanatory power in predicting the bank failures that occurred in 2009 one-to-five years in advance. Asset size can capture the too-big-too-fail effects where larger asset size can cause the regulators to be reluctant to close an insolvent bank. The financial information is at the BHC level whenever available (314 BHCs), otherwise we use the financial information of the stand-alone bank (57 banks).

The size of the BHCs in our sample ranges from $226 million to $1.9 trillion in total assets in 2006. The ratio of the market value of assets to the book value of assets is 107 percent on average and ranges from 52 percent to 148 percent in 2006.

IV. Empirical Results

A. Default Risk and Inside Debt

Using cross-sectional data, we explore the association between BHC default risk and CEO inside debt in the following multivariate setting:

$$DefRisk_{i,08} = \alpha_0 + \alpha_1 IDR_{i,06} + \alpha_2 FDR_{i,06} + \alpha_3 CEO_{i,06} + \alpha_4 BHC_{i,06} + \varepsilon_{i,08} \quad (1)$$

The dependent variable in equation (1), $DefRisk_{i,08}$, represents various proxies we use to capture the default risk of the i^{th} BHC at the end of 2008. The independent variables are measured for bank *i* as of end of 2006. *IDR* is the natural logarithm of the inside debt ratio, *FDR* is the natural logarithm of the firm's debt-to-equity ratio, and *CEO* and *BHC* denote the characteristics of the CEO and the BHC.

We include the BHC characteristics to differentiate the efforts of two CEOs who are endowed with the same amount of business risk but differ only by how their incentives are aligned with the debt holders. Our focal hypothesis is that those CEOs whose incentives are more aligned with the debt holders focus more on mitigating default risk of the BHC and perform better during a crisis.

Table 2 reports the results. The t-statistics, which are based on robust standard errors, are in parentheses. In our baseline specification in Column (1), we test how well the CEOs' inside debt ratio as of the end of 2006 explains the one-year EDF at the end of 2008. The coefficient on the Log of Inside Debt Ratio is negative and significant.

In Columns (2) and (3) we use the one-year default probabilities from May 2008 and September 2008 to check whether our results are robust to excluding the effects of the TARP program. The first date captures the environment after the default of Bear Stearns and the second date reflects the end of month when Lehman Brothers, AIG, Freddie Mac, and Fannie Mae defaulted. In both specifications the inside debt ratio remains significant. Interestingly, as we move from May to December 2008 the sensitivity of the Log of Inside Debt Ratio becomes larger and more statistically significant.

As shown in Column (4) of Table 2, the Log of Inside Debt Ratio maintains its significance when we use the 5-year EDFs at the end of 2008. In unreported results that are available from the authors, we also use long-term EDFs with horizons varying from 2 years to 10 years and obtain similar levels of economic and statistical significance for the Log of Inside Debt Ratio and the control variables.

In unreported results, we also check the sensitivity of our results to the inclusion or exclusion of investment banks. First we add four large investment banks (Morgan Stanley, Goldman Sachs, Lehman Brothers, and Merrill Lynch) to our sample of BHCs and estimate the baseline specification. Next, we increase the threshold for sum of the assets in the insured U.S. depository institutions in the holding company to 90 percent of the BHC's total assets. This filter results in a slightly smaller sample of 360.[15] We re-estimate the baseline specification with this smaller sample. In both cases, the Log of Inside Debt Ratio is significant.[16]

Moody's KMV uses equity prices from 2006 to 2008 as an input to calculate the EDFs in 2008, our dependent variable in Columns (1) to (4) in Table 2. We also use equity prices to calculate the value of inside equity, which is used to construct the inside debt ratio. Therefore, depending on the maturity of the options that the CEO holds, there is potential for the 2006 data to also enter the calculation of the inside debt ratio. To ensure that our results are not affected by overlapping data, the dependent variables in the remaining specifications on Table 2 do not use equity prices from 2006 to estimate default risk.

[15] The new sample excludes the following institutions: (1) Citigroup Inc (2) Wells Fargo & Co (3) State Street Corp (4) Bank of New York Corp (5) Capital One Financial (6) E-Trade Financial (7) Charles Schwab Corp (8) Popular Inc (9) Cass Information Systems, owner of Cass Commercial Bank (10) Countrywide Financial Corp, and (11) Doral Financial Corp.

[16] These results are available from the authors upon request

In Column (5), we use our estimates of the distance to default that use equity prices from the 2007 to 2008 period. The positive and significant coefficient shows that a higher the inside debt ratio is associated with being further away from default boundary which indicates lower default risk. In specification (6) we use equity volatility, again from the 2007 to 2008 period, as an alternative risk measure. The number of observations used to calculate the volatility varies across the sample banks because of failures and mergers. This issue inflates the variance of the errors for some observations and violates the assumption of a constant error variance in the OLS regression. To mitigate this bias we estimate weighted least squares regression where the weights are proportional to the number of observations per bank. The coefficient estimates and the statistical significance of the Log of Inside debt Ratio in the specifications remain unchanged.

INSERT TABLE 2 HERE

The default risk measures in specifications (1) through (6) use stock market information (i.e. equity volatility) as the major input in their calculations. In Column (7), we use the CAMELS ratings at the end of 2008 as a proxy for default risk. In contrast to the other default risk measures, regulatory ratings do not directly use equity volatility; instead they reflect perceptions of default risk and gauge the overall health and stability of the institution. Column (7) reports the results from an ordered probit regression. We observe that a higher inside debt ratio is associated with a lower likelihood of a riskier CAMELS rating in 2008.

The EDF, distance-to-default, stock return volatility, and CAMELS ratings capture expected default risk. In addition to these default measures, we use actual bank failures over the 2007 to 2011 period, during which the lead banks of 36 BHCs failed.

The earliest failure in our sample is from July 11, 2008 and the most recent failure is from September 23, 2011. In Column (8) we estimate a probit regression to analyze the impact of inside debt ratio on the probability of actual default probabilities. The dependent variable is 1 if the institution failed between 2007 and 2011 and 0 otherwise. We observe that higher levels of inside debt ratio significantly reduce the likelihood that a BHC defaults.

Throughout Table 2, other than the inside debt ratio, the only CEO characteristic that is significant is total compensation. As we note above, the coefficient on total compensation can also reflect the size effect. We address this possibility below in Table 7 where we examine the effect of bank size on our estimates.

The financial characteristics of the BHCs all have the expected signs and most are statistically significant at the 5 percent or better levels. We find that the higher levels of non-performing assets are positively associated and cash and securities are negatively associated with the default risk measures. This is plausible because, all else equal, a loan portfolio that has high non-performing loan levels in good times before the crisis is a good indicator of the credit risk in crisis time. On the other hand, cash and securities can provide liquidity during the crisis, therefore reduce default risk.

The results for brokered deposits are particularly interesting. In most specifications, we observe higher levels of brokered deposits are associated with higher levels of default risk. This finding sheds some light to the policy debate regarding whether use of brokered deposits should be restricted. The rationale here is that use of brokered deposits, which are basically wholesale deposits obtained from non-core

depositors, is an indicator of higher probability of default as discussed in FDIC (2011). Our finding supports this view.

To gauge the economic significance of our results we calculate the standardized regression coefficients, which we define as the change in the EDF that is associated with one standard deviation change in the independent variable. The standardized coefficient on the Log of Inside Debt Ratio in the baseline specification is 105 basis points. The standardized coefficient for the leverage ratio is 65 basis points, for brokered deposits is 131 basis points, for non-performing assets is 102 basis points and for securities is 108 basis points. All of the other control variables have lower levels of economic significance.

B. Robustness Tests

The previous tests report the significance of the economic relation between default risk and inside debt using a number of different proxies for default risk. The robustness tests in this section use various measures of inside debt and controls to address econometric issues related to the independent and dependent variables in our regressions.

Measures of Inside Debt. In Table 2, our focal variable is the natural logarithm of the ratio of the CEO's inside debt to inside equity and we show that this variable is significant in all specifications. In Table 3, we use different economic measures of inside debt to check the robustness of the results.

In Column (1), the natural logarithms of inside debt, inside equity, and firm leverage enter the regression model separately. In Column (2) we create a variable, which is the natural logarithm of the CEO D/E divided by firm D/E (Log Relative D/E). This variable follows the one used by Wei and Yermack (forthcoming). Finally, specification

(3) uses the unadjusted levels of inside debt ratio (CEO D/E Ratio) to test whether our results continue to hold without logarithmic transformation.

Column (4) shows the results when we use an inside debt indicator variable where those BHCs that provide inside debt to their CEOs take a value of one and zero otherwise. This indicator variable abstracts from the level of inside debt and therefore is independent of the way the present values of pension, deferred compensation, and executive options are calculated.

We find that the coefficient on the indicator is significant, which indicates that simply having an inside debt program for the CEO signals that there is a broader risk management program at the BHC that reduces default risk. The existence of CEO inside debt can reflect a more general compensation program that includes inside debt components for other employees as well.

In Column (5) we use the ratio of the CEO's inside debt to the sum of inside debt and inside equity. We observe that in all these specifications the inside debt measure remains significant—higher levels of inside debt in 2006 are associated with lower levels of default risk in 2008.

INSERT TABLE 3 HERE

Distribution of Variables. As Table 1 shows, the distributions of EDF, the inside debt ratio, and most control variables exhibit skewness. About 80 percent of BHCs have EDF levels between 0.01 and 3.5 and the remaining institutions have significantly higher levels of default risk (EDF between 3.5 and 35) compared to the rest of the sample.

The first two specifications in Table 4 control for the skewness of the EDF. In specification (1) we run a probit regression after converting the EDF into a binary variable, which is equal to one if the bank is in the top EDF quintile at the end of 2008

and zero otherwise. Specification (2) transforms the EDF into percentile rank form and estimates the OLS regression.[17] In both specifications the inside debt ratio retains its sign and significance.

Although the OLS regression assumes an unrestricted range for the dependent variable, EDF is restricted to the [0.01, 35] interval. To mitigate this problem, in Column (3) of Table 4 we use a fractional probit regression to estimate the determinants of the 2008 EDF levels. The fractional probit differs from the probit in that the dependent variable can assume continuous values over the [0,1] interval. We follow Papke and Wooldridge (1996) and use the quasi-maximum likelihood estimator obtained by maximizing the Bernoulli log-likelihood function. Our result remains robust in this specification as well.

INSERT TABLE 4 HERE

In specification (4) we take the natural logarithm of both the dependent and independent variables. In specification (5) we control for outlier effects and estimate the baseline specification where we winsorize all variables at the one percent level (the 0.5 percent level at both tails of the distribution).

Quantile Estimates. Our baseline specification uses the OLS regression that estimates the central tendency of the relation between default risk and inside debt. To examine the robustness of this result for banks with significantly higher and lower amounts of default risk we run quantile regressions.

Table 5 presents estimates of our baseline specification for the 20^{th}, 40^{th}, 60^{th}, and 80^{th} percentiles (quintiles). Two observations are worth noting. First, the relation between

[17] The transformation of the EDF into percentile rank gives its empirical cumulative distribution function which is between 0 and 1. For instance, Johnson (2004) uses this transformation to control for the skewness problem.

default risk and the inside debt ratio is negative for all four quintiles and significant for the 40th, 60th and 80th percentile. Second, as we move from lower to upper quintiles this relation becomes economically and statistically more significant.[18]

INSERT TABLE 5 HERE

Bank Size Effect. In the baseline specification we use total compensation to control for the level of CEO compensation. However, the correlation between firm size and total compensation is 0.894, so it also captures the size effect. Our baseline specification includes only total compensation to avoid multicollinearity. To control for total compensation and size separately we generate a variable called residual compensation, following Cheng, Hong, and Scheinkman (2010) where we regress total compensation on firm size and use the residuals of this regression. In Column (1) of Table 6 we add residual compensation together with the natural logarithm of BHC asset size. We also add the square of the logarithm of assets in the model to control for nonlinearity. We observe that residual compensation is positive and significant. In other words, default risk increases as both compensation and BHC size increases. However, we also observe that size has a significant nonlinear effect in that default risk increases but at a decreasing rate with BHC size. We do not find such nonlinear effect for the residual compensation and we do not report the nonlinear term in residual compensation in Table 6. In this specification we observe that inside debt ratio maintains its significance.

It is instructive to examine the role of inside debt for different subsets of our sample. The opportunity set that BHCs face is not uniform across large and small BHCs.

[18] Since the dependent variable exhibits skewness, for robustness we run the quantile regressions using the natural logarithm of the dependent variable. The result remain robust and we find that the inside debt ratio is statistically and economically significant in all four quintiles.

For example, Penas and Unal (2004) show that acquirer credit spreads decline only for those BHCs that attain too-big-to-fail status as a result of the acquisition. Also, the incentives of CEO can be influenced by the size of the BHC. Indeed, Minnick, Unal, and Yang (2011) show that the CEO delta significantly predicts bank acquisition announcement returns for small and medium banks, but not large banks.

To further investigate the interaction between size and inside debt, we estimate the following model:

$$EDF_{i,08} = \alpha_0 + \sum_{n=1}^{N} \alpha_n SizeDummy_n \times IDR_{i,06} + \sum_{n=2}^{N} \beta_n SizeDummy_n + CONTROLS_{i,06} + \varepsilon_{i,08} \quad (3)$$

The coefficient estimates of the interactions between the size dummies and inside debt explain how each size cohort contributes to the economic relation between inside debt and EDF.

We define four size groups: small, medium, large, and mega bank. The small group includes BHCs with assets that are less than $1 billion; the medium group includes BHCs with assets between $1 billion and $10 billion; the large group includes BHCs with asset larger than $10 billion but less than $100 billion, and the mega bank group includes BHCs with assets larger than $100 billion. The $10 billion size cutoff is important since the BHCs which are above this size threshold are subject to stress testing and large-bank deposit pricing rules. Prior research (e.g. Penas and Unal, 2004 and Minnick, Unal, and Yang, 2011) has used the $100 billion asset size threshold to define mega size bank groups. In Column (2) the regression results show that the effect of the inside debt ratio is negative and significant for all interactions, except for the mega-size bank group. This finding implies that the CEOs of mega size BHCs are not sensitive to changes in their inside debt holdings. This result is similar to the findings of Penas and Unal (2004) and

Minnick, Unal, and Yang (2011) that show that mega bank CEOs are not sensitive to changes in equity compensation. One plausible explanation given by Minnick, Unal, and Yang (2011) is that as bank size grows, total compensation grows to such high levels that the responsiveness of CEO behavior to marginal effect of equity or debt compensation diminishes.

Overall, using different regression models and dependent variables we establish the inside debt ratio as an important economic variable that is associated with bank default risk. This finding supports the Jensen and Meckling (1976) hypothesis that lower levels of inside debt provide incentives to the CEO to align his interests with the shareholders and increase firm risk at the expense of the debt holders. Therefore, in our sample, those CEOs who have higher inside debt ratios have better incentives to balance the interests of shareholders and debt holders. This alignment in incentives results in lower default probability in a crisis environment. One exception for this relationship is for mega size banks, which have asset size greater than $100 billion. We do not observe a relation between default risk and CEO compensation. Prior research shows similar insensitivity of mega size bank CEO's to equity compensation, which implies that we do not have evidence that mega size bank CEOs can be incentivized through compensation schemes.

INSERT TABLE 6 HERE

Endogeneity. We designed our tests so that the default risk measures in 2008 are regressed on inside debt levels at the end of 2006. Hence, the empirical framework generates a time lag between the dependent and the independent variables, which could help with the identification of the relationship.

To strengthen the causality argument, we use the instrumental variables (IV) estimator with CEO age, squared term for CEO age, and the maximum state income tax rate as the instruments for the inside debt ratio. Because we have more than one instrument the system is overidentified and therefore the IV estimator is a GMM estimator.

We use CEO age as one of the instruments following Cassell et al. (2012) who justify the use of this variable because Sundaram and Yermack (2007) find CEO age to be a significant determinant of inside debt holdings. We also allow a non-linear relation between CEO age and inside debt holding. Although, inside debt can increase linearly as CEO age increases, after a certain age this relationship changes and we can observe a reduction in inside debt. For example, tax regulations may allow plan restrictions to be lifted at age 59½ and generally minimum withdrawals begin at age 70½ . Also, the benefit of contributing to a pension plan diminishes as the CEO approaches retirement and there could be higher demand for liquidity resulting in withdrawals from plans. For these reasons, we add a squared age term as an additional instrument.

Our third instrument, the maximum state income tax rate for individual income, is used as an instrument by Anantharaman, Fang, and Gong (forthcoming) and Cassell et al. (2012).[19] CEOs can derive significant tax benefits if they defer income when they live in a state with high income taxes and then move into a low tax state after retirement.

Our IV estimation results are reported in Table 7. Our instruments are statistically significant at the 1% level and valid in the first stage. The F-test for excluded instruments rejects the null hypothesis that the instruments are weak (p-value=0.0008). We also carry

[19] We obtain the maximum state income rates from http://www.nber.org/~taxsim/state-rates/ which uses the TAXIM model in Feenberg and Coutts (1993).

out the Sargan-Hansen test to check whether the overidentifying restrictions are valid. We cannot reject the null hypothesis that they are valid for the 2008 EDF estimation (p-value=0.8355). The overidentification restrictions are also valid for Distance-to-Default and Equity Volatility estimations with similar levels of p-values for the Sargan-Hansen test.

INSERT TABLE 7 HERE

In Table 7, we also use two bank governance variables, Board Size and Fraction of Outside Directors**,** following Adams and Mehran (2012). Our first stage regression results indicate that Board and CEO characteristics such as Board Size, Fraction of Outside Directors, CEO Compensation, CEO tenure, and CEO age significantly impact the CEO inside debt ratio. These findings are consistent with theory and findings in previous empirical studies.

We observe that inside debt maintains its significance in the second stage regressions. These results provide some support regarding a causal link between inside debt and bank default risk. Hence, the inside debt ratio in both the OLS and the IV estimation show that an increase in inside debt can mitigate BHC risk taking.

C. Bank Performance and Inside Debt

Our findings so far support the argument that BHCs that had lower default risk in 2008 also had higher inside debt in 2006. It is necessary to examine whether this low risk-taking incentive can also explain financial performance during the crisis period. To examine this issue, we model the association between inside debt and bank performance over the 2007 to 2008 period. Specification (1) in Table 8 displays weighted least squares estimates of the association between excess stock returns and the inside debt ratio of its

CEO. Specifications (2) and (3) use the bank's accounting measures of performance, ROA and ROE.

INSERT TABLE 8 HERE

We observe that in all three specifications the association between performance variables and the inside debt ratio is positive and significant during the crisis period, which implies that shareholders benefited in a crisis environment from having compensated the CEO with more inside debt during normal times.

Overall, these results show an important feature of inside debt. Shareholders may obtain lower returns during normal times when the CEO is compensated with a lower inside debt ratio because such compensation structure is associated with less risk taking. However, this reduction of returns in good times can be viewed as an insurance cost that provides protection during times of heightened risk. In an environment when the default risk in the economy rises and the financial institutions have a common adverse system-wide shock, shareholders benefit from the CEO's prior conservative investment decisions.

Columns (4) to (8) investigate the association between the inside debt ratio and components of bank income. This analysis enables us to better explore the channel through which a bank CEO's risk incentives can affect the bank's performance. The dependent variable is the component of net income as a percent of total assets (ROA) annualized quarterly average from 2007Q1 to 2008Q4. The independent variables measure compensation and bank characteristics as of the year-end 2006.

As Column (3) of Table 8 shows, if a CEO has a higher inside debt ratio in 2006, the net income as a percent of assets (ROA) is higher in the subsequent two years. In

Columns (4) to (8) we find that the increase in net income is due to lower interest expenses, lower provisions, and higher non-interest income at BHCs with higher inside debt ratios.

We can interpret these results as follows. If the CEO has a higher inside debt ratio they have less incentive to take on risk because their incentives are also aligned with debt holders. Market participants understand this incentive structure and, controlling for losses on the credit portfolio, they require lower rates from the firm run by a CEO that has his incentives more aligned with debt holders, which results in lower interest expense. This finding is consistent with the argument that the structure of CEO compensation can serve as a signal for risk-taking incentives (John, Saunders, and Senbet, 2000). Furthermore, the risk-mitigation incentives result in loan portfolios with fewer delinquencies and hence supervisors require lower loan loss provisions. Finally, if the compensation structure encourages the CEO to make decisions that are conservative from a risk-taking perspective, then it can be more difficult to achieve earnings targets. In that case, fee-based activities, such as wealth management or trust activities, which result in higher non-interest income, become the safer, but more difficult, avenue to offset the forgone expected earnings.

Our last set of tests focus on contrasting the explanatory power of inside debt ratio and delta and vega. Previous research has shown that delta and vega are related to default risk and performance measures (e.g. DeYoung, Peng, and Yan, 2013, and Fahlenbrach and Stulz, 2011). We follow DeYoung, Peng, and Yan (2013) and use the logarithmic transformation for the heavily skewed compensation measures such as delta and vega to proxy inside equity. In Columns (1) and (2) of Table 9 we observe that delta and vega are

significant variables as shown in previous studies. However, in Column (3) when we examine the impact of the compensation variables (inside debt ratio, delta, and vega) on default risk we observe that only the inside debt ratio remains significant.

INSERT TABLE 9 HERE

In specifications (4) to (6) we show that the delta and vega of CEO compensation are significant variables to explain cumulative excess stock returns but when we estimate the model with three compensation variables, delta is insignificant, vega is marginally significant and the inside debt ratio remains significant. These findings show that among the compensation variables the inside debt ratio provides better explanatory power for the BHC's default risk and stock market returns.

V. Supervisory Ratings and the Inside Debt Ratio

The empirical evidence thus far demonstrates that the inside debt ratio is associated with the default risk and the performance of the BHC. To further explore why this is the case, we look to the component CAMELS ratings. CAMELS represent an ex-ante assessment of the risk of the institution. Because we are interested in why default risk is lower in 2008 and earnings and excess stock returns are higher in 2007 and 2008, we use the ex-ante assessment represented by the 2006 CAMELS component ratings. It is important to note that the prevailing bank examination guidelines in 2006 did not require the examiner to consider the CEO's inside debt or equity holdings when issuing a rating. Therefore, we do not expect there to be a mechanical relation between inside debt and supervisory ratings.

The management, or "M", component is particularly interesting for our purposes because it represents the supervisory assessment of the quality of the board of directors and the management of the bank. When supervisors assign this rating they consider factors such as the quality of oversight, management's response to risks, the quality of the risk management systems, the adequacy of audits and internal controls and policies, the depth and succession of management, the concentration of authority, the avoidance of self-dealing and the reasonableness of compensation policies.[20]

We estimate a cross-sectional regression model where 2006 levels of composite and components ratings are regressed on 2006 the log of the inside debt ratio, controlling for CEO and BHC characteristics. Table 10 shows the results. We observe that higher levels of the inside debt ratio are associated with institutions that have lower risk assessments for the capital, management, earnings and sensitivity to market risk components. From these results, we expect that banks with higher inside debt ratio in 2006 will have stronger capital positions, better management, stronger earnings, and be in a better position to withstand market shocks in the future. Indeed, our results from above show that these characteristics translated into lower default risk in 2008 and better performance and higher excess returns in 2007 and 2008.

INSERT TABLE 10 HERE

[20] See Section 1.1 and Section 4 of FDIC (2012) for more detail of the factors considered when the supervisor assigns the Management component rating.

VI. Conclusion

In this paper, we use a sample of 371 BHCs to examine whether the ratio of inside debt to inside equity held by the CEO can explain their default risk and performance during the credit crisis of 2007 to 2008. In our sample, the average BHC debt-to-equity ratio is 5.34. The CEO's inside debt to inside equity ratio is nowhere close to this ratio. The average level of inside debt compensation for CEOs is $3 million and the average inside equity is $41 million. Such a bias toward inside equity compensation implies that the interests of a CEO are strongly aligned with those of the shareholders. However, our results demonstrate that BHCs faced lower default risk during the crisis if their CEOs held more inside debt relative to inside equity and thus had incentives that were more aligned with the debt holders. In addition, BHCs performed better during the crisis when the CEOs had a higher inside debt ratio, which indicates that shareholders can also benefit when they make the incentives of the CEOs align with those of the debt holders.

We show that the inside-equity-based measures have explanatory power, but lose significance when the inside debt ratio is added to the same regression. Our analysis of bank size shows that the effect of inside debt is higher as the bank size increases but for mega banks we do not observe this relationship. Finally, we obtain verification that inside debt is indeed related to lower risk taking and better performance using information specific to the banking industry. We show that the inside debt ratio of the CEO is significantly related to risk measures, such as the CAMELS ratings (and specifically to capital, management, earnings, and sensitivity to market risk ratings) issued by the bank examiners before the crisis. Given that these ratings do not consider the management

compensation structure, we take this observation as additional evidence that the inside debt aligns the interests of the management and the debt holders.

These findings imply that there is an important role for inside debt as a signal of the risk-taking incentives of the banks' executives. BHCs' stakeholders can use this information to identify banks where the compensation structure provides the CEO with incentives that are aligned more with the debt holders and therefore inclined towards less risk taking, or more aligned with the shareholders and therefore inclined towards more risk taking.

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Table 1. Summary Statistics

Age of CEO and CEO tenure are measured in years. Residual Compensation is the residual from a regression of the Log of Total Compensation on the Log of Total Assets (Size). Deferred Compensation and Pension Indicators are variables that are 1 if the CEO is given this type of compensation and 0 otherwise. The Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are from the Y9C if available, otherwise they are the numbers reported on the Call Report for the largest institution in the holding company. These variables are a percent of the Total Assets from the same regulatory report. Excess returns are the cumulative monthly stock return in excess of the log return of the S&P 500 from January 2006 to December 2008. The ROA and its components and the ROE are the annualized quarterly average of the 2007Q1 to 2008Q4 period.

	Number	Mean	Median	Minimum	Maximum	Standard Deviation	Skewness
Default Risk Measures							
Dec 2006 EDF (%)	371	0.13	0.08	0.01	7.14	0.39	16.20
Dec 2008 EDF (%)	371	3.21	1.02	0.01	35.00	5.55	2.78
May 2008 EDF (%)	371	0.78	0.24	0.01	35	2.28	10.4
Sep 2008 EDF (%)	371	1.42	0.43	0.01	35	3.32	5.75
Dec 2008 5-Year EDF (%)	371	3.13	1.52	0.01	22	4.07	2.26
Distance to Default	371	0.81	0.69	-1.9	11.7	1.31	2.62
Equity Volatility (2007-2008)	371	0.41	0.36	0.0037	2.31	0.23	2.57
Failure Indicator through 2011	371	0.097	0	0	1	0.30	2.72
High Risk Indicator	371	0.20	0	0	1	0.40	1.48
Performance Measures							
Return on Assets (ROA), 2007-2008	371	0.22	0.65	-10.30	4.38	1.41	-2.62
Return on Equity (ROE), 2007-2008	371	2.52	7.11	-129.3	42.8	15.6	-3.02
Excess Stock Returns, 2007-2008	371	-0.20	-0.07	-2.74	0.62	0.49	-1.76
Interest Income (% of Total Assets), 2007-2008	371	6.39	6.33	0.47	10.90	1.10	-0.12
Interest Expense (% of Total Assets), 2007-2008	371	2.93	2.91	0.086	5.07	0.72	-0.02
Provisions for Loan Losses (% of Total Assets), 2007-2008	371	0.78	0.52	-0.2	5.11	0.79	1.84
Non-Interest Income (% of Total Assets), 2007-2008	371	1.21	1.03	-3.58	6.84	1.02	2.06
Non-Interest Expense (% of Total Assets), 2007-2008	371	3.36	3.21	-0.35	9.4	1.26	1.44
CEO Characteristics							
Inside Debt Indicator	371	0.72	1	0	1	0.45	-0.98
Pension Indicator	371	0.60	1	0	1	0.49	-0.39
Deferred Compensation Indicator	371	0.44	0	0	1	0.50	0.23
CEO Debt ($ thousands)	371	3,081	475	0	111,413	9,468	6.91
CEO Equity ($ thousands)	371	40,929	4,280	12	4,475,412	239,999	17.10
CEO D/E (Inside Debt Ratio)	371	0.37	0.09	0.00	19.80	1.35	10.40
Firm D/E	371	5.34	4.92	0.38	27.8	2.78	2.46
CEO D/E to Firm D/E	371	0.074	0.021	0	3.01	0.22	8.72
Log of CEO D/E	371	-3.63	-2.37	-8.17	2.99	3.16	-0.44
Log of Firm D/E	371	1.55	1.59	-0.96	3.32	0.54	-1.03
Log of CEO D/E to Firm D/E	371	-5.06	-3.88	-9.42	1.1	3.05	-0.42
Inside Debt/(Inside Debt+Inside Equity)	371	0.15	0.09	0	0.95	0.19	1.60
CEO Age (years)	371	57	57	34	81	7.39	0.04
Log of CEO Age	371	4.03	4.04	3.53	4.39	0.13	-0.43
CEO Tenure (years)	371	10	8	1	50	7.21	1.43
Log of CEO Tenure	371	1.94	2.08	0	3.91	0.87	-0.56
CEO Total Compensation ($ thousands)	371	2,344	676	120	51,755	5,921	4.99
Log of Total Compensation	371	6.79	6.52	4.80	10.90	1.12	1.30
Residual Compensation	371	0.000	0.002	-2.210	1.480	0.500	-0.061
Delta	371	482	57	0	45,201	2,473	16.20
Log of Delta	371	4.34	4.05	0.11	10.70	1.79	0.44
Vega	371	362	38	0	12,193	1,170	6.59
Log of Vega	371	3.77	3.66	0	9.41	2.13	0.08
BHC Characteristics							
Total Assets ($ millions)	371	26,574	1,907	226	1,884,318	150,792	9.60
Log of Total Assets	371	14.80	14.50	12.30	21.40	1.66	1.23
Small Bank (<$1 Billion in Total Assets)	371	0.35	0	0	1	0.48	0.65
Medium Bank ($1 to 10 Billion)	371	0.47	0	0	1	0.50	0.12
Large Bank ($10 to $100 Billion)	371	0.14	0	0	1	0.35	2.07
Mega Bank (Over $100 Billion)	371	0.05	0	0	1	0.21	4.34
MVA/TA (% of Total Assets)	371	107.00	106.90	51.60	147.60	9.30	-0.70
Loan Loss Reserves (% of Total Assets)	371	0.80	0.81	0.00	3.57	0.30	2.15
Non-Performing Assets (% of Total Assets)	371	1.05	0.87	0	5.21	0.81	1.76
Securities (% of Total Assets)	371	19.00	16.80	0.47	89.40	11.90	1.83
Brokered Deposits (% of Total Assets)	371	1.59	0	0	29.90	4.03	4.08
Cash (% of Total Assets)	371	3.14	2.63	0.11	33.7	2.48	6.44

Table 2. Estimates of Bank Distress, Default Risk and CEO Inside Debt

The specifications in Columns (1) to (5) are estimated with OLS with robust standard errors. The specification in Column (6) is estimated using weighted least squares (WLS) where the weights are proportional to the number of observations used to calculate the volatility estimates. The specification in Column (7) is estimated using ordered probit where CAMELS ratings are between 1 and 5. The specification in Column (8) is estimated using a probit where the dependent variable is 1 if the bank failed between January 1, 2007 and December 31, 2011 and 0 otherwise. MVA/TA is measured as a percent. Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are all measured as a percent of Total Assets. The absolute value of the t-statistic is in parentheses. *p<0.10, ** p<0.05 and *** p<0.01.

	(1) OLS December 2008 EDF (Percent)	(2) OLS May 2008 EDF (Percent)	(3) OLS September 2008 EDF (Percent)	(4) OLS December 2008 5-Year EDF (Percent)	(5) OLS Distance to Default	(6) WLS Equity Volatility (2007-2008)	(7) Ordered Probit CAMELS	(8) Probit Failure Indicator through 2011
Log of Inside Debt Ratio	-0.334***	-0.060**	-0.127***	-0.278***	0.044**	-0.010***	-0.068***	-0.084**
	(3.85)	(2.10)	(2.80)	(4.45)	(2.34)	(3.01)	(3.56)	(2.56)
Log Firm D/E	1.215**	0.230	0.737**	1.169***	-0.641***	0.036	0.658***	0.322
	(2.14)	(1.27)	(2.49)	(2.87)	(4.42)	(1.32)	(5.11)	(1.37)
Log of Total Compensation	0.650**	0.277**	0.521**	0.578***	-0.261***	0.060***	0.245***	0.290***
	(2.32)	(2.06)	(2.48)	(2.77)	(4.38)	(4.92)	(4.59)	(3.27)
Log of CEO Age	-3.068	-2.060	-2.274	-2.166	0.406	-0.173	0.293	-1.463
	(1.15)	(1.06)	(1.07)	(1.21)	(1.07)	(1.58)	(0.59)	(1.62)
Log of CEO Tenure	0.348	0.223	0.227	0.266	-0.038	0.016	-0.076	0.229
	(1.00)	(1.43)	(1.03)	(1.08)	(0.46)	(1.17)	(1.05)	(1.60)
MVA/TA	-0.002	-0.008	-0.004	-0.010	0.018***	-0.002	0.000	-0.010
	(0.04)	(0.79)	(0.27)	(0.33)	(2.60)	(1.16)	(0.02)	(0.94)
Loan Loss Reserves	-1.626	-0.907	-1.033	-1.223	0.140	0.059	0.041	-0.208
	(1.45)	(0.97)	(1.06)	(1.58)	(0.85)	(0.83)	(0.20)	(0.59)
Non-Performing Assets	1.256***	0.373***	0.683***	1.074***	-0.186*	0.039***	0.314***	0.132
	(3.41)	(2.85)	(3.52)	(4.28)	(1.95)	(2.88)	(4.08)	(1.13)
Securities	-0.091***	-0.027**	-0.047***	-0.074***	0.017**	-0.004***	-0.027***	-0.039***
	(3.52)	(1.97)	(2.64)	(4.24)	(2.42)	(2.98)	(4.22)	(2.65)
Brokered Deposits	0.325***	0.054	0.162**	0.237***	-0.032***	0.008**	0.022*	0.065***
	(3.13)	(1.28)	(2.39)	(3.48)	(3.00)	(2.53)	(1.69)	(3.29)
Cash	-0.215**	-0.091***	-0.128***	-0.183***	0.081***	-0.009**	-0.021	-0.095
	(2.29)	(2.73)	(2.67)	(2.63)	(2.93)	(2.37)	(1.02)	(1.12)
Constant	9.444	8.105	6.625	7.095	-0.207	0.784*		3.123
	(0.87)	(1.00)	(0.76)	(0.97)	(0.12)	(1.69)		(0.78)
Adjusted R-Squared	0.198	0.074	0.151	0.257	0.216	0.186		
Pseudo R-Squared							0.121	0.230
Observations	371	371	371	371	371	371	371	371

Table 3. Estimates of Default Risk and Alternative Measures of CEO Inside Debt

The specifications are estimated with OLS with robust standard errors. MVA/TA is measured as a percent. Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are all measured as a percent of Total Assets. The absolute value of the t-statistic is in parentheses. *p<0.10, ** p<0.05 and *** p<0.01.

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
	End of 2008 EDF	End of 2008 EDF	End of 2008 EDF	End of 2008 EDF	End of 2008 EDF
	(Percent)	(Percent)	(Percent)	(Percent)	(Percent)
Log of Inside Debt	-0.284**				
	(2.49)				
Log of Inside Equity	0.513***				
	(2.73)				
Log Relative D/E		-0.368***			
		(4.06)			
Inside Debt Ratio			-0.322**		
			(2.07)		
Inside Debt Indicator				-1.860***	
				(2.74)	
Inside Debt/(Inside Debt+Inside Equity)					-5.355***
					(4.92)
Log of Firm D/E	1.289**		1.178**	1.095*	1.259**
	(2.31)		(2.01)	(1.92)	(2.19)
Log of Total Compensation	0.334	0.564**	0.414	0.668**	0.476*
	(0.82)	(2.06)	(1.56)	(2.34)	(1.78)
Log of CEO Age	-3.123	-3.278	-4.065	-3.879	-2.645
	(1.16)	(1.21)	(1.53)	(1.46)	(1.00)
Log of CEO Tenure	0.146	0.350	0.179	0.385	0.199
	(0.44)	(1.00)	(0.49)	(1.11)	(0.56)
MVA/TA	-0.008	-0.020	-0.009	-0.002	-0.012
	(0.17)	(0.53)	(0.20)	(0.04)	(0.26)
Loan Loss Reserves	-1.595	-1.863	-1.731	-1.622	-1.662
	(1.41)	(1.59)	(1.48)	(1.45)	(1.46)
Non-Performing Assets	1.294***	1.349***	1.211***	1.217***	1.305***
	(3.50)	(3.70)	(3.19)	(3.24)	(3.51)
Securities	-0.092***	-0.084***	-0.093***	-0.092***	-0.088***
	(3.58)	(3.40)	(3.45)	(3.46)	(3.42)
Brokered Deposits	0.324***	0.340***	0.327***	0.335***	0.319***
	(3.12)	(3.22)	(3.10)	(3.26)	(3.01)
Cash	-0.196**	-0.233**	-0.207**	-0.218**	-0.197**
	(2.19)	(2.37)	(2.26)	(2.35)	(2.14)
Constant	10.824	14.103	17.694*	15.308	12.129
	(0.97)	(1.30)	(1.67)	(1.43)	(1.16)
Adjusted R-Squared	0.203	0.195	0.171	0.185	0.197
Observations	371	371	371	371	371

Table 4. Robustness Tests

In Column (1) the High Risk Indicator is 1 if the EDF is in the top quintile of the sample and zero otherwise. In Column (3) the dependent variable is the 2008 EDF scaled by 35. In Column (4) both the dependent and independent variables are expressed in natural logarithms. In Column (5) the specification is the same as the baseline specification but all variables are winsorized at the one percent level (0.50 percent level at both tails of the distribution). The absolute value of the t-statistics is in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1) Probit	(2) OLS	(3) Fractional Probit	(4) OLS	(5) OLS
	High Risk Indicator	End of 2008 EDF Percentile Rank	End of 2008 EDF Scaled	Log of End of 2008 EDF	End of 2008 EDF Winsorized
Log of Inside Debt Ratio	-0.111***	-0.016***	-0.061***	-0.079***	-0.336***
	(4.00)	(3.74)	(4.15)	(3.43)	(3.90)
Log of Firm D/E	0.416**	0.061**	0.212**	0.430***	1.175**
	(2.24)	(2.31)	(2.27)	(3.02)	(2.05)
Log of Total Compensation	0.124*	0.004	0.086**	-0.029	0.614**
	(1.65)	(0.31)	(2.08)	(0.39)	(2.27)
Log of CEO Age	0.159	-0.085	-0.468	-0.100	-2.684
	(0.22)	(0.75)	(1.06)	(0.16)	(1.09)
Log of CEO Tenure	0.065	0.021	0.070	0.070	0.328
	(0.60)	(1.16)	(1.15)	(0.66)	(0.96)
Log of MVA/TA				-1.707**	
				(2.00)	
MVA/TA	0.007	-0.003	-0.002		0.003
	(0.75)	(1.54)	(0.26)		(0.06)
Log of Loan Loss Reserves				0.097	
				(0.67)	
Loan Loss Reserves	-0.281	0.043	-0.163		-1.725
	(1.02)	(1.03)	(0.99)		(1.32)
Log of Non-Performing Assets				0.188**	
				(2.16)	
Non-Performing Assets	0.395***	0.065***	0.214***		1.260***
	(3.83)	(3.56)	(4.10)		(3.36)
Log of Securities				-0.682***	
				(5.79)	
Securities	-0.046***	-0.007***	-0.022***		-0.093***
	(4.38)	(5.81)	(3.78)		(3.50)
Log of Brokered Deposits				0.022	
				(1.42)	
Brokered Deposits	0.057***	0.010***	0.034***		0.316***
	(3.02)	(3.79)	(3.48)		(2.97)
Log of Cash				-0.486***	
				(3.72)	
Cash	-0.085	-0.016***	-0.071*		-0.279**
	(1.57)	(3.35)	(1.96)		(2.33)
Constant	-3.643	0.966*	-0.175	10.046**	8.066
	(1.17)	(1.92)	(0.10)	(2.10)	(0.80)
Adjusted R-Squared		0.247		0.233	0.199
Pseudo R-Squared	0.206				
Log Pseudo-Likelihood			-81.11		
Observations	371	371	371	371	371

Table 5. Quantile Regressions

MVA/TA is expressed as a percent. Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are all expressed as a percent of Total Assets. The absolute value of the t-statistics is in parentheses. * p<0.10, ** p<0.05, *** p<0.01

	(1)	(2)	(3)	(4)
	20th Percentile End of 2008 EDF	40th Percentile End of 2008 EDF	60th Percentile End of 2008 EDF	80th Percentile End of 2008 EDF
Log of Inside Debt Ratio	-0.026	-0.062***	-0.143***	-0.431***
	(1.58)	(2.74)	(3.18)	(3.64)
Log Firm D/E	0.123	0.354**	0.310	1.045
	(1.27)	(2.52)	(0.96)	(1.22)
Log of Total Compensation	0.001	0.048	0.040	0.846***
	(0.02)	(0.70)	(0.30)	(2.80)
Log of CEO Age	-0.281	-0.516	-0.519	-3.744
	(0.66)	(0.93)	(0.45)	(1.21)
Log of CEO Tenure	0.067	0.060	0.021	0.443
	(0.97)	(0.70)	(0.12)	(0.95)
MVA/TA	-0.007	-0.021***	-0.006	0.013
	(1.16)	(2.87)	(0.33)	(0.29)
Loan Loss Reserves	0.193	0.335	-0.011	-1.288
	(1.08)	(1.30)	(0.02)	(1.21)
Non-Performing Assets	0.116**	0.198**	0.681***	1.953***
	(1.98)	(2.32)	(3.77)	(4.01)
Securities	-0.009**	-0.019***	-0.032**	-0.076*
	(2.42)	(3.25)	(2.38)	(1.92)
Brokered Deposits	0.040***	0.116***	0.255***	0.624***
	(3.83)	(6.93)	(7.17)	(7.66)
Cash	-0.021	-0.009	-0.051	-0.161*
	(1.37)	(0.46)	(0.80)	(1.69)
Constant	1.749	3.849	3.084	9.382
	(0.90)	(1.57)	(0.60)	(0.71)
Pseudo R-Squared	0.025	0.055	0.087	0.182
Observations	371	371	371	371

Table 6. Bank Size Regressions

MVA/TA is measured as a percent. Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are all measured as a percent of Total Assets. The absolute value of the t-statistics is in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1) End of 2008 EDF (Percent)	(2) End of 2008 EDF (Percent)
Log of Inside Debt Ratio	-0.380***	
	(4.17)	
Residual Compensation	1.723***	2.102***
	(2.73)	(3.15)
Log of Total Assets	5.583***	
	(2.60)	
Log of Total Assets Squared	-0.168**	
	(2.50)	
Inside Debt Ratio * Small Bank		-0.288**
		(2.49)
Inside Debt Ratio * Medium Bank		-0.275**
		(2.39)
Inside Debt Ratio * Large Bank		-1.410***
		(3.51)
Inside Debt Ratio * Mega Bank		0.410
		(0.96)
Medium Bank		1.501**
		(2.03)
Large Bank		-1.681
		(1.26)
Mega Bank		1.533
		(0.82)
Log Firm D/E	1.335**	0.913
	(2.26)	(1.60)
Log of CEO Age	-3.296	-3.296
	(1.25)	(1.26)
Log of CEO Tenure	0.286	0.252
	(0.80)	(0.71)
MVA/TA	-0.010	-0.034
	(0.24)	(0.80)
Loan Loss Reserves	-2.039*	-1.700
	(1.74)	(1.50)
Non-Performing Assets	1.353***	1.249***
	(3.81)	(3.45)
Securities	-0.096***	-0.098***
	(3.70)	(3.90)
Brokered Deposits	0.318***	0.319***
	(3.04)	(2.94)
Cash	-0.206**	-0.203*
	(2.28)	(1.93)
Constant	-29.548*	18.244
	(1.65)	(1.61)
Adjusted R-Squared	0.215	0.237
Observations	371	371

Table 7. Instrumental Variable Estimates for Default Risk

This table reports the Instrumental Variable (IV) estimates for the determinants of End of 2008 EDF, Distance to Default, and Equity Volatility using the Generalized Method of Moments (GMM). The first stage estimation in column (1) is common to all three specifications and uses the Age of CEO, the Age of CEO Squared and the Maximum State Income Tax Rate as instruments. MVA/TA is measured as a percent. Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are all measured as a percent of Total Assets. The absolute values robust t-statistics are in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	First Stage	Second Stage		
		(1)	(2)	(3)
	Log of Inside Debt Ratio	End of 2008 EDF (Percent)	Distance to Default	Equity Volatility (2007-2008)
Log of Inside Debt Ratio		-1.041**	0.190**	-0.061***
		(2.32)	(2.01)	(3.03)
Log Firm D/E	0.396	1.158*	-0.672***	0.049
	(1.15)	(1.83)	(4.59)	(1.48)
Log of Total Compensation	0.463***	1.112**	-0.348***	0.089***
	(3.01)	(2.54)	(4.28)	(4.53)
MVA/TA (% of Total Assets)	0.013	0.002	0.016*	-0.001
	(0.67)	(0.04)	(1.96)	(0.67)
Loan Loss Reserves (% of Total Assets)	0.682	-1.289	0.065	0.129
	(1.13)	(1.21)	(0.33)	(1.56)
Non-Performing Assets (% of Total Assets)	0.292	1.378***	-0.222**	0.051***
	(1.49)	(3.55)	(2.38)	(3.30)
Securities (% of Total Assets)	0.032**	-0.077***	0.014*	-0.002
	(2.15)	(2.92)	(1.90)	(1.25)
Brokered Deposits (% of Total Assets)	-0.003	0.300***	-0.030**	0.007*
	(0.08)	(2.71)	(2.44)	(1.89)
Cash (% of Total Assets)	-0.004	-0.211**	0.083***	-0.008*
	(0.07)	(2.05)	(2.64)	(1.81)
Log of Number of Board Members (Board Size)	1.249**	-1.840	0.001	-0.035
	(2.13)	(1.50)	(0.00)	(0.58)
Fraction of Outside Directors	4.427***	4.096	-0.654	0.324**
	(2.92)	(1.18)	(0.91)	(2.18)
Log of CEO Tenure	0.486**	0.593	-0.111	0.039**
	(2.51)	(1.37)	(1.12)	(2.08)
Age of CEO	0.612***			
	(2.87)			
Age of CEO Squared	-0.005***			
	(2.66)			
Maximum State Income Tax Rate	0.147***			
	(2.68)			
Constant	-37.081***	-8.958	3.664*	-0.698
	(5.46)	(0.85)	(1.66)	(1.45)
Observations	371	371	371	371

Table 8. Bank Performance over the Crisis

All specifications are estimated using weighted least squares (WLS) where the weights are proportional to the number of observations that are used to calculate the performance measures. Excess stock return is the sum of monthly log stock return in excess of the S&P log return. ROE and ROA are measured as a percent and are annualized quarterly averages over 2007Q1 to 2008Q4. MVA/TA is measured as a percent. Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are all measured as a percent of Total Assets. The absolute value of the t-statistics is in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

	(1) Excess Stock Returns	(2) ROE	(3) ROA	(4) Interest Income	(5) Interest Expense	(6) Provision Expense	(7) Non-Interest Income	(8) Non-Interest Expense
Log of Inside Debt Ratio	0.028***	0.538**	0.048**	0.001	-0.024**	-0.033***	0.027**	0.020
	(3.91)	(2.40)	(2.26)	(0.07)	(2.08)	(2.88)	(2.06)	(0.95)
Log Firm D/E	-0.154***	-2.683*	-0.232*	-0.143	0.215***	0.117*	-0.208**	-0.402***
	(3.16)	(1.96)	(1.67)	(1.52)	(2.85)	(1.69)	(2.00)	(2.88)
Log of Total Compensation	-0.099***	-2.713***	-0.229***	-0.197***	0.015	0.236***	0.236***	0.029
	(4.09)	(3.32)	(3.26)	(4.12)	(0.44)	(6.76)	(4.36)	(0.47)
Log of CEO Age	0.155	9.883	0.505	-0.289	-0.285	-0.417	0.072	0.257
	(0.75)	(1.13)	(0.69)	(0.72)	(0.91)	(1.12)	(0.17)	(0.51)
Log of CEO Tenure	-0.021	-0.562	-0.019	0.076	0.018	0.051	-0.077	-0.048
	(0.70)	(0.53)	(0.20)	(1.18)	(0.44)	(0.99)	(1.39)	(0.63)
MVA/TA	0.004	0.235**	0.029**	0.008	-0.009**	0.004	0.012**	-0.010
	(1.12)	(2.22)	(2.52)	(1.45)	(2.05)	(0.89)	(2.26)	(0.94)
Loan Loss Reserves	-0.032	0.647	0.056	0.791***	0.037	0.260	0.121	0.267
	(0.20)	(0.10)	(0.11)	(3.09)	(0.23)	(1.43)	(0.49)	(0.98)
Non-Performing Assets	-0.109***	-3.662***	-0.283***	-0.085	0.056	0.179***	-0.066	-0.017
	(3.54)	(4.11)	(3.34)	(1.29)	(1.37)	(3.60)	(1.33)	(0.22)
Securities	0.010***	0.207**	0.017**	-0.026***	-0.007*	-0.020***	0.009	-0.021***
	(4.10)	(2.41)	(2.30)	(4.48)	(1.79)	(4.83)	(1.64)	(3.23)
Brokered Deposits	-0.025***	-0.471**	-0.040**	0.006	0.023**	0.028**	-0.020**	-0.023
	(3.40)	(2.14)	(1.97)	(0.29)	(2.49)	(2.44)	(2.37)	(1.39)
Cash	0.021***	0.845***	0.067***	-0.079***	-0.068**	-0.042***	0.139***	0.092***
	(2.82)	(3.57)	(3.02)	(3.45)	(2.11)	(3.44)	(5.13)	(2.72)
Constant	-0.237	-39.313	-3.063	8.326***	4.751***	0.120	-2.020	3.886*
	(0.26)	(1.05)	(0.97)	(5.03)	(3.59)	(0.08)	(1.08)	(1.89)
Adjusted R-Squared	0.268	0.177	0.170	0.245	0.182	0.272	0.332	0.122
Observations	371	371	371	371	371	371	371	371

Table 9. Compensation Measures

The specifications are estimated with ordinary least squares and weighted-least squares with robust standard errors. MVA/TA is measured as a percent. Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are all measured as a percent of Total Assets. Notes: The absolute value of the t-statistic is in parentheses. *p<0.10, ** p<0.05 and *** p<0.01.

	(1) OLS End of 2008 EDF (Percent)	(2) OLS End of 2008 EDF (Percent)	(3) OLS End of 2008 EDF (Percent)	(4) WLS Excess Stock Return	(5) WLS Excess Stock Return	(6) WLS Excess Stock Return
Log of Inside Debt Ratio			-0.271***			0.024***
			(2.65)			(2.95)
Log of Delta	0.689***		0.267	-0.053***		-0.014
	(3.39)		(1.11)	(2.90)		(0.70)
Log of Vega		0.408**	0.256		-0.038**	-0.028*
		(2.12)	(1.31)		(2.43)	(1.81)
Log Firm D/E	1.276**	1.246**	1.315**	-0.157***	-0.155***	-0.163***
	(2.25)	(2.20)	(2.36)	(3.21)	(3.20)	(3.42)
Log of Total Compensation	-0.340	-0.163	-0.057	-0.020	-0.025	-0.040
	(1.04)	(0.43)	(0.13)	(0.70)	(0.81)	(1.08)
Log of CEO Age	-3.811	-3.472	-2.794	0.224	0.190	0.126
	(1.47)	(1.34)	(1.06)	(1.08)	(0.93)	(0.61)
Log of CEO Tenure	-0.096	0.178	0.187	0.013	-0.008	-0.012
	(0.28)	(0.50)	(0.56)	(0.43)	(0.27)	(0.41)
MVA/TA	-0.016	-0.005	-0.004	0.005	0.004	0.004
	(0.36)	(0.11)	(0.10)	(1.47)	(1.20)	(1.12)
Loan Loss Reserves	-1.771	-1.745	-1.625	-0.013	-0.018	-0.033
	(1.51)	(1.50)	(1.46)	(0.08)	(0.11)	(0.21)
Non-Performing Assets	1.285***	1.268***	1.338***	-0.112***	-0.112***	-0.117***
	(3.42)	(3.38)	(3.67)	(3.54)	(3.56)	(3.84)
Securities	-0.096***	-0.093***	-0.089***	0.011***	0.010***	0.010***
	(3.67)	(3.46)	(3.49)	(4.26)	(4.00)	(3.99)
Brokered Deposits	0.324***	0.323***	0.319***	-0.024***	-0.024***	-0.024***
	(3.11)	(3.08)	(3.06)	(3.25)	(3.21)	(3.27)
Cash	-0.194**	-0.189**	-0.198**	0.020***	0.019***	0.020***
	(2.19)	(2.16)	(2.18)	(2.76)	(2.72)	(2.81)
Constant	19.862*	16.952	11.513	-1.128	-0.896	-0.358
	(1.88)	(1.62)	(1.04)	(1.27)	(1.03)	(0.39)
Adjusted R-Squared	0.186	0.176	0.202	0.253	0.249	0.273
Observations	371	371	371	371	371	371

Table 10. Inside Debt and CAMELS Ratings

All specifications are estimated with ordered probit. MVA/TA is measured as a percent. Loan Loss Reserves, Non-Performing Assets, Securities, Brokered Deposits and Cash are all measured as a percent of Total Assets. The absolute value of the t-statistics is in parentheses. * p<0.10, ** p<0.05, *** p<0.01 .

	(1) Capital Adequacy Rating	(2) Asset Quality Rating	(3) Management Rating	(4) Earnings Rating	(5) Liquidity Rating	(6) Sensitivity to Market Risk	(7) Composite CAMELS Rating
Log of Inside Debt Ratio	-0.063***	-0.027	-0.067***	-0.048**	-0.026	-0.068***	-0.068***
	(2.84)	(1.17)	(3.14)	(2.34)	(1.20)	(3.26)	(2.96)
Log Firm D/E	0.681***	0.484***	0.622***	0.874***	0.239	0.504***	0.813***
	(4.01)	(3.28)	(4.08)	(4.34)	(1.61)	(3.47)	(5.05)
Log of CEO Age	0.181	0.004	0.337	1.114**	0.254	-0.018	0.652
	(0.30)	(0.01)	(0.63)	(2.07)	(0.43)	(0.03)	(1.16)
Log of CEO Tenure	-0.037	-0.120	-0.221***	-0.294***	-0.213**	-0.173**	-0.289***
	(0.40)	(1.57)	(2.67)	(3.61)	(2.53)	(1.98)	(3.22)
Log of Total Compensation	0.202***	0.126**	0.269***	-0.048	-0.046	0.222***	0.227***
	(2.89)	(2.08)	(4.53)	(0.85)	(0.64)	(3.78)	(3.67)
MVA/TA	0.004	0.003	-0.005	-0.020**	-0.003	-0.011	-0.008
	(0.43)	(0.44)	(0.68)	(2.45)	(0.44)	(1.20)	(1.07)
Loan Loss Reserves	0.383	0.778***	0.483**	-0.154	0.099	-0.271	0.224
	(1.44)	(2.61)	(1.97)	(0.48)	(0.39)	(1.11)	(0.91)
Non-Performing Assets	0.008	0.378***	0.123	-0.061	0.162**	0.019	0.049
	(0.09)	(4.09)	(1.54)	(0.72)	(2.05)	(0.24)	(0.58)
Securities	-0.023***	-0.018***	-0.011*	-0.010	-0.036***	-0.007	-0.019***
	(3.36)	(2.66)	(1.66)	(1.43)	(4.61)	(1.24)	(2.77)
Brokered Deposits	0.001	-0.011	0.004	-0.006	0.048**	0.008	0.019
	(0.05)	(0.51)	(0.24)	(0.30)	(2.54)	(0.37)	(0.94)
Cash	-0.080**	-0.047*	0.028	0.018	-0.093**	0.028	0.033
	(2.43)	(1.65)	(1.48)	(0.51)	(2.08)	(1.35)	(1.36)
Pseudo R-Squared	0.109	0.122	0.106	0.139	0.151	0.083	0.140
Observations	371	371	371	371	371	371	371

Appendix A. Variable Definitions and Data Sources

Variable Name	Definition	Source
Default Risk Measures		
Dec 2006 EDF (%)	One-year EDF on 12/31/2006	Moody's CreditEdge
Dec 2008 EDF (%)	One-year EDF on 12/31/2008 if available; if merged then the EDF from the last trading day	Moody's CreditEdge
May 2008 EDF (%)	One-year EDF on 5/31/2008 if available; if merged then the EDF from the last trading day	Moody's CreditEdge
Sep 2008 EDF (%)	One-year EDF on 9/30/2008 if available; if merged then the EDF from the last trading day	Moody's CreditEdge
Dec 2008 5-Year EDF (%)	Five-year EDF on 12/31/2008 if available; if merged then the EDF from the last trading day	Moody's CreditEdge
Distance to Default	The natural logarithm of market value of assets deflated by sum of short term debt and one half of long term debt, divided by asset volatility in percentage.	Derived
Equity Volatility (2007-2008)	Annualized standard deviation of the monthly log stock returns of the BHC over the 2007 to 2008 period.	CRSP
Failure Indicator through 2011	Indicator is 1 if the bank failed between January 1, 2007 and December 31, 2011; 0 otherwise	FDIC Failure Transactions Database
Composite CAMELS Rating 2008	CAMELS rating as of 12/31/2008 for the lead bank in the BHC or the stand-alone bank	Confidential supervisory ratings
High Risk Indicator	Indicator variable that is one if the EDF is in the top quintile of the sample and zero otherwise.	Derived from Moody's CreditEdge
Performance Measures		
Return on Assets (ROA)	Cumulative net income from 2007Q1 to 2008Q4 as a percent of total assets in 2006Q4, annualized	Y9C and Call Reports
Return on Equity (ROE)	Cumulative net income from 2007Q1 to 2008Q4 as a percent of total equity in 2006Q4, annualized	Y9C and Call Reports
Excess Stock Returns	Cumulative monthly log of the stock return in excess of the S&P 500 from January 2007 to December 2008, annualized	CRSP
Interest Income (% of Total Assets)	Cumulative interest income from 2007Q1 to 2008Q4 as a percent of total equity in 2006Q4, annualized	Y9C and Call Reports
Interest Expense (% of Total Assets)	Cumulative interest expense from 2007Q1 to 2008Q4 as a percent of total equity in 2006Q4, annualized	Y9C and Call Reports
Provisions for Loan Losses (% of Total Assets)	Cumulative provision expense from 2007Q1 to 2008Q4 as a percent of total equity in 2006Q4, annualized	Y9C and Call Reports
Non-Interest Income (% of Total Assets)	Cumulative non-interest income from 2007Q1 to 2008Q4 as a percent of total equity in 2006Q4, annualized	Y9C and Call Reports
Non-Interest Expense (% of Total Assets)	Cumulative non-interest expense from 2007Q1 to 2008Q4 as a percent of total equity in 2006Q4, annualized	Y9C and Call Reports

Appendix A, Continued

Variable Name	Definition	Source
CEO Characteristics		
Inside Debt Indicator	Indicator variable that is 1 if pension or deferred compensation is greater than 0; 0 otherwise	Derived from Execucomp and SEC Edgar DEF 14A Filings
Pension Indicator	Indicator variable that is 1 if pension is greater than 0; 0 otherwise	Derived from Execucomp and SEC Edgar DEF 14A Filings
Deferred Compensation Indicator	Indicator variable that is 1 if deferred compensation is greater than 0; 0 otherwise	Derived from Execucomp and SEC Edgar DEF 14A Filings
CEO Debt ($ thousands)	Deferred Compensation plus Pension	Execucomp and SEC Edgar DEF 14A Filings
CEO Equity ($ thousands)	Value of the options (using Black-Scholes) plus the value of the equity	Positions from Execucomp and SEC Edgar DEF 14A Filings; Stock price from Execucomp and Compustat; volatility calculated from CRSP
CEO D/E (Inside Debt Ratio)	CEO Debt divided by CEO Equity	Derived from Execucomp and SEC Edgar DEF 14A Filings
Firm D/E	Total liabilities divided by the market value of equity	Y9C and Call Reports and CRSP
CEO D/E to Firm D/E	Ratio of CEO D/E to Firm D/E	Derived
Log Inside Debt Ratio	Natural logarithm of CEO D/E	Derived
Log of Firm D/E	Natural logarithm of Firm D/E	Derived
Log of CEO D/E to Firm D/E	Natural logarithm of CEO D/E to Firm D/E	Derived
Inside Debt/(Inside Debt+Inside Equity)	Inside Debt divided by the sum of Inside Debt and Inside Equity	Derived
CEO Age	Age of the CEO at the end of 2006	Derived from Execucomp and SEC Edgar DEF 14A Filings
Log of CEO Age	Natural logarithm of Age of CEO	Derived
CEO Tenure (years)	Number of years as CEO	Execucomp and SEC Edgar DEF 14A Filings
Log of CEO Tenure	Natural logarithm of CEO tenure	Derived
CEO Total Compensation ($ thousands)	Total direct compensation	Compustat and Execucomp and SEC Edgar DEF 14A
Log of Total Compensation	Natural logarithm of CEO Total Compensation	Derived
Residual Compensation	Residuals from a regression of the log of CEO Cash Compensation on log of Total Assets	Derived
Delta	Change in CEO wealth with respect to a one percent change in the firm's stock price	Derived
Log of Delta	Natural logarithm of Delta	Derived
Vega	Change in CEO wealth with respect to a one percent change in the volatility in the firm's stock price	Derived
Log of Vega	Natural logarithm of Vega	

Appendix A, Continued

Variable Name	Definition	Source
BHC Characteristics		
Total Assets ($ thousands)	Total assets of the BHC or stand-alone bank	Y9C and Call Reports
Log of Total Assets (Bank Size)	Natural logarithm of Total Assets	Derived
Small Bank Indicator (<$ 1 billion in Total Assets)	Indicator variable that is one if Total Assets is less than $1 Billion	Derived
Medium Bank Indicator ($1 to 10 billion)	Indicator variable that is one if Total Assets is more than $1 billion and less than $10 Billion	Derived
Large Bank Indicator (over $10 billion)	Indicator variable that is one if Total Assets is more than $10 billion	Derived
Mega Bank Indicator (over $100 billion)	Indicator variable that is one if Total Assets is more than $100 billion	
MVA/TA (% of Total Assets)	Market value of assets from divided by the book value of assets	Market value of assets from Moody's CreditEdge; book value of assets from Y9C and Call Reports
Loan Loss Reserves (% of Total Assets)	Loan Loss Reserves divided by Total Assets from Regulatory Reports	Y9C and Call Reports
Non-Performing Assets (% of Total Assets)	Loans that are Past Due 30-Days, 60-Days, 90-Days and Non-Accruing Loans as a Percent ot Total Assets	Y9C and Call Reports
Securities (% of Total Assets)	Securities as a Percent of Total Assets	Y9C and Call Reports
Brokered Deposits (% of Total Assets)	Brokered Deposits as a Percent of Total Assets	Y9C and Call Reports
Cash (% of Total Assets)	Cash and Due from Financial Institutions as a Percent of Total Assets	Y9C and Call Reports
Board Size	Number of members of the Board of Directors	SEC EDGAR 10-K and DEF 14A
Fraction of Outside Directors	Outside Directors, defined as board directors who are not employees (e.g. officer or executive) of the BHC, divided by the number of the board members	SEC EDGAR 10-K and DEF 14A
Supervisory Ratings		
Composite CAMELS Rating 2006	Composite rating as of 12/31/2006	Confidential supervisory ratings
Capital Rating 2006	Capital component rating as of 12/31/2006	Confidential supervisory ratings
Asset Quality Rating 2006	Asset quality component rating as of 12/31/2006	Confidential supervisory ratings
Management Rating 2006	Management component rating as of 12/31/2006	Confidential supervisory ratings
Earnings Rating 2006	Earnings component rating as of 12/31/2006	Confidential supervisory ratings
Liquidity Rating 2006	Liquidity component rating as of 12/31/2006	Confidential supervisory ratings
Sensitivity to Market Risk Rating 2006	Sensitivity to market risk component rating as of 12/31/2006	Confidential supervisory ratings
Other Variables		
Maximum State Income Tax Rate	Maximum State Income Tax Rate on Wages using the TAXIM model	NBER