Managerial Incentives, Market Power and Bank Risk taking*

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Abstract

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We investigate the effect of managerial incentives and market power on bank risk-taking for a sample of 212 large US bank holding companies over 1997-2004 (i.e. 1,534 observations). Bank managers have incentives to prefer less risk while bank shareholders have preference for 'excessive' risk. Likewise, the market power is the centre piece of any bank regulation. However, the literature is inconclusive as to the effect of managerial incentives and market power on bank risk-taking. Our results reveal a U-shape relation between bank risk and CEO ownership (proxy for managerial incentives) and between bank risk and charter value (proxy for market power). Particularly, we find that bank risk initially decreases and then increases with both CEO ownership and charter value. These convex relations are robust to various bank risk proxies, different estimation approaches to account for endogeneity and several bank specific control variables.

JEL classification: G21; G28; G30; G32; G38

Keywords: Bank risk-taking; Managerial incentives; Market power, CEO ownership; Charter value; Bank holding companies

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1. Introduction

We examine the effect of managerial incentives and market power on bank risk taking for the U.S. bank holding companies (BHCs). In the presence of agency problems, bank managers and shareholders have conflicting risk taking incentives. Generally, bank managers are risk-averse and have incentives to take less risk mainly because their wealth (both tangible and human capital) is concentrated in the banks they manage (Smith and Stulz 1985). However, bank shareholders have incentives to take 'excessive' risk at the expense of tax-payers funds and creditors because of the well known 'moral hazard' problem from limited liability and mispriced deposit insurance premium (Galai and Masulis 1976; Merton 1977). This is compounded by the 'too-big-to-fail' effect in large banks. In response to the moral hazard problem, the 'market power' (proxied by charter value[1]) considered to be instrumental of any bank regulation to restrain bank risk-taking. The disciplining role of the charter value has first been pointed out by Marcus (1984), who argues that increased competition in the bank industry erodes banks' charter values which in turn increase incentives for excessive risk-taking. However, as discussed later in Section 2, the existing literature on bank risk-taking is inconclusive as to the nature of impact of both managerial incentives and market power on bank risk taking.

As the financial crisis is taking its tolls, the collapse of the Lehman Brothers, Washington Mutual, Wachovia and the ongoing problems with banks such as Citigroup, Bank of America, signifies the inherent flaws with the existing financial system regulation. In response to the global financial crisis, the G-20 leaders in London meeting agreed to reform financial sector regulatory framework including common principles for remuneration so as to discourage outsized risk taking on banks. Since the inception of the crisis in 2007, much of the public debate surrounds the incentives structure in place which is blamed to have promoted short-termism and excessive imprudent risk-taking by banks at the expense of tax payers' money. In this regard, Fahlenbrach and Stulz (2009) provide evidence that banks with CEOs whose interests were better aligned with their shareholders perform worse. Similarly, Chen, Steiner and Whyte (2006) find that banks have increasingly employed stock-based compensation following deregulation in 1992 to 2000 periods which encourage more

[1] The 'charter value', also known as franchise value, of a bank is the present value of a bank's future economic profits when considered as a going concern (Demsetz, Saidenberg and Strahan 1997, p.6).

risk-taking. Likewise, the financial industry including banks in U.S. has been enjoying least regulation since the passing of the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1993 and the Gramm-Leach-Bliley Act of 1997. Apparently, banks pursue to capitalize on this regulatory laxity which may have eroded banks market power by undertaking excessively risky investments. Therefore, this study is timely in that it follows recent financial crisis impacting upon the banking system and relevant in that it expands our knowledge of the interrelations between 'moral hazard' problem, market competition, regulation and bank risk-taking incentives.

Using a sample of 212 large U.S. BHCs over 1997 to 2004 period, we find that the effect of both bank CEOs shareholdings (proxy for managerial incentive) and charter value (proxy for market power) is U-shape. The bank risk initially decreases with CEO shareholding indicating the dominance of 'managerial entrenchment' effect and then increases with CEO shareholding indicating the dominance of shareholders' 'asset-substitution' effect. CEO shareholding at the inflection point (3.62%) for total risk is greater than the mean CEO shareholding of 4.1%. This implies that bank shareholders' asset-substitution effect dominated in the pre-crisis period and hence encouraged bank managers to undertake 'over-sized' risk exposing to the financial crisis. With regard to the market power, the bank risk initially decreases with charter value proving the well-known charter value paradigm dominance and then increases with charter value indicating the dominance of Boyd and De Nicole (2005) risk-shifting paradigm in the loan market.

This study contributes to the existing bank risk taking literature in several important ways. This is the first study to provide evidence of a U-shape relation between bank risk and managerial incentives and between bank risk and market power after controlling for capital regulation, size and other important bank specific variables. This study uses CEO shareholding as a proxy for managerial incentives while prior studies on bank risk-taking use insider shareholding (i.e., board directors and officers shareholding) as a proxy. Kim and Lu (2009, pp. 4-5) describes several reasons for the superiority of CEO shareholding as a better proxy for managerial incentives compare to insider shareholding. For instance, CEOs have more power compare to other executives or directors to capture the incentive contracting process and CEO shareholding is a cleaner proxy than insider shareholding. CEO shareholding also has greater 'within firm variability' to remove the Zhou's (2001) concern related to the power of the test if instead insider shareholding is used as a proxy.

Methodologically, we use multiple proxies of bank risk (e.g. total risk, systematic risk and credit risk) to check the robustness of the results. This is important as various interest groups have their reasons to follow particular type of bank risk. For instance, bank regulators are specifically concern about the insolvency and systematic risks of banks while bank investors are concerned about total and idiosyncratic risks. We have also checked the robustness of our results using various estimation techniques including several approaches to account for endogeneity. For example, we have estimated the econometric model with both fixed effect and system generalized method of moments (GMM) to reduce biases in our coefficients estimates from unobserved heterogeneity, simultaneity and dynamic endogeneity (if any).

The remainder of the paper is structured into four sections. Section 2 presents a critical review of literature on managerial risk-taking incentives and market power which help in formulating the relevant hypotheses. Section 3 describes the data and econometric methods. Section 4 provides the empirical results while section 5 shows the robustness of the results. Finally, Section 6 concludes the paper.

2. Related literature and hypotheses development

2.1. Managerial incentives and bank risk

The separation of ownership from control in corporate firms creates 'agency problem' between shareholders and managers (Berle and Means 1932). This separation bestows the bank's critical portfolio decisions on managers and the later may not always act in the best interests of shareholders. Thus, it is crucial to understand bank managers' incentives regarding risk-taking. Generally, bank managers are risk-averse and have reasons to prefer less risk (known as 'managerial entrenchment' theory).

Like any investor, bank managers' wealth consists of a portfolio of tangible and financial assets as well as human capital (talent, job related experience). In contrast to other investors, the managers' wealth is mostly concentrated in the firms that managers manage. To the extent that bank managers have concentrated wealth including their non-diversifiable human capital, managers are expected to protect this internally by selecting 'excessively safe assets' or by diversification (e.g., Smith and Stulz 1985; and May 1995). While shareholders can diversify their portfolio risk in the capital market, managers can effectively do so only at the firm level (May 1995, p.1292). In addition, the expected value of debt tax shield and bankruptcy costs contribute further toward managerial incentives at levered firms like banks to select overly safe projects, rather than excessively risky projects (Parrino, Poteshman and Weisbach 2005). Furthermore, bank managers could have different risk-taking incentives if managers are compensated through wage and salary contracts rather than through shares and share option programs. When receive fixed-wages, managers behave in a risk-averse manner and so are unlikely to exploit the same 'moral hazard' incentives as stock owner-controlled banks. This is because managers have little to gain if their banks do exceptionally well (when their salaries are fixed) but will probably lose their jobs and human capital investments if their bank fails (Saunders and Cornett 2006, p.532). Thus, bank shareholders want managers to invest in all positive net-present-value projects, irrespective of their associated risks (Guay 1999). Conversely, the 'risk-averse' bank managers may accept some safe, value-reducing projects, and reject some risky but value-increasing projects (May 1995).

Consistent with the incentives alignment theory, several studies support a statistically significant positive association between board officers and directors shareholding (proxy for managerial incentives) and bank risk-taking (e.g., Saunders, Strock and Travlos 1990; Demsetz et al. 1997; Cebenoyan, Cooperman and Register 1999). Fahlenbrach and Stulz (2009) also suggest that the incentives alignment between bank CEOs and shareholders could explain the 'excessive risk-taking' by banks leading to the financial crisis 2007-09. According to Anderson and Fraser (2000), the nature of the relationship between managerial ownership and bank risk-taking behaviour may depend upon the charter value of banks. They further illustrate that managerial ownership and risk-taking behaviour are positively related only at low charter value during periods of deregulation while they are negatively related at high charter value during periods of re-regulations. On the other hand, a few studies show a negative or non-monotonic relation between managerial shareholdings and bank risk-taking consistent with the managerial 'risk-aversion' theory (e.g., Brewer and Saidenberg 1996; Demsetz et al. 1997). For instance, Brewer and Saidenberg (1996) offer a convex (i.e., U-shaped) relation between bank risk and insider shareholding. This demonstrates that bank risk initially decreases (due to the dominance of 'managerial entrenchment' theory) and then increases with managerial shareholdings (due to the dominance of shareholders' 'risk-shifting' effect). However, Gorton and Rosen (1995) find a concave (i.e, inverted U-shaped) relation between bank risk and insider shareholding. The non-linear relation between bank risk and insider shareholding suggest the trade-off between managerial risk aversion/entrenchment effect and shareholders' asset-substitutions effect in the incentives contract.

Thus, based on existing evidence, for banks it is difficult to predict the nature of non-linear relation between bank risk and managerial incentives *ex ante or a priori*. Hence, our first hypothesis related to managerial shareholding (proxy for managerial incentives) is kept open and leave it to the empirical analysis to discover. Thus, the first hypothesis (H1) is formulated as follows:

> **Hypothesis 1 (H1)**: The nature of relation between bank risk and managerial shareholding is non-linear (due to the trade-off between managerial risk-aversion and shareholders' asset-substitution effect at different level of management shareholdings).

2.2. Market power and bank risk

Among other, an important regulatory approach to abate 'moral hazard' problem in banks is to facilitate monopoly rents for bank equity-holders by reducing competition in the financial system. Concentrated market with monopoly profits raises bank charter value which proved to be more valuable than bankruptcy costs to the equity holders. Information is considered to be another important source of bank charter value (Brewer and Saidenberg 1996). Information rent is possible because of banks' accumulation of valuable private information from their lending relation with their customers which is important as it cannot be realized if banks default. Accordingly, both theoretical and empirical studies have documented an inverse relationship between charter value and bank risk taking. For 150 large BHCs over 1970 to 1986 period, Keeley (1990) found that a bank with high market-to-book value of total assets (a proxy for charter value) had incentive to avoid high risk projects as the resulting loss might outweigh its charter value. Galloway, Lee and Roden (1997), using a sample of 86 BHCs over 1977-1994, stated that increased regulation raised bank charter value through entry barriers and hence lowered bank risk.

Nonetheless, the existing literature on charter value is criticized as bank competition effects bank risk not only via deposit channel but also via loan market channel (Boyd and De Nicoló 2005). Specifically, Boyd and De Nicoló (2005) note that concentration in bank (i.e. less competition among banks) also allows banks to charge higher interest rate on business loans, which might increase the credit risk of borrowers. Thus concentration in banks may increase bank problem loans and insolvencies resulting from the 'moral hazard problem' in loan market (termed as 'risk-shifting' effect). In this regard, several studies some evidence of a positive relation between bank risk and market power based on the assumption of a perfect correlations in probabilities of both loan default and bank default (Boyd, De Nicoló and Al Jalal 2006; De Nicoló and Loukoianova 2007). Likewise, in a cross-country study, González (2005) found that regulatory restrictions seem to increase bank risk-taking incentives by reducing their charter value. González (2005) reinforces Barth, Caprio and Levine (2001, 2004) findings that countries with stricter regulatory restrictions face higher probability of banking crisis as tighter regulations favor lower charter value.

However, Martinez-Miera and Repulllo (2009) argues that it is more realistic to assume an imperfect correlation as low interest rates (due to competition) does not necessarily translate into low bank default, as the interest income from non-defaulted borrowers also decreases (due to 'margin effect'). Based on this set up and extending Boyd and De Nicoló (2005) work, they argue for a U-shaped relation between charter value and bank risk and hence resolve the two opposing views in existing bank risk literature. Jiménez, Lopez and Saurina (2007) empirically test the Martinez-Miera and Repullo (2009) theoretical prediction using data on Spanish banks. However, they find a linear negative relation between market power and bank risk favoring classic 'charter value paradigm'. Our study is similar to Jiménez et al. (2007) in that we also intend to examine the Martinez-Miera and Repullo (2009)'s theoretical prediction of a convex relation between bank risk and market power using US bank sample and also controlling for other bank characteristics. As such, it is also important to investigate the relation between market power and bank risk in a more deregulated period in the US bank history following the introduction of the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1993 and the Gramm-Leach-Bliley Act of 1997. Hence, our second testable hypothesis (H2) related to bank market power is stated as follows:

Hypothesis 2 (H2): The nature of relation between bank risk and market power is U-shaped, i.e., bank risk initially decreases (due to the dominance of charter value paradigm and Martinez-Mierra and Repullo (2009) 'margin effect') and then increases with bank market power (due to the dominance of Boyd and De Nicoló's (2005) 'risk-shifting' effect).

3.Data and econometric methods

3.1. Sample and data

The initial sample examined in this paper consists of the largest BHCs headquartered in the US with standard industrial classification of 6021 and 6022 for respective national and state commercial banks over the period 1997 to 2004. The data is sourced from DEF 14A proxy statements, BANKSCOPE, FR Y-9C, DATASTREAM, Federal Reserve Bank of St Louis and SDC Platinum.

The detailed information on bank board structures are hand collected from DEF 14A proxy statements of annual meetings found in the SEC's EDGAR filings. Following Adams and Mehran (2008), the governance data is measured on the date of the proxy statement, i.e. at the beginning of the respective fiscal year. The data collection procedure is then adjusted to account for when the proxies disclose some governance information for the previous fiscal year (e.g., the percentage of CEO shareholding) and others for the following fiscal year (e.g., the number of directors). The financial information on BHCs is mostly obtained from BANKSCOPE database and complemented by fourth quarter Consolidated Financial Statements for BHCs, i.e. Form FR Y-9C, from Federal Reserve Board. The market information on BHCs is collected from DATASTREAM database. Similarly, the US three-month Treasury bill rate in the two-index market model for bank risk computations, is obtained from the Federal Reserve Bank of St. Louis. The information on M&A activities of the sample BHCs over the sample period are obtained from Thomson Financial's SDC Platinum database. The initial sample begins with the 300 largest BHCs as ranked by 2004 year-end book value of total assets. The final sample, an intersection of the data on BHCs with SIC 6021 and 6022 in DEF 14A proxy statements, BANKSCOPE, DATASTREAM, and with minimum two consecutive years' data over 1997-2004, consists of 1,534 observations for 212 BHCs.

3.2. Measures of bank risk

Multiple proxies of bank risk are selected to show whether managerial incentives and market power have any non-monotonic impact on the bank risk-taking. The three primary market measures of bank risk-taking include total risk (TR), idiosyncratic risk (IDIOR), and systematic risk (SYSR). Following Anderson and Fraser (2000), TR of a bank is calculated as the standard deviation of its daily stock returns (R_{it}) for each fiscal year. The daily stock return is calculated as the natural logarithmic of the ratio of equity return series, i.e. $R_{it} = \ln(P_{it}/P_{it-1})$ where P_{it} stock price which is also adjusted for any capital adjustment including dividend and stock splits. TR captures the overall variability in bank stock returns and reflects the market's perceptions about the risks inherent in the bank's assets, liabilities, and off-balance-sheet positions. Both regulators and bank managers frequently monitor this total risk.

SYSR and IDIOR are calculated using the following two-index market model as suggested by Chen, Steiner, and Whyte (2006), and Anderson and Fraser (2000). This model is estimated for each year for each bank:

$$R_{it} = \alpha_i + \beta_{1i} R_{mt} + \beta_{2i} INTEREST_t + \varepsilon_{it} \quad (1)$$

where, *i* and *t* denote bank *i* and time *t* respectively; *R* is the bank's equity return; R_m is the return on S&P 500 market index; *INTEREST* is the yield on the three-month Treasury-bill rate[2]; α is the intercept term; *ε* is the residuals. β_{1i} is the SYSR of bank *i*. while IDIOR is calculated as the standard deviation of residuals of eq.(1) for each year. The coefficient estimate using the above two-index market model, i.e. eq.(2), may be biased if there is any relationship between the interest rate changes and the market returns (Akhigbe and Whyte 2003). However, orthogonalization (i.e. $E(Y_{it}, X_{it}) = 0$) could address this problem (Chance and Lane 1980) which may also provide some bias t-statistics (Kane and Unal 1988). Therefore, following Kane and Unal (1988), and Anderson and Fraser (2000), this study use the un-orthogonalized two-index market model.

Three additional measures of bank risk, i.e. assets return risk (ARR), Z-score and credit risk, are also used to check the robustness of the results. Following Flannery and Rangan (2008), ARR is computed as the standard deviation of the daily stock returns *times* the ratio of market value of equity to market value of total assets *times* square-root of 250. The market value of total assets is the sum of book-value of liabilities and the market value of equity. Following Boyd, Graham and Hewitt (1993), Z-score for each fiscal period is computed as Z = {[Average(Returns) + Average(Equity/Total assets)]/TR}. The Z-score has an inverse form, i.e. 1/Z, so as to make the interpretation of the signs of coefficients comparable. Otherwise a high Z-score means less insolvency risk whereas a high TR, SYSR,

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[2] This study also uses the return on 5-year Treasury bond rate as an alternative interest rate index. The qualitative results, however, remain the same as using three-month T-bill yield and so only the latter one (i.e. three-month T-bill rate) is reported.

IDIOR, or ARR indicates more risk. Finally, credit risk (IMP/GL) is the impaired loan as a percentage of gross loans where gross loan is the sum of total loans and loan loss reserve.

3.3. Measures of explanatory variables

The measurements of the two explanatory variables - related to the testing hypotheses about managerial incentives and market power - are as follows. Following Kim and Lu (2009), we use CEO ownership (CEOWN) as a proxy of managerial incentives. CEOWN is the percentage of the BHC CEO's shareholding as reported in DEF 14A proxy statement. We expect a negative relation between bank risk and CEOWN and positive between bank risk and squared of CEOWN. We have also controlled for outside directors shareholding (OUTSIDEOWN) which is the percentage of total outstanding shares owned by the BHC officers and directors excluding those of the CEO. Following Keeley (1990) bank market power is proxied by charter value (CV). CV is computed as the sum of the market value of equity plus the book value of liabilities divided by the book value of total assets. A positive relation is expected between bank risk and CV and a negative relation is expected between bank risk and squared of CV.

Following prior studies (e.g., Saunders et al. 1990; Demsetz et al. 1997; Anderson and Fraser 2000; Stiroh and Rumble 2006) four other variables are included to control for bank size (TA), capital regulation or financial leverage (CAPITAL), diversification index (DIVER), and any previous M&A activity (MERGER).

Bank size (TA): Prior studies showed that bank size could negatively affect bank risk-taking (e.g., Saunders et al. 1990; Boyd and Runkle 1993; Demsetz and Strahan 1997). Generally, large banks can diversify their assets risk. They also have access to more flexible source of capital and hence can meet any unexpected shortfall of liquidity. Large banks may also exhibit low information risk because they are subjected to frequent investigation by both security analysts and regulators. Finally, investors may have the perception that the regulators will not allow large banks to fail, i.e. 'too-big-to-fail' policy. Following Anderson and Fraser (2000) bank size (TA) is measured as the natural logarithm of end of year bank's total assets, and is expected to be negatively related to bank risk-taking.

Capital regulation (CAPITAL): Following Saunders et al. (1990) and Galloway et al. (1997), this research controls for financial leverage. Financial leverage (CAPITAL) is calculated as the book value of bank equity as a percentage of total assets. According to Kim and Santomero (1988) and Furlong and Keeley (1989) financial leverage has been helpful in maintaining stability of the banking system. Due to its disciplinary effect, CAPITAL is expected to negatively affect bank risk.

Diversification index (DIVER): Prior studies also show that banks may benefit from diversifying their risk through non-traditional activities, like the securities business, as their returns have low correlations (Stiroh and Rumble 2006). Following Stiroh and Rumble (2006, p. 127), bank revenue diversification index (*DIVER*) is computed as one *minus* the sum of the squared fraction of operating income from interest and the squared fraction of net operating income from non-interest sources. Bank risk and DIVER is expected to be negatively related.

Previous M&A (MERGER): Finally, variability in bank's return may increase after it merges or acquires another firm. Therefore, a dummy variable for M&A is also introduced to capture this effect which equals one for BHC that involve with any take-over activities in a year, otherwise zero. For the sake of brevity, further details on the control variables are omitted as they are shown in Panel C of Table 1.

[INSERT TABLE 1 ABOUT HERE]

3.4. Empirical models and estimation methods

3.4.1. Empirical models

The following regression equation is formulated to test empirically the two main hypotheses, H_1, and H_2, given the literature discussion in Section 2.

$$\ln(RISK)_{i,t} = \begin{cases} \beta_0 + \beta_1 \ln(1+\underset{-}{CEOWN})_{i,t-1} + \beta_2 [\ln(1+\underset{+}{CEOWN})]^2_{i,t-1} + \beta_3 \ln(1+\underset{+/-}{OUTOWN})_{i,t-1} \\ + \beta_4 \ln(\underset{-}{CV})_{i,t-1} + \beta_5 [\ln(\underset{+}{CV})]^2_{i,t-1} + \beta_6 \ln(\underset{-}{TA})_{i,t} + \beta_7 (\underset{-}{CAPITAL})_{i,t-1} + \beta_8 (\underset{-}{DIVER})_{i,t} \\ + \beta_9 (\underset{+}{MERGER})_{i,t-1} + \sum_{t=1}^{1998-2008} \delta_t (YEAR)_t + \varepsilon_{i,t} \end{cases} \quad (2)$$

where subscripts *i* denotes individual BHC (i = 1, 2, …, 212), *t* time period (t = 1998, 1999, ….., 2004) and *ln* is the natural logarithmic. β, and δ are the parameters to be estimated. ε is the idiosyncratic error term. The definition of the variables in the regression eq.(2) is as mentioned in Sections 3.2 and 3.3 and also as summarized in Table 1 above. The sign beneath each variable indicates the expected nature of relation between the dependent and relevant explanatory variables. As can be seen later from descriptive statistics of variables in Table 2, CEOWN and OUTSIDEOWN assume fractional numbers and zeros. Therefore, while taking logarithmic of ownership variables, for ease of interpretation and to avoid any inconsistency/irrational number, we add 1 (one) to both CEOWN and OUTSIDEOWN variables.

3.4.2. Estimation method

Following prior studies (e.g., Saunders et al. 1990; Demsetz et al. 1997; and Anderson and Fraser 2000), the primary estimation method of regression equations (2) for bank risk is pooled ordinary least squares (OLS). A *priori*, the variance-covariance matrix in the pooled-OLS estimates will be adjusted with Huber (1964) or White's (1980) estimators, which are robust with respect to heteroskedasticity. To address reverse causality issues, one year lagged values of relevant right-hand side variables are used. Adopting Petersen (2009) procedure, observations are also clustered by both panels (i.e., by banks and time period) to address random unobserved serial and cross-sectional correlation respectively (if any) in residuals.

This study applies several measures to reduce endogeneity in the right-hand side variables. For example, following Kim and Lu (2009), equation (2) is also estimated with bank fixed-effect (FE) to reduce unobserved heterogeneity and the results are reported in Section 5.1. Following Jaminéz et al. (2007), two-step system generalized methods of moments (GMM) estimates in Section 5.2 are also robust to unobserved heterogeneity, simultaneity and dynamic endogeneity (if any).

3.5. Descriptive statistics and correlation matrix

The descriptive statistics for the various ownership and bank-characteristics variables are presented in Table 2. The measures for managerial incentives and market power in Panel A of Table 2 show that the mean (median) CEOWN is 4.41% (1.30%) with a minimum of 0% and a maximum of 65%. The mean (median) CEOWN of 4.41% (1.30%) is greater than that reported by Adams and Mehran (2008) of 2.27%. The mean (median) OUTSIDEOWN is 10.25% (7.24%), which is comparable to the 9.63% reported by Anderson and Fraser (2000). The mean (median) charter value, CV, is 1.10 (1.09) times with a minimum of 0.94 and a maximum of 1.64 times.

The descriptive statistics in Panel B of Table 2, within the bank-specific variables, indicate that the mean (median) book value of bank total assets is US$ 23.66 (US$ 2.07) billion with a minimum of US$ 162.40 million to maximum of US$ 1,484.10 billion. The positively skewed distribution of TA suggests the use of natural logarithmic of TA in the regression analysis. The mean (median) capital ratio, CAPITAL, is 9.26% (9.09%) which is well over the 5% required by the regulators for a bank to be considered well-capitalized. Thus, the sample banks are unanimously well-capitalized. The mean (median) value of diversification variable, DIVER, is 0.36 (0.36) which indicates that they have also diversified their operations between core banking and other activities. Finally, 11% of the sample BHCs involve with either a merger or acquisition activity during the sample period.

[INSERT TABLE 2 ABOUT HERE]

Turning to the descriptive statistics of bank risk measures in Panel C of Table 2, the mean (median) TR of 2.26% (2.02%) is comparable to that mean TR (2.13%) reported by Anderson and Fraser (2000). The mean (median) IDIOR is 1.98% (1.85%) which resembles the mean value (2.08%) shown by Anderson and Fraser (2000). The mean (median) SYSR is 0.52 (0.47) and the mean (median) ARR is 5.06% (4.60%). The mean (median) Z-score for the sample BHCs is 19.74 (16.69). . Finally, the mean (median) impaired loan as percentage of gross loans, IMP/GL, is 0.58% (0.43%).

[INSERT TABLE 3 ABOUT HERE]

Table 3 presents the Pearson's pair-wise correlation matrix between variables. The correlation coefficients between managerial incentives, market power measures and bank risk measures are largely in consistent with the expectation. For example, the correlation coefficient between CEOWN and all bank risk measures except SYSR and ARR are positive and statistically significant at 5% or better. Likewise, the correlation coefficient between CV and all measures of bank risk except for SYSR and Z-score are negative and statistically significant. Multicollinearity among the regressors should not be a concern as the maximum value of correlation coefficient is 0.2505 which is between diversification index (DIVER) and bank size (TA).

4. Empirical results

Table 4 below presents the results of pooled OLS estimates of regression eq.(2) when either TR, IDIOR, SYSR, ARR, 1/Z or IMP/GL is the dependent variable. Particularly, the odd columns (i.e. column 1, 3, 5, 7, 9 and 11) show the estimates of eq.(2) without the squared terms of CEOWN and CV while the even columns (i.e. column 2, 4, 6, 8, 10 and 12) demonstrate the results of eq.(2) with the squared terms. The relevant diagnostic tests in model fits section of Table 4 are based on pooled-OLS without any robust adjustment for residuals. The average variance inflation factors (AVIF) across all the columns indicate that the multicollinearity among the regressors could be a concern particularly in estimating the regression eq.(2) with squared terms of LN(1+CEOWN) and LN(CV).[3] The statistically significant F-statistics (П1) of Wald (1943) test of joint significance of the year dummies validates their inclusion in the structural model for all risk measures. The White (1980) alternative test for heteroskedasticity (П2) shows statistically significant *LM*-statistics for each regression, which confirms the presence of heteroskedasticity with normal OLS estimates. Likewise, the pooled-OLS estimates appear to suffer from first-order serial correlation, as indicated by statistically significant *F*-statistics across all regressions with Wooldridge's (2006) test for first-order serial correlation (П3). The presence of first-order serial correlation in the panel data also indicates the presence of an 'unobserved firm-fixed effect' (Wooldridge 2002, p.176). These justify the pooled-OLS estimates of eq. (1) with Huber (1964) or White (1980) heteroskedasticity robust standard errors with clustered observations by both banks and times to control for unknown fixed- and time-effects in the estimates. The regression eq.(2) is well-fitted with an overall R-squared ranging from 5.2% to 56%.

[INSERT TABLE 4 ABOUT HERE]

With regard to managerial incentives measures, the coefficients on LN(1+CEOWN) in odd columns are all positive but statistically significant for TR, IDIOR, and ARR. However, as anticipated, the coefficients on LN(1+CEOWN) and its quadratic term, $[LN(1+CEOWN)]^2$, in even columns are negative and positive respectively and both coefficients are statistically significant across all bank risk measures. Therefore, in relation to our first hypothesis (H1), we find that bank risk initially decreases (dominance of managerial risk aversion effect) and then increases with CEO shareholdings (dominance of shareholder's asset-substitution effect). This result is also consistent with Brewer and Saidenberg (1996) findings for savings holding institutions. Solving for the level of CEO shareholding that makes the total effect on CEO ownership become negative for TR (for example), the 'inflection point' is 3.62% CEO shareholding.[4] This suggests that the negative effect of CEO entrenchment (risk-aversion effect) on bank risk dominates over the positive asset substitution effect for CEO ownership

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[3] According to Chatterjee, Hadi and Prince (2000), the guidelines for detecting multicollinearity are: (i) the largest VIF is greater than 10, and (ii) the mean VIF is larger than 1.

[4] Following Cebenoyan et al. (1999), the 'full effect' of the CEO ownership for the non-linear specification is equal to the coefficient on CEOWN plus two times the product of the coefficients on squared of CEO ownership and a given CEO ownership level. The turning point is calculated by solving for the unknown CEO ownership level that makes this 'full effect' equal to zero, i.e. $\delta_5 + 2*\{\delta_6*LN(1+CEOWN)\} = 0$.

of less than 3.62%, and vice-versa for CEO ownership greater than 3.62%. It also specifies that the mean CEO shareholding (4.1% in Panel A of Table 2) was well above the inflection point (3.62%) in the pre-financial crisis period. Thus, the comparative statistics on CEOWN to some extent suggest that bank management incentives were more aligned with those of bank shareholders and shareholders' risk-shifting effect dominated particularly in pre-crisis period. Hence bank undertook 'excessive risk' leading to the financial crisis.

[FIGURE 1A AND FIGURE 1B ABOUT HERE]

With regard to market power measure, the coefficients on LN(CV) in odd columns show mix signs for different bank risk measures. Particularly, the statistically significant positive coefficient on LN(CV) for SYSR indicates that banks with high charter-value are exposed to more systematic risk and is consistent with Saunders and Wilson (2001). However, as hypothesized, the coefficients on LN(CV) and its quadratic term, $[LN(CV)]^2$, in even columns, are negative and positive respectively across all bank risk measures except for SYSR and both coefficients are statistically significant at 5% or better for all bank risk measures. This illustrates that, after controlling for other governance and bank characteristics, the nature of relation between bank market power and bank risk is convex (i.e U-shaped). That is, bank risk initially decreases and then increases with bank market power. Thus, our second hypothesis (H2) is well-supported. This result is also consistent with the theoretical prediction of Martinez-Miera and Repullo (2009) regarding the convex nature of relation between market competition and bank risk-taking. Solving for the level of CV that makes the total effect on CV become negative for TR, the 'inflection point' is 1.19.[5] This suggests that the negative impact of margin effect on bank risk dominates over the positive risk-shifting effect for CV of less than 1.19, and vice-versa for CV greater than 1.19. Thus, this finding mitigates and reconciles previously empirically documented mix and opposing results on the relation between charter value and bank risk.

The coefficients on other bank characteristics variables offer some important insights. For instance, while no directional prediction was made on OUTSIDEOWN, a statistically significant coefficient on LN(1+OUTSIDEOWN) for IDIOR, SYSR and IMP/GL suggest that banks with greater outside director shareholding have higher idiosyncratic risk

[5] The 'full effect' of the CV for the non-linear specification is equal to the coefficient on CV plus two times the product of the coefficients on squared of CV and a given CV level. The turning point is calculated by solving for the unknown CV level that makes this 'full effect' equal to zero, i.e. $\delta_5 + 2*\{\delta_6*LN(CV)\} = 0$.

(IDIOR) but have lower systematic (SYSR) and credit (IMP/GL) risks. The statistically significant negative coefficients on LN(TA) for TR, IDIOR and ARR are consistent with our prediction. However, the statistically significant positive coefficients on LN(TA) for SYSR, 1/Z and IMP/GL, are consistent with Stever (2006) who shows that the systematic risks of large banks are two to five times greater than those of small banks. At odds to our expectation, the statistically significant positive coefficients on CAPITAL for ARR and 1/Z indicate that capital regulation do not constraint banks from risk-taking. Similarly, the statistically significant coefficients on DIVER for TR and IMP/GL demonstrate that diversification via non-interest income activities could lower banks' total (TR) and idiosyncratic (IDIOR) risks but increase their credit risk. Finally, consistent with our anticipation, the coefficients on previous period MERGER dummy are positive across all bank risk measures and statistically significant for TR, IDIOR, ARR and IMP/GL.

5. Robustness tests

5.1. Fixed-Effect estimation

Table 5 reports on the fixed-effect panel estimation of equation (2) when TR, IDIOR, SYSR, ARR, 1/Z or IMP/GL is the dependent variable. The odd columns (i.e. column 1, 3, 5, 7, 9 and 11) show the FE estimates of eq.(2) without the squared terms of CEOWN and CV while the even columns (i.e. column 2, 4, 6, 8, 10 and 12) demonstrate the FE results of eq.(2) with the squared terms. FE estimates are robust to endogeneity in variables from unobserved heterogeneity. The R-squared of eq.(2) for various risk measures ranges from 1.8% to 28.7%.

[INSERT TABLE 5 ABOUT HERE]

The interpretation of the estimates related to managerial incentives and market power remains the same as those in Table 4 except that the coefficients on LN(1+CEOWN) in odd columns are no longer statistical significant for any of the bank risk measures. However, the coefficients on LN(1+CEOWN) and its quadratic term, $[LN(1+CEOWN)]^2$, remain negative and positive respectively and statistically significant for all bank risk measures except for IMP/GL. Similarly, the coefficients on LN(CV) and its squared term, $[LN(CV)]^2$, also assume negative and positive sign respectively for all bank risk measures except for SYSR and are statistically significant for all bank risks. Thus, even after controlling for unobserved heterogeneity, the FE estimates also confirm a convex relation between bank risk and managerial incentives and bank risk and bank market power.

5.2. Two-step system GMM

Table 6 below reports the results of Arellano and Bover (1995) and Blundell and Bond (1998) 'system GMM' estimation of eq.(2) using different measures of bank risk. In the system GMM, first-differenced variables are used as instruments for the equations in levels and the estimates are robust to unobserved heterogeneity, simultaneity and dynamic endogeneity (if any).[6] The model fits section of Table 6 show test statistics for both first-order (*Π1*) and second-order autocorrelation in second differences (*Π2*) and Hansen J-statistics of over-identifying restrictions. The residuals in the first difference should be serially correlated (*Π1*) by way of construction but the residuals in the second difference should not be serially correlated (*Π2*). Accordingly, in Table 6, we find statistically significant *Π1* across all risks and statistically insignificant *Π2* for all bank risk measures except for 1/Z and IMP/GL. Similarly, the Hansen J-statistics of over-identifying restrictions tests the null of instrument validity and the statistically insignificant Hansen J-statistics for all the bank measures indicate that the instruments are valid in the respective estimation. So, we find statistically insignificant Hansen J-statistics for all bank risk except for SYSR and ARR. Finally, the number of instruments (i.e. 151 or 170) used in the model is less than the panel (i.e. 212) which makes the Hansen J-statistics more reliable.

[INSERT TABLE 6 ABOUT HERE]

Compare to pooled-OLS estimates in Table 4, system GMM estimates in Table 6 above present one notable difference. The positive and negative coefficients on LN(1+CEOWN) and its squared term, $[\text{LN}(1+\text{CEOWN})]^2$, respectively are no longer statistically significant for any of the bank risk measures. However, the coefficients on LN(CV) and $[\text{LN(CV)}]^2$ are still significantly negative and positive respectively for all bank risks. Thus, even after controlling for unobserved heterogeneity, simultaneity and dynamic endogeneity with two-step the 'system GMM', the estimates in Table 6 still supports that bank market power relates to bank risk in a way consistent with the expectation.

6.Conclusion

This study examines the effect of managerial incentives and market power on bank risk taking. To that end, evidence is sought whether CEO shareholding (a proxy for

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[6] The 'system GMM' estimates are obtained using the Roodman '*xtabond2*' module in Stata. Please see Roodman (2006) for detail estimation procedure of dynamic panel data using '*xtabond2*'.

managerial incentives) non-linearly associated with bank risk-taking due to the interplay of the managerial entrenchment/risk-aversion effect and shareholders' asset-substitution effect. Similarly, evidence is also sought as to whether the effect of bank charter value (a proxy for market power) on bank risk-taking is convex (i.e. U-shaped) because of the trade-off between charter value paradigm, margin effect, and shareholder's risk-shifting effect.

Using a sample of 212 US BHCs over 1997-2004 periods, i.e. 1,534 bank observations, the results show a U-shaped relation between bank risk measures and CEO shareholding. This suggests that bank risk initially decreases with CEO shareholding until it reaches a threshold and then a further increase in CEO shareholding beyond the threshold point lower bank risk. CEO shareholding at the threshold point for total risk measures was 3.62% which is higher than the mean CEO shareholding of 4.10%. It indicates that bank CEOs incentives were more aligned with bank shareholding in the pre-crisis period. Hence bank took excessive risk in the pre-crisis period due to the dominance of the shareholders' asset-substitution effect. This ultimately leads to the financial crisis. Consistent with our expectation, we also find evidence of a convex (i.e. U-shaped) relation between charter value and bank risk measures. That is, at low level of charter value, the nature of relation between charter value and bank risk is negative due to the dominance of charter value paradigm and Martinez-Miera and Repullo's (2009) margin effect. However, at higher level of charter value, bank risk positively related to charter value conveying the dominance of shareholders' risk-shifting effect. These findings are robust to various bank risk measures including total risk, idiosyncratic risk and systematic risk as well as different estimation methods.

Perhaps one of the important policy implications of the findings is that bank CEOs incentives were more aligned with shareholders' incentives in the pre-crisis period and so encouraged banks to assume 'excessive risk' at the cost of tax payers fund. This advocates the recent various governments move towards reforming existing executives pay structure including President Obama administration. to avoid repetition of such financial catastrophe and to ensure a stable financial system. Similarly, the result for charter value implies that market power (charter value) is effective in restricting bank risk taking at high level of competition. Thus, bank regulators, and policy makers should appreciate the importance of managerial incentives and market power while designing appropriate incentives structure in banks and evaluating the bank entry and exit requirements in a particular market to avoid ‘excessive risk taking.

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Figure1A: Optimum CEO Ownership (%)

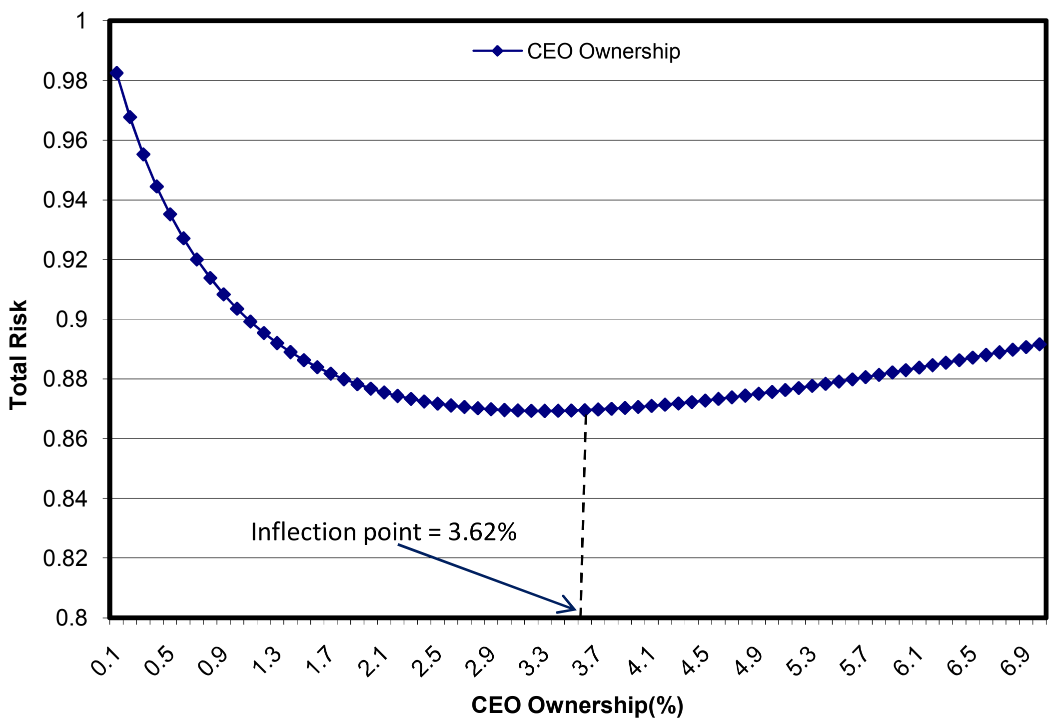

Figure 1B: Optimum Charter Value

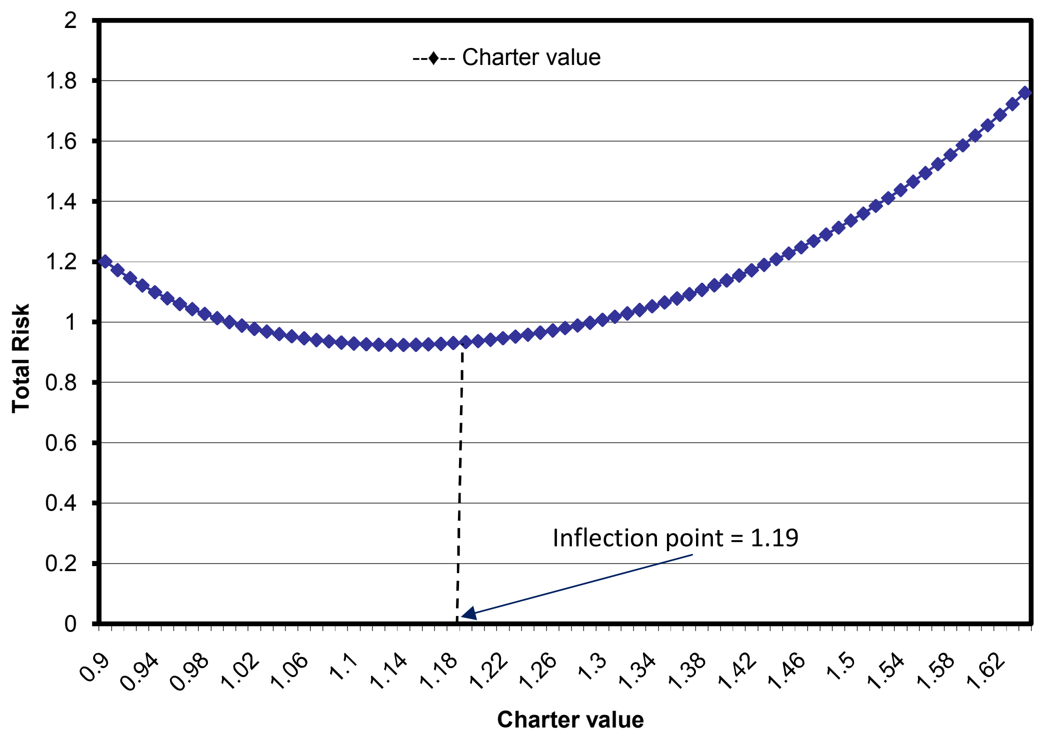

Table 1: Definitions of Variables

Variables	Measures
Panel A: Dependent variables (RISK)	
1. Total risk (TR)	The standard deviation of the daily bank stock returns in each year.
2. Idiosyncratic risk (IDIOR)	The standard deviation of the error terms in Eq.(1).
3. Systematic risk (SYSR)	Coefficient of Rmt (i.e. β_1) in Eq.(1).
4. Assets return risk (ARR)	The standard deviation of the daily stock returns *times* the ratio of market value of equity to market value of total assets *times* the square-root of 250.
5. Insolvency risk (Z-score)	Z = [Average(Returns) + Average(Equity/Total assets)]/Std(Equity/Total assets).
6. Credit risk (IMP/GL)	Impaired loan as percentage of gross loans where gross loan is the sum of total loans and loan loss reserve.
Panel B: Managerial incentives and market power variables	
CEO ownership (CEOWN)	The percentage of the BHC CEO's shareholdings.
Outside ownership (OUTOWN)	The percentage of total outstanding shares owned by the BHC officers and directors excluding those of the CEO.
Charter value (CV)	Keeley's Q (Keeley 1990) which is calculated as the sum of the market value of equity *plus* the book value of liabilities *divided* by the book value of total assets.
Panel C: Control variables	
Bank size (TA)	Total assets as at the end of each fiscal year.
Bank capital (CAPITAL)	The BHC's total equity as a percentage of the total assets.
Diversification index (DIVER)	The diversification index is calculated following Stiroh and Rumble (2006) which is 1 – (squared of fraction of operating income from interest *plus* squared of fraction of net operating income from non-interest sources such as fees and charges, fiduciary income, trading revenues).
Previous M&A (MERGER)	A dummy for any previous period M&A, i.e. a dummy variable which equals one for BHC that made an acquisition in a year, otherwise zero.
Year dummies (YEAR)	Seven individual dummy variables which equals either one or zero for each year from 1998 to 2004 with 1997 being the excluded year.

Table 2: Descriptive Statistics

This table presents the distribution of variables by showing mean, standard deviation (SD), minimum (Min.), first quartile (1st Quartile), median (Median), second quartile (2nd Quartile), skewness (Skew.), and kurtosis (Kurt.). See Table 1 for variable definitions.

Variables	Mean	SD	Min.	1st Quartile	Median	2nd Quartile	Max.	Skew.	Kurt.
Panel A: Managerial incentives and market power proxies:									
CEOWN (%)	4.41	8.8	0	0.55	1.3	3.46	65.19	3.72	18.72
OUTOWN (%)	10.25	9.96	0.19	4.04	7.24	13.36	83.32	2.7	14.46
CV	1.1	0.07	0.94	1.05	1.09	1.13	1.64	1.82	10.54
Panel B: Bank-specific variables:									
TA (in bil.)	23.66	105.78	.16	1.02	2.07	7.66	1484.1	8.23	81.31
CAPITAL (%)	9.26	1.9	3	7.99	9.09	10.16	21.59	1.34	7.93
DIVER	0.36	0.09	0.06	0.3	0.36	0.43	0.5	-0.53	2.71
MERGER	0.11	0.32	0	0	0	0	1	2.45	6.99
Panel C: Bank risk measures:									
TR (%)	2.26	1.2	0.65	1.65	2.02	2.53	17.32	4.81	42.75
IDIOR (%)	1.98	0.82	0.58	1.44	1.85	2.35	10.23	1.87	12.07
SYSR	0.52	0.42	-0.54	0.17	0.47	0.81	2.38	0.58	2.98
ARR (%)	5.06	2.49	1.21	3.45	4.6	6.05	28.15	2.41	14.94
Z-score	19.74	14.43	2.24	11.23	16.69	23.74	211.31	4.06	35.57
IMP/GL (%)	0.58	0.55	0.00	0.25	0.43	0.72	5.20	2.70	14.14

Table 3: Correlation Matrix

The table shows Pearson pairs-wise correlation matrix. Bold texts indicate statistically significant at 1% level or better. See Table 1 for variable definitions.

	Variables	1	2	3	4	5	6	7
1	CEOWN	1	0.0589	**-0.1348**	**-0.0882**	0.0246	-0.0011	-0.0675
2	OUTOWN		1	**-0.1811**	**-0.1737**	**-0.1262**	**-0.186**	-0.0232
3	CV			1	0.0434	**0.1714**	0.0774	-0.0235
4	TA				1	**-0.088**	**0.2505**	**0.1962**
5	CAPITAL					1	-0.0731	0.0172
6	DIVER						1	-0.0015
7	MERGER							1
8	TR	**0.0861**	0.0799	**-0.1811**	-0.0495	0.014	**-0.1768**	-0.0084
9	IDIOR	**0.1941**	**0.2063**	**-0.2403**	**-0.1392**	-0.0243	**-0.2613**	0.0039
10	SYSR	-0.0651	**-0.0854**	0.0449	0.0638	0.043	0.0023	-0.0155
11	ARR	-0.0651	**-0.08**	**-0.5825**	-0.0089	**0.3409**	**-0.081**	0.0395
12	Z-score	**0.0999**	-0.0594	0.0013	0.07	0.0417	0.042	**0.0496**
13	IMP/GL	**0.1624**	0.0589	**-0.1348**	**-0.0882**	0.0246	-0.0011	-0.0675

Table 4: Pooled-OLS Regression Results of Managerial Incentives and Market Power on Bank Risk

This table presents the results of the pooled- OLS estimates of eq.(2):

$$\ln(RISK)_{i,t} = \begin{cases} \beta_0 + \beta_1 \ln(1+\underset{-}{CEOWN})_{i,t-1} + \beta_2[\ln(1+\underset{+}{CEOWN})]^2_{i,t-1} + \beta_3 \ln(1+\underset{+/-}{OUTOWN})_{i,t-1} + \beta_4 \ln(\underset{-}{CV})_{i,t-1} + \beta_5[\ln(\underset{+}{CV})]^2_{i,t-1} + \beta_6 \ln(\underset{-}{TA})_{i,t} \\ + \beta_7(\underset{-}{CAPITAL})_{i,t-1} + \beta_8(\underset{-}{DIVER})_{i,t} + \beta_9(\underset{+}{OL})_{i,t} + \beta_{10}(\underset{+}{MERGER})_{i,t-1} + \sum_{t=1}^{1998-2008} \delta_t(YEAR)_t + \varepsilon_{i,t} \end{cases}$$

Subscripts *i* denotes individual banks, *t* time period, *ln* natural logarithms. The dependent variable *RISK* is either total risk (*TR*) or idiosyncratic risk (*IDIOR*) or systematic risk (*SYSR*) or asset return risk (*ARR*) or insolvency risk (*1/Z*) or credit risk (IMP/GL). *TR* is the standard deviation of the bank's daily stock returns over a year. *IDIOR* is calculated as the standard deviation of ε_{it} in eq.(2). *SYSR* is the coefficient of Rmt, i.e. β_1 in the two-index market model as represented by eq.(2). Flannery and Rangan's (2008) *ARR* is the natural logarithmic of the standard deviation of the daily stock return *times* the ratio of market value of equity to market value of total assets *times* square-root of 250 in a year. Z-score risk is calculated as [Average(Returns) + Average(Equity/Total assets)]/Std(Equity/Total assets). IMP/GL is the ratio of impaired loan and gross loan. *CEOWN* is the percentage of shares owned by the CEO. *OUTOWN* is the percentage of share owned by board directors and officers excluding CEO. *CV* is the charter value of the bank calculated (following Keeley 1990) as the book value of total assets *plus* market value of equity *minus* book value of equity, all *divided* by the book value of total assets. *CAPITAL* is the bank equity as a percentage of total assets. *DIVER* is the revenue diversification index calculated following Stiroh and Rumble (2006). *MERGER* is the dummy variable which equals 1 if the bank has any M&A in the period, otherwise zero. *YEAR* is a time dummy. α is the constant. β and δ are the parameters to be estimated. ε is the idiosyncratic error term. *Π1* is the Wald (1943) test F- statistics for the joint significance of the year fixed-effects. *Π2* is the White (1980) test for heteroskedasticity which provides the Lagrange Multiplier (LM) statistics based on alternative procedure explained in Wooldridge (2006, pp. 282-283). Finally, *Π3* is the test for first-order serial correlation which provides an F-statistic based on Wooldridge (2002, pp. 282-283). The reported t-statistics in parentheses are corrected for heteroskedasticiy with Huber (1964) or White (1980) Sandwich Estimator for variance. Figures in parentheses are t-statistics. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables		TR	TR	IDIOR	IDIOR	SYSR	SYSR	ARR	ARR	1/Z	1/Z	IMP/GL	IMP/GL
LN(1+CEOWN)	-	0.0224**	-0.101***	0.0338***	-0.127***	0.0209	-0.339**	-0.0292***	-0.127***	0.0053	-0.0416***	0.041	-0.161*
		(2.45)	(-3.16)	(4.06)	(-4.75)	(0.48)	(-2.21)	(-3.17)	(-4.39)	(1.52)	(-4.02)	(1.46)	(-1.92)
$[LN(1+CEOWN)]^2$	+	.	0.0330***	.	0.0445***	.	0.0879**	.	0.0310***	.	0.0132***	.	0.0599**
		.	(3.99)	.	(6.16)	.	(2.16)	.	(3.80)	.	(4.10)	.	(2.49)
LN(1+OUTOWN)		-0.0157	-0.00887	0.0115	0.0214**	-0.114**	-0.134***	-0.0117	-0.00271	-0.00506	-0.002	-0.0931***	-0.0788***
		(-1.47)	(-0.79)	(1.19)	(2.15)	(-2.21)	(-2.57)	(-1.11)	(-0.26)	(-1.42)	(-0.61)	(-3.00)	(-2.61)
LN(CV)	-	0.0214	-1.230***	-0.192	-1.132***	4.842***	6.726***	4.253***	-5.457***	-0.0277	-0.174*	-3.129***	-2.322***
		(0.13)	(-3.17)	(-1.44)	(-4.10)	(7.51)	(4.12)	(29.03)	(-18.47)	(-0.58)	(-1.81)	(-7.74)	(-2.60)
$[LN(CV)]^2$	+	.	4.796***	.	3.799***	.	-7.546*	.	5.867***	.	0.654**	.	2.269*
		.	(4.61)	.	(5.11)	.	(-1.82)	.	(6.23)	.	(2.31)	.	(1.79)
LN(TA)	-	-0.0553***	-0.0589***	-0.0825***	-0.0867***	0.496***	0.503***	-0.0452***	-0.0462***	0.00426*	0.00314	0.0973***	0.0934***
		(-6.39)	(-6.89)	(-11.69)	(-12.48)	(13.42)	(13.73)	(-5.85)	(-6.06)	(1.94)	(1.39)	(4.91)	(4.64)
CAPITAL	-	0.00163	-0.00323	0.00147	-0.00343	0.015	0.0245	0.0499***	0.0515***	0.00330**	0.00214	-0.000952	-0.00347
		(0.27)	(-0.50)	(0.34)	(-0.79)	(0.60)	(0.97)	(10.64)	(11.35)	(2.41)	(1.52)	(-0.08)	(-0.27)
DIVER	-	-0.235**	-0.258**	-0.127	-0.163*	-0.209	-0.145	-0.0713	-0.11	0.0208	0.00941	1.050***	0.984***
		(-1.98)	(-2.20)	(-1.37)	(-1.78)	(-0.37)	(-0.25)	(-0.67)	(-1.04)	(0.71)	(0.33)	(3.44)	(3.25)
MERGER	+	0.0452*	0.0464**	0.0552**	0.0544**	-0.00773	-0.00631	0.0965***	0.0881***	0.0111	0.0104	0.133**	0.124*

	(1.92)	(2.01)	(2.54)	(2.56)	(-0.06)	(-0.05)	(3.87)	(3.57)	(1.46)	(1.38)	(2.06)	(1.91)
CONSTANT	1.185***	1.381***	1.256***	1.453***	-7.780***	-8.164***	0.960***	0.892***	0.288***	0.335***	-1.399***	-1.316***
	(11.50)	(12.17)	(15.47)	(17.12)	(-16.11)	(-15.79)	(10.37)	(9.70)	(11.16)	(11.54)	(-5.93)	(-5.11)
Year dummies	Included	included	included	included	included	included	included	included	included	included	included	included
Model fits:												
Adj. R^2	0.307	0.324	0.507	0.526	0.359	0.361	0.546	0.56	0.052	0.073	0.112	0.115
No. of observation	1532	1532	1532	1532	1492	1492	1532	1532	1532	1532	1490	1490
AVIF (max.)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)
П1: *F-stat* (7, 1515)	75.1***	59.64***	143.7***	126.7***	21.5***	20.03***	92.4***	102.03***	8.89***	7.2***	3.9***	3.47**
П2: *LM* ($\chi 2 = 2$)	23.69***	20.24***	21.12***	14.0***	86.49***	90.48***	10.31***	9.2**	22.0***	45.61***	18.17***	16.13***
П3: *F-stat* (1, 211)	22.25***	21.84***	32.2***	31.7***	56.42***	56.49***	40.81***	36.09***	4.05**	3.88*	25.7***	25.7***

Table 5: Fixed Effect (FE) Panel Regression Results of Managerial Incentives and Market Power on Bank Risk

This table presents the results of the fixed effect panel estimates of eq.(2):

$$\ln(RISK)_{i,t} = \begin{cases} \beta_0 + \beta_1 \ln(1+\underset{-}{CEOWN})_{i,t-1} + \beta_2[\ln(1+\underset{+}{CEOWN})]^2_{i,t-1} + \beta_3 \ln(1+\underset{+/-}{OUTOWN})_{i,t-1} + \beta_4 \ln(\underset{-}{CV})_{i,t-1} + \beta_5[\ln(\underset{+}{CV})]^2_{i,t-1} + \beta_6 \ln(\underset{-}{TA})_{i,t} \\ + \beta_7(\underset{-}{CAPITAL})_{i,t-1} + \beta_8(\underset{-}{DIVER})_{i,t} + \beta_9(\underset{+}{OL})_{i,t} + \beta_{10}(\underset{+}{MERGER})_{i,t-1} + \sum_{t=1}^{1998-2008} \delta_t (YEAR)_t + \varepsilon_{i,t} \end{cases}$$

Subscripts *i* denotes individual banks, *t* time period, *ln* natural logarithms. The dependent variable *RISK* is either total risk (*TR*) or idiosyncratic risk (*IDIOR*) or systematic risk (*SYSR*) or asset return risk (*ARR*) or insolvency risk (*1/Z*) or credit risk (IMP/GL). *TR* is the standard deviation of the bank's daily stock returns over a year. *IDIOR* is calculated as the standard deviation of ε_{it} in eq.(2). *SYSR* is the coefficient of Rmt, i.e. β_1 in the two-index market model as represented by eq.(2). Flannery and Rangan's (2008) *ARR* is the natural logarithmic of the standard deviation of the daily stock return *times* the ratio of market value of equity to market value of total assets *times* square-root of 250 in a year. Z-score risk is calculated as [Average(Returns) + Average(Equity/Total assets)]/Std(Equity/Total assets). IMP/GL is the ratio of impaired loan and gross loan. *CEOWN* is the percentage of shares owned by the CEO. *OUTOWN* is the percentage of share owned by board directors and officers excluding CEO. *CV* is the charter value of the bank calculated (following Keeley 1990) as the book value of total assets *plus* market value of equity *minus* book value of equity, all *divided* by the book value of total assets. *CAPITAL* is the bank equity as a percentage of total assets. *DIVER* is the revenue diversification index calculated following Stiroh and Rumble (2006). *MERGER* is the dummy variable which equals 1 if the bank has any M&A in the period, otherwise zero. *YEAR* is a time dummy. α is the constant. β and δ are the parameters to be estimated. ε is the idiosyncratic error term. *Π1* is the Hausman (1978) specification test statistics of the appropriateness of the random-effects estimator against fixed effect estimator. t-statistics are reported in parentheses. Figures in parentheses are t-statistics. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables		TR	TR	IDIOR	IDIOR	SYSR	SYSR	ARR	ARR	1/Z	1/Z	IMP/GL	IMP/GL
LN(1+CEOWN)	-	-0.00793	-0.192***	0.000413	-0.181***	-0.128	-0.600**	-0.0314	-0.150**	-0.00032	-0.0542***	-0.0914	-0.0413
		(-0.28)	(-3.01)	(0.01)	(-2.74)	(-0.99)	(-2.04)	(-1.04)	(-2.19)	(-0.04)	(-2.70)	(-1.55)	(-0.30)
$[LN(1+CEOWN)]^2$	+	.	0.0658***	.	0.0646***	.	0.18*	.	0.0444*	.	0.0196***	.	0.018
		.	(3.10)	.	(2.93)	.	(1.82)	.	(1.94)	.	(2.92)	.	(0.39)
LN(1+OUTOWN)		0.0379	0.0586**	0.0424*	0.0635**	0.0236	0.0672	0.0266	0.037	0.0165**	0.0222***	-0.0525	-0.0577
		(1.59)	(2.44)	(1.71)	(2.55)	(0.22)	(0.61)	(1.05)	(1.43)	(2.22)	(2.93)	(-1.06)	(-1.14)
LN(CV)	-	-1.479***	-3.075***	-1.508***	-3.373***	4.727***	6.895***	2.148***	-1.124***	0.169***	-0.126*	-2.222***	-1.838**
		(-7.72)	(-8.84)	(-7.57)	(-9.36)	(5.50)	(4.35)	(10.56)	(6.47)	(2.82)	(-1.85)	(-5.54)	(-2.48)
$[LN(CV)]^2$	+	.	6.826***	.	7.968***	.	-8.971*	.	2.421*	.	1.268***	.	1.626*
		.	(5.51)	.	(6.20)	.	(-1.70)	.	(1.84)	.	(3.24)	.	(1.69)
LN(TA)	-	-0.341***	-0.312***	-0.416***	-0.384***	1.261***	1.257***	-0.321***	-0.318***	0.0127	0.0191**	0.140***	0.132**
		(-13.80)	(-12.59)	(-16.18)	(-14.93)	(11.33)	(11.12)	(-12.21)	(-11.91)	(1.64)	(2.44)	(2.64)	(2.46)
CAPITAL	-	-0.0101	-0.00657	-0.0204***	-0.0162**	0.115***	0.108***	0.0199***	0.0188***	0.00415**	0.00475**	0.0297**	0.0289**
		(-1.51)	(-0.99)	(-2.93)	(-2.34)	(3.81)	(3.56)	(2.79)	(2.63)	(1.98)	(2.26)	(2.12)	(2.04)
DIVER	-	-0.400**	-0.401**	-0.636***	-0.639***	2.655***	2.683***	-0.296	-0.291	-0.153**	-0.153**	0.761*	0.761*
		(-2.09)	(-2.12)	(-3.19)	(-3.26)	(3.07)	(3.11)	(-1.46)	(-1.43)	(-2.55)	(-2.56)	(1.89)	(1.89)
MERGER	+	0.0616**	0.0567**	0.0787***	0.0737***	-0.0725	-0.0815	0.108***	0.106***	0.00932	0.00795	0.0569	0.0579
		(2.31)	(2.15)	(2.84)	(2.70)	(-0.60)	(-0.67)	(3.83)	(3.73)	(1.11)	(0.96)	(1.02)	(1.03)
CONSTANT		3.789***	3.609***	4.436***	4.233***	-15.17***	-15.10***	3.811***	3.806***	0.240***	0.202**	-2.145***	-2.102***

	(17.38)	(16.67)	(19.57)	(18.85)	(-15.38)	(-15.20)	(16.47)	(16.33)	(3.52)	(2.96)	(-4.63)	(-4.50)
Year dummies	Included	included	included	included	included	included	included	included	included	included	included	included
Model fits:												
R^2	0.203	0.227	0.26	0.287	0.162	0.166	0.211	0.213	0.018	0.033	0.051	0.052
No. of observation	1532	1532	1532	1532	1492	1492	1532	1532	1532	1532	1490	1490
AVIF (max.)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)	1.84(2.41)	3.77(12.8)
Π1 (χ2 = 7|9)	184.05***	151.65***	254.93***	209.65***	73.41***	74.10***	223.28***	243.11***	38.73***	46.31***	6.09	6.77

Table 6: Two-Step System GMM Regression Results of Managerial Incentives and Market Power on Bank Risk

This table presents the results of the two-step system generalized method of moments (GMM) estimates of eq.(2):

$$\ln(RISK)_{i,t} = \begin{cases} \beta_0 + \beta_1 \ln(1+\underset{-}{CEOWN})_{i,t-1} + \beta_2[\ln(1+\underset{+}{CEOWN})]^2_{i,t-1} + \beta_3 \ln(1+\underset{+/-}{OUTOWN})_{i,t-1} + \beta_4 \ln(\underset{-}{CV})_{i,t-1} + \beta_5[\ln(\underset{+}{CV})]^2_{i,t-1} + \beta_6 \ln(\underset{-}{TA})_{i,t} \\ + \beta_7(\underset{-}{CAPITAL})_{i,t-1} + \beta_8(\underset{-}{DIVER})_{i,t} + \beta_9(\underset{+}{OL})_{i,t} + \beta_{10}(\underset{+}{MERGER})_{i,t-1} + \sum_{t=1}^{1998-2008}\delta_t(YEAR)_t + \varepsilon_{i,t} \end{cases}$$

Subscripts *i* denotes individual banks, *t* time period, *ln* natural logarithms. The dependent variable *RISK* is either total risk (*TR*) or idiosyncratic risk (*IDIOR*) or systematic risk (*SYSR*) or asset return risk (*ARR*) or insolvency risk (*1/Z*) or credit risk (IMP/GL). *TR* is the standard deviation of the bank's daily stock returns over a year. *IDIOR* is calculated as the standard deviation of ε_{it} in eq.(2). *SYSR* is the coefficient of Rmt, i.e. β_1 in the two-index market model as represented by eq.(2). Flannery and Rangan's (2008) *ARR* is the natural logarithmic of the standard deviation of the daily stock return *times* the ratio of market value of equity to market value of total assets *times* square-root of 250 in a year. Z-score risk is calculated as [Average(Returns) + Average(Equity/Total assets)]/Std(Equity/Total assets). IMP/GL is the ratio of impaired loan and gross loan. *CEOWN* is the percentage of shares owned by the CEO. *OUTOWN* is the percentage of share owned by board directors and officers excluding CEO. *CV* is the charter value of the bank calculated (following Keeley 1990) as the book value of total assets *plus* market value of equity *minus* book value of equity, all *divided* by the book value of total assets. *CAPITAL* is the bank equity as a percentage of total assets. *DIVER* is the revenue diversification index calculated following Stiroh and Rumble (2006). *MERGER* is the dummy variable which equals 1 if the bank has any M&A in the period, otherwise zero. *YEAR* is a time dummy. α is the constant. β and δ are the parameters to be estimated. ε is the idiosyncratic error term. Finally, *Π1* and *Π2* are the test statistics for first-order and second-order serial correlation respectively. Hansen J-statistics is the test of over-identifying restrictions. Figures in parentheses are t-statistics while *p*-values are in brackets. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables		TR	TR	IDIOR	IDIOR	SYSR	SYSR	ARR	ARR	1/Z	1/Z	IMP/GL	IMP/GL
LN(1+CEOWN)	-	0.0432	-0.0822	0.0287	-0.0358	-0.0436	-0.200	-0.0139	0.00044	0.0122	-0.0409	-0.0636	-0.490
		(1.11)	(-0.62)	(0.78)	(-0.28)	(-0.21)	(-0.32)	(-0.35)	(0.00)	(0.99)	(-1.46)	(-0.61)	(-1.35)
[LN(1+CEOWN)]^2	+		0.021		0.0145		0.0131		-0.0166		0.0153*		0.137
			(0.57)		(0.38)		(0.07)		(-0.53)		(1.95)		(1.17)
LN(1+OUTOWN)		-0.0208	-0.029	0.0175	0.0238	-0.181	0.133	-0.0498	-0.0258	0.0110	0.00674	0.0109	-0.118
		(-0.57)	(-0.67)	(0.62)	(0.68)	(-0.94)	(0.47)	(-1.49)	(-0.75)	(1.07)	(0.55)	(0.13)	(-1.00)
LN(CV)	-	0.0159	-1.919***	0.0512	-2.413***	4.513***	14.18***	3.135***	-3.504***	0.118	-1.088*	-1.726**	-1.811*
		(0.05)	(-2.63)	(0.17)	(-4.01)	(3.39)	(5.12)	(10.50)	(-9.51)	(1.09)	(-1.69)	(-2.20)	(-1.80)
[LN(CV)]^2	+		6.446***		7.404***		-24.14***		5.426**		0.283*		4.209*
			(2.78)		(3.45)		(-3.07)		(2.18)		(1.72)		(1.71)
LN(TA)	-	-0.054***	-0.0663***	-0.0749***	-0.0755***	0.466***	0.51***	-0.0456***	-0.0523***	0.00812*	0.0076	0.0994**	0.0747
		(-2.69)	(-2.84)	(-4.76)	(-4.84)	(4.57)	(3.91)	(-2.76)	(-3.01)	(1.75)	(1.38)	(2.28)	(1.39)
CAPITAL	-	0.0152	0.00602	0.00544	0.00255	0.0400	0.0143	0.0436***	0.0518***	0.00284	-0.00362	0.00354	0.00647
		(1.03)	(0.44)	(0.47)	(0.20)	(0.72)	(0.22)	(3.55)	(4.13)	(0.86)	(-0.96)	(0.13)	(0.18)
DIVER	-	-0.222	-0.178	-0.142	-0.0783	-0.478	-0.373	-0.203	-0.0558	0.0167	-0.0126	0.895*	0.659
		(-1.08)	(-0.90)	(-1.00)	(-0.56)	(-0.45)	(-0.35)	(-1.33)	(-0.37)	(0.42)	(-0.34)	(1.70)	(1.29)
MERGER	+	0.0160	0.0218	0.0215	0.0336	-0.0126	-0.133	0.0624**	0.0782***	0.00333	0.00015	0.0746*	0.0677
		(0.71)	(0.93)	(0.97)	(1.49)	(-0.11)	(-1.07)	(2.29)	(2.98)	(0.43)	(0.02)	(1.79)	(1.49)

CONSTANT	1.024***	1.589***	1.132***	1.466***	-7.506***	-8.153***	1.285***	1.241***	0.207***	0.373***	-1.669***	-1.119
	(3.45)	(4.66)	(5.24)	(6.14)	(-5.30)	(-5.13)	(6.01)	(5.02)	(3.55)	(4.82)	(-3.30)	(-1.59)
Year dummies	included	included	included	included	included	included	included	included	included	included	included	included
Model fits:												
F-stats (12, 211)	36.2***	40.88***	50.67***	65.22***	33.75***	31.81***	53.80***	78.15***	3.72***	2.61***	6.09***	6.29***
No. of obs.	1532	1532	1532	1532	1492	1492	1532	1532	1532	1532	1490	1490
Π1	-5.89***	-7.05***	-5.97***	-6.92***	-6.52***	-7.58***	-6.08***	-6.54***	-5.9***	-5.75***	-4.95***	-5.03***
	[.00]	[.00]	[.00]	[.00]	[.00]	[0.00]	[.00]	[.00]	[.00]	[.00]	[.00]	[.00]
Π2	.03	1.47	-1.41	.58	-.69	1.37	-1.00	.16	2.29**	2.79***	-2.2**2	-2.42**
	[.98]	[.49]	[.16]	[.562]	[.49]	[.171]	[.32]	[.872]	[.02]	[.01]	[.03]	[.015]
Hansen *J*-stats.	156.97	168.23	151.25	170.88	166.61**	184.42*	167.62**	180.84*	150.38	169.17	141.05	162.3
	[.11]	[.238]	[.18]	[.196]	[.04]	[.06]	[.03]	[.085]	[.19]	[.223]	[.37]	[.349]
No. of instruments	151	170	151	170	151	170	151	170	151	170	151	170