Institutional Ownership, Diversification, and Risk-taking in BHCs

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JEL Classification: *G21, G32*

Keywords: BHC risk, Diversification, Institutional ownership stability, Market discipline

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Abstract

This study examines the relationship among institutional ownership, diversification, and the risk-taking of BHCs. The empirical results indicate that, geographic, revenue, and non-traditional banking activity diversification is associated with lower risk-taking of BHCs. However, asset diversification is associated with higher risk-taking due to a large exposure in risky real estate loans. In addition, both the size and stability of institutional ownership are positively related to diversification, indicating that diversification is a channel through which institutional investors reduce the risk-taking in BHCs. Furthermore, the positive relationship between institutional ownership and diversification is more pronounced in BHCs during the deregulation period.

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1. Introduction

Existing studies on diversification focus on the association between diversification and firm value, while the impact of diversification on firm risk receives less attention; even less research on the factors leading to the risk effect of diversification. Building upon the existing literature on diversification and risk (Galai and Masulis, 1976; Shapiro, 1978; Boot and Schmeits, 2000; Rivard and Thomas, 1997; Akhigbe and Whyte, 2003; Hughes, Lang, Mester, and Moon, 1999), we examine how various dimensions of diversification affect the risk-taking of publicly traded bank holding companies (BHCs). BHCs can reduce their operation risk via diversification in multiple dimensions, such as geographic, revenue, asset, and non-traditional banking activity diversification, yet most existing studies do not distinguish the various dimensions of diversification. Moreover, we take a further step to investigate the role of institutional ownership in the risk effects of diversification.

Managers choose the level of diversification as a function of monitoring received from institutional shareholders, diversification is a channel through which institutional ownership influences risk-taking of BHCs. As indicated in the framework of Jensen and Meckling (1976), ownership structure affects firm value through investment channel such as diversification. With a large and stable stake in the firm, institutional shareholders have the incentive to monitor managerial opportunistic behavior and mitigate the conflicts between shareholder and debtholder, resulting in diversification investment decision and lower risk-taking. In the recent decades, institutional investors become the largest shareholders of publicly traded firms

including large BHCs.[1] To the extent institutional investors influence management's activities either directly through their activism (Smith, 1996), or indirectly by trading their shares (Gillan and Starks, 2003), they have become an important market force to monitor the operations of BHCs.

A notable lapse in the existing diversification literature is the failure to account for the influence of institutional ownership in the strategic decision of diversification of BHCs. For instance, Campa and Kedia (2002) argue that the strategic decision of diversification is endogenously determined by firm-specific variables (i.e., profitability, firm size, etc.) and industry characteristics, while leaving out ownership structure in their analysis. Denis, Denis, and Sarin (1997), and Anderson, Bates, Bizjak, and Lemmon (2000) focus on managerial ownership and exclude financial firms. Similarly, most prior banking studies focus on the relationship between managerial ownership and risk in banking, while leaving out institutional ownership. For example, Saunders, Strock, and Travlos (1990) find managerial ownership is positively related to market risk of BHCs. Sullivan and Spong (2007) find that bank risk falls with managerial wealth concentration; and significant motivation to monitor tied with wealth concentration is associated with lower risk.

Our paper differs from the above studies in the following ways: first, we focus on the relationship between institutional ownership (with managerial ownership controlled), diversification, and risk-taking of BHCs. We investigate whether diversification is an investment channel through which institutional ownership influences the risk-taking of BHCs. Second, existing literature commonly uses the proportion of institutional shareholding to examine the influence of institutional ownership on firm value, disregarding the second moment of the

[1] According to Adams and Mehran (2003), institutional investors hold 42.4 percent of BHCs' stocks on average. They also report that there are 204 institutional shareholders on average for each BHC during 1986-1999.

ownership distribution (McConnell and Servaes, 1990; Del Guercio, 1996). We propose both the proportion and stability of institutional ownership are important in describing the monitoring incentives of institutional investors. The rationale is that an institutional shareholder may hold a large stake of stock merely for a short period of time and for trading purpose, and they will be less inclined to monitor the management; a stable institutional shareholder with low stake may lack the incentive to monitor the management. It is more likely that those institutional investors with high stake and stable ownership have greater monitoring incentive. Third, to address the endogeneity problem in the relationship between risk-taking and diversification and avoid the biased estimates of OLS, we employ three-stage least squares (3SLS) technique with firm fixed effects, and estimate the risk and diversification models in a simultaneous equation framework. Therefore, we provide a more comprehensive analysis of the relationships among institutional ownership, diversification, and risk-taking of BHCs.

We assemble our sample of publicly traded BHCs from various databases, including FDIC's Summary of Deposits (SOD), BHC database, CRSP (Center for Research in Security Prices), Thomson Financial 13f Institutional holdings database, and Compustat Executive Compensation database during 1994-2006. The sample contains 602 BHC-year observations, with 98 BHCs.

This study yields four main findings. First, geographic, revenue, and non-traditional banking activity diversification are associated with lower risk-taking of BHCs (significant at 1% level). On the contrary, asset diversification is associated with higher risk-taking, due to the large exposure in real estate loans. Second, both the proportion and stability of institutional ownership are positively related to the degree of diversification. The result suggests that stable institutional investors with large stake in the BHC have incentive to monitor the strategic decision of

diversification, and diversification is a channel through which institutional investors reduce the risk-taking behavior in BHCs. Third, the positive relationship between institutional ownership and geographic, revenue and activity diversification is more pronounced in BHCs in a deregulated period when BHCs are subject to less regulatory scrutiny. This result suggests that regulation serves as a substitute for market discipline from institutional shareholders, and complements Booth, Cornett and Tehranian (2002) who find that regulation serve as a substitute for internal monitoring from corporate board.

The paper is organized as follows: Section II presents the theoretical framework; Section III describes the methodology and data; Section IV provides empirical results; and Section V concludes.

2. Theoretical framework

2.1. Diversification and risk-taking

Conventional portfolio theory suggests that diversification reduces firm risk, due to the imperfect correlation among different regions/activities. Diversified firms can spread their operations across regions with different economic environments, reducing earning volatility. Some empirical studies indicate that diversification is associated with lower risk-taking in banking (Hughes, Lang, and Mester, 1996; Rivard and Thomas, 1997; Akhigbe and Whyte, 2003; and Deng, Elyasiani and Mao, 2007; etc.). The decrease in the risk-taking of diversified BHCs may come from the benefits of cost reduction and revenue synergies (Saunders and Cornett, 2007). Diversified BHCs can reduce operational costs by consolidating back office operations such as custody, escrow, trust services, settlement services, and research and advisory functions, and eliminating redundant costs, such as closing overlapping branches. Diversified

BHCs can also stabilize revenue stream by merging with a bank exhibiting different credit, interest rate, and liquidity risk characteristics. Therefore, we expect to see a negative relationship between firm risk and diversification.

Alternatively, diversification of BHCs may be associated with a higher firm specific risk due to agency problems, competition, and lack of experience. Jensen (1986), Stulz (1990), Shleifer and Vishny (1989), Amihud and Lev (1981) suggest that firms might diversify as the result of managerial entrenchment and heightened agency problems. In addition, as firms expand their business operation to different asset holdings, geographic regions and product lines, firm organizational structure becomes more complex, and information asymmetry between shareholders and managers strengthens (Krishnaswami, Spindt, and Subramaniam, 1999). The severe information asymmetry problem escalates the difficulties shareholders face in monitoring managers, and thus may intensify the agency problem. Increased competition, due to interstate banking and other form of deregulation, drives banks to undertake more risk in their business activities, and to overlook hidden loan problems (Chong, 1991; Demsetz and Strahan, 1997). Acharya, Hasan, and Saunders (2006) argue that geographic expansion into a market without prior lending experience will induce diseconomies of diversification and higher risk. In these scenarios, we would expect to find a positive relationship between diversification and firm specific risk of BHCs.

2.2. Institutional ownership, diversification and risk-taking

There is a large body of literature focusing on the role of institutional investors as corporate monitors (McConnell and Servaes, 1990; Smith, 1996; Parrino, Sias, and Starks, 2003; etc.). Most of the existing studies find that monitoring by institutional shareholders is associated with improved firm performance and less managerial opportunistic or self-serving behavior.

Shleifer and Vishny (1986) argue that the monitoring incentive of blockholders, including institutional investors, is positively related to the size of their shareholding, because monitoring is costly and there is a larger probability of the monitoring benefits from bigger shareholdings to cover the associated costs. However, an institutional investor with large shareholding may hold the stock merely for a short period of time and for trading purpose, and will be less interested in monitoring the management and less effective in doing so. Only those institutional investors with large stake and stable ownership have greater incentive to monitor the management and reduce the managerial myopia behavior (Bushee, 1998, 2001; Chen, Harford, and Li, 2007). Chen, Harford, and Li (2007) argue that long-term independent institutional investors have higher incentive to monitor than short-term institutional investors, and they found that only the concentrated holding by long-term independent institutional investors is positively associated with post-merger firm performance. Bushee (1998, 2001) document that the shareholding level by institutional investors with high portfolio turnover (unstable institutional investors) is positively associated with the firm's expected near-term earnings and the probability that managers reduce R&D to meet short-term earning goals.

Therefore both the size and the stability of institutional shareholding are important dimensions in describing the monitoring incentive of institutional investors. With large stake in the BHC, institutional shareholders, especially stable institutional investors as blockholders with long-term investment horizon, have the incentive to monitor corporate management, and to mitigate the conflicts between shareholders and debtholders (Anderson, Mansi and Reeb, 2003), resulting in a lower level of risk-taking.

Institutional ownership may be positively related to diversification. If diversification is associated with lower risk as portfolio theory suggests, stable institutional investors as

blockholders with long investment horizon may have incentive to mitigate the conflicts between shareholders and debtholders, resulting in lower risk-taking, institutional ownership will be positively related to diversification. In other words, diversification is a channel through which institutional investors reduce the risk-taking in BHCs. In addition, institutional investors may prefer to invest in BHCs with larger degree of diversification associated with lower risk (Bennett, Sias, and Starks, 2003). Institutional shareholders prefer prudent stocks due to their fiduciary duties (Del Guercio, 1996). Bank managers who value institutional investors as important clients may try to adjust their strategy to attract stable institutional investors as their clientele base. Therefore we may expect to see that institutional ownership measure is positively related to diversification, which in turn, is associated with lower risk.

Alternatively, institutional ownership may be negatively related to diversification, if diversification is a result of agency problem. Shleifer and Vishny (1989) propose the 'managerial entrenchment' theory in that managers tend to make investments beyond the value-maximization level in order to increase the firm's demand for their own particular skills, to make their position with the firm more secure, and to increase their power, compensation, and prestige. Aggarwal and Samwick (2003) find that managers choose to diversify to increase the private benefits associated with diversification, i.e., better market's perception of the manager's ability in running a more complex organization, and additional nonpecuniary private benefits. Due to large stake with the BHC, institutional shareholders have the incentive to monitor the self-serving behavior of managers and vote against harmful decision. As a result, institutional ownership may lead to a lower degree diversification to control for the associated managerial entrenchment problem.

2.3. Regulation and market discipline from institutional shareholders

Current regulation imposes a strict limitation on the change of ownership structure of BHCs than on that of industrial firms. For instance, the "Notice of Change in Bank Control", (originated in 1979 and now reported on FR 2081a), requires prior notice before any changes in the controlling ownership of a state member bank or bank holding company can occur. If institutional shareholders exercise market discipline to limit managerial discretion and prevent BHCs from taking excessive risk, the regulation on the ownership changes will interfere with this beneficial function. Specifically, institutional investors may have a lower incentive to monitor the operations of BHCs if they cannot trade freely. As a result, regulator will have to take the full responsibility of supervising the risk-taking behavior of BHCs, and BHCs have to comply with the regulation at the cost of efficiency.

Some existing studies suggest that regulation is a mere substitute for the internal monitoring mechanisms. For example, Booth, Cornett and Tehranian (2002) find that bank regulation serves as a substitute for internal monitoring mechanism, measured by a set of corporate governance variables such as board independence, director stock ownership, and CEO/Chair duality, etc. Adams and Mehran (2003) found that both the aggregate institutional investor holding and number of institutional investors are lower in banks than in manufacturing firms. In addition, BHCs face a more limited level of activism from their institutional investors because of the tight regulation. Following this rationale, we investigate whether regulation is a substitute for market discipline from institutional shareholders.

3. Methodology

3.1. Data and Sample

We assemble our sample of publicly traded BHCs from the following databases: Bank Holding Company (BHC) database from Federal Reserve Bank of Chicago, FDIC's Summary of Deposits (SOD) database, CRSP (Center for Research in Security Prices), Thomson Financial 13f Institutional Holdings database, and Compustat Executive Compensation database. BHC database is used to extract BHC-specific variables such as total assets, total equity, total loans, etc. In addition, BHC database provides detailed information on income from various sources, loans to various economic sectors, and non-interest income activities, from which we construct revenue, asset and non-traditional banking activity diversification. The SOD database provides annual information on the amount of deposits and location for each and every branch of subsidiary banks, as well as their associated parent BHCs. These are the most detailed data available on bank geographic expansion and are used to construct geographic diversification measures. CRSP provides both monthly and daily data on stock prices and returns. Thomson Financial 13f database is used to extract institutional ownership information. Executive Compensation database provides the top managers' total and incentive compensation.

Because the SOD database starts from 1994, our sample is restricted to the period of 1994-2006. Our sample selection procedure is as follows. First, we hand-match the 1,959 financial firms extracted from CRSP based on SIC codes with the 6,443 BHCs from the SOD and BHC databases and obtain 666 matched BHCs. Second, we match the BHCs from step one with the institutional ownership data from Thomson Financial 13f database by PERMNO (the principal identifier of the CRSP database), and we get 528 BHCs. Third, we obtain 428 unique financial institutions (with SIC code between 6000 and 6999) between 1994-2006 from Compustat Executive Compensation database, and match them with CRSP database by CUSIP (identifier of Compensation database) to get their PERMNO. Fourth, we match the 528 BHCs

from step two with the 428 financial institutions from step three by PERMNO. Deleting those observations with missing values on BHC-specific variables, risk, and institutional ownership, managerial ownership data, etc., we get 98 BHCs, with 602 BHC-year observations.

3.2. Model Specification

Portfolio and agency theory suggest that diversification may influence risk; on the other hand, diversification itself might be an endogenous choice as risky firms may seek to diversify more to bring down risk. To address this endogeneity issue, we employ a simultaneous equation model with risk and diversification both treated as endogenous variables. The model is described by equations (1A-1B), and it is estimated using the three-stage least squares (3SLS) procedure with firm fixed effects:

$$Risk = \alpha_0 + \beta_1 DIV + \beta_2 Size + \beta_3 Capratio + \beta_4 Creditrisk + \beta_5 Liquidity + \beta_6 OBSA + \varepsilon \quad (1A)$$

$$DIV = \phi_0 + \gamma_1 InstProp + \gamma_2 InstDuration + \gamma_3 Managerial + \gamma_4 Incentive + \gamma_5 ROA + \gamma_6 Size + \gamma_7 Liquidity + \gamma_8 Risk + \xi \quad (1B)$$

The model described by equation (1A) will be used to investigate the effect of various dimensions of diversification on BHC risk. Our variable of interest is diversification (DIV). If diversification works to reduce firm risk, we would expect the coefficient of diversification to be negative; otherwise, positive. In this paper, we examine four dimensions of diversification, namely, geographic, revenue, asset, and non-traditional activity diversification, as described in previous section.

The model described by equation (1B) will be employed to examine the impact of both the size and stability of institutional ownership on firms' decision to diversify. If institutional shareholders act as long-term and prudent investors, they prefer greater degree of diversification to reduce risk, suggesting a positive coefficient. The untabulated correlation matrix indicates that the correlation between the proportion and duration measures of institutional ownership is high

and significant (0.36 and 0.22 for non-zero-points and maintain-stake-points duration, respectively). Therefore, to study the additional impact of institutional ownership duration on diversification, we orthogonize the duration measure against the proportion measure and use the residuals of duration in the diversification equation following Klock, Mansi, and Maxwell (2005).

Managerial ownership may be positively related to diversification. If diversification is associated with lower risk, managers with higher stake and thus better aligning their interests with shareholders will have more incentive to reduce the level of diversification to benefit from the higher risk-taking. On the other hand, managerial ownership may be negatively related to diversification because managers may reduce value-destroying diversification with increasing shareholding (Denis, Denis, and Sarin, 1997).

3.3. Variable Construction

3.3.1. Measures of Diversification

In the banking literature, the conventional variables used to measure BHC geographic diversification include the number of branches, and the number of states where the BHC operates (Hughes, Lang, and Mester, 1996), or a binary variable (Dick, 2006). All of these measures suffer from the same weakness: they only account for the number of geographic regions, without accounting for the level of activity in each of the regions. To overcome this shortcoming, we construct diversification measures accounting for both number of regions and level of activity in each region. Following Hughes, Lang, Mester, and Moon (1999) and Deng, Elyasiani, and Mao (2007), we employ deposit dispersion as a measure of geographic diversification, which is similar to a Herfindahl index that measures deposit dispersion across states. Specifically, this measure is constructed as one minus the sum of the squared ratios of the deposits in each state

($deposit_i$) to the sum of the deposits over all states where the BHC operates (deposit data is at branch level from SOD database):

$$GeoDivSt = 1 - \sum_i \left(\frac{deposit_i}{\sum_i deposit_i}\right)^2 \quad \text{i = 1, 2,.., m (m = \# of states)} \tag{2}$$

Following Stiroh and Rumble (2006), we construct revenue diversification, which is based on a breakdown of net operating revenue into net interest income and non-interest income, as follows:

$$\text{Re}vdiv = 1 - \left[\left(\frac{IntIncome}{IntIncome + NonIntIncome}\right)^2 + \left(\frac{NonintIncome}{IntIncome + NonIntIncome}\right)^2\right] \tag{3}$$

Most of the interest income comes from traditional banking activities such as loans made to different economic sectors, including commercial and industrial, real estate, agriculture, financial institutions, individuals, and other loans. In the past two decades, the share of traditional banking activities has been shrinking, while that of non-traditional banking has been steadily rising.[2] Non-traditional banking includes off-balance-sheet, fee-based, and non-intermediation activities producing fiduciary income, service charges, trading revenue, investment banking, securitization, and insurance activities, and other non-interest income. Following Acharya, Hasan, and Saunders (2006) and Doukas and Lang (2003), we employ a Herfindahl-type index to measure asset and non-traditional activity diversification, which are constructed as follows:

$$AHHI = 1 - \sum_i \left(\frac{Loan_i}{Total\ Loan}\right)^2 \tag{4}$$

[2] DeYoung and Roland (2001) report that non-interest income at FDIC-insured commercial banks, used as a measure of non-traditional banking, increased from 25% to over 40% of aggregate income over the period of 1984 to 2001.

where i =commercial and industrial, real estate, agriculture, financial institutions, individuals, and others.

$$ACTHHI = 1 - \sum_{j} \left(\frac{Income_j}{Total\ Noninterest\ Income}\right)^2 \quad (5)$$

where j = fiduciary income, service charges, trading revenue, investment banking, securitization, and insurance activities, and others.

The above diversification indices take the value of zero when no diversification occurs (e.g., loans are made to a single economic sector), and increase in value as the bank diversifies. They are continuous and range between zero and one, facilitating the comparison of the degree of diversification across firms.

3.3.2. Ownership Measures

The existing literature commonly uses the institutional shareholding proportion to examine the influence of institutional ownership on firm value and bondholder wealth, disregarding the stability of institutional ownership (McConnell and Servaes, 1990; Del Guercio, 1996). We propose that both the proportion and stability of institutional ownership are important in describing their monitoring incentives, since institutional investors with large stake and have long investment horizon will have greater incentive to monitor.

Following McConnell and Servaes (1990) and Del Guercio (996), we construct institutional shareholding proportion, which is the aggregated shareholding proportion by all institutional investors. Following Bohren, Priestley, and Odegaard (2005), we construct two institutional ownership duration measures. The first is non-zero-points duration, which is the number of quarters in which an institutional investor has non-zero holdings out of the 20 quarters over a 5-year rolling window. The second measure is maintain-stake-points duration, which is the number of quarters in which an institutional investor maintains his stake (either keeps the

same proportion or increases the holding) out of the 20 quarters over a 5-year rolling window. Thus, the higher the duration, the more stable the institutional ownership. We calculate the average of each of these two measures across all the institutional investors in a BHC, and use them as institutional stability measures.

For managerial ownership measure, we use managerial shareholding which is the percentage shareholding of all managers, obtained by dividing the aggregate managerial share holdings by total number of shares outstanding. We also include the managerial compensation structure into the analysis, which is proxied by incentive ratio, calculated as the incentive compensation (total compensation minus salary minus bonus) divided by the total compensation of CEO.

3.3.3. Firm Risk

Based on portfolio theory, diversification works to reduce unsystematic risk and in turn total risk. Since firm-specific and total risks are highly correlated (0.94), we focus on total risk, measured by the annual standard deviation of the monthly stock returns (Krishnaswami, Spindt, and Subramaniam, 1999).[3]

Following Lepetit, Nys, Rous, and Tarazi (2007) and Boyd and Graham (1986), we also construct an insolvency risk measure, Market-based Z-Score:

$$\text{MZ-score} = \frac{\overline{R} + 1}{\sigma_R} \qquad (6)$$

where $\overline{R}$ and σ_R are respectively the mean and the standard deviation of the monthly returns R_t for a given year.

[3] The results of unsystematic risk are similar to those of total risk. For the sake of brevity, we do not report them in the text.

We also construct a market-based Sharpe ratio, which measures the risk-adjusted return, as follows:

$$\text{Sharpe} = \frac{R - R_f}{\sigma_R}, \text{ where } R_f \text{ is the 3-month T-bill rate;} \quad (7)$$

3.3.4. BHC-Specific Variables

Following Saunders, Strock and Travlos (1990), we include firm size, and capital ratio as control variables in the risk model. Based on Saunders and Cornett (2007), credit risk, liquidity risk, and off-balance-sheet risk are also major risk categories that may affect the risk level of financial institutions; therefore we also include them in the risk model.

BHC size is measured by the logarithm of total assets. BHC size is expected to be negatively related to firm risk, since larger BHCs are usually more well-established and associated with better credit quality and lower default risk. Capital ratio is measured as the book value of total equity divided by book value of total assets. A higher capital ratio serves as a cushion to prevent bank insolvency and as a factor contributing to the BHC survival probability, thus it leads to lower firm risk. Credit risk is measured by provision for loan and lease losses/total loans. Higher provision ratio indicates higher credit risk, thus higher firm risk. Following Angbazo (1997), Saunders and Cornett (2007), we measure liquidity risk by (liquid assets – liquid liability)/total assets, with higher ratio indicating lower liquidity risk. Off-Balance-Sheet (OBS) risk is measured by total noninterest income over total interest income. Given the risky nature of OBS activities, it is expected to raise firm risk. In addition, we include a set of firm dummies to control for firm fixed effect.

In the diversification model, following Campa and Kedia (2002), we include profitability (ROA), firm-size (log of total assets), liquidity risk, firm risk (stock return volatility),

Profitability is expected to be negatively related to diversification, as poor performing firms seek to diversify (Campa and Kedia, 2002; Graham, Lemmon, and Wolf, 2002). Firm size is supposed to be positively related to diversification, as larger firms have more capacity to diversify (Demsetz and Strahan, 1997). More liquid firms are more likely to diversify. More risky firms tend to diversify more to bring down the risk. We also include a set of firm dummies to control for firm fixed effect.

3.4. Sample Descriptive Statistics

Summary statistics for the 602 firm-year observations from 98 BHCs are presented in Table 1. There are three categories of variables: diversification measures, institutional, managerial ownership and managerial compensation measures, and firm-specific characteristics. The mean (median) of geographic, revenue, asset and activity diversification are 0.39 (0.41), 0.34 (0.35), 0.55 (0.58), and 0.54 (0.55), respectively, displaying a variety degree of diversification. The mean (median) of institutional ownership proportion is 42.83% (43.14%), indicating that about 43% of all outstanding shares of the sample BHCs is held by institutional investors. The mean (median) of non-zero-points duration and maintain-stake-points duration are 7.65 (7.68) and 4.89 (4.92) quarters, respectively. The interpretation of these numbers is that on average institutional investors hold the BHC stocks for almost two years (8 quarters) and they maintain the holding levels for over one year (5 quarters). The mean (median) of total asset is $63.77 (16.27) billion, suggesting that BHCs in our sample are very large and that the asset distribution is positively skewed. The mean and median capital ratios are both around 0.08 indicating that these BHCs in our sample are symmetrically distributed in terms of capital adequacy.

IV. Empirical Results[4]

4.1. Diversification and risk

The results with total risk (Sharpe ratio) as risk measure and non-zero-points duration as the proxy for stability of institutional ownership is displayed in columns (1-4) of Table 2 (Table 3). In the risk (Sharpe ratio) model, three dimensions of diversification, namely, geographic, revenue, and non-traditional banking activity diversification are associated with lower risk-taking (higher Sharpe Ratio) of BHCs (significant at 1% level).[5] The results suggest that 'coinsurance effect' dominates the agency problem associated with diversification. Total risk declines as a BHC diversify into various economic regions, across interest and non-interest activities, and diversify within non-traditional banking activities, such as trading, investment banking, and insurance activities, etc..

Our result on revenue diversification is consistent with Stiroh and Rumble (2006), who find that revenue diversification improves the risk-adjusted accounting return of the sample BHCs. Furthermore, we find that diversification within non-traditional banking activities is associated with a lower risk-taking; while Stiroh and Rumble (2006) find that the share of non-interest income activities is associated with greater risk.

However, asset diversification is associated with a higher risk-taking, which is in contradictory to the conventional portfolio theory. A closer look at the loan components reveals that a majority of the loans of the sample is real estate loans, with mean (median) $170,96 Million ($4,958Million), and mean (median) share of total loans is 53.35% (54.25%). Real estate

[4] To save space, we only report the estimation results based on non-zero -point duration. The results of maintain-stake-point duration are consistent with the reported ones, though less significant sometimes.
[5] Given the space limitation, only the estimation results of Total Risk and Sharpe Ratio are reported. The results of MZ-Score as risk measure are consistent with the reported ones.

loans could be very risky, as the recent mortgage market turmoil in 2007 suggests.[6] We conjecture that the risk increase associated with asset diversification is due to the large exposure of real estate loans and hence the lack of asset diversification in loan portfolio during the sample period.

To test this conjecture, we include the interactive term of asset diversification and the share of real estate loan, and the interactive term of asset diversification and the share of commercial and industrial loans (the second largest loan component) in the risk equation, and re-estimate the model. The rationale of including these two interactive terms is that asset diversification could be the same, but the loan components could be very different. The interactive term captures the impact of increasing proportion of real estate loans or commercial & industrial loans at a given level of asset diversification on risk. The results shown in columns (1-3) of Table 4 indicate that the interactive term between asset diversification and real estate loans is significantly and positively related to total risk, while that of asset diversification becomes insignificant. The result suggests that when the share of real estate loans in the loan portfolio increases at a constant level of asset diversification, bank risk rises. We also utilize MZ-score and Sharpe Ratio as alternative risk measures. The interactive term between asset diversification and real estate loans is significantly and negatively related to both MZ-score and Sharpe Ratio, suggesting that increasing share of real estate loans in the loan portfolio at a constant level of asset diversification is associated with a higher probability of insolvency and lower risk-adjusted returns.

Most control variables in the estimation of risk equation display signs consistent with our expectation. BHC size is positively (negatively) related to total risk (Sharpe ratio), suggesting

[6] Due to the subprime mortgage crisis and huge losses from mortgage-backed securities, a lot of financial institutions including CitiGroup, Merrill Lynch, Bank of America, etc. experienced huge write-downs in the third and fourth quarter of 2007.

larger BHCs seek more risky activities in operation; capital adequacy ratio is negatively (positively) related to total risk (Sharpe ratio); credit risk is positively (insignificantly) related to total risk (Sharpe ratio), suggesting market fully captures the credit risk position of BHCs; liquidity risk and off-balance-sheet risk is insignificant for total risk, but positively and negatively significant for Sharpe ratio. High liquidity of asset composition and lower non-interest income are associated with higher Sharpe ratio.

4.2. Institutional ownership and diversification

The effects of institutional ownership on diversification are reported in columns (5-8) of Table 2 and Table 3. In geographic diversification, both the coefficients of the proportion and stability of institutional ownership are positive and significant (at 1% level), suggesting that both the size and the stability of institutional ownership are important upside factors in determining the level of geographic diversification. In revenue diversification, only the proportion coefficient is significantly positive. In asset diversification, both coefficients of the proportion and the stability of institutional ownership are negative and significant (at 1% level), suggesting that both the size and duration of institutional ownership negatively affect the level of asset diversification. The result is very interesting in that institutional investors seem to have looked into the loan portfolio components and realized that BHCs are making too much real estate loans and thus are more risky, and do not want BHCs to pursue more diversification in this dimension. In activity diversification, both the size and the stability of institutional ownership are important positive determinants of the level of non-traditional activity diversification.

Using Sharpe ratio as an alternative risk measure, results are qualitatively similar. Both the size and the stability of institutional ownership are significantly related to geographic diversification; only the size of institutional ownership is significantly associated with revenue

diversification; only the stability of institutional ownership is significantly associated with asset and non-traditional banking activity diversification. The results generally are consistent with the idea that long-term institutional investors with large stake perform diligent monitoring on corporate management and mitigate the shareholder-debtholder conflict, and diversification is a channel through which institutional investors reduce the risk-taking of BHCs.

On the other hand, managerial ownership and CEO incentive pay are mostly insignificant in all dimensions of diversification. Among the control variables, firm size is positively associated with diversification, consistent with the notion that larger BHCs have more capacity to diversify, consistent with Demsetz and Strahan (1997). The risk position of BHCs is positively related to diversification, indicating BHCs with greater risk seek to diversify more. The result confirms the endogeneity problem between risk and diversification, and thus the validity and necessity of the simultaneous equation framework. Liquidity position is also positively related to the degree of diversification, the more liquid a BHCs is, the greater it can deploy the resources to diversify. BHC profitability is insignificant in geographic and asset diversification, yet it is positively related to both revenue and activity diversification. Better performing BHCs seek to diversify more in revenue and activity diversification.

The documented negative relationship between geographic, revenue and non-traditional banking activity diversification measures and risk, combined with the positive relationship between the size and stability of institutional ownership and the above three dimensions of diversification, indicate that stable institutional shareholders with large stakes mitigate the conflicts between shareholder and debtholder, by positively influencing the diversification strategy through which to reduce the excessive risk-taking behavior of BHCs. Though asset diversification is associated with larger risk due to huge real estate loan exposure, the evidence

that institutional ownership is negatively related to asset diversification suggests that institutional ownership is associated with lower risk-taking through the influence on asset diversification.

4.3. Regulation as a substitute of market discipline from institutional shareholders

Booth, Cornett and Tehranian (2002) find that bank regulation serves as a substitute for internal monitoring mechanism, measured by a set of corporate governance variables such as board independence, director stock ownership, and CEO/Chair duality, etc. In this study, we examine whether there is a substitution effect of regulation for market discipline from institutional shareholders, which is a complement of Booth, Cornett and Tehranian (2002).

Several important major pieces of legislation in the 1990s (i.e., the 1994 Riegle-Neal Interstate Branching Act, and the 1999 Graham-Leach-Bliley Act) enabled BHCs to operate in a more deregulated environment. We construct a deregulation dummy, which takes the unit value for those years after 2000 (a period characterized by more deregulation), and zero otherwise. If there is a substitution effect of regulation for market discipline exercised by institutional investors, we expect to see a more pronounced effect of institutional ownership on the degree of diversification in the more deregulated period (i.e., the interactive term between institutional ownership and deregulation dummy is positive). The estimation results for diversification equation including the interactive terms are reported in Table 5.

In the unreported estimation of risk equation, the impact of various dimensions of diversification on risk remains qualitatively similar to those obtained in the baseline models, and the control variables display signs as expected. In the geographic diversification model, the coefficients of the interactive terms between institutional ownership proportion, duration and deregulation dummy are both positive and significant, suggesting that both the size and stability of institutional ownership exert greater influence on geographic diversification in those less

regulated years. In the revenue diversification model, the coefficient of the interactive term between institutional ownership proportion and deregulation dummy is significantly positive, while that of institutional ownership stability and deregulation dummy is insignificant. The result indicates that institutional investors with larger stake exert greater influence on revenue diversification in the less regulated period. In the asset diversification model, the coefficients of the interactive terms between institutional ownership proportion, duration and deregulation dummy are both negative and significant, suggesting that both the size and stability of institutional ownership exert less influence on asset diversification in those less regulated years. Probably because institutional investors have realized that asset diversification is associated with more risk-taking, they vote for less diversification in this dimension. In the activity diversification model, the coefficient of the interactive term between institutional ownership proportion and deregulation dummy is significantly positive, while that of institutional ownership stability and deregulation dummy is insignificant. The result indicates that the size of institutional ownership exerts greater influence on activity diversification in a period characterized by more deregulation.

4.4. Robustness check

It is possible that there is a twofold relationship between diversification and board effectiveness: If diversification is beneficial to BHCs in reducing excess risk and enhancing performance by cost reduction and revenue synergies, board effectiveness can be positively related to diversification. However, if diversification is associated with managerial entrenchment and other heightened agency conflicts within the firm, we expect to see an inverse relationship between effective corporate board and the decision to diversify because effective corporate board monitors managers and thus mitigates agency conflicts between managers and shareholders

(Anderson, Bates, Bizjak, and Lemmon, 2000). To check whether our previous results on the relationship between diversification and institutional ownership are driven by the impact of board effectiveness, we include a set of variables describing board characteristics.

According to Booth, Cornett and Tehranian (2002), an effective board is characterized as more independent directors, CEO/Chair separation, and smaller board, etc. We collect a set of corporate governance variables including board size, board independence and CEO/Chair duality from Investor Responsibility Research Center (IRRC) database, and include them in the diversification model. Board size is measured by the number of directors; board independence is measured by the percentage of independent directors (excluding dependent and affiliated directors); CEO/Chair duality is a dummy variable, which takes the unit value when CEO/chair is the same person, and zero otherwise.

Since IRRC database is available between 1996 and 2005, we lose three years' data (1994, 1995 and 2006). After deleting those observations with missing value, the number of observations in the sample is reduced from 602 to 332. The untabulated results indicate that baseline results on risk still hold. The estimation results for diversification model including corporate governance variables are reported in Table 6. The stability of institutional ownership is positively related to geographic, revenue and non-traditional activity diversification. All the coefficients of institutional ownership size are positive, but some are insignificant.[7] Therefore stable institutional investors affect the risk-taking behavior through the strategic decision of diversification, and our primary results are robust to the inclusion of board effectiveness variables. The above results indicate that even when the endogeneity problem between diversification and risk, and board characteristics are accounted for, diversification is still

[7] With board effectiveness variables as control variables in asset diversification equation (AHHI), the coefficients of institutional ownership variables turn insignificant. The results are not reported.

associated with lower BHC risk-taking. In this process, large and stable institutional ownership is one of the determinants of strategic decision of diversification, which leads to higher level of diversification associated with lower risk-taking.

However, we do not find strong evidence that corporate governance variables have significant impact on the degree of diversification. There are two exceptions in revenue and non-traditional activity diversification: CEO/Chair duality is significantly positively related to revenue diversification and board independence is positively related to activity diversification, suggesting that CEO/Chair duality and independent board is associated with greater extent of diversification along revenue and non-traditional business activities, respectively. The above results indicate that CEO/Chair duality and independent board are beneficial to BHCs by enhancing revenue diversification and non-traditional activity diversification, resulting in lower risk-taking.

V. Conclusion

This paper examines the relationship between institutional ownership, diversification, and the risk-taking behavior of BHCs. Our results indicate that geographic, revenue and non-interest income activity diversification are associated with lower risk-taking of BHCs. However, asset diversification is associated with greater risk-taking due to a large exposure in real estate loans. We also find that large and stable institutional ownership is associated with a higher (lower) level of geographic, revenue and non-interest income activity diversification (asset diversification), suggesting that institutional shareholders exert influence on managers in the strategic decision of diversification, and in turn diversification is a channel through which institutional shareholders negatively influence BHC risk-taking. Furthermore, we find that the

magnitude of the positive relationship between institutional ownership (both size and stability) and diversification is more pronounced in an era characterized by more deregulation, suggesting a substitution effect of regulation for market discipline from institutional shareholders. The study has important implications for the current ownership regulation of BHCs: If diversification is associated with lower risk-taking, and stable institutional ownership with large stake is positively related to diversification, regulators may consider relaxing the ownership regulation on BHCs which serve as a substitute for market monitoring.

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Table 1
Sample descriptive statistics

	N	Mean	Median	Std	Min	25th Pctl	75th Pctl	Max
				Diversification Measures				
GeodivSt	602	0.39	0.41	0.30	0.00	0.07	0.66	0.94
Revdiv	602	0.34	0.35	0.10	0.02	0.27	0.42	0.50
AHHI	602	0.55	0.58	0.15	0.00	0.49	0.66	0.75
ACTHHI	602	0.54	0.55	0.14	0.02	0.45	0.64	0.81
				Institutional and Managerial Ownership Measures				
Prop	602	42.83	43.14	16.91	5.97	29.42	56.21	92.99
Non-zero-points duration	602	7.65	7.68	1.29	2.14	6.89	8.57	11.55
Maintain-stake-points duration	602	4.89	4.92	0.71	1.64	4.47	5.33	6.71
Shpc	602	14.78	7.91	16.74	0.48	3.70	19.53	97.16
Incen	602	0.42	0.42	0.27	0.00	0.19	0.64	0.99
				Firm-Specific Measures				
Stdret	602	0.07	0.06	0.03	0.02	0.05	0.09	0.24
Sharpe Ratio	602	2.82	2.09	4.58	-7.80	-0.76	5.84	19.73
MZ-Score	602	17.48	16.74	7.43	4.71	11.67	21.88	49.54
Size	602	16.71	16.60	1.53	12.37	15.60	17.69	21.10
leverage	602	0.08	0.08	0.02	0.04	0.07	0.10	0.22
LIQUID	602	0.18	0.16	0.12	-0.11	0.10	0.22	0.68
CRISK	602	0.00	0.00	0.00	-0.02	0.00	0.01	0.04
OBSA	602	0.74	0.49	0.89	0.02	0.33	0.74	8.95
ROA	602	0.01	0.01	0.00	-0.02	0.01	0.01	0.04
Total assets ($Billion)	602	63.77	16.27	0.16	0.24	5.95	48.23	1463.69

Notes: This table reports summary statistics for our sample during 1994-2006. There are three categories of variables: Diversification Measures, Institutional and Managerial Ownership and Compensation Measures, and Firm Characteristics. Geographic Diversification Measure (GeoDivSt) is constructed as one minus the sum of the squared ratios of the deposits in each state. Revenue diversification (Revdiv) is constructed as one minus the sum of the squared ratios of non-interest income/interest income over total income. Asset Diversification (AHHI) and Nontraditional Diversification (ACTHHI) are calculated as one minus the sum of the squared exposures as a fraction of total exposure for asset. Institutional Ownership Proportion (Prop) is aggregate institutional ownership proportion (Prop) in a BHC in a specific year. Non-zero-points duration is the average number of quarters in which an institutional investor has non-zero holdings out of the 20 quarters over a 5 years rolling sample period (current and past four years). Maintain-stake-points duration is the average number of quarters in which an institutional investor maintains his stake (either keeps the same proportion or increases the holding) out of the 20 quarters. The percentage shareholding of all managers (Shpc) is obtained by dividing the sum of shares owned by all managers by total number of shares outstanding. Managerial incentive ratio (Incen) is calculated as the incentive compensation (total compensation-salary-bonus) divided by total compensation of CEO. Total risk measure (Stdret) is annual standard deviation of monthly stock returns. Sharpe ratio is calculated as the ratio of monthly risk-adjusted stock return to standard deviation of monthly stock return. MZ-Score is calculated as the ratio of average monthly return plus one to standard deviation of monthly return. Firm Size (Size) is measured by the logarithm of total assets. Capital ratio (Capratio) is measured as the book value of total equity divided by book value of total assets. Credit risk (CRISK) is measured by provision for loan and lease losses/total loans. Liquidity risk (LIQUID) is proxied by (liquid assets-liquid liability)/total assets. Off-Balance-Sheet risk (OBSA) is measured by total non-interest income over total interest income. ROA is calculated as net income divided by total assets.

Table 2
Institutional ownership, diversification and total risk

	Dependent variable = Total Risk					Dependent variable = DIV			
	DIV= GeoDivSt	DIV= Revdiv	DIV= AHHI	DIV= ACTHHI		DIV= GeoDivSt	DIV= Revdiv	DIV= AHHI	DIV= ACTHHI
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
Intercept	-0.4826**	0.0170	-0.7715*	-0.2854***	Intercept	-1.0995***	-0.3178***	0.9424***	-0.7377***
	(-2.29)	(0.23)	(-1.89)	(-3.20)		(-5.44)	(-3.55)	(9.81)	(-4.85)
DIV	-0.4442***	-0.3447***	0.8281**	-0.3998***	Proportion	0.0028***	0.0011***	-0.0009***	0.0015***
	(-3.28)	(-3.06)	(2.32)	(-6.97)		(3.91)	(3.41)	(-2.90)	(2.95)
Size	0.0532***	0.0133*	0.0362**	0.0333***	Duration	0.0463**	0.0080	-0.0188***	0.0350***
	(2.93)	(1.91)	(1.98)	(5.01)		(3.89)	(1.52)	(-3.27)	(3.58)
leverage	-0.3674**	-0.2554**	-0.2913**	-0.2017*	Shpc*100	-0.0671	-0.0179	-0.0067	0.0023
	(-2.09)	(-2.09)	(-2.32)	(-1.88)		(-1.16)	(-0.71)	(-0.39)	(0.07)
LIQUID	0.0662	-0.0335	-0.0325	-0.0280	Incen*100	-1.2630	0.0287	0.0390	-0.6376
	(1.64)	(-1.33)	(-0.76)	(-1.04)		(-0.77)	(0.04)	(0.07)	(-0.64)
CRISK	3.5038***	2.5442***	2.5697***	2.0691***	ROA	0.7597	2.6810***	0.0470	1.4357
	(5.02)	(5.61)	(3.68)	(4.26)		(0.58)	(4.04)	(0.09)	(1.59)
OBSA	0.0094	0.0019	0.0037	0.0027	Size	0.0947***	0.0403***	-0.0346***	0.0673***
	(1.52)	(0.69)	(0.61)	(1.16)		(6.94)	(6.65)	(-5.47)	(6.45)
					Stdret	1.4850***	0.0844	-0.1416	-0.2173
						(2.43)	(0.31)	(-0.45)	(-0.44)
					LIQUID	0.309127***	-0.0528	-0.0124	0.0132
						(4.30)	(-1.64)	(-0.33)	(0.23)
Firm fixed effect	Yes	Yes	Yes	Yes	Firm fixed effect	Yes	Yes	Yes	Yes
No. of obs.	602	602	602	602	No. of obs.	602	602	602	602
System R-Sq	0.9057	0.7565	0.8597	0.6648	System R-Sq	0.9057	0.7565	0.8597	0.6648

Notes: This table provides estimation results of the system model (Equation 1A and 1B) estimated with the 3SLS technique. Total risk measure (Stdret) is the proxy of risk-taking of BHCs. The diversification measures are geographic (GeoDivSt), revenue (Revdiv), asset (AHHI), and non-traditional activity (ACTHHI), respectively. The institutional ownership measures include institutional ownership proportion and non-zero-points duration. In diversification regression, non-zero-points duration is orthognalized against institutional ownership proportion measure. Other variables are as defined in Table 1. T-statistics are reported in parentheses.*, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

Table 3
Institutional ownership, diversification and Sharpe ratio

	Dependent variable = Sharpe ratio					Dependent variable = DIV			
	DIV= GeoDivSt	DIV= Revdiv	DIV= AHHI	DIV= ACTHHI		DIV= GeoDivSt	DIV= Revdiv	DIV= AHHI	DIV= ACTHHI
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
Intercept	87.5327***	53.2279***	109.7467**	76.2767***	Intercept	-0.1524	-0.4965***	0.5602**	-1.3280***
	(3.66)	(4.72)	(2.31)	(5.78)		(-0.30)	(-2.83)	(2.12)	(-3.72)
DIV	35.7019**	35.9957**	-64.6424	34.3238***	Proportion	0.0023***	0.0007***	-0.0007	0.0007
	(2.32)	(2.10)	(-1.56)	(4.05)		(2.88)	(2.65)	(-1.64)	(1.57)
Size	-6.9391***	-4.3332***	-5.6153***	-5.6766***	Duration	0.0327**	-0.0004	-0.0206***	0.0242***
	(-3.35)	(-4.06)	(-2.61)	(-5.77)		(2.31)	(-0.07)	(-2.81)	(2.54)
leverage	45.2300**	35.0604*	53.5016**	25.7540	Shpc*100	-0.1546*	-0.0157	-0.0121	0.0076
	(1.96)	(1.85)	(2.16)	(1.59)		(-1.92)	(-0.63)	(-0.29)	(0.26)
LIQUID	7.1883	13.2681***	15.0244***	11.7624***	Incen*100	-1.5599	0.1984	-0.7423	-0.4949
	(1.54)	(3.41)	(2.89)	(2.92)		(-0.62)	(0.26)	(-0.57)	(-0.54)
CRISK	-98.7860	3.0216	21.9638	9.1441	ROA	0.9323	2.8624***	0.4292	2.2127***
	(-1.21)	(0.05)	(0.24)	(0.23)		(0.47)	(4.28)	(0.41)	(2.38)
OBSA	-2.3021***	-0.9788**	-1.9543**	-0.7852*	Size	0.0477	0.0525***	-0.0131	0.1037***
	(-3.02)	(-2.19)	(-2.31)	(-1.73)		(1.46)	(4.67)	(-0.78)	(4.48)
					Sharpe ratio	-0.0211***	0.0024	0.0095**	0.0104*
						(-2.55)	(0.82)	(2.22)	(1.71)
					LIQUID	0.4638***	-0.0862**	-0.0912	-0.0961
						(3.71)	(-1.98)	(-1.41)	(-1.05)
Firm fixed effect	Yes	Yes	Yes	Yes	Firm fixed effect	Yes	Yes	Yes	Yes
No. of obs.	602	602	602	602	No. of obs.	602	602	602	602
System R-Sq	0.8440	0.7321	0.8126	0.6041	System R-Sq	0.8440	0.7321	0.8126	0.6041

Notes: This table provides estimation results of the system model (Equation 1A and 1B) estimated with the 3SLS technique. Risk-adjusted return is proxied by Sharpe ratio. The diversification measures are geographic (GeoDivSt), revenue (Revdiv), asset (AHHI), and non-traditional activity (ACTHHI), respectively. The institutional ownership measures include institutional ownership proportion and non-zero-points duration. In diversification regression, non-zero-points duration is orthognalized against institutional ownership proportion measure. Other variables are as defined in Table 1. T-statistics are reported in parentheses.*, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

Table 4
Real estate loans, asset diversification and risk

	Dependent variable: Risk		
	Risk=Total Risk	Risk=MZ-Score	Risk=Sharpe Ratio
	(1)	(2)	(3)
Intercept	0.024	88.005	63.786
	(0.03)	(0.52)	(0.73)
AHHI	-0.771	45.521	34.057
	(-0.68)	(0.18)	(0.26)
AHHI*Real Estate Loan Ratio	2.315***	-450.597**	-194.511*
	(2.47)	(-2.18)	(-1.82)
AHHI* C&I Loan Ratio	1.997	-310.969	-117.712
	(1.45)	(-1.03)	(-0.75)
size	-0.020	1.986	-1.465
	(-0.61)	(0.28)	(-0.40)
leverage	-0.535	89.563	47.964
	(-1.70)*	(1.38)	(1.35)
LIQUID	0.025	-8.951	10.505
	(0.34)	(-0.56)	(1.26)
CRISK	2.876***	-476.831***	-0.723
	(3.15)	(-2.45)	(-0.01)
OBSA	-0.001	1.340	-1.004
	(-0.05)	(0.72)	(-0.99)
Firm fixed effect	Yes	Yes	Yes
No. of obs.	602	602	602
System R-Sq	0.8682	0.8603	0.8175

Notes: This table reports the effect of real estate loan ratio on the risk-taking from the system model (Equation 1A and 1B) estimated with the 3SLS technique. The estimates of equation (1A) are reported here. Total risk (Stdret), MZ-Score and Sharpe Ratio are the proxies of risk-taking of BHCs. The diversification measure is asset diversification (AHHI). The institutional ownership measures are shareholding proportion and non-zero-points duration. Other variables are as defined in Table 1. T-statistics are reported in parentheses.*, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

Table 5
Regulation as a substitute for market discipline from institutional shareholders

	Dependent variable = DIV			
	DIV=GeoDivSt	DIV= Revdiv	DIV=AHHI	DIV=ACTHHI
	(1)	(2)	(3)	(4)
Intercept	0.3322	0.0577	0.2936	-0.1770
	(0.76)	(0.35)	(1.47)	(-0.60)
Proportion	0.0014***	0.0002	-0.0003	0.0002
	(2.48)	(1.06)	(-1.52)	(0.72)
Duration	0.0290***	0.0012	-0.0093**	0.0108**
	(2.78)	(0.35)	(-2.21)	(2.04)
Prop×Dereg	0.0032***	0.0008***	-0.0013***	0.0013***
	(4.30)	(2.92)	(-3.79)	(2.43)
Dura×Dereg	0.0166*	0.0009	-0.0156***	0.0076
	(1.67)	(0.28)	(-3.27)	(1.58)
Shpc×100	-0.0962	-0.0078	0.0170	-0.0068
	(-1.45)	(-0.40)	(0.71)	(-0.27)
Incen×100	-2.0429	-0.1637	0.2827	-0.6192
	(-1.06)	(-0.28)	(0.39)	(-0.80)
ROA	-1.1659	0.9012*	0.8985	0.0295
	(-0.77)	(1.79)	(1.50)	(0.05)
Size	0.0046	0.0217*	0.0059	0.0394*
	(0.15)	(1.88)	(0.42)	(1.89)
Stdret	2.4946***	-0.2293	-0.5405	-0.9160*
	(3.20)	(-0.76)	(-1.44)	(-1.66)
LIQUID	0.1875***	-0.0877***	0.0329	-0.0533
	(2.34)	(-2.80)	(0.86)	(-0.94)
Firm fixed effect	Yes	Yes	Yes	Yes
No. of obs.	602	602	602	602
System R-Sq	0.9123	0.8259	0.8702	0.7589

Notes: This table provides estimation results of the substitution effect of regulation for market discipline from institutional shareholders, captured by the interactive term between institutional ownership and deregulation dummy, estimated with the 3SLS technique. The estimates of equation (1B) are reported here. Total risk measure (Stdret) is the proxy of risk-taking of BHCs. The diversification measures are geographic (GeoDivSt), revenue (Revdiv), asset (AHHI), and non-traditional activity (ACTHHI), respectively. The institutional ownership measures are shareholding proportion and non-zero-points duration. Dereg is the deregulation dummy, takes the unit value for year larger than 2000, zero otherwise. Prop×Dereg and Dura×Dereg are interaction terms between Proportion, duration and Dereg, respectively. Other variables are as defined in Table 1. T-statistics are reported in parentheses.*, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

Table 6
Institutional ownership, corporate governance, diversification and risk

	Dependent variable = DIV					
	DIV =GeoDivSt		DIV = Revdiv		DIV = ACTHHI	
	Risk = Total Risk	Risk = MZ-Score	Risk = Total Risk	Risk = MZ-Score	Risk= Total Risk	Risk = MZ-Score
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-4.139***	-3.138***	-1.072	-0.781*	-5.725**	-4.055***
	(-3.06)	(-3.85)	(-1.60)	(-1.83)	(-2.38)	(-2.87)
Proportion	0.0001	0.001	0.001**	0.001**	0.0001	0.0005
	(0.20)	(1.28)	(2.24)	(2.50)	(0.09)	(0.43)
Duration	0.053**	0.061**	0.033**	0.036***	0.146***	0.141***
	(2.10)	(2.43)	(2.59)	(2.69)	(3.27)	(3.17)
Shpc/100	0.337**	0.297**	0.009	0.015	0.048	0.054
	(2.05)	(2.13)	(0.11)	(0.20)	(0.18)	(0.22)
Incen/100	-0.543	-1.990	1.496	0.944	2.070	0.839
	(-0.19)	(-0.82)	(1.05)	(0.70)	(0.45)	(0.20)
ROA	8.557**	6.478**	4.410**	3.997***	13.339**	11.598**
	(2.25)	(2.36)	(2.33)	(2.72)	(2.02)	(2.45)
Size	0.265***	0.224***	0.079**	0.069***	0.331***	0.271***
	(3.67)	(4.49)	(2.22)	(2.65)	(2.58)	(3.12)
Risk	2.383*	-0.008*	0.924	-0.003	5.162**	-0.017**
	(1.67)	(-1.78)	(1.30)	(-1.38)	(2.04)	(-2.06)
LIQUID	0.461***	0.385***	0.048	0.022	0.671***	0.474***
	(3.06)	(3.47)	(0.64)	(0.37)	(2.50)	(2.46)
Boardsize	-0.003	-0.002	-0.001	-0.001	-0.001	-0.001
	(-0.70)	(-0.66)	(-0.53)	(-0.57)	(-0.10)	(-0.11)
BoardIndep	0.047	0.025	0.014	0.009	0.419***	0.365***
	(0.58)	(0.36)	(0.33)	(0.24)	(3.02)	(2.99)
Duality	0.032	0.024	0.046**	0.040**	-0.070	-0.067
	(0.94)	(0.80)	(2.60)	(2.41)	(-1.23)	(-1.28)
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs	332	332	332	332	332	332
System R-sq	0.9211	0.9305	0.8003	0.8108	0.6240	0.6314

Notes: This table provides estimation results for diversification equation in the system model (Equation 1A and B) estimated using the 3SLS technique. Corporate governance variables (board size, board independence, and CEO/Chair duality) are included in Equation (1B) and the estimates are reported here. Total risk (Stdret), and MZ-Score are the proxies of risk-taking of BHCs. The diversification measure is geographic (GeoDivSt), revenue (Revdiv), and non-traditional activity (ACTHHI). The institutional ownership measures are share holding proportion and non-zero-points duration. In diversification regression, duration measure is orthognalized by regressing on share holding proportion. Other variables are as defined in Table 1. T-statistics are reported in parentheses.*, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.