ESSAYS ON STOCK RETURN VOLATILITY IN BANK HOLDING COMPANY AND TRADING BY COMPANY INSIDER AND INSTITUTIONAL INVESTORS

By

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Abstract

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Chapter one, "Insider Trading and Risk Taking in BHCs", documents a significant and positive relation between current and past quarter insider purchases (net demand) and current quarter changes in risk taking for BHCs with lower than average capital ratios over the 1995-2003 time period. My findings are consistent with the argument that the dramatic increase in the use of equity-based compensation combined with banks' high leverage has had a substantial impact on bank managers' willingness to take risk.

Chapter two, "Institutional Investor Demand and Idiosyncratic Volatility: Are Bank Holding Companies Special?" examines the relation between quarterly institutional demand and the previous quarter's change in idiosyncratic volatility. While changes in percentage institutional ownership are inversely related to the previous quarter's changes in idiosyncratic volatility of non-financial stocks in the NYSE/AMEX/Nasdaq common stock universe, they are not significantly related to the previous quarter's changes in idiosyncratic volatility of BHC stocks. I find that the risk-seeking affiliated trust departments of BHCs appear to increase their holdings of parent company stock following an increase in idiosyncratic volatility during the

period from 1986 to 1996, thereby offsetting any aversion to the increased risk by other institutions. In addition, institutional investors' overall indifference to risk-taking changes among BHCs is likely also due to the low level of idiosyncratic volatility and few opportunities for informed trading in the banking industry.

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Chapter 1: Insider Trading and Risk Taking in BHCs

1. Introduction

Much of the blame for the recent banking crisis has been attributed to 'excessive risk taking' by banks. In particular, many of the abuses have been attributed to the moral hazard problem associated with high leverage and disinterested creditors (due to deposit insurance and the too-big-to-fail doctrine) that provide bank shareholders with tremendous upside potential and limited downside. In addition, some authors have suggested that the use of equity based compensation in recent years extended these risk taking incentives to bank managers [see Chen, Steiner and Whyte (2006) and Bebchuk and Spamann (2010)]. In fact, a number of authors document an increase in bank risk taking following the implementation of equity based compensation schemes for managers. There is little evidence, however, concerning the interaction between managers' personal portfolio decisions and corporate risk taking. This paper investigates whether BHC managers' open-market transactions involving company shares convey information about or influence their corporate risk-taking decisions.

Previous literature says little about the dynamic interaction between insider trading and changes in firm risk-taking. Open-market transactions change managers' exposure to equity risk and can potentially be positively or negatively associated with changes in firm risk. On the one hand, managers might choose to hold less of their companies' shares in an effort to limit their personal wealth exposure to company risk following the implementation of a risky investment project. This is consistent with a number of studies that find evidence of managerial risk aversion [see Amihud and Lev (1981), May (1995), Tufano (1998), and Ofek and Yermack (2000)] ("managerial risk aversion hypothesis"). On the other hand, holding higher equity stakes in their companies might encourage managers to be less conservative in making corporate risk-taking decisions. Agency theory suggests that equity ownership

can alleviate managerial risk-aversion problems because managers will share proportionally in the value created by the risk taking ("interest alignment hypothesis"). Existing studies that examine levels of ownership and risk are complicated by the endogeneity of equity-based compensation. Our focus on open-market transactions and their relation to lead and lag changes in risk taking over a long period of time allow us to address the potential endogeneity.

The interaction between open-market purchases or sales of BHC stock and BHC risk taking is likely to depend on at least two additional factors. First, the moral hazard problem suggests that shareholders' risk-taking preferences will depend on capital levels. Low (high) capital levels encourage shareholders to be more (less) risk seeking because low (high) capital levels increase (reduce) the convexity of equity holders' payoff functions. We therefore expect the relation between insider demand and changes in firm risk-taking to be stronger among firms with low capital ratios.

Second, managers' preference for risk will likely depend on their level of ownership. Previous research on the relation between insider ownership and firm risk-taking suggests that the relation may be non-monotonic, i.e. the sign may be a function of the level of managerial equity ownership. This may be caused by the endogeniety of compensation and/or a trade-off between insider ownership's incentive effect and entrenchment effect. The positive relation between insider ownership and risk-taking might be stronger among firms with more growth opportunities and at the same time these firms may be more likely to implement equity-based compensation, which leads to higher levels of insider ownership [Smith and Watts (1992), Hubbard and Palia (1995), Baber, Janakiraman and Kang (1996), and Brewer, Hunter and William E. (2003)]. On the other hand, the relation between insider ownership and risk-taking may also depend on the trade-off between incentives and control/entrenchment [Gorton and Rosen (1995), Wright, Ferris, Sarin and Awasthi (1996), Berger, Ofek and Yermack (1997), Konishi and Yasuda (2004)]. Increases in inside ownership could lead to

entrenchment that dominates the associated increase in incentives at higher or lower levels of insider ownership depending on the benefits of entrenchment. If higher ownership leads to entrenchment and the benefits of entrenchment exceed the incentive effects of ownership, then increases in insider ownership may be associated with a decrease in risk taking as managers seek to protect their positions. Ultimately, we expect the relation between insider demand and changes in risk-taking to depend on the interactions between the above mentioned influences.

We examine cross-sectional variation in quarterly changes in firm risk-taking and find evidence of a positive relation between BHC risk taking and current and past quarter insider demand. When we separately analyze BHCs with high capital ratios and BHCs with low capital ratios, however, we find that the positive relation between risk taking and insider demand is concentrated in the low capital ratio group, consistent with the moral hazard problem. Due to data limitations, our analysis of the impact of ownership levels on our results is limited to the subset of our sample that is included in the Execucomp database. Using this subset of BHCs, however, we find that the positive relation between risk taking and insider demand is limited to the group of BHCs with relatively high ownership levels. Further comparisons between two time periods suggests that the positive relation is significant in the 1995-2003 time period, when risk-inducing compensation schemes were common among BHCs, but not in the 1986-1994 period, when equity based compensation was less prevalent. Our results are still significant even after controlling for lagged stock returns indicating that the relation is not the result of a spurious correlation due to market timing insider trades [Jenter (2005)] and any association between risk-taking and past performance [Christie (1982)].

An alternative interpretation for why managers increase company share holding when firm risk increases is that insiders can better exploit private information and informational asymmetry when firm risk-taking is high [Bebchuk and Fershtman (1994) and Aboody and Lev (2000)]. However, studies on

the profitability of insider trading suggest that private information can explain some but not all of the gains from insider trading [Piotroski and Roulstone (2005) and Ben-David and Roulstone (2009)]. As a result, this interpretation is not able to fully explain our findings of a positive association between insider purchases (net demand) and changes in risk-taking.

The remainder of this paper is organized as follows. Section 2 reviews relevant literature and develops our hypotheses. Section 3 explains the data and methodology. Sections 4, 5, and 6 discuss our empirical results. Specifically, Section 4 provides the test results of the "interest alignment hypothesis." We test the sensitivity of this explanation to capital ratios in section 5 and to compensation and ownership levels in section 6. Section 7 concludes.

2. Literature Review and Hypotheses Development

2.1 Managerial risk-aversion and firm risk-taking

Our paper is closely related to a branch of the managerial compensation literature that investigates whether increasing managers' exposure to uncertainty in company value, through equity-based compensation (EBC), encourages managers to take risks. Most studies in this area examine the relation between ownership levels (sometimes combined with option holdings) and the level of firm risk taking. We propose that exploring the dynamic interaction between risk-taking and incentives within a relatively homogenous group of firms (bank holding companies, to be specific) will allow us to control for industry differences in compensation practices and, perhaps more importantly, contribute to the policy debate on risk taking in the banking industry.

A critical challenge in analyzing the relation between risk-taking and equity holding is the reverse causality problem. Coles, Daniel and Naveen (2006) point out that some studies research how managerial ownership level can influence firm risk-taking while other studies investigate how firm-risk

taking determines equity-based compensation and insider ownership. Care must be used when interpreting evidence of a positive association between the two variables because the literature suggests causality in both directions.

Some studies predict that firm risk-taking is increasing in equity ownership levels assuming managerial risk-aversion generally causes managers to choose firm risk-taking levels that are lower than optimal and higher ownership provides managers with incentives to improve firm value through increased risk-taking. Due to the concentration of equity holdings in their company and their human capital investment, however, managers tend to behave in a more risk-averse way than outside shareholders who are in better position to diversify.[1] This risk preference conflict potentially leads to under-investment and inefficient diversification that damages firm value. Smith and Stulz (1985) were among the first to theorize how managerial risk aversion can motivate managers to engage in over-hedging[2] and how the introduction of convexity into a manager's compensation package can make her behave in a more risk-seeking way. A positive empirical association between equity based compensation and firm risk taking has been documented in many studies. Equity based compensation has been found to be positively related to R&D and Capital Expenditures [Coles, Daniel and Naveen (2006)], volatility of company stock price [Guay (1999), Low (2009) and Kempf, Ruenzi and Thiele (2009)], leverage [Agrawal and Mandelker (1987)], and negatively related to financial hedging (Tufano 1996) and corporate diversification [May (1995), Denis, Denis and Sarin (1997) and Servaes (1996)]. Among bank holding companies, substantial evidence suggests that stock price volatility is positively related to equity incentives [Saunders, Strock and Travlos (1990), , Anderson and Fraser (2000), Chen, Steiner and

[1] There is empirical evidence for this managerial risk aversion. For instance, Bettis et al (2001) find evidence suggesting that managers engage in hedging activities to reduce risks associated with their equity holdings.

[2] They define hedging as not only the use of financial derivative securities but also any real operating decision that can reduce the exposure of firm value to risk factors.

Whyte (2006) and Lee (2002)]. In addition, Whidbee and Wohar (1999) find that when bank managers have higher percentage of company equity they are less likely to use derivatives.

Other studies also predict that firm risk can impact managerial incentives in both a positive and negative direction. Guay (1999) finds that firms with more growth options, which result in higher volatility, tend to pack more convexity into managerial compensation packages. The logic is that firms with more growth opportunities, i.e. risky projects with positive NPVs, are more affected by potential under-investment due to managerial risk-aversion. The impact of firm risk on pay-performance sensitivity, however, is less straightforward. Although pay-performance sensitivity gives managers an incentive not to under-invest, increases in pay-performance sensitivity which derive from ownership of company shares can aggravate managerial risk aversion. Higher pay-performance sensitivity leads to higher concentration of manager wealth in their companies. Managers are not allowed to short company shares and hence have limited ability to hedge company risk, so they may be increasingly reluctant to increase risk-taking of their companies or they may demand a larger value transfer from shareholders. Therefore, the use of equity-based compensation may be more costly when stronger managerial risk aversion incurs higher principal-agent costs. As a result, we expect the amount of pay-performance sensitivity in managerial compensation plans to be negatively related to firm risk-taking.

This reverse causality problem is part of the broader issue of endogeneity in the relation between firm risk and managerial ownership. Literature on incentives and firm value addresses this issue. According to agency theory as proposed by Jensen and Meckling (1976), maximum firm value is achieved conditional on the contracting environment faced by different firms; incentive compensation decisions and investment decisions are determined simultaneously as part of the overall maximization of firm value. Based on this theory, a group of researchers [Demsetz and Lehn (1985), Cho (1998), Himmelberg, Hubbard and Palia (1999), and Poletti Hughes (2007)] further develop the endogeneity

issue. They stress that there is an optimal equilibrium and therefore assume that firms generally reach and maintain an optimal level for every endogenous variable. Variation in incentive levels across firms is not due to differences in how successful firms reduce agency costs but caused by diversity in the external contracting and investment environment. Therefore, a cross-section of firms exposed to a variety of externalities should not reveal a uniformly positive relation between firm value and incentives and any observed positive relation can be caused by a common determinant.

The logic of the endogeneity issue applies for the relation between risk taking and incentives as well. The variation in risk-taking might not be the result of differences in how well firms resolve the managerial risk aversion problem. Rather, it may be the result of differences in their contracting and investment environment. We examine the dynamic interaction between changes in risk-taking and insider trading instead of the relation between the level of risk taking and insider ownership.

2. 2 Insider trading and endogeniety

We use insider trades aggregated over quarters as our measure of external shocks to managerial equity ownership for three reasons: First, insider trading is largely personal and not subject to the authority of outside shareholders and therefore does not directly act as an endogenous variable used for firm value maximization. One may be tempted to argue that insider trading is limited by SEC regulations[3] and vesting period rules in compensation contracts. However, managers usually possess both restricted and non-restricted company shares and they have relative freedom to sell unrestricted stocks. Second, relevant literature indicates that insider trading is motivated by various reasons other than reducing personal exposure to firm specific risk after large stock or option grants. For instance,

[3] A Security Exchange Act of 1934, Insider Trading Sanctions Act of 1984 and the Insider Trading and Securities Fraud Enforcement Act of 1988 broadly have prohibited insider trading that exploits material private informative, including a specific forbidding of short-swing profits gained within six months.

Jenter (2005) finds that insiders' trades are motivated by a contrarian view of the value of their company's shares. Last, managers and shareholders typically contract only once a year regarding equity based compensation. Insider trading, however, takes place throughout the year. Although, the compensation committee can prescribe a specific window of trading, it is not a general practice and such arrangements only affects restricted and unvested shares, not unrestricted and vested shares. Therefore, managers' purchases or sales of their companies' shares in the open market are at least partly uncontrolled by the compensation committee.

2.3 Hypothesis

Based on the predictions of agency theory, as discussed above, managers' open market transactions should influence managerial risk-aversion and firm risk taking. All else the same, an increase in equity holdings should align managers' interests with those of shareholders and, therefore, be associated with increases in firm risk-taking. Therefore, we propose the "interest alignment hypothesis":

H1: managers' open market purchases (sales) increase (decrease) managers' incentive to take risk and thus are positively (negatively) associated with changes in firm risk-taking.

Alternatively, to rebalance their personal wealth exposure to company risk, managers might choose to hold less of their companies' shares when they decide to implement a risky investment project. Most papers investigating insider-trading focus on whether such trading reflects private information and whether managers profit from such trading;[4] few papers consider the association of

[4] Doffou (2003) provides a literature review on insider trading.

such trading with corporate decisions.[5] To our knowledge, no prior study examines its association with corporate risk-taking decisions.

An alternative explanation for why managers might increase the holdings of company shares when firm risk is increasing is that managers trade on and profit from private information ("private information hypothesis"). Bebchuk and Fershtman (1994) propose that freedom to participate in insider trading enables managers to profit from their private information on the likely outcome of risky corporate projects, which generally result in higher firm risk levels. Following their argument, managers buy shares in their company after they implement a risky corporate project in the expectation that they will profit from private information about the future outcome of these projects. Aboody and Lev (2000) find evidence that insider gains are larger in firms with higher degrees of information asymmetry. Roulstone (2003) finds that firms need to pay extra in compensation in order to limit insider trading within certain trading windows. The "private information hypothesis" and "interest alignment hypothesis" are not mutually exclusive. We do not directly test one against the other.

However, one might argue that insiders' ability to trade on and profit from inside information is constrained by insider trading laws. Indeed, studies on profitability of insider trading suggest that private information can explain some but not all of the gains from insider trading [Piotroski and Roulstone (2005) and Ben-David and Roulstone (2009)]. We therefore argue that this private information explanation cannot solely explain any relation between insider demand and changes in risk-taking.

[5] There are few papers that examine the impact of insider trading on corporate decisions. Bebchuk and Fershtman (1994) explore whether insider trading affects managers' preference for risky projects but their analysis focuses on how insider trading affects managers' opportunity to profit from private information. Hu and Noe (2001) discuss how insider trading allows higher level of alignment between manager and shareholders than otherwise.

2.4 Financial regulation, banker compensation and bank risk-taking

The risk-inducing compensation after deregulation may challenge the effectiveness of financial regulations in curbing risk-taking in the banking industry. Because of their high leverage and important role in the economy, banks are under regulation in terms of their risk-taking. The regulatory intent to limit bank risk has mainly been expressed in restrictions on the scope and nature of business activity for banks. For example, the Glass-Steagall Act of 1933 stipulated the separation of commercial banking from investment banking, prohibition of cross-state acquisitions, and establishment of the Federal Depository Insurance Corporation. However, as pointed out by Bebchuk and Spamann (2010), although managerial incentives may play an important role in the actual risk-taking practice of banks, compensation for bank executives is still not included in regulatory efforts to limit bank risk-taking. In addition, Laeven and Levine (2009) argue that the effectiveness of risk-curbing regulation depends on whether shareholder can successfully influence risk-taking. If equity-based compensation achieves alignment of interests between managers and shareholders (even without the help of outside block holders) and if bank shareholders are risk-seeking, bank managers might choose to take excessive risk despite regulatory pressure.

The lack of regulatory oversight of banker compensation may be especially important for the post-deregulation period. There has been a change in compensation practices in banks after deregulation. Houston and James (1995) use a sample for time period 1980 to 1990 and find that manager compensation was not generally structured to induce risk-taking when compared with industry firms. Chen, Steiner and Whyte (2006) examine option-based compensation during the 1992-2000 period, however, and find that the design of banker compensation appears to be risk-inducing and option-based compensation is positively associated with bank risk-taking. Chen, Steiner and Whyte

attribute the shift in compensation practice to the expansion in investment opportunities that resulted from deregulation in the 1990's.

Park and Peristiani (2007) point out that, although bank equity holders have incentives to encourage risk-taking due to moral hazard, their intention of preserving charter value may also lead to risk-aversion. However, the too-big-too-fail doctrine may alleviate the concern of losing charter value and the expansion in investment opportunities may bring about risky but impressive short-term rewards that outweigh the long-term rewards from maintaining charter value.

Our analysis on insider trades and bank risk-taking helps evaluate the effectiveness of regulatory efforts to limit bank risk-taking and understand the role played by equity-based compensation in affecting managers' risk-taking incentives.

3. Data and Methodology

3.1 Sample bank holding companies

Our sample includes 830 publicly traded U.S. bank holding companies covering the time period from 1986 to 2003. BHCs are supervised by the Federal Reserve Board of Governors under Regulation Y and are required to file quarterly performance reports. Consolidated Financial Statements for Bank Holding Companies, i.e. Form FR Y-9C, are a parallel to the Call Reports filed by commercial banks to the FDIC. In order to use information in Form FR Y-9C and the CRSP database, we need a link between a BHC's regulatory identification number (i.e. entity ID in Call Report) and its PERMNO. The link for 805 of the 830 BHCs in our sample is provided by the Federal Reserve Bank of

New York. We also constructed this link ourselves before the FRB link was released and obtained a link for 25 additional companies[6].

In order to compare our sample BHCs to a broader group of BHCs, we compile all Form FR Y-9C reports filed during the 1986 to 2003 period[7], and identify a group of BHCs that have more than $150 million[8] worth of assets and have registered with the SEC. If a BHC has more than 300 shareholders, it is required to register with SEC. Therefore, we use this group of BHCs to represent the universe of publicly traded BHCs. We exclude very small BHCs. From now on, we refer to this group as 'All' BHCs. Our sample BHCs is then a subset of these firms.

From Form FR Y-9C we extract information on the following quarterly balance sheet and income statement items: total assets, non-performing loans, equity, debt, retained earnings, interest income, net income, non-interest income, other non-interest income, Federal Physical District, and number of banks controlled.

[Insert Table 1 Here]

Table 1 provides a comparison between our sample bank holding companies and all US publicly traded bank holding companies with more than $150 million in total assets. All publicly traded BHCs are divided into five size quintiles using an annual sorting method.[9] Means and medians are produced for six quarterly bank characteristic variables: total assets, non-interest income rate ratio, other non-interest income rate ratio, number of banks held, non-performing loan ratio and equity ratio. The median and means among our sample BHCs that fall into each of the five quintiles are also provided.

[6] We successfully match the regulatory identification number of each of 358 BHC to a CRSP permno, and 25 of them are confirmed to be both correct and additional to the FRB NY match.

[7] June 30, 1986 is the earliest date that Form FR Y-9C is available from the Chicago Federal Reserve website.

[8] Only BHCs with more than $150 million worth of assets are required to file FR-9C quarterly. This threshold is increased to $500 million in 2006.

[9] For every year from 1986 to 2006 the average of the four quarterly total assets values is calculated for every BHC and all BHCs are sorted into five quintiles according to this annual average (size quintiles) (therefore a BHCs size quintile status will be the same for all four quarters within every year but might change over years.

Our sample BHCs spread across the size quintiles but relatively more of them fall into the fourth and fifth higher quintiles. Therefore, our sample represents a relatively large group of BHCs but still reflects size diversification relative to the US publicly traded BHC universe.

Within each quintile, our sample-BHCs do not appear to be substantially different from the rest of the group in terms of income composition and loan quality. The mean and median non-performing ratio of our sample BHCs is slightly lower than that of All BHCs; their equity ratio is slightly higher than 'All BHCs' in four out of five quintiles. These differences are not statistically significant. The only statistically significant difference between our sample BHCs and All BHCs is the difference in non-interest income ratio. However, this difference is not consistent throughout size quintiles: the non-interest rate income ratio of our sample BHCs is higher relative to 'All BCHs' in the first and second size quintiles but lower in the fourth quintile. In addition, the size of the difference is still small. We believe our sample is in general representative of 'All BHCs' in terms of loan quality and income composition. These measures also are frequently used as indicators for the riskiness of BHCs, so our sample seems to be representative of the risk-taking practices among 'All BHCs'.

Our sample period spans 18 years and the cross-section of BHCs changes over time, so we examine whether our sample is representative of the 'All BHCs' over time. In unreported results, we find that although our sample tilts towards larger BHCs in the 1995-2003 period, it is still representative of BHCs of all size quintiles.

From the Center for Research on Security Prices (CRSP), we obtain information on the following stock characteristic variables: quarter-end stock price, stock returns, quarterly turnover, dividend and outstanding shares. We also use CRSP-COMPUSTAT to obtain additional quarterly observations on accounting variables to complement the data from the Federal Reserve. This combination greatly increases the availability of accounting information for our sample.

3.2 Insider trading data

Our insider trading data set[10] is drawn from the SEC's Ownership Reporting System (ORS) database and Thomson Financials' Value-Added Insider Data Feed. This data contains information on insider transactions reported on SEC Form 3, Form 4, and Form 5 filings.

We use three measures of insider trades: the first two are percentage insider purchase and percentage insider sale. Insider purchase is the summation of shares involved in all transactions coded with "P", "B" and also "J" and "T"[11]; insider sales is the summation of shares involved in all transactions coded with "S", "U" and also "J" and "T"[12]. Therefore, our insider purchase and sale measures both open-market and private transactions. We expect insider sales and insider purchases to impact risk-taking differently. Therefore, to account for possible asymmetry in the relation between insider trades and changes in risk-taking, we use purchase percentage and sales percentage separately in regressions.

The third measure of insider trade is insider demand measures ('NetPF').

$$NetPF = \frac{Insider\ Purchase - Insider\ Sales}{Insider\ Purchase + Insider\ Sales}$$

NetPF measure the extent at which insiders buy their own company shares. NetPF takes value from -1 to 1. It is positive when insiders buy more than they sell and is negative when insiders sell more. A Zero NetPF indicates a tie between the buying force and the selling force.

[Insert Table 2 Here]

10 The data set originally includes 21252 bank and non-bank firms. Observations of all bank holding companies that appear in the institutional ownership data set are extracted.

11 "J" and "T" are counted as purchase only when an acquisition is explicitly indicated.

12 "J" and "T" are counted as sale only when a disposal is explicitly indicated.

[Insert Table 3 Here]

Table 2 provides summary statistics for quarterly executive ownership and trading variables. Over the 1986 to 2003 sample period, the average size of quarterly insider purchases is larger than that of insider sales and insider demand appears to be positive across the whole sample period. It is shown that Mean (Median) NetPF is 11.45% (3.48%). However, when we divide the sample into two periods, 1986 to 1994 and 1995 to 2003, we find that insider purchase has decreased slightly from 0.087% to 0.074% while insider sale has increased considerably from 0.035% to 0.067%. Insider demand appears to be strong and positive (18.009%) in the earlier period but has become substantially weaker (4.726%) in the latter period.[13] Table 3 provides a comparison between insider trade variables of BHCs and those of non-bank firms. Insider purchase decreases over time for all firms but decreases more for non-bank firms. Insider purchase among BHCs is not significantly different from that of non-bank firms in the earlier time period (1986-1994) but is significantly larger in the later time period (1995-2003). The insider sale of non-bank firms remains stable and significantly higher than that of BHCs over the two time periods. Insider demand for non-bank stocks is negative while insider demand for BHC stock is positive. Their difference is statistically significant and both demands experience substantial decrease over time. In sum, managers of BHCs appear to be more inclined to buying their company shares and less inclined to selling relative to managers of non-bank firms.

Ofek and Yermack (2000) find that managers tend to sell company shares after stock and option grants if they already own a considerable fraction of company equity. Since the equity-based compensation practice in the banking industry in our earlier sample period may be considerably less

[13] Because the insider purchase and insider sale for an individual BHC often do not take place in the same quarter in our sample, the insider demand distributes heavily on the values, -1, 0 and 1 (4910, 12223 and 8144 observations respectively out of the total 29281 sample observations). The large difference between the median and mean of insider demand persists after we delete transactions that involve more than 20% of outstanding shares and after we delete transactions in the one percentile and 99 percentile. Therefore, the large difference is not likely caused by outliers but by the extreme distribution.

extensive relative to that among contemporaneous non-bank firms [Houston and James (1995)], this may result in lower managerial ownership among BHCs and might explain why the insider selling is less pronounced for BHCs. Also, since there is an increased popularity of equity-based compensation in BHCs in the later time period, this may contribute to the stronger intention to sell among bank managers.

Table 4 provides summary statistics on insider trade variables across three BHC size groups. We find that the decrease in insider purchases in the latter time period is driven by observations of smallest and largest BHCs, while the increase in insider sales is seen in all sizes of BHCs.

3.3 Measuring BHC risk-taking

Because our sample consists of publicly traded bank holding companies, we are able to use both accounting-based and market-based measures of risk-taking. This section explains how we construct both types of measures. Market-based measures include standard deviation of stock returns, i.e. total volatility, and volatility component that is not related to common risk factors. In other words, we estimate total risk (stock return volatility) and idiosyncratic risk (return fluctuation that cannot be explained by common factors)[14]. The results for idiosyncratic risk throughout our analysis are largely similar to those for return volatility.

[14] To account for common risk factors, we use two models:

(1) Market model with momentum;

$$r_i = \alpha_i + \beta_i \times r_m + \gamma_i \times r_{m,\ t-1} + \varepsilon_i$$

(2) Fama-French four factor model.

$$r_i = \alpha_i + \beta_i \times r_m + \gamma_i \times r_{SMB} + \theta_i \times r_{HML} + \varphi_i \times r_{MOM} + \varepsilon_i$$

We use the standard error as a proxy for a firm's idiosyncratic risk.

In order to obtain quarterly estimates of return volatility, we use daily returns[15]. Using daily returns enables us to use data within each quarter to estimate quarterly risk-taking and, therefore, there will not be overlapping time periods used for the quarterly estimates. Table 2 gives the summary statistics of natural logarithm of daily return standard deviation and its changes. Stock return volatility appears to be lower in the 1995-2003 period. Its changes are negative on average in the later time period but are positive in the earlier time period. Houston and Stiroh (2007) find that over the 1975-2005 time period volatility in commercial bank returns has increased. We also produce summary statistics on market risk measure variables across three BHC size groups in Table 4. These results suggest that the decrease in stock return volatility is driven by small and medium size BHCs. In the large BHC group, we observe a larger stock return standard deviation for the 1995-2003 period than for the earlier period. In addition, quarterly changes in volatility among medium and small BHCs shift from positive to negative while quarterly changes for large BHCs remains negative and small in absolute value.

We also use three accounting proxies as ex ante measures for volatility in returns from the underlying assets. Non-performing ratio ('NPL') is the ratio of non-performing loans to total loans.[16] Non-interest income rate is the natural logarithm of 1 plus the ratio of total non-interest income to the sum of total interest and non-interest income. Other non-interest income rate is the natural logarithm of 1 plus the ratio of other non-interest income to total interest income. Table 3 provides summary statistics for these variables and their quarterly changes. Non-performing ratio is used in previous

15 We also use weekly and monthly returns in un-reported results. These returns and daily returns have all been used to measure bank and nonbank firm risk taking in previous literature [Saunders, Strock and Travlos (1990), Sias (1996), Guay (1999), Anderson and Fraser (2000), Lee (2002), Chen, Steiner and Whyte (2006), Rubin and Smith (2009) and Low (2009)].

16 NPL are calculated as the sum of two items "Total loans, leasing financing receivables and debt securities and other assets – past due 90 days or more and still accruing", and "total loans, leasing financing receivables and debt securities and other assets – nonaccrual". NPL ratio is NPL measured as a portion of all loans.

research and in banks to measure loan quality. Lower (higher) non-perform ratio indicates better (worse) loan quality and smaller (larger) exposure to credit risk. Non-interest income rate may be among the factors that drives the cross-sectional differences in BHC risk [Stiroh (2006), DeYoung and Rice (2004)]. Higher (lower) non-interest income rate may be associated with more (less) volatile assets and poorer-risk-return tradeoffs.

We find that NPL decreases over time and the reduction is much more substantial than that of the market measures. Non-interest income measures have increased to a large extent. Perhaps the risk source of BHC assets has tilted toward more to non-interest related activities over time. This is consistent with the ongoing deregulation during the sample period and banks' shift toward fee-based activities. Table 4 shows that the increase in non-interest income is most substantial among all sizes of BHCs.

3.4 Regression Model

In order to test our hypotheses, we first estimate the following regression equations:

$$RISK_{i,t} = \alpha + \alpha_1 \cdot RISK_{i,t-1} + \boldsymbol{\beta} \cdot \boldsymbol{insider}_{i,t} + \alpha_2 \cdot \Delta lnassets_{i,t} + \alpha_3 \cdot \Delta lnlev_{i,t} + \alpha_4 \cdot \Delta lnqturn_{i,t} + \alpha_5 \cdot \Delta lnbmq_{i,t} + \alpha_6 \cdot Return_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

"***insider*** $_{i,t}$" is the insider trade variable and it is one of the three insider trade measures introduced earlier. If insider trades reflect the intention of managers to increase bank risk-taking and they exercise their trade close to the time when such information arrives in the market, we expect a significant estimate of "β".

$$RISK_{i,t} = \theta + \theta_1 \cdot RISK_{i,t-1} + \boldsymbol{\omega} \cdot \boldsymbol{insider}_{i,t-1} + \theta_2 \cdot \Delta lnassets_{i,t-1} + \theta_3 \cdot \Delta lnlev_{i,t-1} + \theta_4 \cdot \Delta lnqturn_{i,t-1} + \theta_5 \cdot \Delta lnbmq_{i,t-1} + \theta_6 \cdot Return_{i,t-1} + \varepsilon_{i,t-1} \quad (2)$$

If insider trades convey information about future (e.g. one quarter ahead) changes in bank risk-taking, i.e. managers trade on their knowledge of changes in risk-taking ahead of the awareness of the market, we expect last quarter insider trade variable "$\boldsymbol{insider}_{i,t-1}$" to be associated with current quarter change in our risk measures.

We include a set of control variables in our model: 1) lagged stock returns. This is included to control for the correlation between stock performance and return volatility. Also because there is evidence of market-timing by insiders [Jenter (2005)], including lagged stock returns minimizes the potential for spurious correlation between risk-taking and insider trading that is due to the correlation of both measures with performance; 2) change in firm characteristics: total assets, book-to-market ratio, turnover, and leverage. Saunders, Strock and Travlos (1990) argue that larger banks have better ability to diversify, more analyst coverage that reduces information asymmetry, and more regulatory protection. Consequently, they find that bank total assets appear to relate positively to market risk and negatively to interest rate risk. However, Demsetz and Strahan (1997) find that large banks' loan portfolio consists of a larger proportion of risky assets, which offsets the risk reducing effects of their better ability to diversify. Leverage may indicate the conservativeness of management [Lev (1974)]. Turnover rate is used to proxy for the speed with which the market price of a firm's stock responds to new information and also for investor sentiment. Last, we use book-to-market ratio as a rough (inverse) proxy for the franchise value of banks, which is found to be negatively related to bank risk taking [Demsetz, Saidenberg and Strahan (1997)].

As specified in equations (1) and (2), we do not use change in our risk measures as dependent variable. We use current level of risk measure on the left-hand side and include one-period lagged level of risk measure on the right-hand size, following Sias (1996). Such specification offers additional control for level of our risk-measure.

4. Change in Bank Risk-taking and Insider Trades

In this section, we investigate whether insider trading variables can explain cross-sectional variation in changes in our measures of bank risk-taking.

4.1 Univariate Analysis

We sort all sample BHCs into three capitalization[17] groups: small, medium, and large BHCs[18], and then further sort them into three risk measure tertiles: based on the ranking of either current quarter stock return standard deviation or current quarter non-performing loan ratio. The risk measure ranking is created independent of the capitalization grouping.

[Insert Table 5 Here]

Table 5 provides means of insider trades from the double-sorted portfolios.[19] Only the means of the top ("high", i.e. BHCs with highest return standard deviation or non-perform ratio ranking) and bottom ("low", i.e. BHCs with lowest return standard deviation or non-perform ratio ranking) risk measure tertiles are reported. In Panel A, we find that both current quarter and last quarter insider purchase is higher for BHCs with highest current quarter return standard deviation than for BHCs with lowest. The 3rd, 6th and 9th columns report z-statistic for the null hypothesis that the insider trade does not differ between the top and bottom standard deviation tertiles within each of 3 capitalization groups. The difference is statistically significant only for small and medium BHCs. In Panel B, we find

[17] Due to many missing observations for BHC assets, I use capitalization to form the size tertiles.

[18] Each year, we average the four or less quarterly capitalization values of each BHC and then assign it an annual cross-sectional size ranking (0, 1 or 2). Therefore, the size ranking for a BHC is stable within a year but may vary across years.

[19] In un-reported results, we test and confirm that in both sample periods the equity ratio is significantly different between these two equity-ratio-sorted groups and the differences are similar in size.

that insider purchases are higher for BHCs with the highest non-performing loan ratio than for BHCs with the lowest but for small and medium BHCs only (significant only for medium BHCs). Yet, managers in BHCs with lower non-perform ratio demonstrate stronger net demand ("Netpf") for their company shares than managers in BHCs with higher non-perform ratio, although the difference is statistically significant only for small BHCs. It appears that managers' open market purchases are more risk-seeking than insider sales and that their selling decisions are more likely to be associated with bank loan quality than total volatility.

We see some evidence that insider purchases may be associated with the current level of both market and accounting measures of bank risk-taking. However, this indicates that insiders tend to purchase their company shares when bank risk-taking is high but whether such purchases reflect new information (changes) is investigated next.

4.2 Regression Analysis

We estimate equation (1) to test whether insider trades are associated with changes in bank risk-taking.

[Insert Table 6 Here]

Panel A of Table 6 provides estimates for coefficients in equation (1)[20]. We also estimate a reduced version of it with the lagged dependent variable, last quarter stock return, and one insider trade variable (insider demand, insider purchase or insider sale) in order to examine how our results are sensitive to model specification. Higher insider demand seems to be significantly and positively associated with same quarter increases in stock return volatility, regardless of model specification. The

[20] From this point on, we no longer report coefficient estimates for intercept term and lagged dependent variable. These results are largely similar to those provided in Table 6 and are available at request.

coefficient estimates for insider purchase and insider sales are positive but they are statistically significant in only one of the two model specifications. For example, coefficient estimate for insider purchase is 2.041 with a t-statistic of 2.4 when only quarterly return is controlled, but the estimate becomes 3.283 with a t-statistic of 1.1 when more control variables are introduced into the regression model. The positive association between insider net demand and change in return standard deviation is consistent with our hypothesis that higher equity holding increases company insiders' incentives to take risk.

Panel B of Table 6 provides estimates for the equation (2). We find little evidence that our insider trade measures have predictive power on changes in stock return standard deviation. The only significant association is between last quarter insider purchase and current quarter change in volatility, but this result is sensitive to model specification. In sum, we find only weak evidence of a significant and positive association between insider demand and changes in bank risk taking using the whole sample.

Due to the uniqueness of panel data analysis, we also estimate equation (1) and (2) using OLS with firm and time fixed effects and GMM with instrument variables created from on lags of the independent variables. Our main results here and in the rest of this paper are not sensitive to the use of alternative estimation methodologies. We also perform robustness check by deleting transactions in the one percentile and 99 percentile.

5. High Equity Ratio BHCs Vs. Low Equity Ratio BHCs

Studies suggest that capital ratio affects shareholders' tendency of risk seeking: low (high) level of capital ratio, i.e. high (low) leverage, encourages shareholders to be more (less) risk seeking. We therefore expect the relation between insider demand and change in firm risk-taking to be stronger

among firms with low capital ratio. To test for such difference, we examine the relation between managers' trades and changes in firm risk-taking for a group of BHCs with high capital ratios and a group with low capital ratios separately.

An alternative scenario is that due to extensive regulation on bank risk taking, if the capital ratio is high, there will be more room for management to increase risk-taking; while, if it is low, managers will need to limit risk-taking or acquire more capital before taking additional risk. If managers' concern for bankruptcy outweighs the benefits from increasing risk and if BHCs generally are able to meet their regulatory capital requirement, we should instead expect the relation between insider demand and changes in firm risk-taking to be stronger among firms with high capital ratios.

5.1 Firm characteristics

In this section, we sort all quarter-BHC observations into three groups based on an annual ranking of average equity ratio of each BHC and then examine whether there is a significant relation between insider trade and bank risk taking changes among BHCs in any of these subgroups. We omit reporting the results for the quarter-BHC observations with medium level of equity ratio.

[Insert Table 7 here]

We are interested in whether high equity ratio group and the low equity ratio group are different from each other in firm characteristics other than the equity ratio. The firm characteristics in consideration are total assets, non-performing loans ratio, non-interest income ratio, and stock return standard deviation. To control for size effects, the comparison is done within each of three size tertiles of BHCs, i.e. small, medium and large capitalization BHCs. The sorting of the equity ratio is independent of the size sorting. Table 7 provides the means of each firm characteristic for the double-

sorted portfolios. First, the number of BHCs with high equity ratio and that of BHCs with low equity ratio within each of the three size tertiles are comparable to each other except that the low-equity-ratio BHCs have slightly larger assets than high-equity-ratio BHCs. The range of equity ratio within one size tertile is also similar to that of another (i.e. 0.0588 to 0.1007 for small BHCs and 0.0631 to 0.0983 for large BHCs). The low-equity-ratio BHCs have higher non-performing ratio than do the higher-equity-ratio BHCs. The comparisons on non-interest income and stock return standard deviation also indicates that the low-equity-ratio BHCs appear to be more risk seeking.

5.2 Regression results

Panel A and Panel B of Table 8 provides estimates for coefficients in equation (1) for BHCs in the top capital ratio tertile and BHCs in the bottom capital ratio tertile, separately. As before, we estimate a reduced version of the regression with only the lagged dependent variable, last quarter stock return, and one insider trade variable (insider demand, insider purchase or insider sale) in order to examine how our results are sensitive to model specification. In the reduced version results (columns 1, 3 and 5), higher insider demand seems to be associated with same quarter increase in stock return volatility for both high and low equity ratio BHCs and larger insider purchase seems to be associated with risk increase only for low equity ratio BHCs. No significant association is found in the results from the full version specification.

[Insert Table 8 here]

Panel C and Panel D of Table 8 provides estimates for coefficients in equation (2) for BHCs in the top capital ratio tertile and BHCs in the bottom capital ratio tertile, separately. Higher insider

demand and larger insider purchases in the previous quarter seem to be associated with an increase in stock return volatility for low equity ratio BHCs only.

In sum, separation between high and low equity ratio BHCs do not identify a strong and robust relation between insider demand and change in risk-taking. However, there is some evidence suggesting that the relation is relatively stronger in the group of BHCs with high leverage. Next, we investigate whether further control for equity-based compensation adds to our understanding of the relation.

6. High Equity-based Compensation vs. Low Equity-Based Compensation

6.1 Theoretical predictions

We expect the relation between insider demand and changes in firm risk-taking to depend on managers' equity-based ownership and compensation levels, because previous research on the relation between insider ownership and firm risk-taking suggests a non-monotonic association, i.e. the sign of the relation may be a function of the level of managerial equity ownership.

This non-monotony may be caused by the endogeniety of compensation and/or a trade-off between insider ownership's incentive effect and entrenchment effect. Shareholder wealth may suffer more from managerial risk-aversion in firms with more growth opportunities than it would in those with less growth opportunities. Consequently, the positive relation between compensation and risk-taking might be stronger among firms with more growth opportunities and at the same time these firms are more likely to implement equity-based compensation, which leads to higher levels of insider ownership. Empirical evidence supportive of this view is found in the banking industry [Hubbard and Palia (1995), Brewer, Hunter and William E. (2003)] and among non-bank firms [Smith and Watts (1992) and Baber, Janakiraman and Kang (1996)]. Therefore, we may expect the positive relation

between insider ownership and risk taking to be more pronounced among firms with higher insider ownership relatively to firms with lower.

On the other hand, the non-linearity of the relation between insider ownership and risk-taking may also come from the trade-off between incentives and the benefits of control. Although higher equity ownership may improve interest alignment and thus increase incentives for managers to increase risk-taking, the managerial entrenchment literature suggests that with higher equity ownership managers may also achieve larger control over the firm and lead to the pursuit of private benefits, e.g. risk avoidance [Gorton and Rosen (1995), Wright, Ferris, Sarin and Awasthi (1996), Berger, Ofek and Yermack (1997), Konishi and Yasuda (2004)]. Entrenchment could dominate the incentive effect at lower levels of insider ownership because convexity in manager's compensation may not yet be enough to align managers' interest with shareholders. Alternatively, entrenchment could also dominate incentive effect at higher levels of ownership because large equity risk exposure may trigger managers to weigh risk-reduction over additional value.

Therefore, whether the expected positive relation between insider purchase (demand) and change in risk-taking is more pronounced among BHCs with higher equity-based compensation or among those with lower is subject to empirical examination.

6.2 Regime shift in banking industry: 1986-1994 period vs. 1995-2003 period

The banking industry has undergone a substantial change in regulation and compensation practices. We consider 1986-1994 and 1995-2003 to be two periods substantially different in terms of compensation practices, ownership levels, and the competitive environment. The 1986-1994 period features lower insider ownership and more regulatory restraints on bank operations. During this period, commercial banks face a reduction in profitable investment opportunities. There was a period

of recession between 1989 and 1992, when a large number of banks failed. The banking industry was also subject to a moral hazard problem because of the fixed rate deposit insurance premium, which has been removed by the 1991 Federal Deposit Insurance Corporation Improvement Act (FDICIA) that activated risk-based deposit insurance premiums effectively at 1993. Fixed rate deposit insurance premium makes it possible for banks to increase risk without paying for it. Research finds a positive relation between insider ownership and BHC risk-taking for this time period. However, Houston and James (1995) use a sample for time period 1980 to 1990 and find that manager compensation was not generally structured to induce risk-taking as compared to industry firms.

During the 1995-03 period, the use of option grants has greatly increased among commercial banks [Chen, Steiner and Whyte (2006)]. Also, there was a substantial improvement in profitability after a stream of legislation that deregulated much of the industry (1994 Riegle-Neal Act and 1999 Financial Services Modernization Act). If there are more profitable risky investment opportunities for BHCs, it is expect that shareholders are likely to address the managerial risk aversion issue and put in place compensation contracts that encourage risk-taking. In Figure 1, we plot the annual average compensation for our sample [21]BHCs that have available compensation data in Execucomp. Over the time period 1992-03, options and stock shares held by insiders increase dramatically. Such a substantial increase might cause bank managers to have larger proportion of their wealth to be exposed to risk in their company assets. We also notice a steady increase in options held as percentage of outstanding shares. [22] As pointed out by previous research, option grants may be more effectively introduce convexity into managers' compensation and thus more risk-inducing. Hence, the observed increase in

[21] Only a part of the BHCs in our sample have Execucomp data available.

[22] We expect the trend to be more dramatic if there is data available for pre-1992 period.

the weight in options in compensation packages might indicate that compensation in the banking industry has become more risk-inducing. In addition, the change in compensation appears to be effective in risk-inducing. Chen, Steiner and Whyte (2006) find that equity compensation has had a positive impact on BHC risk taking using a sample for time period 1992-2000. In Figure 2, we plot the quarterly return standard deviation and Tobin's q for the same BHCs that we use for Figure 1. There is a substantial increase in both variables, although not as dramatic as the compensation variables.

[Insert Figure 1 and 2 here]

The comparison over two historic periods allow us to examine how increased competition and growth opportunities resulted from deregulation have influenced both bank shareholders' intention to encourage risk-taking and managers' reaction to such encouragement. Analysis on cross-sectional variance cannot capture the critical role played by regulatory efforts, i.e. whether ownership level can explain risk-taking may depend on regulator environment of banks.

6.3 Regression results: 1986-94 period vs. 1995-03 period

In this section, we examine the evolution of the relation between changes in risk taking measures and insider trades over time.

[Insert Table 9 Here]

Panel A and Panel B of Table 9 provides estimates for coefficients in equation (1) for 1986-1994 period and 1995-2003 period separately and Panel C and Panel D of Table 9 provides estimates for coefficients in equation (2) for 1986-94 period and 1995-03 period separately. As before, we estimate a reduced version in order to examine how our results are sensitive to model specification. In all specifications, higher insider demands of current and last quarter and larger insider purchase of last quarter seem to be associated with same quarter increase in stock return volatility for the 1995-2003

period. We only find significant and positive relation between current quarter insider demand (purchase) and current quarter change in risk for 1986-1994 period and no significant results for last quarter insider trades.

Our results suggests that the insider demand can better explain the cross-sectional variation in change in return standard deviation in the time period with higher insider ownership and more equity based compensation (1995-2003) than in the time period with lower insider ownership (1986-1994).

6.4 Controlling for equity ownership level

To further confirm that high insider ownership contributes to a stronger positive relation between insider demand and changes in bank risk-taking, we use a sample of BHCs with compensation information available and control for ownership levels directly.

[Insert Table 10 Here]

Each year, we divide BHCs into 3 tertiles according to their relative ranking of percentage ownership (the sum of shares and options held). If a BHC falls into the top ownership tertile, we assign value of "2" to variable "execudum"; if a BHC falls into the bottom ownership tertile, we assign value of "0" to variable "execudum". We then estimate Equation (1) and (2) with an additional interaction term of "execudum" and our corresponding insider trade variable.[23] We report the results for insider purchase only. Coefficient estimates for interaction term in Panel A and B are both significant and positive, indicating that higher insider purchase of current and last quarter is associated with current

[23] In un-reported results, we also divide BHCs into two groups according to their executive ownership level: BHCs with ownership that is higher than cross-sectional median level and BHCs ownership level that is lower. The results are qualitatively the same and are available at request.

quarter increase in risk-taking for BHCs with higher than average insider ownership but not for BHCs with lower.

[Insert Table 11 Here]

Table 11 provides a comparison of firm characteristics between BHCs of the top ownership tertile and BHCs of the bottom ownership tertile. Cross-sectional averages are compared within each of three capitalization groups (small, medium and large BHCs). Most of the BHCs included in the Execucomp data fall into the largest group of BHCs and none of them are of similar size to the smallest BHCs in our whole sample. Within the large size group, BHCs with higher level of equity-based compensation appear to be larger in size, have lower non-interest income ratio and higher stock return standard deviation relative to BHCs with lower levels of equity based compensation. The two groups are not significantly different, however, in terms of leverage ratio. This suggests that the sensitivity of the relation between insider purchases (net demand) and changes in risk-taking due to equity-based compensation levels is not caused by differences in leverage. In addition, the two groups of BHCs are not significantly different in book-to-market ratio either. Book-to-market ratio is often used to proxy for growth opportunities, so this suggests that the sensitivity of the relation between insider purchase (net demand) and risk-taking changes are not caused by differences in growth opportunities. Rather, it may indicate that managerial entrenchment is dominated by managerial incentives at higher levels of equity-based compensation among BHCs.

6.5 Regression results: 1995-03 period, BHCs with high leverage

Finally, we re-examine the classification of BHCs by controlling simultaneously for insider ownership. To be specific, we divide our sample in to four subsamples: BHCs with high capital ratios in

1986-1994 period, BHCs with low capital ratio in 1986-1994 period, BHCs with high capital ratio in 1995-2003 period, and BHCs with low capital ratio in 1995-2003. We then estimate equations (1) and (2) using these four groups separately. Consistent with previous findings, results in Table 11 show that larger insider purchases and higher insider demand of current and last quarter are associated with current quarter increases in risk-taking for BHCs with low capital ratios (i.e. high leverage) in the 1995-2003 period, regardless of which model specification is used. We find much weaker results for the other three groups of BHCs.

[Insert Table 12 Here]

7. Conclusion

We examine whether quarterly insider trades can explain cross-sectional variation in inter-temporal changes in BHC risk-taking. We use uneven panel data which span over 18 years, during which there is a dramatic change in the use of equity based compensation. This change creates a natural experiment for us because insider ownership is generally low during the earlier part of the sample period while it is substantial higher later.

Our findings indicate that insider trades have a significant impact on BHC risk taking. We interpret this as evidence that increasing managerial equity ownership increases managers' risk-taking incentives. Our findings suggest that the dramatic increase in the use of equity-based compensation has had a substantial impact on bank managers' willingness to take risk and that managers of highly levered BHCs are not especially concerned with losing charter value.

An alternative interpretation of our results is that insiders increase their holdings of company shares in times when they decide to implement risky projects because they intend to trade on and profit from private information on the outcomes of those projects. However, this does not explain why the

relation is stronger among BHCs with low equity ratios and why relation between insider trading and change in firm risk-taking reverse over time.

Table 1-1 Sample BHC analysis

This table provides information on firm characteristics for two groups of BHCs. 'All' refers to all BHCs that are registered with SEC and have more than 150 million worth of assets. 'Sample' refers to BHCs that we have matched their Form FR Y-9C entity id with a single PERMNO. For each quarter, we divide all BHCs with more than 150 million total assets into quartiles according to total assets. 'Bank Count' is the counts of all BHC within each quarterly cross-section. Means and medians are means of cross-sectional means and medians. 'Total assets' is the dollar value of total assets, in millions. 'non-interest income' is ratio of non-interest income to total income. 'other non-interest' is ratio of other non-interest rate income to total interest rate income. 'number of banks held' is the number of subsidiary banks held by individual BHC. 'Non-performing ratio' is the ratio of non-performing loans to total loans. 'Equity ratio is ratio of equity to total assets. Standardized Wilcoxon Z-statistics test hypothesis that the cross-sectional averages of insider trade variables of all BHCs are not statistically different from those of sample BHCs.

Size	Variables	BHC #		Mean		Median		Z-stat
		All	Sample	All	Sample	All	Sample	
1	Total Assets	112	35	211.8095	215.3147	211.9611	216.0711	-1.4
	Non-interest Income			0.102	0.110	0.089	0.093	-2.2
	Other Non-interest			0.230	0.231	0.183	0.182	0.0
	banks			1	1	1	1	1.4
	Non-perform ratio			0.014	0.013	0.010	0.009	1.1
	Equity ratio			0.089	0.090	0.085	0.087	-0.3
2	Total Assets	123	58	336.3332	340.9173	332.5605	339.297	-0.6
	Non-interest Income			0.110	0.119	0.098	0.104	-2.0
	Other Non-interest			0.233	0.238	0.192	0.198	-0.5
	banks			1	1	1	1	-0.4
	Non-perform ratio			0.014	0.013	0.010	0.009	0.6
	Equity ratio			0.088	0.088	0.086	0.086	0.4
3	Total Assets	124	76	606.9633	618.2994	583.1069	601.0585	-1.2
	Non-interest Income			0.119	0.121	0.107	0.108	-0.5
	Other Non-interest			0.234	0.225	0.184	0.174	1.4
	banks			2	2	1	1	-0.6
	Non-perform ratio			0.015	0.013	0.010	0.009	1.3
	Equity ratio			0.086	0.086	0.084	0.084	0.1
4	Total Assets	124	98	1643.313	1654.375	1492.585	1507.105	-0.3
	Non-interest Income			0.135	0.131	0.123	0.121	2.2
	Other Non-interest			0.245	0.235	0.204	0.198	1.5
	banks			3	3	2	2	-0.4
	Non-perform ratio			0.014	0.013	0.010	0.009	0.8
	Equity ratio			0.083	0.083	0.081	0.082	-0.7
5	Total Assets	126	102	37121.74	39158.46	9821.794	9847.162	-1.0
	Non-interest Income			0.207	0.210	0.185	0.186	-0.7
	Other Non-interest			0.219	0.217	0.185	0.185	0.1
	banks			6	6	3	3	-0.5
	Non-perform ratio			0.016	0.014	0.012	0.011	0.8
	Equity ratio			0.080	0.081	0.077	0.077	-0.1

Table 1.2 Descriptive Statistics

This table provides summary statistics for five sets of variables: quarterly Executive ownership and insider trading variables, quarterly risk measures, quarterly change in risk measures, firm characteristics and their quarterly changes. Reported mean, median and standard deviation are time-series averages of quarterly cross-sectional means, medians and standard deviations. We also provide averages of numbers of BHCs in each quarterly cross-section used to calculate the mean, median and standard deviation. Summary statistics are given for the whole sample period ('Whole', 1986-2003), as well as for two sub-periods ('early', 1986-1994; 'late', 1995-2003). Construction details of the variables are provided in Appendix A.

	Mean			Median			Std Dev			# of BHC		
	Whole	Early	Late	Whole	Early	Late	Whole	Early	Late	Whole	Early	Late
Quarterly Executive Ownership and Insider Trading Variables												
Total Stock Held by Executives	2.81%	2.30%	2.98%	0.53%	0.90%	0.81%	5.77%	5.65%	5.81%	57	28	86
Total Option Held by Executives	1.73%	1.17%	1.92%	0.91%	1.25%	1.16%	1.88%	0.97%	2.19%	60	29	90
Insider Purchase (%)	0.081%	0.087%	0.074%	0.001%	0.001%	0.001%	0.445%	0.444%	0.447%	412	352	471
Insider Sales (%)	0.051%	0.035%	0.067%	0.000%	0.000%	0.000%	0.234%	0.153%	0.313%	412	352	471
Net Insider Demand (%)	11.45%	18.37%	4.73%	3.48%	0.62%	2.03%	67.68%	63.91%	71.35%	412	352	471
Risk Measures												
ln(daily return standard deviation)	-3.854	-3.832	-3.876	-3.849	-3.877	-3.863	0.500	0.592	0.409	406	346	465
ln(1+non-performing loans ratio)	0.015	0.020	0.009	0.015	0.007	0.011	0.014	0.018	0.009	348	286	408
ln(1+non-interest income ratio)	0.130	0.120	0.140	0.110	0.122	0.116	0.073	0.062	0.083	351	287	413
ln(1+other non-interest ratio)	0.187	0.176	0.198	0.149	0.168	0.158	0.134	0.131	0.138	351	286	413
Quarterly Change in Risk Measures												
Δln(daily return Std. Dev.)	-0.003	0.008	-0.013	0.001	-0.012	-0.005	0.349	0.348	0.350	398	338	456
Δln(1+non-performing ratio)	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.006	0.004	342	279	404
Δln(1+non-interest income ratio)	0.002	0.001	0.002	0.001	0.001	0.001	0.015	0.012	0.018	346	280	410
Δln(1+other non-interest ratio)	0.001	-0.002	0.003	-0.002	0.002	0.000	0.069	0.072	0.066	346	279	410
Firm Characteristics												
ln(1+stock turnover)	0.097	0.093	0.100	0.059	0.069	0.064	0.100	0.103	0.098	412	352	471
ln(1+book-to-market ratio)	0.566	0.647	0.487	0.611	0.469	0.539	0.181	0.214	0.149	310	176	440
ln(total assets)	21.182	21.260	21.107	20.996	20.699	20.846	1.612	1.595	1.629	351	287	414
ln(1+capital ratio)	0.080	0.074	0.086	0.072	0.083	0.077	0.022	0.018	0.025	351	287	414
# of banks held by BHC	3.715	5.463	2.889	2.176	1.139	1.472	6.061	9.159	4.599	276	135	414

Table 1.2 Descriptive Statistics (cont.)

	Mean			Median			Std Dev			# of BHC		
	Whole	**Early**	**Late**	**Whole**	**Early**	**Late**	**Whole**	**Early**	**Late**	**Whole**	**Early**	**Late**
Firm Characteristics												
quarterly stock return	0.045	0.032	0.058	0.022	0.044	0.033	0.143	0.153	0.133	409	349	468
Quarterly Changes in Firm Characteristic												
Δln(1+stock turnover)	0	0	0	0	0	0	0.0671	0.0697	0.0646	404	344	462
Δln(1+book-to-market ratio)	-0.005	-0.001	-0.008	0.002	-0.006	-0.002	0.072	0.086	0.058	300	165	432
Δln(total assets)	0.029	0.024	0.034	0.015	0.021	0.018	0.077	0.075	0.079	346	280	411
Δln(1+capital ratio)	0.0001	0.0002	-0.0001	0.0004	0.0001	0.0003	0.006	0.005	0.006	346	280	411

Table 1.3 Insider Trading - BHC vs. Non-bank Firms

This table provides a comparison of insider trade variables of BHCs with those of Non-bank firms. Non-bank firms are all firms included in the insider data which are not identified as BHCs. Means of 'Insider Purchase', 'Insider Sales' and 'Net Insider Demand' are calculated for two sub-periods ('early', 1986-1994; 'late', 1995-2003). Standardized Wilcoxon Z-statistics test hypothesis that the cross-sectional averages of insider trade variables of BHCs are not statistically different from those of non-bank firms. Construction details of the variables are provided in Appendix A.

	Early (1986-1994)			Late (1995-2003)		
	Non-Bank Firms	**BHCs**	**z-stat**	**Non-Bank Firms**	**BHCs**	**z-stat**
Insider Purchase (in %)	0.089%	0.086%	-0.4	0.054%	0.074%	-4.0
Insider Sales (in %)	0.117%	0.035%	6.8	0.109%	0.067%	5.2
Net Insider Demand (in %)	-0.764%	18.009%	-6.5	-4.418%	4.726%	-3.7
# of firms	6686	349		7692	473	

Table 1.4 Summary Statistics: Means Across Size Groups, Two Historic Periods

This table provides summary statistics for 3 sets of variables: quarterly insider trading variables, quarterly risk measures and quarterly change in risk measures. Reported mean are time-series averages of quarterly cross-sectional means. For each variable, summary statistics are calculated for two sub-periods ('early', 1986-1994; 'late', 1995-2003) and for three capitalization portfolios, small, medium and large BHCs. Construction details of the variables are provided in Appendix A.

	Small BHCs		Medium BHCs		Large BHCs	
	Early	**Late**	**Early**	**Late**	**Early**	**Late**
ln(capitalization)	16.63	17.33	18.28	18.63	20.43	21.13
Insider Trade and Holdings						
Insider Purchase (in %)	0.155%	0.120%	0.068%	0.073%	0.041%	0.032%
Insider Sales (in %)	0.038%	0.064%	0.039%	0.072%	0.028%	0.064%
Net Insider Demand (in %)	17.86%	21.92%	18.61%	10.93%	18.65%	-17.90%
Risk Measures						
ln(daily return standard deviation)	-3.556	-3.746	-3.817	-3.872	-4.094	-3.999
ln(1+non-performing loans ratio)	0.026	0.010	0.017	0.008	0.020	0.009
ln(1+non-interest income ratio)	0.101	0.111	0.099	0.120	0.151	0.182
ln(1+other non-interest income ratio)	0.186	0.212	0.177	0.190	0.169	0.194
Quarterly Change in Risk Measures						
Δln(daily return standard deviation)	0.022	-0.022	0.009	-0.012	-0.005	-0.006
Δln(1+non-performing loans ratio)	0.000	0.000	0.000	0.000	0.000	0.000
Δln(1+non-interest income ratio)	0.001	0.002	0.001	0.002	0.002	0.002
Δln(1+other non-interest income ratio)	-0.002	0.002	-0.003	0.003	-0.001	0.003
Ave. # of BHC	113	153	119	157	121	161

Table 1.5 Double Sorted Means by Capitalization and Level of Risk Measures

This table reports means of insider trade measures double-sorted quintiles. We further sort each of three capitalization portfolios, small, medium and large BHCs, into tertiles according to a risk measure, either current quarter stock return standard deviation or current quarter non-performing loan ratio. Only the means of the top ("high", i.e. BHCs with highest return standard deviation or non-perform ratio ranking) and bottom ("low", i.e. BHCs with lowest return standard deviation or non-perform ratio ranking) risk measure tertiles are reported. The 3rd, 6th and 9th columns report standardized Wilcoxon Z-statistic for the null hypothesis that the insider trade does not differ between the top and bottom standard deviation tertiles within each of 3 capitalization groups. Definition of the variables are provided in Appendix A.

	Low	High	z-stat		Low	High	z-stat		Low	High	z-stat
	Small BHCs				Medium BHCs				Large BHCs		
Panel A	**Stock Return Deviation Sorting**										
ln(daily return standard deviation)	-4.4758	-3.2511	-10.3		-4.4035	-3.4187	-10.3		-4.2939	-3.4531	-10.3
Insider Purchase (t-1)	0.10%	0.14%	-2.6	*	0.07%	0.09%	-2.0	*	0.04%	0.06%	1.1
Previous Quarter Insider Sales (t-1)	0.07%	0.04%	1.8		0.06%	0.05%	-0.1		0.04%	0.06%	0.1
Net Insider Demand (t-1)	16.01%	20.08%	-1.5		13.79%	16.76%	-0.9		1.06%	4.92%	-0.4
Insider Purchase	0.10%	0.15%	-4.0	*	0.05%	0.08%	-2.9	*	0.03%	0.05%	0.1
Insider Sales	0.05%	0.05%	0.1		0.06%	0.05%	-0.3		0.04%	0.05%	-0.1
Net Insider Demand	16.94%	20.74%	-1.1		13.24%	15.31%	-0.7		-1.98%	7.69%	-1.4
Ave. # of BHC	29	69			36	46			71	20	
Panel B	**Non-Perform Ratio Sorting**										
ln(1+non-performing loans ratio)	0.0042	0.0317	-10.3		0.0047	0.0266	-10.3		0.0054	0.0267	-10.3
Insider Purchase (t-1)	0.12%	0.15%	0.0		0.07%	0.11%	-2.7	*	0.05%	0.04%	0.1
Previous Quarter Insider Sales (t-1)	0.04%	0.06%	-1.9		0.05%	0.06%	-1.0		0.05%	0.04%	1.4
Net Insider Demand (t-1)	25.51%	17.61%	3.1	*	18.15%	15.35%	1.1		4.31%	1.93%	1.1
Insider Purchase	0.14%	0.16%	0.0		0.06%	0.09%	-2.4	*	0.05%	0.03%	0.0
Insider Sales	0.05%	0.06%	-2.0	*	0.05%	0.06%	-1.3		0.05%	0.04%	1.5
Net Insider Demand	25.37%	17.88%	3.0	*	17.92%	13.74%	1.5		4.26%	1.47%	1.0
Ave. # of BHC	32	37			49	37			35	42	

Table 1.6 Regression Results: Insider Trade and Change in Risk Measure

This table provides results from regressions of quarterly return standard deviation on its lagged variable, insider trade measures and other change variables. We have estimated 6 specifications. Regressions 1, 3, 5 are short regressions that only include intercept, lagged dependent variable, last quarter stock return and one insider trade variable (quarterly insider demand, insider purchase or insider sale). Regressions 2, 4 and 6 are regressions that include controls: quarterly changes in bank assets, book-to-market ratio, turnover, and equity ratio, as well as last quarter return. In Panel A contemporaneous insider trade and other change variables are used on the right-hand side, except for last quarter return. In Panel B we use all last quarter variables on the right-hand side. These regressions are estimated with **Fama-MacBeth methodology.** T-statistic is calculated based on Newey-West-adjusted Fama-MacBeth standard errors.

	1			2			3			4			5			6		
Panel A: Current quarter insider trade variable on the right-hand side																		
Intercept Term	-1.093	-8.3	*	-1.281	-12.6	*	-1.094	-8.3	*	-1.293	-12.7	*	-1.092	-8.3	*	-1.288	-12.8	*
Return Std Dev (t-1)	0.716	21.7	*	0.682	26.4	*	0.715	21.6	*	0.679	26.3	*	0.716	21.7	*	0.680	26.4	*
Net Insider Demand	0.016	6.5	*	0.010	3.0	*												
Insider Purchase							2.041	2.4	*	3.283	1.1							
Insider Sales													2.268	1.2		5.257	2.3	*
Δln(total assets)				-0.039	-0.6					-0.043	-0.6					-0.030	-0.5	
Δln(1+BE/ME)				-0.207	-2.1	*				-0.197	-2.0	*				-0.205	-2.1	*
Δln(1+capital ratio)				-1.806	-1.6					-2.021	-1.6					-1.578	-1.5	
Δln(1+turnover)				0.998	13.2	*				1.010	14.2	*				1.006	13.6	*
stock return	-0.308	-12.0	*	-0.212	-6.3	*	-0.310	-12.1	*	-0.208	-6.3	*	-0.308	-12.0	*	-0.215	-6.3	*
Ave. # of BHC	398			268			398			268			398			268		
Adj. R Square	0.54			0.54			0.54			0.54			0.54			0.54		

Table 1.6 Regression Results: Insider Trade and Change in Risk Measure (cont.)

	1			2			3			4			5			6		
Panel B: Past quarter insider trade variable on the right-hand side																		
Intercept Term	-1.092	-8.3	*	-1.268	-11.5	*	-1.093	-8.3	*	-1.278	-11.7	*	-1.089	-8.3	*	-1.267	-11.4	*
Lagged return Std. Dev.	0.715	21.6	*	0.679	23.8	*	0.715	21.6	*	0.677	23.9	*	0.716	21.6	*	0.679	23.7	*
Net Insider Demand (t-1)	0.001	0.2		0.003	0.8													
Insider Purchase (t-1)							0.083	0.1		4.087	2.1	*						
Insider Sales (t-1)													0.336	0.2		2.551	1.0	
Δ ln(total assets) (t-1)				-0.056	-0.7					-0.076	-0.9					-0.060	-0.7	
Δ ln(1+BE/ME) (t-1)				-0.142	-1.2					-0.118	-1.0					-0.154	-1.3	
Δ ln(1+capital ratio) (t-1)				-2.184	-1.7					-2.610	-2.0					-2.245	-1.8	
Δ ln(1+stock turnover) (t-1)				-0.473	-8.3	*				-0.475	-8.3	*				-0.466	-8.1	*
stock return (t-1)	-0.313	-12.1	*	-0.335	-6.5	*	-0.311	-11.7	*	-0.321	-6.1	*	-0.309	-11.8	*	-0.336	-6.5	*
Ave. # of BHC	398			266			398			266			398			266		
Adj. R Square	0.54			0.50			0.54			0.50			0.54			0.50		

Table 1.7 Firm Characteristics: High Equity Ratio BHCs vs. Low Equity Ratio BHCs

This table reports means of firm characteristics. Every year, we further sort each of three capitalization portfolios, small, medium and large BHCs, into tertiles according to equity ratio. Only the means of the top ("high", i.e. BHCs with highest equity ratio) and bottom ("low", i.e. BHCs with lowest equity ratio) tertiles are reported. The 3rd, 6th and 9th columns report standardized Wilcoxon Z-statistic for the null hypothesis that the insider trade does not differ between the top and bottom equity ratio tertiles within each of 3 capitalization groups. Definition of the variables are provided in Appendix A.

	Low	High	z-stat		Low	High	z-stat		Low	High	z-stat	
	Small BHCs				Medium BHCs				Large BHCs			
ln(1+capital ratio)	0.0588	0.1007	-10.3	*	0.0630	0.1017	-10.3	*	0.0631	0.0983	-10.3	*
ln(total assets)	19.7602	19.4542	8.5	*	20.9050	20.3508	10.2	*	23.2852	22.1132	10.3	*
ln(1+non-performing loans ratio)	0.0230	0.0152	3.0	*	0.0163	0.0112	2.6	*	0.0174	0.0109	2.4	*
ln(1+non-interest income ratio)	0.1095	0.1042	2.7	*	0.1102	0.1096	0.7		0.1774	0.1541	5.0	*
ln(daily return standard deviation)	-3.5446	-3.7188	3.4	*	-3.8048	-3.8780	1.7		-4.0403	-4.0195	-1.0	
Ave. # of BHC	33	34			35	51			52	33		

Table 1.8 Regression Results: High Equity Ratio BHCs vs. Low Equity Ratio BHCs

This table provides results from regressions of quarterly return standard deviation on its lagged variable, insider trade measures and other change variables. We have estimated 6 specifications. Regressions 1, 3, 5 are short regressions that only include intercept, lagged dependent variable, last quarter stock return and one insider trade variable (quarter insider demand, insider purchase or insider sale). Regressions 2, 4 and 6 are regressions that include controls: quarterly changes in bank assets, book-to-market ratio, turnover, and equity ratio, as well as last quarter return. Coefficient estimates for control variables are not reported. In Panels A and B, contemporaneous insider trade and other change variables are used on the right-hand side, except for last quarter return. In Panels C and D we use all last quarter variables on the right-hand side. These regressions are estimated with **Fama-MacBeth methodology.** T-statistic is calculated based on Newey-West-adjusted Fama-MacBeth standard errors.

	1			2		3			4		5		6	
Panel A: High Equity Ratio BHCs, Current quarter insider trade variable on the right-hand side														
Net Insider Demand	0.0117	2.4	*	0.0021	0.3									
Insider Purchase						2.9582	1.1		-9.2968	-0.7				
Insider Sales											12.3522	1.7	88.9918	0.8
Ave. # of BHC	114			78		114			78		114		78	
Adj. R Square	0.51			0.47		0.51			0.48		0.51		0.47	
Panel B: Low Equity Ratio BHCs, Current quarter insider trade variable on the right-hand side														
Net Insider Demand	0.0188	3.9	*	0.0070	1.4									
Insider Purchase						6.7602	3.0	*	4.9937	1.5				
Insider Sales											-2.4413	-0.5	-5.1255	-0.8
Ave. # of BHC	118			99		118			99		118		99	
Adj. R Square	0.56			0.58		0.55			0.58		0.56		0.58	
Panel C: High Equity Ratio BHCs, Last quarter insider trade variable on the right-hand side														
Net Insider Demand (t-1)	-0.0004	-0.1		-0.0085	-0.8									
Insider Purchase (t-1)						4.3614	1.7		34.3588	1.1				
Insider Sales (t-1)											2.5658	0.4	126.1946	1.2
Ave. # of BHC	114			77		114			77		114		77	
Adj. R Square	0.51			0.44		0.51			0.44		0.51		0.44	

Table 1.8 Regression Results: High Equity Ratio BHCs vs. Low Equity Ratio BHCs

	1		2			3			4		5		6	
Panel D: Low Equity Ratio BHCs, Last quarter insider trade variable on the right-hand side														
Net Insider Demand (t-1)	0.0069	1.3	0.0103	2.1	*									
Insider Purchase (t-1)						6.5895	1.9	*	4.8715	1.4				
Insider Sales (t-1)											1.4687	0.2	6.8065	1.1
Ave. # of BHC	118		99			118			99		118		99	
Adj. R Square	0.55		0.55			0.55			0.55		0.55		0.54	

Table 1.9 Regression Results: 1986-1994 vs. 1995-2003

This table provides results from regressions of quarterly return standard deviation on its lagged variable, insider trade measures and other change variables. We have estimated 6 specifications. Regressions 1, 3, 5 are short regressions that only include intercept, lagged dependent variable, last quarter stock return and one insider trade variable (quarter insider demand, insider purchase or insider sale). Regressions 2, 4 and 6 are regressions that include controls: quarterly changes in bank assets, book-to-market ratio, turnover, and equity ratio, as well as last quarter return. Coefficient estimates for control variables are not reported. In Panels A and B, contemporaneous insider trade and other change variables are used on the right-hand side, except for last quarter return. In Panels C and D we use all last quarter variables on the right-hand side. These regressions are estimated with **Fama-MacBeth methodology.** T-statistic is calculated based on Newey-West-adjusted Fama-MacBeth standard errors.

	1			2			3			4			5			6		
Panel A: 1986-1994, Current quarter insider trade variable on the right-hand side																		
Net Insider Demand	0.0180	4.7	*	0.0075	1.3													
Insider Purchase							2.6427	2.1	*	6.6701	1.2							
Insider Sales													3.3254	0.9		10.2535	2.5	*
Ave. # of BHC	338			147			338			147			338			147		
Adj. R Square	0.69			0.64			0.69			0.64			0.69			0.64		
Panel B: 1995-2003, Current quarter insider trade variable on the right-hand side																		
Net Insider Demand	0.0138	4.8	*	0.0118	3.5	*												
Insider Purchase							1.4568	1.3		0.0844	0.1							
Insider Sales													1.2396	1.0		0.5376	0.5	
Ave. # of BHC	456			382			456			382			456			382		
Adj. R Square	0.40			0.44			0.40			0.44			0.40			0.44		
Panel C: 1986-1994, Last quarter insider trade variable on the right-hand side																		
Net Insider Demand (t-1)	-0.0079	-1.3		-0.0026	-0.4													
Insider Purchase (t-1)							-1.1907	-0.7		6.2104	1.6							
Insider Sales (t-1)													-0.1197	0.0		4.0912	0.8	
Ave. # of BHC	338			142			338			142			338			142		
Adj. R Square	0.69			0.61			0.69			0.62			0.69			0.61		

Table 1.9 Regression Results: 1986-1994 vs. 1995-2003 (cont.)

	1		2		3		4		5		6	
Panel D: 1995-2003, Last quarter insider trade variable on the right-hand side												
Net Insider Demand (t-1)	0.0089	2.7 *	0.0082	2.1 *								
Insider Purchase (t-1)					1.3215	2.1 *	2.1411	2.4 *				
Insider Sales (t-1)									0.7796	0.4	1.1394	0.6
Ave. # of BHC	456		380		456		380		456		380	
Adj. R Square	0.40		0.40		0.40		0.40		0.40		0.40	

Table 1.10: Regression Results: 1995-2003, Controlling for Executive Compensation

This table provides results from regressions of quarterly return standard deviation on its lagged variable, insider purchase, interaction term of insider purchase and executive compensation dummy, and last quarter return. Executive compensation dummy equals 1 if the percentage holding of shares and options by executives falls into the top tertile and equals 0 if it falls into the bottom tertile. Coefficient estimates for control variables are not reported. In Panel A contemporaneous insider trade and other change variables are used on the right-hand side, except for last quarter return. In Panel B we use all last quarter variables on the right-hand side. These regressions are estimated with **Fama-MacBeth methodology.** T-statistic is calculated based on Newey-West-adjusted Fama-MacBeth standard errors. Only BHCs with available Execucomp data are used.

	Estimate	T-Stat	
Panel A: Current quarter insider trade variable on the right-hand side			
Insider Purchase	-138.01	-1.6	
Insider Purchase*execudum	122.51	2.1	*
Ave. # of BHC	60		
Adj. R Square	0.46		
Panel B: Past quarter insider trade variable on the right-hand side			
Insider Purchase (t-1)	-187.30	-1.8	
Insider Purchase (t-1)*execudum	123.02	2.0	*
Ave. # of BHC	60		
Adj. R Square	0.45		

Table 1.11 Firm Characteristics: High Equity-based Compensation BHCs vs. Low Equity-based Compensation BHCs

This table reports means of firm characteristics. We further sort each of three capitalization portfolios, small, medium and large BHCs, into tertiles according to percentage ownership (the sum of shares and options held). Only the means of the top ("high", i.e. BHCs with highest percentage ownership) and bottom ("low", i.e. BHCs with lowest percentage ownership) tertiles are reported. The 3rd, 6th and 9th columns report standardized Wilcoxon Z-statistic for the null hypothesis that the insider trade does not differ between the top and bottom percentage ownership tertiles within each of 3 capitalization groups. Definition of the variables are provided in Appendix A.

	Low	High	z-stat	Low	High	z-stat		Low	High	z-stat	
	Small BHCs			Medium BHCs				Large BHCs			
Total pct. Ownership				0.0007	0.1105	-4.4		0.0087	0.1008	-8.4	
ln(capitalization)				19.2202	19.0580	0.8		22.6342	20.9556	8.4	*
ln(1+book-to-market ratio)				0.6286	0.4464	2.1	*	0.4308	0.4124	0.7	
ln(total assets)				21.7952	21.0363	2.9	*	24.4908	22.5832	8.4	*
ln(1+capital ratio)				0.0630	0.0715	-0.9		0.0785	0.0818	-0.8	
ln(daily return standard deviation)				-3.6189	-3.7795	1.0		-4.1053	-3.9666	-2.9	*
ln(1+non-performing loans ratio)				0.0355	0.0113	2.1	*	0.0129	0.0121	1.2	
ln(1+non-interest income ratio)				0.1765	0.1816	-0.3		0.2179	0.1976	2.4	*
ln(1+other non-interest income ratio)				0.2013	0.2591	-0.4		0.1771	0.1839	-0.7	
Ave. # of BHC	0	0		2	2			29	28		

Table 1.12: Regression Results: Low Equity Ratio BHCs, 1995-2003

This table provides results from regressions of quarterly return standard deviation on its lagged variable, insider trade measures and other change variables. We have estimated 6 specifications. Regressions 1, 3, 5 are short regressions that only include intercept, lagged dependent variable, last quarter stock return and one insider trade variable (quarter insider demand, insider purchase or insider sale). Regressions 2, 4 and 6 are regressions that include controls: quarterly changes in bank assets, book-to-market ratio, turnover, and equity ratio, as well as last quarter return. In Panel A contemporaneous insider trade and other change variables are used on the right-hand side, except for last quarter return. In Panel B we use all last quarter variables on the right-hand side. These regressions are estimated with **Fama-MacBeth methodology.** T-statistic is calculated based on Newey-West-adjusted Fama-MacBeth standard errors.

	1			2			3			4			5			6		
Panel A: Current quarter insider trade variable on the right-hand side																		
Net Insider Demand	0.0202	3.3	*	0.0151	2.1	*												
Insider Purchase							5.2932	2.5	*	3.9779	1.4							
Insider Sales													-1.2362	-0.5		-1.3556	-0.6	
Ave. # of BHC	139			130			139			130			139			130		
Adj. R Square	0.40			0.47			0.40			0.47			0.40			0.46		
Panel B: Past quarter insider trade variable on the right-hand side																		
Net Insider Demand (t-1)	0.0148	2.6	*	0.0122	2.0	*												
Insider Purchase (t-1)							6.1169	3.1	*	7.2049	2.6	*						
Insider Sales (t-1)													-3.3272	-2.3	*	-3.2934	-2.1	*
Ave. # of BHC	139			130			139			130			139			130		
Adj. R Square	0.40			0.42			0.40			0.42			0.40			0.42		

Figure 1.1 Insider Ownership among BHCs over Time

This figure depicts the annual cross-sectional average of total number of shares and options held and percentage ownership of equity over time period of 1992-2003. Due to limited availability of Execucomp data, only a subset of our sample BHCs are use to constructed this figure.

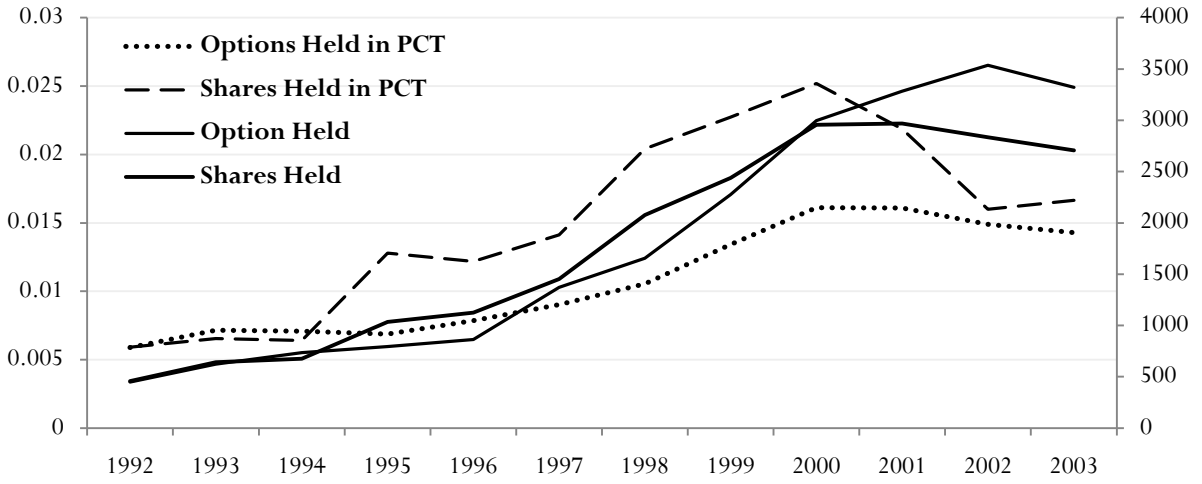
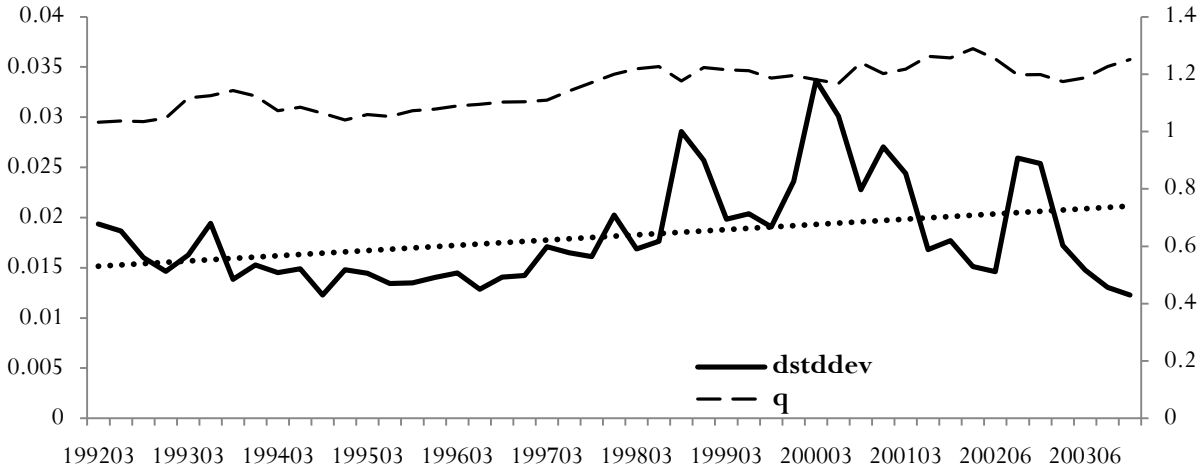


Figure 1.2 Equity Return Standard Deviation and Tobin's Q among BHCs

This table depicts annual cross-sectional means of Tobin's Q and return standard deviation over time period 1992-2003. This figure is constructed using same BHCs as those used for figure 1.



Chapter 2: Institutional Investor Demand and Idiosyncratic Volatility

1. Introduction

Assuming investors have sufficient opportunities to diversify and similar expectations about future returns, classic portfolio theory views idiosyncratic volatility as being irrelevant. The assumption of adequate diversification and homogenous expectations have long been questioned [Miller (1977), Friend, Westerfield and Granito (1978)]. A wave of recent research provides further theories and documents new empirical evidence suggesting that idiosyncratic volatility may be relevant [Shleifer and Vishny (1997), Ang, Hodrick, Xing and Zhang (2006), Boyer, Mitton and Vorkink (2010); Fu (2009)]. In spite of the extensive research on the importance of idiosyncratic risk, few studies explore empirically how idiosyncratic volatility influences investors' trading decisions. Using a sample of bank holding companies (BHCs), we examine this issue by testing whether inter-temporal changes in idiosyncratic volatility predict institutional demand.

This investigation is especially important from a banking policy and regulatory perspective. Policy makers are engaged in an ongoing debate over whether equity market discipline acts as a substitute or threat to regulatory efforts to curb risk-taking in the banking industry. Because institutional ownership accounts for a substantial portion of the equity ownership of large BHCs and institutional investors are considered sophisticated and possessing an information advantage, they are a potentially important source of market discipline [Chen, Harford and Li (2007) and Cornett, Marcus, Saunders and Tehranian (2007)]. Our assessment of the trading behavior by institutions in response to changes in firm-specific volatility may help

to reveal the potential role of institutional equity holders in monitoring the risk-taking behavior of bank holding companies.

We consider three potential reasons why institutions may demonstrate aversion to idiosyncratic volatility of individual stocks when they buy and sell. First, underdiversification exposes investors to diversifiable risk. Research indicates that individual investors typically do not fully exploit available means for diversification [Goetzmann and Kumar (2008)] and thus institutional investors may be more sensitive to idiosyncratic volatility. Second, high idiosyncratic volatility may keep mispriced stocks from returning to their fundamental values [Shleifer and Vishny (1997)] and decrease the attractiveness of trading against mispricing by informed investors. Institutional investors on average are more likely than individual investors to have sufficient sophistication to be involved in such trading. Third, institutional investors are subject to loss liability based on legal standards that focus on individual stock riskiness [Del Guercio (1996)]. Because some institutional investors may be affected by these three reasons more than others, we also expect to see different levels of aversion to idiosyncratic volatility by different institutions.

We expect that institutional equity holders in aggregate are not as concerned with changes in idiosyncratic volatility for BHCs stocks as for non-bank stocks. First, the heavy financial regulation that seeks to limit excessive bank risk-taking may cause investors to adopt an indifferent attitude towards risk among banks. In addition, affiliated bank trusts demonstrate special consideration for their parent BHC stocks [Whidbee (2002)] and their trading decisions may also be based on such consideration. Second, BHCs tend to have relatively low levels of idiosyncratic volatility. As a result, even large percentage increases in the level of idiosyncratic volatility may result in an overall level that is still relatively low. Third, there are fewer

opportunities for informed institutional investors to take advantage of short-term market-mispricing among BHCs than among non-bank firms because BHCs are more likely than non-bank firms to forgo growth opportunities due to regulatory constraints.

We document that although changes in percentage institutional ownership are inversely related to one-period lagged changes in idiosyncratic volatility for non-financial stocks in the NYSE/AMEX/NASDAQ common stock universe, they are not significantly related to last quarter changes in idiosyncratic volatility for BHC stocks. We hypothesize and test two potential non-mutually exclusive reasons for the difference.

First, the composition of institutional investors holding BHCs may be different from the composition of institutions holding non-bank firms ("investor base hypothesis"). If relative to other firms, BHCs are held to a larger extent by institutions that are less concerned with idiosyncratic volatility, the relation between changes in institutional ownership and changes in non-systemic risk will be less negative. We find that different institutional investors clearly demonstrate different levels of aversion to firm specific volatility. The observed pattern indicates that better diversified and more informed traders are more concerned with idiosyncratic risk. In addition, the institutional investor base of BHCs is different from the investor base of other firms. The most notable difference is that the fraction of ownership by affiliated bank trusts is significantly higher among BHCs than among other firms. We also find a change in behavior of these affiliated institutions between the 1986-1996 period and the 1997-2006 period. In the earlier period, affiliated bank trusts tend to increase their holdings of parent company stock in response to an increase in idiosyncratic risk, while the better informed and diversified institutions decrease holdings; in the later time period, they seem to become indifferent along with other institutions.

Second, we hypothesize that institutions are less concerned with changes in idiosyncratic volatility of BHC stocks because the distinct firm characteristics of BHCs causes institutional investors to evaluate their idiosyncratic volatility differently than the idiosyncratic volatility of other firms ("firm characteristics hypothesis"). This implies that even if BHCs and non-bank firms are held by the same institutions we may still observe institutional inertia with respect idiosyncratic volatility. We consider two relevant characteristics. First, BHCs are at the lower end of the idiosyncratic volatility spectrum across firms. The marginal effect of an increase in idiosyncratic volatility for firms with higher levels of firm specific risk may not be the same as the marginal effect for firms with lower levels of firm specific risk. Prior research indicates that institutions' preference for volatility in individual stocks is likely non-linear: they prefer higher volatility to lower among stocks with volatility in the lower range but are averse to higher volatility among stocks with volatility in the higher range [Falkenstein (1996), Rubin and Smith (2009), Barinov (2009)]. Second, the banking industry may be different from other industries in terms of the availability of opportunities to profit from firm-specific informational advantages. We find strong evidence that the level of idiosyncratic volatility and average size of institutional trades, a proxy for likelihood of informed trading, may cause institutional indifference toward firm specific risk among BHCs. Specifically, we find that the negative association between institutional demand and change in idiosyncratic volatility is of a larger magnitude and higher significance for firms with lower level idiosyncratic volatility and larger average trade size than that for firms with higher volatility and smaller trades. The difference persists after controlling for types of institutional investor.

We are aware of two alternative explanations for our observed negative relation between institutional demand and previous period change in idiosyncratic volatility. First, stock

liquidity may be positively correlated with idiosyncratic volatility [Andersen (1996)] and institutions may be net sellers of securities with recent large increases in liquidity [Barber and Odean (2008)]. Therefore, the observed negative association could be caused by institutions' aversion to increases in liquidity not idiosyncratic volatility. While this is plausible, we control for changes in turnover in our analysis and find that institutional demand is not significantly related to last quarter change in turnover. The other alternative explanation for our findings is that institutions are momentum traders [Bennett, Sias and Starks (2003) and Sias (2007)] and stock return volatility tends to be negatively related to past returns [Christie (1982), Duffee (1995), and Bekaert and Wu (2000)]. Therefore, the observed negative association may be the result of institutions moving from losers to winners. To address this possibility, our analysis controls for past returns. Although past returns are indeed significantly positively related to institutional demand, our results remain significant after its inclusion. In addition, neither of these two interpretations can explain why our results for sample BHCs are different from those for non-bank firms.

The paper is organized as follows: section 1 discusses previous literature and hypotheses development; section 2 investigates the relation between institutional demand and last quarter change in idiosyncratic risk; section 3 tests the "institutional investor base hypothesis" ; section 4 test the "firm characteristic hypothesis"; section 5 compares contribution by institutional purchases and contribution by institutional sells to the relation between institutional demand and last quarter change in idiosyncratic risk; and section 6 concludes.

2. Literature Review and Hypothesis Development

Previous literature suggests several potential reasons why institutions may consider idiosyncratic volatility of individual stocks relevant to their decisions to buy and sell. This section summarizes and discusses each reason and its implications for our investigation.

2.1 Liability for losses

Institutional investors act as agents and manage the wealth of their principals. Many institutions are subject to legal liability if they commit wrongdoing, according to the 'prudent man' standard, in making investment decisions. Given the subjective nature of the prudent man standard, these legal constraints tend to manifest themselves through a focus on individual stock riskiness, thereby forcing managers to avoid individual stocks with high return volatility even when these stocks do not increase overall portfolio volatility. Hence, when making portfolio selections, institutions may weigh the idiosyncratic volatility of stock returns, i.e. the diversifiable volatility, in the sense that they are attempting to avoid likely legal punishment in case losses occur. Del Guercio (1996) and Parrino, Sias and Starks (2003) find some evidence suggesting institutional investors are concerned with prudence and tend to abandon firms exhibiting signs of becoming imprudent.

Del Guercio (1996) points out that such loss liability does not impact every institution equally. She finds evidence that variation in legal standards across different types of institutional investors has contributed to a divergence in investment incentives. Specifically, bank managers, who are subject to the most stringent legal standard, i.e. the prudent-man rule of common law, are most conservative and have a strong preference for stocks with high ratings by Standard and Poor's. Mutual fund managers and other institutional investors are less likely to be held legally

liable for losses. Del Guercio finds a significant and negative cross-sectional relation between the portfolio weights assigned by mutual fund managers and return standard deviation, but much weaker than that for bank managers.

In addition to legal concerns, performance evaluation and fund flow may also prompt institutional investors to be concerned about idiosyncratic volatility because their principals might only focus on losses while dismissing risk-return efficiency created by diversification. As discussed by Shleifer and Vishny (1997), institutional investors might be risk-averse due to the agent-principal relationship and, consequently, forego investment opportunities with potential abnormal returns. Sirri and Tufano (1998) find that mutual fund flows are asymmetrically conditional on fund prior performance, i.e. they invest disproportionately more in funds with exceptionally good prior performance. If whether one can excel in the competition to be a winner fund depends critically on success in avoiding loss, mutual funds will be averse to firm specific risk.

To sum up, the concern for loss liability may cause institutional investors to have an aversion to idiosyncratic volatility and such aversion can give rise to a negative correlation between changes in idiosyncratic volatility and change in percentage institutional ownership. However, the correlation might differ across types of institutions.

2.2 Underdiversification

Idiosyncratic volatility is not considered relevant by classic portfolio selection theory because it is assumed that investors are presented with sufficient diversification opportunities to minimize portfolio exposure to firm specific risk to a negligibly small amount. If investors intentionally under-diversify or investors are prevented from reaching adequate diversification,

however, then idiosyncratic volatility will likely be a considered relevant. In any event, under-diversification can potentially expose investors to a substantial amount of risk due to idiosyncratic volatility.

If investors seek to capitalize on idiosyncratic skewness, they will intentionally reduce diversification because diversification erodes the skewness of their portfolios. Empirical evidence shows that individuals who appear to seek stocks with high skewness are highly under-diversified [Goetzmann and Kumar (2008), Mitton and Vorkink (2007)]. Although institutions in aggregate may not pursue skewness, a sub-group that aims at beating the market might [Chan, Chen and Lakonishok (2002)]. Hence, some of the institutions might voluntarily hold an under-diversified portfolio.

Bennett and Sias (2010) evaluate the viability of constructing a well-diversified portfolio using actual stock return data and point out that diversification is a daunting challenge and does not present itself easily to investors. We also find that there is a disperse distribution in the level of accomplished diversification among institutions.

The importance of under-diversification in portfolio selection based on idiosyncratic volatility remains an empirical question. Several studies (Fu (2009), Xu and Malkiel (2003), Huang, Liu, Rhee and Zhang (2009),) investigate whether investors require compensation for idiosyncratic volatility due to under-diversification and find that idiosyncratic risk is positively priced in the stock return cross-section, i.e. investors require higher expected return for bearing firm specific risk. However, their findings are at odds with other studies that suggest investors' are indifferent toward or have a preference for idiosyncratic volatility [Bali and Cakici (2008), Ang, Hodrick, Xing and Zhang (2006), Ang, Hodrick, Xing and Zhang (2009), and Jiang, Xu and Yao (2009)].

One possible reason for of the mixed results concerning idiosyncratic volatility could be the dispersion in the level of accomplished diversification among investors. The dominant investors for some securities might be better diversified than the dominant investors in other securities. Therefore, using different groups of securities in examining the pricing for firm specific risk may lead to different empirical results: Evidence of negative pricing might emerge from studies that use a portfolio largely held by investors who are better diversified, while evidence for positive pricing might come forth in studies that use a portfolio predominantly owned by investors who are not as well diversified.

How institutions' portfolio selection is affected by under-diversification has received limited attention in the literature. Bushee and Goodman (2009) argue that the institutional investor base that holds a stock is relevant to whether the stock's idiosyncratic risk is priced. Specifically, an investor base that consists of under-diversified institutions will give rise to compensation for bearing non-systematic risks. Their argument implies that differences in the level of diversification cause the clustering of different institutional investors into different groups of equity securities. For our purposes, this argument implies that differences in achieved levels of diversification may lead to difference in the importance of idiosyncratic volatility across institutions.

2.3 Limits of arbitrage and institutions' informational advantage

Shleifer and Vishny (1997)) argue that capitalizing on a mispriced security is riskier when the security has high idiosyncratic risk and this might prevent such capitalization from occurring. Consequently, mispricing in securities with high idiosyncratic risk may take longer to correct. If institutions possess private information or superior analytical ability regarding the

mispricing of individual stocks, higher firm specific volatility compromises the profitability of institutional investors' informational advantage.

Whether or not institutions investors do indeed possess an informational advantage is a topic of on-going debate [Sias and Starks (1997), Carhart (1997), Sias, Starks and Titman (2006), Lewellen (2009)]. Bushee and Goodman (2007) and Yan and Zhang (2009) point out that not all institutional investors are equally blessed with informational advantage. They find that institutions with larger shares of ownership in a specific firm and institutions that are short-term traders are more likely to be able to predict future stock performance and achieve profits. In addition, studies also find that institutional informational advantages seem to be associated with smaller firms.

However, Lewellen (2009) find that institutions' portfolios, in aggregate, do not tilt toward any stock characteristics that are associated with fundamental pricing anomalies and they do not generally earn abnormal returns. His empirical findings could alternatively indicate a dispersion of institutional investment in different anomalies. Different institutions may prefer different stock characteristics, and thus they appear to have balanced portfolio in aggregate. An examination of the association between changes in aggregated institutional ownership and changes in firm idiosyncratic risk may yield better evidence on whether institutions bet on pricing anomalies.

2.4 Other theories

In addition to the literature that argues that institutions prefer to avoid idiosyncratic risk, another stream of literature suggests that investors can be attracted to high levels of firm specific volatility. Boyer, Mitton and Vorkink (2010) demonstrate that idiosyncratic volatility

predicts firm specific expected skewness, and that the preference for skewness renders idiosyncratic volatility to appear being negatively priced in the cross-section of stock returns. In other words, investors' preference for high skewness will cause them to prefer high idiosyncratic volatility. Ang, Hodrick, Xing and Zhang (2006), and Ang, Hodrick, Xing and Zhang (2009) argue that stocks with high idiosyncratic volatility are preferable to investors if they wish to hedge against time variation in market volatility. Therefore, investors may be willing to sacrifice some compensation in terms of return in exchange for the hedging opportunity. They examine the cross-section of stock returns and find that idiosyncratic risk is negatively priced.

2.5 Hypotheses

The evidence discussed to this point suggests that idiosyncratic volatility is potentially an important consideration in institutional investors' portfolio decisions. Everything else equal, a stock can be attractive to institutions because it has high or low firm specific risk, depending on which of the above-mentioned reasons dominates. Our approach to this issue is to examine the marginal response of institutional demand to volatility changes that take place within a medium period of time within a quarter, which is less subject to noise trading than using shorter time frame. We assume that the changes are at least somewhat unexpected and thus the marginal response can reflect institutional investors' preference over unexpected changes in firm specific volatility.

Previous studies on institutional preference for stock return volatility focus on the relation between institutional ownership levels and the level of volatility of individual firms. Their findings are mixed. For example, Del Guercio (1996) finds a significant and negative

cross-sectional relation between stock return standard deviation and the portfolio weights assigned by mutual fund managers and banks. As a counter example, Bennett, Sias and Starks (2003) find that idiosyncratic volatility does seems to affect institutional portfolio selection and more institutions appear to hold stocks with higher firm specific volatility instead of lower.

Few studies [Sias (1996), Rubin and Smith (2009)] look at changes in institutions ownership, or institutional demand. Both Sias (1996) and Rubin and Smith (2009) point out that volatility (idiosyncratic volatility) and institutional ownership might relate to each other from another direction – institutions may influence the risk-taking behavior of the firms they hold and institutions' trading activities cause returns to be more volatile. Empirical evidence has been accumulating along this line of studies [Bushee (1998), Cornett, Marcus, Saunders and Tehranian (2007), Chen, Harford and Li (2007)]. Therefore, the contemporaneous association between institutional ownership and volatility can be misleading. To isolate the impact of change in firm specific risk on institutional demand, we examine the lead-lag relation.

H1: In the event of an unexpected change in idiosyncratic volatility, institutional investors' concern for legal liability of loss, under-diversification, and losing short-term profit in informed trading outweigh their attraction to higher firm-specific volatility and hence institutional demand is negatively correlated with one-period-lagged change in idiosyncratic volatility.

There are two alternative scenarios to our hypothesis. The first is that institutional investors are not concerned with idiosyncratic volatility and we observe an insignificant correlation between institutional demand and quarterly changes in non-diversifiable risk. The second is that institutional investors are persistently attracted to stocks with higher idiosyncratic volatility and we observe a positive association.

In addition, we expect that the negative correlation between institutional demand and one-period-lagged change in firm specific volatility may be less significant than that for the non-bank firms because of the following reasons. First, BHCs may be more appealing to risk-averse investors and those that, for the reasons mentioned above, avoid investments with high idiosyncratic volatility. Unlike other industries, BHCs are influenced by heavy financial regulation that seeks to limit excessive risk-taking. This regulatory oversight may act as a substitute for market monitoring and cause investors to adopt a passive strategy towards BHC holdings [Demsetz and Lehn (1985), Adams and Mehran (2003)][24]. In addition, Whidbee (2002) finds that affiliated bank trusts appears to use one selection agenda for their parent BHC and yet another for other BHCs. Since bank trust holdings represent a significant part of (at least 20%) aggregate institutional equity ownership, if affiliated trusts tend to remain loyal shareholders for their parent companies or even try to counteract trading by non-affiliated trusts and other institutions, this will also cause the investors of BHCs in aggregate to appear less sensitive to changes in idiosyncratic volatility. Second, BHCs tend to have relatively low levels of idiosyncratic volatility. As a result, even large percentage increases in the level of idiosyncratic volatility may result in an overall level that is still relatively low.[25] Third, there are fewer opportunities for informed institutional investors to take advantage of short-term market-mispricing among BHCs than among non-bank firms and, therefore, investors may tend to passively hold bank shares. BHCs are more likely than non-bank firms to forgo growth

[24] For instance, while incentive compensation and monitoring in other industries tend to promote risk-taking, these measures seem to do otherwise in the banking industry [Houston and Christopher (1995)]

[25] Prior research indicates institutions' preference for idiosyncratic volatility of individual stocks is likely non-linear: they prefer higher volatility to lower among stocks with volatility in the lower range but repel higher volatility among stocks with volatility in the higher range [Falkenstein (1996), Rubin and Smith (2009), Barinov (2009)].

opportunities due to regulatory limits.[26] Thus, BHCs may be less appealing to investors that specialize in identifying under-valued firms with growth potential. For instance, prior to deregulations, the scope and nature of banks' lines of business were substantially constrained. In addition, the extensive disclosure requirements and regulatory inspection may have reduced the opaqueness of bank assets. Although bank assets have been considered opaque in the past, increasing evidence suggests that "they are simply boring"[Flannery, Kwan and Nimalendran (2004), Flannery and Sorescu (1996)].

Based on the above reasons, we further hypothesize:

H2: The correlation between institutional demand and one-period-lagged change in firm specific volatility among BHCs is less affected by investors' concern for legal liability of loss, under-diversification, and losing short-term profit in informed trading and is less negative, i.e. negative but with less statistically significance or positive, relative to non-bank firms.

Our hypothesis (H1) implies that the relation between institutional demand and changes in idiosyncratic volatility for one group of stocks may differ from that for another due to two possible reasons: first, institutional investors of these two groups of stocks could be different in terms of their concern for legal liability of loss, under-diversification, or losing short-term profit in informed trading. Second, due to differences in firm characteristics between the two groups, institutions may be more likely to respond differently to changes in firm specific risk for one group relative to the other. Therefore, a comparison between the institutional investor composition of BHCs and that of non-bank firms and a comparison between the response by institutions to changes in volatility among firms with similar firm

[26] Controlling for size, our sample BHCs have significantly lower book-to-market ratio than non-bank firms.

characteristics to those of BHCs and the response by the same institutions among firms without may help us examine how the expected institutional inertia with respect to changes in idiosyncratic risk manifests itself. We hence propose two additional hypotheses:

H3: Institutional investors of BHCs have less concern for legal liability of loss, under-diversification, and/or losing short-term profit in informed trading than institutional investors of non-bank firms. Therefore, the relation between institutional demand and one-period-lagged change in firm specific volatility among BHCs will be less negative, i.e. negative but with less statistically significance or positive.

We use three classifications to differentiate institutions: 1) legal types; 2) high or low achieved diversification level; 3) better or worse informed. The classification of legal types is intended to differentiate institutions that are more vulnerable to legal liability for investment loss from institutions that are less so. If loss liability is a major cause of the expected negative association between institutional demand and changes in idiosyncratic risk, those changes will have a larger and more significant impact on demand by bank trusts than demand by mutual funds. The sorting on achieved diversification level is intended to distinguish institutional investors that are more threatened by idiosyncratic volatility exposure from those that are more resistant or have bigger risk appetites. If under-diversification is a critical reason why institutions respond inversely to changes in firm specific volatility, we expect the negative correlation to be more significant for institutions with smaller appetite for idiosyncratic risk. Since short-term profit from informed trading is sensitive to volatility, institutions that specialize in informed trading may be more likely to avoid high idiosyncratic volatility. If this is a crucial reason for the negative correlation between institutional demand and firm specific risk changes, such association will be more significant for better informed institutions. Through

these three classifications, we investigate whether the difference in response by different institutions is consistent with the proposed causes for institutional aversion to increase in firm specific volatility. Therefore, a further comparison between the institutional investor composition among BHCs and that among non-bank firms will shed light on the cause for the expected institutional inertia among BHCs.

H4: The relation between institutional demand and one-period-lagged change in firm specific volatility will be less significant among BHCs than among non-bank firms due to BHC's low levels of idiosyncratic volatility and the scarcity in informed trading among BHCs.

An increase from a low level of idiosyncratic volatility may not be as threatening as an increase from an already high level of idiosyncratic volatility if the negative relation between institutional demand and changes in firm specific risk is driven by institutions with relatively low levels of diversification. Although institutional investors are often considered more sophisticated and informed investors as opposed to individual investors, they may not be able to perform informed trading on all the securities that they hold and some securities might be held passively. Earlier studies document evidence suggesting that successful informed trading is more abundant among smaller firms and firms with more growth opportunities. If concern for short-term loss in informed trading is a driving cause for the inverse relation between institutional demand and changes in idiosyncratic volatility, we expect the relation to be less significant among firms that are passively held. If the negative institutional response to changes in firm specific risk is less significant among firms with low level of idiosyncratic volatility and infrequent informed trading, the BHCs' share in such firm characteristics may have caused institutions' indifference toward changes in idiosyncratic risk in BHCs.

3. Idiosyncratic Volatility and Institutional Investors: BHCs vs. All Firms

3.1 Data

We sample two groups of firms over the time period from June 1986 to June 2006. The first is 830 bank holding companies. The second includes all NYSE/AMEX/Nasdaq common stocks. Security characteristics data and accounting data are extracted from CRSP-COMPUSTAT. Institutional investor ownership information is originally obtained from Thomson Financial, which is compiled from the quarterly 13(f) data.[27]

Among the 830 BHCs, 805 companies are identified in a link between BHC permno's and their regulatory identification number, which is produced by the Federal Reserve Bank of New York. We also construct this link ourselves[28] and obtain 25 additional companies. BHC accounting data is obtained from Form FR Y9C provided by the Federal Reserve Bank of Chicago. This data is complemented by quarterly bank data from CRSP-COMPUSTAT. We analyze how representative our sample of BHCs is for the banking industry and the results are available on request.

[Table 1: Summary statistic for firm characteristics, BHC vs Non-bank Firms]

Table 1 reports summary statistics for our sample after sorting into five quintiles based on capitalization levels. Panel A gives the average cross-sectional means and standard deviations of key firm characteristics for BHCs and non-bank firms separately. Our sample BHCs fall evenly across the largest four capitalization quintiles based on firm capitalization ranking of all firms and relatively fewer BHCs fall into the smallest quintile. Within every capitalization

27 The 13(f) data has a large number of missing observations in the second and third quarters of 1988. These missing observations account for approximately half of the institutions. Our results are robust upon deleting all observations during year 1988.

28 We successfully match the regulatory identification number of each of 358 BHC to a CRSP permno, and 25 of them are confirmed be both correct and additional to FRB NY match.

quintile, BHCs appear to have significantly lower idiosyncratic volatility and quarterly turnover rates. Except for the smallest quintile, BHCs also tend to have significantly lower institutional ownership. Mean dividend yield of BHCs is significantly higher in the middle three quintiles. Mean book-to-market ratio of BHCs is higher than that of non-bank firms but the difference is statistically significant in only three of the five quintiles. Panel B shows the summary statistics for quarterly institutional demand and changes in our control variables. Within each capitalization quintile, the means of changes in idiosyncratic volatility, book-to-market ratio, turnover, dividend yield, and quarter return for BHCs are not significantly different from those for non-bank firms. However, institutional demand for BHCs in the top three capitalization quintiles is significantly lower than institutional demand for non-bank firms of similar sizes but institutional demand for BHCs in the bottom two size quintiles appears to be larger.

3.2 Institutional demand

Institutional ownership is measured as a percentage of outstanding shares. It is the sum of the number of shares held by all institutional investors divided by the total number of shares outstanding.

$$IO_{i,t} = \sum_j \frac{\#\text{ shares of stock i owned by institutions}_j \text{ at t}}{\#\text{ outstanding shares of stock i at t}} = \sum_j IO_{j,i,t}$$

We calculate institutional demand as following:

$$\Delta IO_{i,t} =$$

$$\sum_j \left(\frac{\#\text{ shares of stock i owned by instituions}_j \text{ at t}}{\#\text{ outstanding shares of stock i at t}} - \right.$$

$$\left. \frac{\#\text{ shares of stock i owned by instituions}_j \text{ at t}-1}{\#\text{ outstanding shares of stock i at t}}\right)$$

$$= \sum_j \Delta IO_{j,i,t}$$

$IO_{i,t}$ is the institutional ownership for stock i at quarter t. $\Delta IO_{i,t}$ is the institutional demand for stock i at quarter t. As shown above, institutional demand is not exactly calculated based on actual buys and sells and we use it as an approximation due to data limitations following [Sias and Whidbee (Forthcoming)].

We also compute institutional demand by the one-quarter difference in percentage ownership summed at firm-level. However, institutional demand so calculated suffers from spurious change due to deleting questionable observations[29] of individual quarterly holdings. Therefore, we use the sum of change in individual managers' holding as the institutional demand. Although such approach may omit some managers due to the deletion, the result correctly represents demand by most managers. The alternative measure does lead to some substantial difference in the results.

3.3 Idiosyncratic Volatility Measures

[29] We delete a manager-permno observation if the manager did not file a report during the either current quarter or the previous quarter and if the reported holdings are inconsistent with reported transaction amount. Due to these deletes, we keep an average of 86% of managers for each permno.

Following Fu (2009), we measure firm specific risk as the root mean squared errors obtained from quarterly regressions of daily returns on the Fama-French four-factor model. We require at least 45 non-missing daily returns within a quarter.

$$r_i = \alpha_i + \beta_i r_m + \gamma_i r_{SMB} + \theta_i r_{HML} + \varphi_i r_{MOM} + \varepsilon_i$$

After obtaining quarterly estimates of idiosyncratic volatility for each firm, we calculate changes as the current quarter's value minus the previous quarter's value. Annual changes are also constructed and analyzed but results are not reported (they are available from the authors upon request). We use this change to proxy for a persistent change in firm specific risk. Although previous research on firm-level return volatility suggests that there are both jump and smooth changes in volatility and only smooth changes are likely to be persistent [Maheu and McCurdy (2004)], we do not differentiate them now. Further research effort could improve on this.

In un-reported results, we use an alternative measure of firm specific risk. Each quarter, we estimate individual firm beta coefficients using monthly returns over the past 36 to 60 months and then use the beta estimates to decompose quarterly volatility of daily returns into systemic and non-systemic components. The non-systemic component is used as our alternative measure of firm specific volatility. This approach yields qualitatively similar results.

3.4 Methodology

We employ regression analysis to test for an association between institutional demand and lagged changes in idiosyncratic volatility.

$$\Delta IO_{i,t} = \alpha 1 + \beta \Delta \sigma_{i,t-1} + \sum_{m \in K} \varphi_m \Delta x_{m,i,t-1} \qquad (1)_{30}$$

We include the following control variables (K variables):

1) Last quarter return: Institutions are known to favor investing in large firms, in terms of capitalization, over investing in small firms [Gompers and Metrick (2001)]. Quarterly return is used to control for change in capitalization.
2) Same quarter return: In light of the documented positive feedback trading by institutions [Nofsinger and Sias (1999), Campbell, Ramadorai and Schwartz (2009)] and the negative relation between return and change in return volatility [Christie (1982), Duffee (1995), and Bekaert and Wu (2000)], we consider it necessary to control for possible spurious association between institutional demand and lagged change in volatility caused by institutions' pursuit of positive returns.
3) Last quarter change in turnover rate: Institutional investors tend to prefer high liquidity as measured by the share turnover rate [Gompers and Metrick (2001) and Bennett, Sias and Starks (2003)].
4) Last quarter change in book-to-market ratio: Institutional investors appear to prefer low book-to-market ratio firms. Bennett, Sias and Starks (2003) find that share price is a more important predictor of institutional ownership than other security characteristics.

[30] The one percentile and 99 percentile value of institutional demand are 0.1859 and -0.1173 respectively. The negative-one- and positive-one- boundaries for the value of the institutional demand variable is never reached in our sample. However, still, to address the limited dependent variable issue, we perform Tobit analysis and confirm that both the significant and negative relation between institutional demand and change in idiosyncratic volatility for non-bank firms and the insignificance of this relation for BHCs are sustained.

5) Last quarter change in dividend yield: Institutional investors appear to avoid both high dividend-yield firms and firms with no dividend [see Bennett, Sias and Starks (2003), Grinstein and Michaely (2005)]

We estimate equation (1) using quarterly OLS and then use Fama-MacBeth Methodology to aggregate the results. As an alternative, panel data regressions, including firm and time fixed effects, were estimated. Results based on this approach are qualitative similar and available from the authors upon request.

In addition, in order to be able to compare our beta estimates across different historic time periods and subgroups, we standardize all the variables within the cross-section for each quarter, i.e. for a given observation of a variable, we subtract its cross-sectional mean and then divide the difference by the variable's cross-sectional standard deviation. We use the standardized variables in all our regressions.

3.5 Findings

[Insert Table 2: regression results BHC]

Table 2 reports regression results for the BHC sample. Changes in idiosyncratic volatility are not significantly associated with subsequent changes in institutional demand for BHCs companies over the sample period from 1986 to 2006. To investigate whether the relation has changed over time or varies by BHC size, we divide the sample into two historical periods (1986-1996, and 1997-2006) and into three different size groups. We divide the sample period into two parts because individual institutional investors' portfolios have increased sharply in value and number of stocks and demonstrate divergent development across

legal types over the 1997-2006 time period[31]. In unreported results, we find that prior to 1996 the average portfolio size for institutional investors was stable; while since 1996 the average size and number of securities in an institutional portfolio have experienced explosive growth. Bennett, Sias and Starks (2003) find evidence suggesting that at the same time as institutional investors increasingly hold larger proportions of the equity market there has also been a change in the institutional preference for firm characteristics. We examine whether the expected negative association between institutional demand and change in idiosyncratic volatility is affected by the growth of institutional investors and their dynamic preference. In addition, deregulation in 1980 and 1994 has revised the role government plays in monitoring bank risk-taking and allowed increased complexity in bank assets and thus it may potentially change how investors evaluate changes in firm specific risk of BHCs.

Estimates of the coefficient of past change in idiosyncratic volatility are not significant in either of the historic periods, although the sign of the estimate changes from positive to negative (from 0.0034 to -0.0017). It might be that deregulation and growth of institutional investors has caused multiple but counter-acting impacts. Likewise, size does not seem to make a significant difference. Estimates of the coefficient of past change in idiosyncratic volatility are not significant in any of the size groups. Only quarterly return seems to have somewhat significant predictive power for institutional demand for BHCs.

[Insert table 3: regression results ALL, pool and for size groups]

Table 3 reports regression results for all non-bank NYSE/AMEX/NASDAQ firms and reveal an obviously different picture. In Panel A, we report regression results using all available

[31] See Figure 1 in Appendix A.

non-bank firm observations. Coefficient estimate for last quarter change in idiosyncratic volatility is negative and significant (-0.03, T-statistic -10.59), suggesting that institutional demand is inversely related to the previous quarters' change in firm specific volatility. To ensure that the statistical significance found in Panel A and the lack of significance in Table 2 are not the result of differences in sample sizes, we use a random sample procedure to control for sample size and report the results in Panel B. In result, the average number of firms in the random samples of non-bank firms is 263, which is comparable to the size of our BHC sample (see Table 2). To test whether the non-bank firm results are sensitive to firm size, we divide all firms into three size groups[32]. Estimates of the coefficient of past changes in idiosyncratic volatility are significantly negative in all three size groups. In all regression results, current and past quarter returns are positively and significantly related to current quarter institutional demand while other control variables have little explanatory power. In unreported results, we also estimate the regression in two historic time periods but find no qualitative difference. The relation is only slightly weaker in the 1997-2006 period.

Our results suggest that, in general, institutions tend to buy (sell) non-financial stocks following a decrease (increase) in idiosyncratic volatility. However, idiosyncratic volatility of BHCs does not appear to influence institutional demand. In the next section, we investigate whether the difference in results can be attributed to the uniqueness of BHCs' institutional investor composition, firm characteristics, or both.

[32] We also use 10 deciles and the results are consistent throughout the deciles.

4. Preference for idiosyncratic volatility by different institutions

In this section, we decompose institutional ownership into pieces held by different subgroups of institutions in an effort to better understand why institutional investors respond to changes in idiosyncratic risk for BHCs differently than they do for other firms. The subgroups are formed based on legal type, level of diversification, and investment style, separately. Using these groupings, we investigate whether BHCs are different from other firms in terms of their institutional ownership composition and whether changes in idiosyncratic volatility predict different changes in ownership by different subgroups of institutions. If the institutional investor composition for BHCs differs from other firms and different institutions respond to changes in idiosyncratic volatility differently, then the apparent indifference of institutional investors to changes in the idiosyncratic risk of BHCs may be due to BHCs being held by institutions that are not concerned with idiosyncratic volatility.

4.1 Institutional investor ownership decomposition

We use three classifications to divide institutions into subgroups.

First, we use legal types. There are five legal types of institutions: banks, insurance companies, mutual funds, independent advisors, and others. Del Guercio (1996) finds evidence that variation in legal standards affecting different types of institutional investors contributes to a divergence in investment incentives among the different types of institutional investors. Bank trusts are subject to the most stringent standard. Therefore, we expect bank managers to exhibit the greatest aversion to loss liability and, consequently, be most inclined to sell (buy) stock in a firm following an increase (decrease) in idiosyncratic volatility. In addition, Whidbee (2002) finds that subsidiary bank trusts use different investment criteria for their parent

companies than for other BHCs. We further divide all bank trust holding BHCs into affiliated bank trusts and non-affiliated bank trusts.

Next, we classify institutions into five groups according to their achieved diversification levels. The sorting on achieved diversification level is intended to distinguish institutional investors that are more threatened by idiosyncratic volatility exposure from those that are more resistant or have bigger risk appetite. We expect to see bigger negative response to changes in firm specific volatility from institutions that have smaller risk appetite. However, we are aware that either less vulnerability to diversifiable risk or stronger intention to diversify can be the potentially plausible interpretation of a higher level of achieved diversification. If the dispersion in our measure of achieved diversification across institutional portfolios is caused by difference in investment styles of institutions, the higher achieved diversification may indicate smaller risk appetite and therefore the negative association between institutional demand and changes in idiosyncratic risk may be more significant for better diversified institutions. If the cross-sectional variation in achieved diversification is caused by differences in institutional investors' ability to diversify, the higher achieved diversification may suggest less vulnerability and we may expect the inverse response of institutional demand to changes in idiosyncratic risk to be less significant for better diversified institutions. Although less generously funded institutions can find diversification more costly than institutions that are better funded and therefore have weaker ability to diversify, we are skeptical about how much this issue will drive the variation in diversification. A study on individual investors' investment behavior reveals that achieved diversification is not related to portfolio size and thus is probably more of a proxy for diversification preference rather than ability [Goetzmann and Kumar (2008)].

We use two proxies for diversification: number of stocks in a manager's portfolio and normalized portfolio daily return volatility [Goetzmann and Kumar (2008)]. Appendix A explains the details of our construction of these two proxies. According to the value of these two proxies, we rank and classify managers into five subgroups.

Last, we differentiate short-term institutional investors from long-term and medium-term institutional investors. If institutions' intention to profit from their informational advantage causes their demand to be inversely related to last quarter change in idiosyncratic volatility, we expect to see that trading by managers with reputation to have information advantage contributes most to such correlation. Yan and Zhang (2009) find evidence suggesting that short-term institutional investors seem to possess private information and are able to gain from it. Therefore, we expect short-term institutions to drive the inverse correlation. Also, Bushee and Goodman (2007) point out that a manager is not likely to possess informational advantages for all stocks in her portfolio and argue that a manager is more likely to have private information for stocks of larger stakes to her. Hence, we expect to see ownership by large stake institutions to contribute to the inverse relation more than ownership by small stake institutions.

Our definition of large stake-holders is similar in spirit to the definition used by Bushee and Goodman (2007). We define a manager to be a large-stake-holder if her percentage ownership exceeds a critical value or if her portfolio weight for this stock exceeds a critical value. Unlike Bushee and Goodman, we impose an absolute critical value for a group of firms while their critical value is specific to individual firms. Details of our approach are explained in Appendix B.

To identify "short-term" institutional investors, we follow Yan and Zhang (2009) and construct a proxy for portfolio turnover. Short-term institutional investors are those with high turnover rate. We explain this approach in Appendix C.

Using the above three classifications, we decompose change in total institutional ownership by summing all the fraction changes in ownership of managers across groups:

$$\Delta IO_{G,i,t} = \sum_{k \in G} \Delta IO_{k,i,t}$$

$\Delta IO_{G,i,t}$ is the change in ownership of stock i by subgroup G at quarter t. When we use classification of legal types, G will be one of the five subgroups of banks, insurance companies, mutual funds, independent advisors and others. $\Delta IO_{k,i,t}$ is the change in percentage ownership of stock i by manager k at the end of quarter t.

Then, the change in total institutional investor ownership of stock i at quarter t is decomposed as:

$$\Delta IO_{i,t} = \Delta IO_{G1,i,t} + \Delta IO_{G2,i,t} + \cdots + \Delta IO_{Gn,i,t} \qquad (2)$$

For example, using legal type decomposition, it will be:

$$\Delta IO_{i,t} = \Delta IO_{bank,i,t} + \Delta IO_{InsC,i,t} + \Delta IO_{Mutual,i,t} + \Delta IO_{IndA,i,t} + \Delta IO_{other,i,t}$$

We decompose total institutional ownership using our three classifications for all firm-quarter observations.

4.2 Different institutions and idiosyncratic volatility

Following Bennett, Sias and Starks (2003), we decompose the OLS beta coefficient estimate for last quarter change in idiosyncratic volatility from regression equation (1), i.e. $\beta^{ALL}_{i,t}$:

$$\beta_{i,t}^{ALL} = \frac{S_t^{subgroup\ 1}}{S_t^{All}} \beta_{i,t}^{subgroup\ 1} + \frac{S_t^{subgrp\ 2}}{S_t^{All}} \beta_{i,t}^{subgrp\ 2} + \cdots + \frac{S_t^{subgrp\ k}}{S_t^{All}} \beta_{i,t}^{subgrp\ k} \quad (3)$$

Equation (3) holds since we use standardized variables for our regressions. Appendix D gives the detailed derivation of this decomposition. Beta estimates for the *k* different subgroups of institutions, $\beta^{\text{subgroup k}}{}_{i,t}$ are obtained from separate regressions of equation (1) using changes in ownership by respective subgroups of institutions as dependent variables. The adjusted beta coefficient estimates for each subgroup measures the contribution from this group to the aggregate beta coefficient estimate. For example, the contribution from bank trusts will be:

$$\frac{S_t^{Bank}}{S_t^{All}} \beta_{i,t}^{Bank}.$$

$S^{\text{Bank}}{}_t$ is the cross-sectional standard deviation of changes in ownership by banks trusts for quarter t. $S^{\text{All}}{}_t$ is the cross-sectional standard deviation of changes in ownership by all institutions for quarter t. $\beta^{\text{bank}}{}_{i,t}$ is the beta coefficient estimate in equation (1) using demand by bank trusts as dependant variable. We perform this decomposition every quarter. Since we standardize our variables used in equation (1) as Bennett, Sias and Starks (2003) do, we are able to average our decomposition across quarters and obtain a reasonable average.

[Insert Table 4: contribution to total beta coefficient by institution subgroups]

Table 4 reports the decomposition results demonstrated in equation (3). Panels A to C provide adjusted beta coefficients constructed separately based on the three classifications discussed in section 3.1, using non-bank firms, BHCs or BHCs with identified affiliated trusts. Bennett, Sias and Starks (2003) show that institutional ownership has changed substantially over the last two decades. We also provide our decomposition for two historic periods separately. Panel A gives results based on legal types. Surprisingly, independent investment advisors seem

to be the legal group that drives the inverse relation between institutional demand and past quarter change in firm specific risk. Banks contribute more to the overall relation than insurance companies and other institutions, but their contribution is relatively small. The results for BHCs, on the other hand, indicate that institutions in aggregate do not respond to firm specific volatility changes, but some sub-groups do in a way that counter-acts each other. During the 1986 to 1996 period, Independent investment advisors respond negatively (-0.0236) to increases in firm specific risk while bank trusts respond positively (0.0196) to an increase. Further decomposition shows that the positive response by bank trusts are mostly contributed by affiliated trust (0.012 out of 0.019).

Panel B shows beta contributions from subgroups of managers who are different in their achieved level of portfolio diversification. Managers with the lowest normalized portfolio volatility and the largest number of stocks in their portfolios contribute far more to the total beta estimate than those with the highest normalized portfolio volatility and the smallest number of stocks in portfolio. For BHCs, this pattern is somewhat preserved only when diversification is measured by normalized bank trust and for the pre-deregulation time period. This may suggest that although bank trusts tend to hold more stocks than other institutions their loyalty to parent companies costs a price of inefficient diversification.

Panel C reports the beta estimate decomposition based on informative trader classification. Managers with large block holdings, higher portfolio turnover rate and smaller portfolio weight tend to pitch in the most. The inverse relation is slightly weaker in later historic periods, accompanied by a decrease in beta contribution by most institutional subgroups. The BHCs results suggest that bank trusts, especially affiliated bank trust of BHCs,

do not respond to change in firm specific risk the same way as informed institutional investors do.

In summary, different institutional investor managers demonstrate different responses to past-quarter changes in firm specific volatility. The observed pattern is consistent with the hypothesis that informed traders are more concerned with idiosyncratic risk in that managers with high turnover rate and high percentage ownership demonstrate stronger aversion to increases in idiosyncratic volatility. The inverse response of institutional demand to changes in firm specific risk is of larger magnitude for institutions with high levels of achieved diversification (i.e. having more stocks in their portfolio or having low normalized volatility) than for institutions with low levels. If higher levels of achieved diversification suggest a smaller appetite for diversifiable risk, our results are consistent with the argument that under-diversification causes institutional investors to be averse to idiosyncratic risk.

As for BHCs, contributions from different subgroups of institutions seem to vary over time. In the earlier time period of 1986-1996, contributions by each subgroup of institutions to the relation between aggregate institutional demand and past changes in firm specific volatility for BHCs are similar to those for non-bank firms, except for affiliated bank trusts. Affiliated bank trusts respond favorably to an increase in idiosyncratic risk of their parent company, which in effect cancel out independent investment investors' unfavorable response and render the aggregate institutional demand insignificant. However, in the later time period of 1997-2006, all institutional investors seem to become indifferent to changes in firm specific risk of BHCs. These findings suggest that most institutional investors are not concerned with changes in idiosyncratic volatility of BHCs after deregulation. However, in pre-deregulation time period, the apparent indifference toward idiosyncratic risk is caused by the risk-seeking of

affiliated trusts. Our findings suggest that affiliated bank trusts do not behave the same way as well-diversified or informed institutions in terms of their response to change in idiosyncratic volatility of their parent BHCs.

4.3 Institutional investor ownership composition: BHC vs. All firms

Section 3.2 shows that different institutions make different contributions to the observed inverse association between institutional demand and last-quarter change in firm specific risk among all firms. We now ask whether BHCs have a distinct institutional investor ownership composition, which could lead to the absence of a similar inverse relation.

[Insert Table 5: ownership composition comparison]

Table 5 reports the average decomposed ownerships by subgroups of institutions for BHCs and for all firms. To control for firm capitalization effect on institutional ownership, we divide all stocks into ten size deciles and then within each decile we compare the institutional investor ownership of BHCs with that of all firms. Panels A to C provide comparison of subgroup ownerships based on classifications by legal types, diversification level, and informed trading. BHCs differ from other firms when institutional ownership is decomposed according to the diversification level classification and informative trader classification. Their ownership is composed of smaller proportion of highly diversified and more informed institutions relative to non-financial firms. Also, ownership by banks is substantially higher among BHCs than among all firms across nine out of ten deciles. Possibly as a result, the proportion of ownership by independent investment advisors is lower when compared with other firms.

Therefore, the lack of responsiveness of institutional demand to changes in firm specific risk among BHCs seems to derive from their unusually high ownership by affiliated bank trust

ownership. Whidbee (2002) finds that subsidiary bank trust use one investment criterion for their parent companies but another for other BHCs and this can contribute to the observed high bank ownership among BHCs. However, in the post-deregulation time period, all institutions appear to be indifferent to changes in firm specific risk of BHCs. This suggests that institutional investor composition is not likely the reason for the institutional demand inertia in this time period.

4.4 Correlation among classifications

To this point, we have established that the relation between institutional demand and changes in idiosyncratic volatility is sensitive to three different classifications of institutions and that such sensitivity may suggest that there are multiple causes for the inverse association. However, it could be that the three classifications could be highly correlated and the negative relation may truly be sensitive to one or two the classifications. For example, if institutions with high portfolio turnover tend to be institutions with low diversification, we may not be able to interpret the results from these two classifications separately. Therefore, we next test whether our three classification of institutions are independent of one another.

[Insert Table 6: correlation among classifications]

Table 6 reports the Spearman correlation between the normalized volatility rank and portfolio turnover rank of individual managers. The correlation of -0.3 does indicate that managers who are more concerned with diversification are likely to be those who frequently

participate in informed trading. However, the degree of such correlation is not high enough to suggest that the two rankings are redundant.[33]

5. Preference for idiosyncratic volatility and firm characteristics

The previous section examines whether differences in institutional investor composition help explain the lack of responsiveness of institutional demand to change in BHC firm specific risk. This section explores which firm characteristics may also be the cause of such inertia and whether BHCs are distinct beyond these characteristics ("Firm Characteristic Hypotheses"). We expect that institutions are less concerned with changes in idiosyncratic volatility of BHC stocks because BHCs have very low idiosyncratic volatility and informed trading is infrequent among BHCs due to the opaqueness of their assets (or the less likely ultimate transparency). To test this firm characteristic hypothesis, we first divide all firms into groups according to whether they have low level of idiosyncratic risk or whether their stocks are subject to infrequent informed trading. Then we examine whether the relation between lagged changes of idiosyncratic volatility and demand by similar institutions is different across subgroups of firms. Throughout this section we use institution subgroups formed in the previous section in addition to aggregate institutional demand in order to control for the difference in institutional ownership composition. In Section 4.3, we compare institutional demand sensitivity to idiosyncratic volatility among BHCs with that among non-bank firms with both low idiosyncratic volatility and infrequent informed trading. This analysis will reveal

[33] In un-reported results, we also examine the correlation between firm level ownership by one subgroup and that of another subgroup. The results are qualitatively similar to those here.

whether institutional investors treat BHCs differently beyond their low risk and sparse private information features.

5.1 Level of idiosyncratic volatility

BHCs are at the lower end of the idiosyncratic volatility spectrum and we expect this feature may cause institutions to be less sensitive to changes in firm specific volatility. In addition, Houston and Stiroh (2007) suggest that BHCs have a distinct risk-profile in contrast to other non-financial companies over the past three decades: bank holding companies are increasingly exposed to sector-wide risk and their idiosyncratic risk has consequently declined. However, during the same time period, empirical evidence [see Campbell, Lettau, Burton and Xu (2001), and Irvine and Pontiff (2009)] indicates a significant increase in diversifiable risk among non-financial firms.

Prior research indicates that institutions' preference for idiosyncratic volatility of individual stocks is likely non-linear: they prefer higher volatility to lower among stocks with volatility in the lower range but repel higher volatility among stocks with volatility in the higher range [Falkenstein (1996), Barinov (2009)]. Rubin and Smith (2009) find that whether or not institutions prefer volatility depends on whether or not a firm pays dividends. Since dividends are significantly correlated with return volatility, their findings are also consistent with a non-linear institutional preference for volatility

[Insert Table 7: Low idiosyncratic volatility]

We estimate equation (1) for firms with high idiosyncratic volatility and firms with low idiosyncratic volatility separately. To avoid mixing with the size effect, we divide all non-bank

firms into five size quintiles and perform the estimation for each quintile separately.[34] Panel A of Table 7 provides the estimated results when aggregate institutional demand is used as dependent variable. Results for five size quintiles all indicate that managers are significantly averse to firm specific risk when the stock has high level of idiosyncratic volatility, while significance is only found in the top two quintiles for the group of firms with low firm specific risk. In addition, the beta coefficient estimate for last quarter change in idiosyncratic volatility is substantially larger for the high risk firms relative to that for low risk firms. In Panel B, we provide the results when using demand by institutions with relatively higher level of diversification as dependent variable, in order to control for difference in institutional investor composition. In addition, since better diversified institutions seem to be more concerned with idiosyncratic volatility changes due to their intention to keep a small exposure to firm specific risk, comparing their responses across firms with different level of idiosyncratic risk is more appropriate than using aggregate institutional demand. The results in Panel B are qualitatively same as those in Panel A. The level of idiosyncratic volatility and capitalization are sorted separately. Therefore, the observed pattern is not likely due to only within decile size effect.

To sum up, our findings are consistent with the hypothesis that the low firm specific risk level of BHCs may cause the indifference of institutional demand to its changes.

5.2 Intensity of informed trading

Some institutions may be concerned with changes in idiosyncratic volatility because they are trading on private information and idiosyncratic volatility can damage the profitability

[34] To avoid a serious disparity in the number of firms between double-sorted groups in comparison, we use five size quintiles instead of ten deciles.

of their trades. We expect that institutional demand indifference with respect to firm specific risk in the banking industry may be also caused by a lack of opportunities for institutional investors to profit from their bank specific informational advantage: informed trading of BHC shares by institutions may be less frequent and therefore institutional demand will appear less responsive to volatility changes, other things equal.[35, 36] To assess the importance of the intensity of informed trading of a firm, we test whether institutional investors are more alert to changes in idiosyncratic volatility for firms with abundant informed trading than they are for firms with sparse informed trading.

To measure the availability of informed trading opportunities of each firm, we use trade size - quarterly change in holdings of individual managers. Informed traders may prefer large trades [Easley and O'Hara (1987), Grundy and McNichols (1989), Battalio and Mendenhall (2005)] and therefore large trades are more likely to contain information than small trades. In contrast, some other studies suggest that informed investors may engage in "stealth trading" by dividing one large trade into smaller trades and therefore most informative trades are of medium size [Barclay and Warner (1993), Chakravarty (2001), Piotroski and Roulstone (2004)]. However, since our measure is the accumulation of trades taken place within a quarter, our "large trade" is either a large single trade or a large-sized sum of several medium trades by a manager. Thus, our "large trades" are more likely to have information content than "small trades".

[Insert Table 8: Informed trading intensity: BHCs Vs Non-bank firms]

[35] We treat the actual intensity of informed trading as equivalent to availability of opportunity to profit from private information.

[36] We investigate industry effect on the relation between institutional demand and last quarter change in firm specific risk and find that this relation is not significant in several industries other than the banking industry.

Table 8 reports the cross-sectional average mean trade size for BHCs and for non-bank firms. To establish a trade size measure for each firm in each quarter, we calculate the mean of the absolute value of quarterly changes in percentage ownership across individual managers. The cross-sectional means are produced within each of five capitalization quintiles. Except for the bottom quintile, BHCs have smaller average trade size than non-bank firms do. This is consistent with our expectation that there is less frequent informed trading among BHCs. In addition, in Table 1 Panel A, we also show that BHCs have higher book-to-market value than non-bank firms. This suggests that investors see less growth opportunities in banks and may also lead to infrequent informed trading among BHCs.

Next, we rank the mean trade within each quarterly cross-section of all sample firms and divide firms within each of five capitalization quintiles into two groups based on this ranking: one group with higher mean absolute change in percentage ownership of individual managers and one with lower mean absolute change[37]. Table 9 provides regressions results for equation (1) using the resulting ten double-sorted portfolios of firms. Panel A and Panel B gives results for aggregate institutional demand and for demand by better informed institutions (i.e. with higher turnover rate). When aggregate institutional demand is used as independent variable, we find that the inverse relation between institutional demand and change in last quarter firm specific risk is significant and negative among firms with larger mean trade size. However, for firms with smaller mean trade size, the relation is also significantly negative but the estimate for the coefficient of change in firm specific risk is substantially smaller. When we use demand by better informed institutional investors as the dependent variable, we only find

[37] Firms with mid-range mean absolute change are left out of our analysis.

significantly negative relation in the firms with larger mean trades. These findings suggest that institutions are more sensitive to idiosyncratic volatility changes when there are more opportunities to trade on private information.

[Insert Table 9: Intensity of informed trading]

We also use book-to-market ratio to proxy for availability of informed trading opportunities. Firms with low book-to-market ratio, i.e. the "growth firms", are often associated with more informed trading. In our unreported results, the findings are qualitatively similar to our findings with mean trade size.

Therefore, our findings are consistent with the hypothesis that the informational opaqueness of BHCs to institutional investors as a whole is one of the reasons for the inertia of institutional demand regarding firm specific changes.

5.3 Uniqueness of BHC

So far, our findings suggest that institutions have treated BHCs the same as they do for firms with low firm specific volatility and few opportunities for informed trading. In this section, we further ask whether BHCs are special beyond these characteristics.

[Insert Table 10 BHCs vs Control Non-bank Firms]

Table 10 reports regression results for equation (1) for three samples, BHCs held by affiliated trusts, BHCs not held by affiliated trusts and Non-Financial Control Firms. 'Non-Financial Control Firms' are obtained by random sampling from non-bank firms with low idiosyncratic volatility, small mean trade size and size similar to BHCs. Panel A gives results for aggregate institutional demand while Panel B gives results for demand by bank trusts. In all regression results, the estimate for the coefficient of change in idiosyncratic volatility is not significant for both BHCs groups and the non-bank control group, except that we find that bank

trust demand appears to be positively and significantly related to firm specific changes among BHCs held by affiliated trusts.

We do not find BHCs are special beyond their characteristics of low firm specific volatility and few opportunities for informed trading, but affiliated bank trusts somewhat distort the relation between institutional demand and idiosyncratic risk changes for their parent companies.

6. Conclusion

This paper is motivated by a wave of recent literature suggesting that idiosyncratic volatility is relevant for portfolio selection, as opposed to the traditional view that it is irrelevant. Few studies explore empirically how investors, such as institutional investors, employ idiosyncratic volatility information in their trading decisions. Using a sample of bank holding companies (BHCs), we examine this issue by testing whether inter-temporal changes in idiosyncratic volatility predict institutional demand.

We propose that institutional demand may be negatively correlated with past changes in idiosyncratic volatility due to institutions' concern for legal liability of loss, under-diversification, and losing short-term profit in informed trading. However, we also expect that the correlation between institutional demand and one-period-lagged change in firm specific volatility among BHCs is less affected by these concerns relative to non-bank firms. Our findings are consistent with this expectation.

Upon further investigation, we find that different institutional investors do not demonstrate equal aversion to idiosyncratic risk and that the institutions driving the results are those who achieve better diversification and are better informed. In contrast to non-bank firms,

the institutional investor base of BHCs consists less of these institutions and the holding of their affiliated trusts respond particularly favorably to increases in idiosyncratic volatility from 1986 to 1996. Also, the inverse relation is less significant for firms with lower levels of idiosyncratic volatility and traded in smaller sizes by institutions. It appears that institutional investors consider BHCs similar to non-bank firms with low idiosyncratic volatility and infrequent informed trading, despite their substantially higher leverage. Our findings suggest that in the pre-deregulation sample period the apparent indifference toward idiosyncratic risk is caused by the risk-seeking of affiliated trusts. However, most institutional investors are not concerned with changes in idiosyncratic volatility of BHCs after deregulation.

Our results should raise regulatory concern for at least two reasons: First, in the post deregulation time period, BHCs are treated by institutional investors in a similar way as they trade non-bank firms with low idiosyncratic volatility and "boring" assets. However, BHCs have substantially higher leverage than these non-bank counter parties and there has been a substantial increase in the complexity and riskiness of bank assets after deregulation. The passive investment strategy toward bank risk by equity holders might be caused by the "too big to fail" doctrine or inadequate disclosure regarding risk. Regardless, the passive trading weakens the potential role of market discipline in controlling bank risk-taking. Second, parent company ownership by affiliated bank trusts alters the relation between institutional demand and bank risk-taking, working against other institutional investors. Although we do not find a significant influence by affiliated bank trusts in the post deregulation period, one should be cautious about their potential impact on market discipline, especially when outside institutional investors no longer passively hold bank shares.

Table 2.1 Summary Statistics

This table reports means of quarterly cross-sectional means of institutional ownership and firm characteristics. All firms on NYSE/AMEX/Nasdaq are divided into five quintiles according to annual sorting of firm capitalization and means of variables are calculated for each quintile. Within each quintile, BHCs and non-bank firms are compared. Panel A provides average cross-sectional means and standard deviations for institutional ownership and firm characteristic and Panel B provides average cross-sectional means and standard deviations for quarterly change variables. 'Firm #' is the average number of firms in each quarterly cross-section. 'IO' is the percentage of outstanding shares held by all institutions. 'Idiosyncratic Volatility' is the root mean squared errors from the Fama-French 4 factor model using daily returns within a quarter. 'Capitalization' is the quarter end capitalization. 'Firm age' is the number of quarters since a permno first appears in CRSP. 'Turnover' is the ratio of quarterly trading volume to outstanding shares. 'Dividend yield' is the ratio of quarterly dividend to stock price. 'book-to-market' is the ratio of book value of equity to market capitalization. 'Institutional demand' is the quarterly difference in percentage ownership of institutions. 'Return' is the quarterly stock return. 'Δ' indicates the first order difference of quarterly values. Based on standardized Wilcoxon Z-statistic, we assign a '*' next to a mean indicating statistically significant difference between the values for BHCs and the values for all firms (if Z-statistic is larger than 1.96).

Panel A: Institutional ownership and firm characteristics

Variables	Firm Type	Smallest Cap		2		3		4		Largest Cap	
		Mean	STD	Mean	STD	Mean	STD	Mean	STD	Mean	STD
Firm #	BHC	26		86		96		87		95	
Market Cap. ($ millions)		16 *	5	41	13	111	35	349	136	7165	13888
Idiosyncratic Volatility		0.04 *	0.03	0.03 *	0.02	0.02 *	0.01	0.02 *	0.01	0.01 *	0.01
IO (%)		8.87	11.95	7.89 *	8.15	13.38 *	12.15	20.74 *	15.18	37.90 *	17.86
Turnover		0.24 *	0.46	0.09 *	0.10	0.09 *	0.10	0.12 *	0.13	0.17 *	0.13
Dividend Yield		0.003	0.006	0.005 *	0.014	0.007 *	0.038	0.005 *	0.006	0.005 *	0.004
Firm Age		19.77 *	10.89	20.92 *	12.14	25.33	13.22	33.03 *	12.46	41.72 *	7.70
Book-to-Market		2.80	0.42	1.21 *	0.61	0.81	0.36	0.77 *	0.28	0.65 *	0.26
Firm #	Non-bank Firms	908		1025		1066		1106		1148	
Market Cap. ($ millions)		12	7	42	18	115	46	363	155	5926	15169
Volatility		0.07	0.05	0.05	0.03	0.04	0.02	0.03	0.01	0.02	0.01
IO (%)		7.97	11.41	16.51	14.79	28.70	18.36	43.05	21.22	52.74	19.53
Turnover		0.21	0.66	0.23	0.38	0.31	0.40	0.40	0.45	0.37	0.40
Dividend Yield		0.004	0.097	0.003	0.052	0.003	0.032	0.003	0.023	0.006	0.069
Firm Age		28.63	13.65	26.90	14.09	26.47	14.32	27.95	14.56	34.71	13.40
Book-to-Market		1.25	1.63	0.87	0.89	0.72	0.70	0.60	0.53	0.50	0.36

Table 2.1 Summary Statistics (cont.)
Panel B: Quarterly change variables

	Firm Type	Smallest Cap			2			3			4			Largest Cap		
		Mean		STD	Mean		STD	Mean		STD	Mean		STD	Mean		STD
Institutional Demand (%)	BHC	0.71	*	3.37	0.28	*	2.56	0.48	*	2.36	0.71	*	2.41	0.63	*	2.55
ΔIdiosyncratic Volatility		0.000	*	0.018	0.000		0.012	0.000		0.009	0.000		0.007	0.000		0.005
ΔTurnover		0.015		0.688	-0.004		0.095	-0.003		0.099	0.002		0.079	0.003		0.075
ΔDividend Yield		0.000		0.009	-0.002		0.038	0.002		0.041	0.000		0.003	0.000		0.002
ΔBook-to-Market		0.580		0.215	-0.037		0.298	-0.247		0.646	-0.006		0.130	-0.005		0.109
Return		0.032		0.201	0.037		0.154	0.049		0.134	0.048		0.118	0.047		0.104
Institutional Demand (%)	Non-bank Firms	-0.05		5.41	0.22		4.81	0.90		5.87	1.58		6.88	0.98		5.04
ΔIdiosyncratic Volatility		0.003		0.039	0.001		0.023	0.000		0.016	0.000		0.011	0.000		0.008
ΔTurnover		0.008		0.774	-0.003		0.378	-0.002		0.359	0.007		0.301	0.008		0.206
ΔDividend Yield		0.001		0.145	0.000		0.077	0.000		0.048	0.000		0.035	0.001		0.099
ΔBook-to-Market		0.024		0.987	0.013		0.497	0.008		0.396	0.005		0.255	0.000		0.146
Return		0.002		0.430	0.032		0.356	0.048		0.325	0.057		0.267	0.054		0.195

Table 2.2 Regression Results: BHCs

This table provides quarterly regression results from equation (1) using our BHC sample. Dependent variable is the institutional demand, measured by quarterly change in percentage institutional ownership. 'Change in Idiosyncratic Volatility' is the quarterly difference of natural logarithm of root mean squared errors from the Fama-French 4 factor model using daily returns within a quarter. 'Change in dividend yield' is the quarterly difference of natural logarithm of 1 plus dividend-to-price ratio. Change in book-to-market' is the quarterly difference of natural logarithm of 1 plus the ratio of book value of equity to market capitalization. 'Return' is quarterly raw return. All the independent variables are one quarter lagged except for same quarter return. All specifications are estimated with Fama-MacBeth methodology. All variables are standardized before used in cross-sectional OLS regressions. T-statistic is calculated based on Newey-West-adjusted Fama-MacBeth standard errors.

Panel A: Time periods

	1986-2006		**1986-1996**		**1997-2006**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
Δ Idiosyncratic Volatility (t-1)	0.0009	0.14	0.0034	0.28	-0.0017	-0.38
Δ Book-to-Market (t-1)	0.0024	0.13	-0.0244	-0.85	0.0299	1.5
Δ Dividend Yield (t-1)	0.0606	0.92	0.1176	0.92	0.0022	0.09
Δ Turnover (t-1)	0.0094	0.84	-0.0042	-0.32	0.0234	1.36
Return (t-1)	0.0759	2.81	0.0895	1.82	0.062	2.88
Return (t)	0.1122	6.13	0.1126	3.34	0.1118	7.68
Ave. No. of Firms	299		183		419	
Adj. R square	0.04		0.05		0.04	

Panel B: BHC size

	Small BHC		**Medium BHC**		**Large BHC**	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
Δ Idiosyncratic Volatility (t-1)	0.0833	0.96	-0.0935	-1.41	0.0044	0.51
Δ Book-to-Market (t-1)	-0.017	-0.34	0.1538	1.28	0.0469	1.66
Δ Dividend Yield (t-1)	-0.0597	-0.13	-1.6626	-1.55	0.16	1.48
Δ Turnover (t-1)	0.023	0.62	0.1326	0.97	0.0147	0.77
Return (t-1)	0.0236	0.73	0.255	1.79	0.1512	4.96
Return (t)	0.0668	1.96	0.0376	0.71	0.19	6.91
Ave. No. of Firms	81		96		123	
Adj. R square	-0.01		0.11		0.06	

Table 2.3 Regression Results, Non-bank Firms

This table provides quarterly regression results from equation (1) using all non-bank firms on NYSE/AMEX/Nasdaq. Dependent variable is the institutional demand, measured by quarterly change in percentage institutional ownership. Panel A report results using all available non-bank observations. In Panel B, we create a random sample from all available firms each quarter and use it for regression and reported estimates and T-statistics are average from 100 sampling. 'Small', 'Median' and 'Large' refer to firm size. We rank firm size annually. 'Small' contains firms from the bottom 4 size deciles. 'Medium' contains firms from middle 3 deciles while 'large' contains firms from the top four deciles. 'Change in Idiosyncratic Volatility' is the quarterly difference of natural logarithm of root mean squared errors from the Fama-French 4 factor model using daily returns within a quarter. 'Change in dividend yield' is the quarterly difference of natural logarithm of 1 plus dividend-to-price ratio. Change in book-to-market' is the quarterly difference of natural logarithm of 1 plus the ratio of book value of equity to market capitalization. 'Return' is quarterly raw return. All the independent variables are one quarter lagged except for same quarter return. All specifications are estimated with Fama-MacBeth methodology. All variables are standardized before used in cross-sectional OLS regressions. T-statistic is reported below the estimate. T-statistic is calculated based on Newey-West-adjusted Fama-MacBeth standard errors.

	ΔIdiosyncratic Volatility (t-1)	ΔBook-to-Market (t-1)	ΔDividend Yield (t-1)	ΔTurnover (t-1)	Return (t-1)	Return (t)	Ave. Firm #	Adj. R square
Panel A: All Non-bank Firms								
All	-0.0280						5047	0.00
	-10.59							
All	-0.0310	-0.0020	0.0030	0.0050	0.1010	0.1290	4625	0.04
	-14.61	-0.49	0.72	0.86	19.68	18.29		
Panel B: With Random Selection								
All	-0.0263				0.0996	0.1258	288	0.04
	-4.00				9.51	8.57		
All	-0.0295	0.0028	0.0027	0.0070	0.1094	0.1331	263	0.05
	-4.46	0.12	-0.03	0.69	8.47	9.41		
Small (D1 - D4)	-0.0187	-0.0048	-0.0281	0.0002	0.0481	0.0458	127	0.03
	-2.56	-0.48	-0.26	0.04	3.68	4.68		
Medium (D5 - D7)	-0.0386	-0.0055	0.1068	0.0144	0.1596	0.2057	129	0.09
	-3.15	-0.27	0.64	0.92	7.39	9.46		
Large (D8 - D10)	-0.0393	-0.0032	0.1126	0.0070	0.1649	0.3167	139	0.11
	-3.09	-0.17	0.53	0.41	5.75	9.47		

Table 2.4: Decomposition of Beta Estimate by Institution Subgroups

This table reports the decomposition results demonstrated in equation (3). Panels A to C provide adjusted beta coefficients constructed separately based on the three classifications discussed in section 3.1, i.e. legal types, diversification rank and informational advantage rank. Sum of contributions of each of the subgroups equals total beta, given in the 2nd column. The contribution of a subgroup is calculated by dividing the multiple of beta estimate for the subgroup and cross-sectional standard deviation of un-standardized changes in ownership by that subgroup by the cross-sectional standard deviation of un-standardized changes in ownership by all institutions. Contributions are calculated quarterly and time-series average for three time periods are provided. In rows 1, 4, 7 and 11 of Panel A, based on standardized Wilcoxon Z-statistic, we assign a '*' next to a value indicating statistically significant difference between the beta estimate for left-hand-side subgroup and beta estimate for bank trusts (if Z-statistic is larger than 1.96). For example, a '*' to the right of 'Mutual' indicates that the '86-06' beta estimate for bank trusts is statistically different from the '86-06' beta estimate for mutual funds. In rows 2, 5, 8 and 12 of Panel A, B and C, we assign a '*' to indicate the statistical significance of the difference between the '86-96' beta estimate and '97-06' beta estimate for each subgroup. In rows 1, 4, 7 and 11 of Panel B and C, '*' indicates the statistical difference between the beta estimates of the subgroup at the left-hand-side end of each classification and the beta estimate of another subgroup.

Panel A: Legal Types

	Year	All	Banks		Ins. Co.		Mutual		Independent		Others	
						All Firms						
1	86-06	-0.0294	-0.0038		-0.0013	*	-0.0062	*	-0.0173	*	-0.0009	*
2	86-96	-0.0327	-0.0039		-0.0021		-0.0050		-0.0207	*	-0.0010	
3	97-06	-0.0258	-0.0037		-0.0004		-0.0074		-0.0136		-0.0007	
						BHCs						
4	86-06	-0.0052	0.0109		-0.0020		-0.0007		-0.0151	*	0.0016	
5	86-96	-0.0035	0.0196		-0.0038		0.0020		-0.0236		0.0022	
6	97-06	-0.0071	0.0015		-0.0001		-0.0036		-0.0059		0.0010	
						BHCs with Identified Affiliated Trusts						
7	86-06	0.0046	0.0185		-0.0038	*	-0.0020	*	-0.0088	*	0.0007	
8	86-96	0.0103	0.0272	*	-0.0058		0.0040		-0.0151		-0.0001	
9	97-06	-0.0034	0.0063		-0.0009		-0.0105		0.0000		0.0018	

	Year	Banks	Aff. Bank Trust	Non-Aff. Trust
			BHCs with Identified Affiliated Trusts	
11	86-06	0.0185	0.0124	0.0061
12	86-96	0.0272	0.0207	0.0066
13	97-06	0.0063	0.0008	0.0055

Table 2.4: Contribution to Total Beta Coefficient by Institution Subgroups (cont.)

Panel B: Classification Based on Diversification Measures

Year	All	No. of Shares In A Manager's Portfolio Subgroups				
		Smallest	2		Largest	
		All Firms				
86-06	-0.0294	-0.0014	-0.0039	*	-0.0240	*
86-96	-0.0327	-0.0026	-0.0051	*	-0.0250	
97-06	-0.0258	-0.0001	-0.0027		-0.0230	
		BHCs				
86-06	-0.0052	0.0039	-0.0058		-0.0036	
86-96	-0.0035	0.0051	-0.0108		0.0022	
97-06	-0.0071	0.0025	-0.0004		-0.0099	
		BHCs with Identified Affiliated Trusts				
86-06	0.0046	0.0006	-0.0051		0.0091	
86-96	0.0103	-0.0043	-0.0100		0.0246	*
97-06	-0.0034	0.0074	0.0017		-0.0125	

Year	All	Normalized Volatility Subgroups				
		Lowest	2		Highest	
		All Firms				
86-06	-0.0294	-0.0170	-0.0100	*	-0.0024	*
86-96	-0.0327	-0.0187	-0.0105		-0.0036	*
97-06	-0.0258	-0.0153	-0.0094		-0.0011	
		BHCs				
86-06	-0.0052	-0.0106	-0.0027		0.0078	*
86-96	-0.0035	-0.0132	-0.0094		0.0191	*
97-06	-0.0071	-0.0079	0.0044		-0.0043	
		BHCs with Identified Affiliated Trusts				
86-06	0.0046	-0.0078	-0.0003		0.0126	
86-96	0.0103	-0.0035	-0.0081		0.0218	
97-06	-0.0034	-0.0138	0.0107		-0.0003	

Table 2.4: Contribution to Total Beta Coefficient by Institution Subgroups (cont.)

Panel C: Classification Based on Informational Advantage

Year	All	Mgr's Percentage Ownership Subgroups		Portfolio Weight Subgroups	
		High	Low	Large	Small
			All Firms		
86-06	-0.0294	-0.0212	-0.0082 *	-0.0021	-0.0273 *
86-96	-0.0327	-0.0199	-0.0128	-0.0024	-0.0303
97-06	-0.0258	-0.0225	-0.0033	-0.0018	-0.0240
			BHCs		
86-06	-0.0052	-0.0030	-0.0022	0.0086	-0.0138 *
86-96	-0.0035	-0.0034	-0.0001	0.0116	-0.0151
97-06	-0.0071	-0.0025	-0.0046	0.0053	-0.0124
			BHCs with Identified Affiliated Trusts		
86-06	0.0046	0.0120	-0.0074	0.0148	-0.0102
86-96	0.0103	0.0149	-0.0046	0.0149	-0.0046
97-06	-0.0034	0.0079	-0.0113	0.0146	-0.0180

Year	All	Portfolio Turnover Subgroups		
		Lowest	2	Highest
			All Firms	
86-06	-0.0294	-0.0039	-0.0120 *	-0.0135 *
86-96	-0.0327	-0.0043	-0.0109	-0.0176 *
97-06	-0.0258	-0.0034	-0.0132	-0.0091
			BHCs	
86-06	-0.0052	-0.0009	0.0067	-0.0110
86-96	-0.0035	-0.0018	0.0137	-0.0154
97-06	-0.0071	0.0001	-0.0009	-0.0063
			BHCs with Identified Affiliated Trusts	
86-06	0.0046	0.0146	0.0063	-0.0162 *
86-96	0.0103	0.0027	0.0200 *	-0.0125
97-06	-0.0034	0.0312	-0.0130	-0.0215

Table 2.5: Ownership composition comparison, BHCs vs. Non-bank

This table reports the average decomposed ownerships by subgroups of institutions for BHCs and for all non-bank firms. The value reported is the ratio of the ownership by a subgroup of institutions to the total institutional ownership. To control for firm capitalization effect on institutional ownership, we divide all stocks into 10 size deciles and then within each decile we compare the institutional investor ownership of BHCs with that of all firm. Based on quarterly standardized Wilcoxon Z-statistic, we assign a '*' next to a value indicating statistical significant difference between the value for BHCs and that for non-bank firms.

Panel A: Legal Types

Size	Banks			Ins. Co.			Mutual			Independent			Others		
	Non-bank	BHC		Non-bank	BHC		Non-bank	BHC		Non-bank	BHC		Non-bank	BHC	
0	29.9	20.8	*	4.1	6.9	*	5.1	12.0		54.5	56.0		2.9	3.1	*
1	23.6	26.2		4.5	11.5	*	7.5	8.7		59.9	47.9	*	3.0	3.0	*
2	20.3	30.9	*	3.9	6.0		9.3	9.5		62.4	48.8	*	3.4	3.5	*
3	17.7	29.7	*	3.8	4.8		10.9	10.7		63.6	50.9	*	3.7	2.7	*
4	17.3	30.2	*	4.2	3.6	*	12.3	11.9		61.4	51.0	*	4.6	2.7	*
5	17.2	33.7	*	4.6	3.0	*	14.0	13.0		58.9	46.6	*	5.2	3.3	*
6	17.1	36.5	*	5.6	2.9	*	15.4	12.2	*	56.0	43.9	*	6.0	4.5	*
7	17.0	38.6	*	7.2	4.0	*	16.8	12.9	*	52.8	39.6	*	6.3	4.9	*
8	17.8	36.9	*	8.0	5.9	*	18.6	14.1	*	48.4	36.5	*	7.2	6.6	
9	21.4	27.0	*	8.5	8.8		19.4	17.0	*	41.6	38.4	*	9.2	8.9	

Table 2.5: Ownership composition comparison, BHCs vs. Non-bank (cont.)

Panel B: Classification Based on Normalized Volatility

Size	Low			Medium			High		
	Non-bank	BHC		Non-bank	BHC		Non-bank	BHC	
0	59.9%	59.0%		30.3%	33.8%		6.2%	6.1%	*
1	66.7%	56.6%	*	26.0%	34.3%	*	5.7%	6.4%	
2	69.2%	56.8%	*	24.8%	31.9%	*	5.2%	9.9%	*
3	69.9%	59.1%	*	24.6%	30.7%	*	5.1%	8.9%	*
4	68.9%	57.4%	*	25.9%	32.0%	*	5.0%	9.9%	*
5	66.7%	55.2%	*	27.8%	35.7%	*	5.4%	8.7%	*
6	63.6%	52.1%	*	30.2%	37.4%	*	6.1%	10.4%	*
7	60.2%	49.0%	*	32.6%	39.3%	*	7.2%	11.7%	*
8	52.3%	46.0%	*	37.9%	41.7%		9.8%	12.3%	*
9	37.9%	35.6%		46.6%	47.4%		15.4%	17.0%	

Panel C: Classification Based on Portfolio Turnover

Size	Low			Medium			High		
	Non-bank	BHC		Non-bank	BHC		Non-bank	BHC	
0	45.6%	40.5%	*	33.9%	47.3%	*	16.9%	11.1%	*
1	41.4%	26.9%	*	37.5%	56.3%	*	19.7%	14.1%	*
2	40.2%	31.4%	*	38.1%	50.9%	*	21.0%	16.4%	*
3	37.6%	36.6%		38.4%	46.5%	*	23.6%	15.6%	*
4	35.6%	42.5%	*	38.9%	41.1%		25.3%	15.8%	*
5	32.9%	48.3%	*	38.7%	36.9%		28.3%	14.4%	*
6	30.6%	47.0%	*	39.7%	37.0%	*	29.7%	15.9%	*
7	28.9%	46.9%	*	40.1%	37.8%	*	31.0%	15.2%	*
8	28.4%	42.3%	*	41.0%	39.7%		30.6%	17.9%	*
9	33.7%	38.4%	*	41.7%	41.1%		24.6%	20.5%	*

Table 2.6: Correlation among Classifications

This table shows the correlation between manager classifications. It provides the time series average of Spearman correlation between the portfolio turnover rank and normalized volatility rank each year.

	Normalized volatility Rank	Portfolio Turnover Rank
Normalized Volatility Rank	1.00	-0.30
Portfolio Turnover Rank	-0.30	1.00

Table 2.7 Regression Results: High vs. Low Idiosyncratic Volatility Firms

This table provides regressions results for equation (1) using 10 double-sorted portfolios of firms. Firms are first sorted by capitalization and level of idiosyncrasies volatility separately. Then in each of 5 capitalization quintiles, we group firms into subgroups with high, median and low level of idiosyncratic volatility. Only beta estimate for variable, change in idiosyncratic volatility is given. Panel A gives results for aggregate institutional demand while Panel B gives results for demand by relatively well-diversified institutions.

Size Quintile	Idiosyncratic Volatility	Δ Idiosyncratic Volatility (t-1)		Ave. No. of Firms	Adj. R square	# of Cross-sections
		Est.	t-Stat			
Panel A: Aggregate Institutional Demand						
1	Low	-0.0085	-1.13	78	0.03	80
	High	-0.0138	-3.93	619	0.02	80
2	Low	-0.0014	-0.30	160	0.03	80
	High	-0.0323	-8.06	533	0.04	80
3	Low	-0.0169	-1.66	246	0.04	80
	High	-0.0548	-6.49	396	0.09	80
4	Low	-0.0264	-2.57	485	0.04	80
	High	-0.0573	-5.35	192	0.15	80
5	Low	-0.0185	-4.12	892	0.04	80
	High	-0.1435	-2.81	48	0.22	80
Panel B: Demand by Institutions with Relatively Higher Level of Diversification						
1	Low	-0.0065	-0.80	78	0.03	80
	High	-0.0151	-4.62	619	0.01	80
2	Low	0.0015	0.23	160	0.02	80
	High	-0.0359	-7.18	533	0.03	80
3	Low	-0.0121	-1.09	246	0.03	80
	High	-0.0557	-6.98	396	0.05	80
4	Low	-0.0236	-2.37	485	0.02	80
	High	-0.0478	-4.39	192	0.07	80
5	Low	-0.0053	-1.97	892	0.02	80
	High	0.0306	0.38	48	0.09	80

Table 2.8 Informed Trading Intensity: BHCs vs. Non-bank Firms

This table provides a comparison between the average trade size of institutional investors for BHCs and that for non-bank firms. Firms are first sorted by capitalization and average size of institutional trade separately. Then in each of 5 capitalization quintiles, we provide the average of trade size for BHCs and non-bank firms, separately. We report standardized Wilcoxon Z-statistic indicating statistical significant difference between the value for BHCs and that for non-bank firms.

Size Quintile	Firm	Average Trade Size		Ave. No. of Firms
		Est.	Z-Stat	
1	Non-bank	0.0034	1.5	909
	BHC	0.0046		26
2	Non-bank	0.0032	2.5	1025
	BHC	0.0030		86
3	Non-bank	0.0031	8.0	1066
	BHC	0.0020		96
4	Non-bank	0.0026	10.1	1106
	BHC	0.0013		87
5	Non-bank	0.0012	9.8	1148
	BHC	0.0006		95

Table 2.9 Regression Results: High vs. Low Intensity of Informed Trading Firms

The table provides regressions results for equation (1) using 10 double-sorted portfolios of firms. Firms are first sorted by capitalization and level mean trade-size separately. Then in each of 5 capitalization quintiles, we group firms into subgroups with large, median and small mean-trade-size. Mean trade-size is the average of all absolute value of changes in individual managers' ownership for a stock within a quarter. Only beta estimate for variable, change in idiosyncratic volatility is given. Panel A gives results for aggregate institutional demand while Panel B gives results for demand by relatively better informed institutions.

Size Quintile	Mean Trade Size	Δ Idiosyncratic Volatility (t-1) Est.	t-Stat	Ave. #. of Firms	Adj. R square	# of Cross-sections
Panel A: Aggregate Institutional Demand						
1	Small	-0.0011	-1.98	372	0.01	80
	Large	-0.0283	-4.18	300	0.02	80
2	Small	-0.0023	-2.80	283	0.03	80
	Large	-0.0375	-5.57	416	0.04	80
3	Small	-0.0054	-3.30	208	0.04	80
	Large	-0.0469	-5.01	499	0.08	80
4	Small	-0.0078	-2.54	232	0.05	80
	Large	-0.0665	-5.28	462	0.11	80
5	Small	-0.0130	-3.01	748	0.06	80
	Large	-0.0879	-2.37	110	0.12	80
Panel B: Demand by Relatively Better Informed Institutions						
1	Small	-0.0003	-0.76	372	0.00	80
	Large	-0.0105	-1.82	300	0.02	80
2	Small	-0.0007	-1.07	283	0.01	80
	Large	-0.0313	-4.23	416	0.05	80
3	Small	-0.0024	-1.35	208	0.03	80
	Large	-0.0242	-2.31	499	0.11	80
4	Small	-0.0072	-1.79	232	0.05	80
	Large	-0.0539	-4.06	462	0.17	80
5	Small	-0.0037	-1.17	748	0.11	80
	Large	-0.0805	-1.68	110	0.19	80

Table 2.10 Regression Results: BHCs vs. Non-Financial Control Firms

This table reports regression results for equation (1) for three samples, BHCs held by affiliated trusts, BHCs not held by affiliated trust and Non-Financial Control Firms. 'Non-Financial Control Firms' are obtained by random sampling form non-bank firms with low idiosyncratic volatility, small mean trade size and size similar to BHCs. Panel A gives results for aggregate institutional demand while Panel B gives results for demand by bank trusts.

Panel A: Dependent variable is demand by all institutions

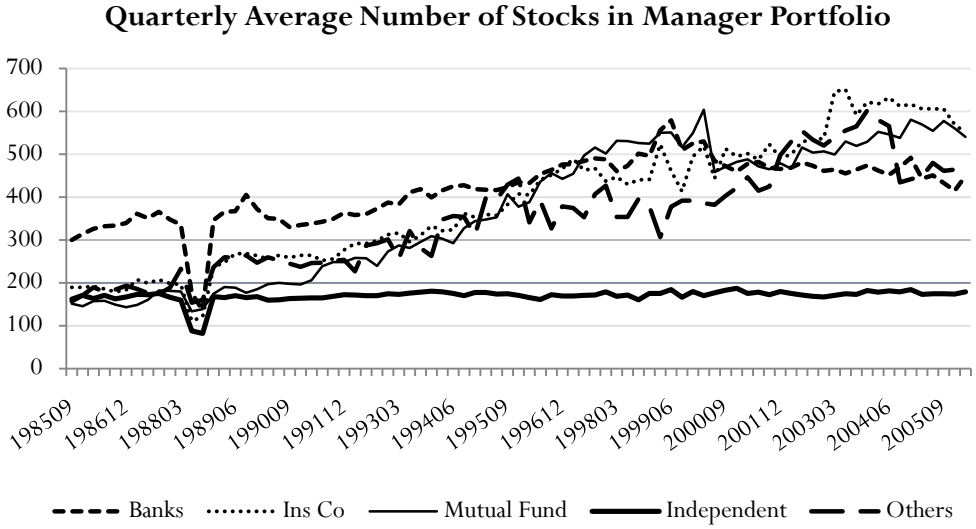
	BHC Held by Aff. Trust		BHC Not Held by Aff Trust		Non-bank Control Firms	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
Δ Idiosyncratic Volatility (t-1)	-0.0007	-0.09	-0.0426	-1.54	-0.0073	-1.21
Δ Book-to-Market (t-1)	-0.0302	-1.17	-0.0459	-0.56	-0.0229	-0.72
Δ Dividend Yield (t-1)	-0.0295	-0.25	-11.2810	-1.17	-0.1190	-2.53
Δ Turnover (t-1)	-0.0069	-0.4	-0.3823	-0.95	-0.0216	-2.01
Return (t-1)	0.0380	1.33	-0.1272	-0.96	0.0379	1.43
Return (t)	0.1166	4.74	0.0459	0.59	0.1516	11.34
Ave. No. of Firms	95		48		180	
Adj. R square	0.05		0.11		0.05	

Panel B: Dependent variable is demand by bank trusts

	BHC Held by Aff. Trust		BHC Not Held by Aff Trust		Non-bank Control Firms	
	Estimate	t-statistic	Estimate	t-statistic	Estimate	t-statistic
Δ Idiosyncratic Volatility (t-1)	0.0214	2.09	-0.0055	-0.12	0.0029	0.43
Δ Book-to-Market (t-1)	0.0073	0.18	0.1835	0.92	-0.0052	-0.2
Δ Dividend Yield (t-1)	0.0859	0.51	-0.5714	-0.29	-0.0455	-0.66
Δ Turnover (t-1)	-0.0237	-1.01	0.0694	0.47	-0.0433	-2.62
Return (t-1)	0.0236	0.48	-0.0023	-0.04	0.0439	1.81
Return (t)	0.0595	2.48	-0.1939	-0.97	0.0700	4.39
Ave. No. of Firms	95		48		180	
Adj. R square	0.01		0.06		0.01	

Figure 1: Quarterly Means of Number of Stocks in Manager Portfolio and Dollar Value of Manager Portfolio

This figure describes the means of the number of stock in and the dollar value of individual institutional managers' portfolios over time period from 198506 to 200606. Each quarter, we calculate the total number of stocks in every portfolio of managers who file form 13F and then find the means for five legal types of institutional investors, i.e. bank trusts, insurance companies, mutual funds, independent investment advisor and other institutional investors. Dollar value of each manager's portfolio is the sum of the dollar value of each stock he/she owns according to the quarter-end price.



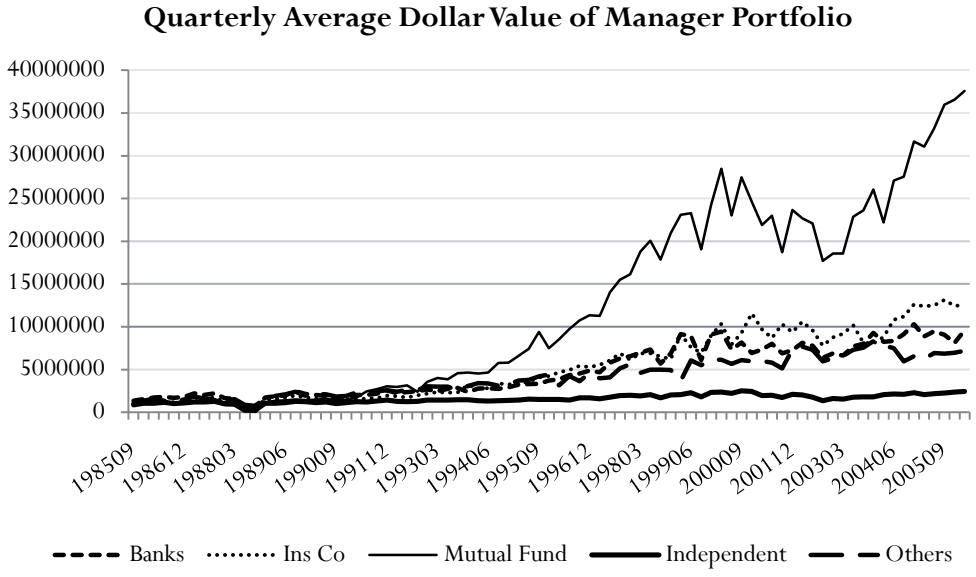
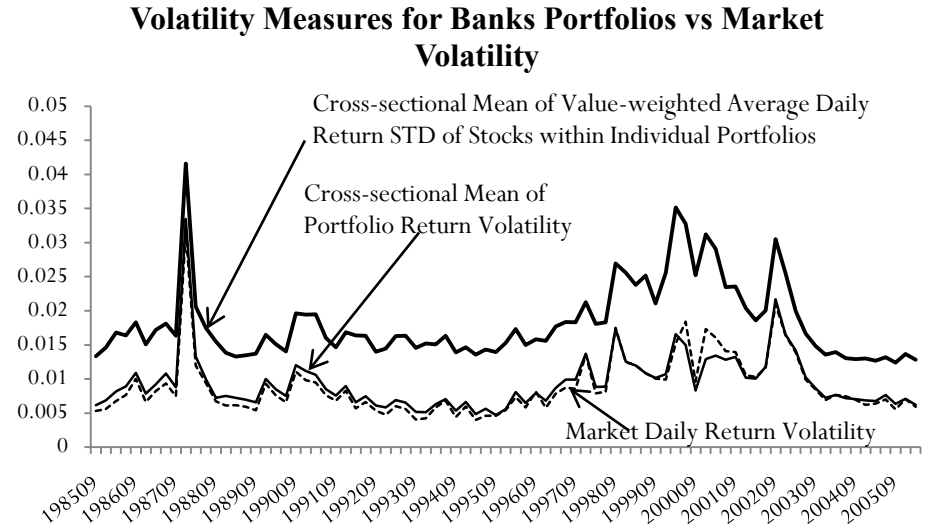
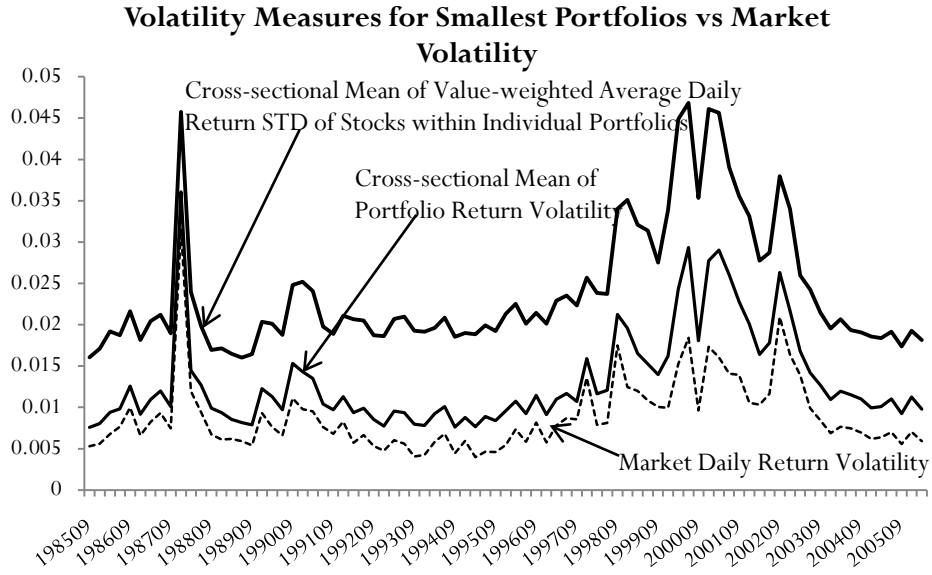


Figure 2: Volatility Measures for Banks Portfolios vs. Market Volatility and Volatility Measures for Fewest-stock Portfolios vs. Market Volatility

The figure describes the cross-sectional means of value-weighted average daily return standard deviation of stocks within a manager's portfolio and standard deviation of portfolio return and the standard deviation of daily market returns for every quarter from 198506 to 200606. Every quarter, portfolio volatility is calculated as the standard deviation of daily portfolio return, i.e. the value-weighted average of daily stock returns within a manager portfolio. The value-weighted average stock volatility is the value-weighted average of the daily return standard deviations of stocks in a manager's portfolio. The results for bank trusts and for institutions with smallest average number of stock in their portfolio are provided separately.





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APPENDIX

Appendix A: Manager Diversification Measure

Following, we use two measures to proxy for the achieved level of diversification.

We use the number of stocks in the portfolio of a manager as a crude measure and the normalized portfolio return volatility as a more refined measure. Number of stocks within a portfolio as a proxy for diversification does not differentiate passive diversification from active diversification. Normalized portfolio return volatility is calculated as the ratio of portfolio return volatility to average volatility across stocks within a portfolio.

$$NV = \frac{\sigma_P}{\bar{\sigma}}$$

Every quarter, portfolio volatility is calculated as the standard deviation of daily portfolio returns, i.e. the value-weighted averages of daily stock returns within a manager portfolio. To be consistent with the portfolio return, we compute average stock volatility as a value-weighted average of daily return standard deviation across stocks.

[Insert Figure 1 here]

The cross-sectional mean of the number of stocks within each manager portfolio, as well as the average market value of the portfolio, has increased sharply over the sample period, as shown in Figure 1. However, when broken down by type, institutions do not increase the number of stocks in their portfolio by the same speed: banks start from 300 and reach 450; insurance companies, mutual funds and others start from around 180 and reach over 500; while independent advisors stay steadily at 180 over time.

The time series of cross-sectional means of portfolio volatility and average stock volatility (value-weighted and equally weighted) closely track the time series of market volatility: true for all sizes of portfolios, but the largest managers' portfolio volatility is only slightly higher than the market all the time throughout the sample period.

[Insert Figure 2 here]

Different types (banks, insurance companies, mutual funds, independent investment advisors, others) of institutions do not behave significantly different in terms of cross-sectional average portfolio volatility, while, banks are somewhat more risk-averse than any other type of institutions.

Appendix B: Identifying Large-stake-holder Institutions

We define a large stake to be either of large percentage of outstanding shares or of large manager portfolio weight.

We identify a manger to be a large-stake-holder if her ownership exceeds a critical value. This critical value is the cross-sectional mean of the percentage holding of an individual manager. Since the percentage ownership value tends to be right-skewed, using the means as critical values will allow us to identify larger stake holders. When we divide all observations into five size groups based on firm capitalization, we find statistically different means of percentage holding across size groups. Using one critical value for all sizes of firms might cause large stake holders of large firms not to be identified. Hence, we calculated cross-sectional means for each size group and use them for all firms within each corresponding size group. In addition, since firm size and institutional ownership have both substantially increased over time, our critical values are also time-varying: one critical value is assigned to sample period from June 1986 to June 1996 and another one is assigned to sample period from June 1996 to June 2006. (We find that average percentage ownership for a manager has decreased over time and more so for smaller firms.)

We also identify a manager to be large-stake-holder if the portfolio weight that she assigns to a stock exceeds a critical value. This critical value is the cross-sectional means of portfolio weights. As for critical values for percentage holding, our critical values for portfolio weights are conditional on manager portfolio size and time.

We do not follow the exact approach of Bushee and Goodman (2007) because their approach tends to ignore variation across firms. Our approach will result in some firms that do not have large-stake-holders while theirs will never do so.

Appendix C: Manager Portfolio Turnover

Yan and Zhang (2009)'s measure of portfolio turnover is the ratio of the minimum of purchase and sell over the average of purchase and sell. It can be expressed as:

$$CR_{k,t} = \frac{min\left(CR\_buy_{k,t},\ CR\_sell_{k,t}\right)}{\sum_{i=1}^{N_{k,t}} \frac{S_{k,i,t}P_{i,t} + S_{k,i,t-1}P_{i,t-1}}{2}}$$

$CR\_buy_{k,t}$ $CR\_sell_{k,t}$ are aggregated purchase and sell made by manager k at quarter t. is the number of stocks in the portfolio of manager k at quarter t. They are calculated as:

$$CR\_buy_{k,t} = \sum_{\substack{i=1 \\ S_{k,i,t} > S_{k,i,t-1}}}^{N_{k,t}} \left|S_{k,i,t}P_{i,t} - S_{k,i,t-1}P_{i,t-1} - S_{k,i,t-1}\Delta P_{i,t-1}\right|$$

$$CR\_sell_{k,t} = \sum_{\substack{i=1 \\ S_{k,i,t} \leq S_{k,i,t-1}}}^{N_{k,t}} \left|S_{k,i,t}P_{i,t} - S_{k,i,t-1}P_{i,t-1} - S_{k,i,t-1}\Delta P_{i,t-1}\right|$$

$S_{k,i,t}$ is number of share of stock i held by manager k at quarter t and $P_{i,t}$ is the price of stock i at quarter t.

We calculate quarterly turnover rate for every sample manager. Ranking based on this measure is done annually according to the average turnover rate over four quarters.

Appendix D: Decomposition of Total Beta into Betas for Subgroups

Our decomposition follows the exact logic in Bennett, Sias and Starks (2003). Based on one of our three classifications, all individual institutional investors of a firm will be grouped into K groups each quarter. Then we divide total change in institutional percentage ownership into K parts – each for one of the K subgroups. The change in ownership of subgroup k for stock i in quarter t is defined as:

$$change_{i,t}^{k} = \Delta IO_{i,t}^{k} = \sum_{j}^{j \in k} \Delta IO_{j,i,t}$$

"j" identifies an individual manager. "j ∈ k" indicates that manager j belongs to subgroup k.

Hence, aggregated change in institutional percentage ownership is the sum of the changes for K subgroups.

$$\Delta IO_{i,t} = \sum_{k=1}^{K} \sum_{j}^{j \in \, subgroup \; k} \Delta IO_{j,i,t}$$

Then, we have the equality for covariance:

$$\mathrm{cov}\left(\Delta \mathrm{IO}_{i,t}, \Delta\sigma_{i,t-1}\right)$$

$$= \mathrm{cov}\left(\Delta \mathrm{IO}_{i,t}^{\mathrm{Subgroup\ 1}}, \Delta\sigma_{i,t-1}\right) + \cdots + \mathrm{cov}\left(\Delta \mathrm{IO}_{i,t}^{\mathrm{Subgroup\ K}}, \Delta\sigma_{i,t-1}\right)$$

Therefore, if we use un-standardized data in regression of equation (1), we will have the following equality for quarter t:

$$b_t^{subgroup\ 1} + \cdots + b_t^{subgroup\ k} + \cdots + b_t^{subgroup\ K}$$

$$= \frac{cov\left(\Delta IO_{i,t}^{Subgroup\ 1}, \Delta\sigma_{i,t-1}\right)}{var\left(\Delta\sigma_{i,t}\right)} + \cdots + \frac{cov\left(\Delta IO_{i,t}^{Subgroup\ k}, \Delta\sigma_{i,t-1}\right)}{var\left(\Delta\sigma_{i,t}\right)} + \cdots$$

$$+ \frac{cov\left(\Delta IO_{i,t}^{Subgroup\ K}, \Delta\sigma_{i,t-1}\right)}{var\left(\Delta\sigma_{i,t}\right)}$$

$$= \frac{cov(\Delta IO_{i,t}, \Delta\sigma_{i,t-1})}{var(\Delta\sigma_{i,t})} = b_t$$

b_t, and $b^{subgroup\ k}t$ are beta estimates from equation (1) using quarterly aggregated change in percentage ownership and change in ownership of subgroup k as dependent variable respectively.

When we use standardized data, this equality does not hold for the new beta estimates, β_t, and $\beta^{subgroup\ k}t$. The new beta estimate for subgroup k will be:

$$\beta_t^{subgroup\ k} = \frac{cov\left(\frac{\Delta IO_{i,t}^{subgroup\ k} - \overline{\Delta IO_{i,t}^{subgroup\ k}}}{std\left(\Delta IO_{i,t}^{subgroup\ k}\right)}, \frac{\Delta\sigma_{i,t-1} - \overline{\Delta\sigma_{i,t-1}}}{std\left(\Delta\sigma_{i,t-1}\right)}\right)}{var\left(\frac{\Delta\sigma_{i,t-1} - \overline{\Delta\sigma_{i,t-1}}}{std\left(\Delta\sigma_{i,t-1}\right)}\right)}.$$

We can re-write it into the following form:

$$\beta_t^{subgroup\ k} = \frac{\frac{cov(\Delta IO_{i,t}^{subgroup\ k}, \Delta\sigma_{i,t-1})}{std(\Delta IO_{i,t}^{subgroup\ k})std(\Delta\sigma_{i,t-1})}}{\frac{var(\Delta\sigma_{i,t-1})}{var(\Delta\sigma_{i,t-1})}} = b_t^{subgroup\ k} \frac{std\,(\Delta\sigma_{i,t-1})}{std(\Delta IO_{i,t}^{subgroup\ k})}$$

Similarly, we have:

$$\beta_t = b_t \frac{std(\Delta\sigma_{i,t-1})}{std\,(\Delta IO_{i,t})}$$

Substitute out b_t, and $b^{subgroup\ k}t$ with β_t, and $\beta^{subgroup\ k}t$ and then we get:

$$\frac{std(\Delta IO_{i,t})}{std\,(\Delta\sigma_{i,t-1})}\beta_t = \frac{std\,(\Delta IO_{i,t}^{\text{subgroup 1}})}{std\,(\Delta\sigma_{i,t-1}))}\beta_t^{\text{subgroup 1}} + \cdots + \frac{std\left(\Delta IO_{i,t}^{\text{subgroup k}}\right)}{std(\Delta\sigma_{i,t-1}))}\beta_t^{\text{subgroup k}} + \cdots + \frac{std(\Delta IO_{i,t}^{\text{subgroup K}})}{std(\Delta\sigma_{i,t-1}))}\beta_t^{\text{subgroup K}}$$

Re-arrange and we obtain the revised equality among betas from standardized data:

$$\beta_t = \frac{\text{std}(\Delta\text{IO}_{i,t}^{\text{subgroup 1}})}{\text{std}(\Delta\text{IO}_{i,t})}\beta_t^{\text{subgroup 1}} + \cdots + \frac{\text{std}(\Delta\text{IO}_{i,t}^{\text{subgroup K}})}{\text{std}(\Delta\text{IO}_{i,t})}\beta_t^{\text{subgroup K}}$$

Appendix E: Definitions of variables

Variable Name	Definition
Insider Purchase (in %)	percentage of shares outstanding purchased by insiders
Insider Sales (in %)	percentage of shares outstanding sold by insiders
Net Insider Demand (in %)	(Insider Purchase - Insider Sales) / (Insider Purchase + Insider Sales)
Total Stock Held by Executives (in %)	percentage of shares outstanding owned by company executives, including restricted and unrestricted shares
Total Option Held by Executives (in %)	percentage of share outstanding owned by company executives via options, including unexercised un-exercisable and unexercised exercisable options
ln(daily return standard deviation)	natural log of 1 plus standard deviation of daily returns, using only within quarter data
ln(1+non-performing loans ratio)	natural log of 1 plus non-performing loan ratio, which is non-performing loans divided by total loans
ln(1+non-interest income ratio)	natural logarithm of 1 plus the ratio of total non-interest income to the sum of total interest and non-interest income
ln(1+other non-interest income ratio)	natural logarithm of 1 plus the ratio of other non-interest income to total interest income
ln(1+capital ratio)	natural log of 1 plus equity capital divided by total assets
ln(1+stock turnover)	natural log of 1 plus turnover rate, which is quarterly volume divided by quarter-end outstanding shares
ln(capitalization)	natural log of capitalization
district	physical federal district code
# of banks held by BHC	number of subsidiary banks
ln(total assets)	natural log of total assets
ln(1+book-to-market ratio)	natural log of 1 plus book-to-market ratio, which is equity capital divided by capitalization
quarterly stock return	quarterly stock return