Master thesis

Managerial ownership and bank risk taking

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Abstract

This thesis investigates the relation between managerial stockownership and bank risk taking, using different proxies for risk taking. The relation will be tested with the creation of a new database for the United States that includes 120 banks during the period 2000-2010. Proxies for risk taking include: the z-score, volatility of earnings, loan loss provision ratio, volatility of stock return, and yearly z-score. Empirical assessment indicates that the effect of managerial ownership on bank risk taking differs depending on what risk measure is used as the dependent variable. Overall, this study concludes that managerial ownership positively influences bank risk taking and some of these findings appear to be significant. In addition, the franchise value appears to be negatively related to bank risk taking, while the presence of a large shareholder is expected to lead to more risk taking. These findings appear to be significant in some of the regressions. Next to this, findings indicate that it can be expected that an increase in the percentage of shares held by institutional investors leads to more risk taking, but this finding is not significantly confirmed.

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1. Introduction

In this thesis, the relation between managerial stockownership and bank risk taking will be studied. To assess this relation, a new database will be created that covers 120 banks in the United States during the period 2000-2010. Empirical assessment indicates that the effect of managerial ownership on bank risk taking differs depending on what risk measure is used as the dependent variable. Proxies for risk taking include: the z-score, volatility of earnings, loan loss provision ratio, volatility of stock return, and yearly z-score. Overall, this study concludes that managerial ownership positively influences bank risk taking, which is consistent with some previous findings (Saunders, Strock & Travlos, 1990; Demsetz, Saidenberg & Strahan, 1997), but in contrast to others (Anderson & Fraser, 2000).

The ongoing banking crisis highlights the unstable nature of banking and the tendency of banks to take on excessive risks. Following the failure of Lehman Brothers in September 2008, many banks went bankrupt. Although it all started in the United States, Europe was affected as well. During 2007-2008, the European banks wrote down a total of $200 billion in bad debts (Haq & Heaney, 2012). At the end of 2007, most of the banks had leveraged up 30 times their equity and this was not an exception (Carmassi, Gros & Micossi; 2009). Recently, banks and governments are negotiating about new proposals to increase the health of the banking sector. These proposals were designed to strengthen bank capital and liquidity regulation with a view to increase the stability of the banking sector (Hag & Heaney, 2012).

Although regulation could help in decreasing the risk taking by banks, Bhattacharyya and Purnanandam (2011) blame the CEO's and the managers of the banks as a cause of the increase in risk taking by banks. Their analysis on compensation and risk taking by banks provides a possible explanation about the excessive levels of risk taking. They show that it was in the interest of the bank CEO's to boost their banks' short-term earnings by taking on greater levels of systematic risk in a booming market as their compensation depended heavily on EPS (Bhattacharyya & Purnanandam, 2011). This study indicates that managers have incentives to increase risk and this is confirmed by previous research (Saunders et al., 1990; Demsetz et al., 1997).

It is interesting to study whether risk taking is encouraged by rewarding stockownership to the managers. If stockownership could explain the excessive risk taking by banks, this could be one of the potential causes of the banking crisis. If a clear relation can be found between managerial stockownership and bank risk taking, actions can be taken by the stockholders or even by the government to change risk taking incentives. This is a relevant discussion, due to the fact that many world leaders are looking for regulations that can lower bank risk taking. Although regulation in the banking industry can lower bank risk taking, attention can also be given to changing incentives and trying to solve fundamental issues that could influence bank risk taking.

A growing literature has been written about the relation between managerial ownership and bank risk taking. While some studies found positive and significant relations between managerial ownership and risk taking (Saunders et al., 1990; Chen & Steiner, 1999; Chen, Steiner & Whyte, 2006), other studies found mixed results in different periods (Anderson & Fraser, 2000) and could only suggest that managerial stockownership can influence bank risk taking. Also, it appeared that some studies found no relationship between the percentage of stockownership held by bank CEO's and the level of risk taking (Houston & James, 1995).

More recent studies on bank risk taking, suggest that there are fields that are unexplored and problems that are unanswered yet. Recent studies like Laeven and Levine (2009) focused on bank governance, regulation and risk taking; while Houston, Lin, Lin and Ma (2010) focused on creditor rights, information sharing and bank risk taking; and Erkens, Hung and Matos (2012) focused on corporate governance and determinants of bank risk taking. Except for one regression by Laeven and Levine (2009), these studies did not take managerial stockownership into account as one of the potential explaining factors for bank risk taking.

Although much is written about this topic, there still exists a gap in the current literature. Most of the studies to the relation between managerial ownership and bank risk taking are conducted for the period prior to the financial crisis (Saunders et al., 1990; Demsetz et al., 1997; Anderson & Fraser, 2000; Chen, Steiner & Whyte, 2001). Other studies on risk taking that are conducted in the run-up period to the crisis and during the crisis, did not take managerial ownership into account as one of the potential explaining factors for bank risk taking (Haq & Heaney, 2012; King & Wen, 2011). Only the recent study by Chesney, Stromberg and Wagner (2011) took managerial ownership into account while explaining write downs in 2007/2008.

This thesis attempts to fill this gap by exploring in detail the relation between managerial stockownership and bank risk taking for a period (2000-2010) that yet has not been studied. This study contributes to the previous literature by testing multiple proxies for risk taking in the considered period. Also, the yearly z-score founded by Konishi and Yasuda (2004) will be used for the first time in a study conducted in the United States. To be able to get a clear answer to the relation that will be studied, the research question that is tried to be answered in this thesis is the following:
What is the effect of managerial ownership on bank risk taking?

This relation will be tested using different proxies for risk taking and different models with different control variables will be tested. To be able to fully answer the research question, there are some sub-questions that need to be taken into account to give the research more direction.
These sub-questions are:

- *What are the different proxies for bank risk taking that can be used in this study?*
- *Which control variables can be considered in this study?*
- *Which relations are expected by the underlying theory?*

This study will be conducted with a new database that includes 120 banks in the United States for the period 2000-2010. With the use of different proxies for risk taking, the relation between managerial ownership and risk taking will be studied. Linear regressions will be conducted for the period 2000-2010 and different control variables will be included. Next to total period regressions, regressions for the individual years within the total period will be conducted. Also regressions that include year dummies and an interaction term will be considered.

This study is academically and societally relevant in various ways. In an academic context, this study and its results can be used to confirm previous findings with different proxies for risk taking. This study could confirm the robustness of the yearly z-score, which is only used once in a Japanese study. This study could also provide empirical evidence for the agency theory that aligning the interest of the managers with the shareholders will induce an increase in risk taking. In a societal way, policy considerations motivate this research. As emphasized by Laeven and Levine (2009), the risk taking behavior or banks affects financial and economic stability. In turn, international agencies propose divers regulations to shape and decrease risk taking by banks. This study could provide a recommendation that the risk taking behavior of banks can possibly be caused by managerial incentives. This study could advise world leaders and economists that lowering bank risk taking can be possibly achieved by changing the incentives of the banks' managers.

This thesis is organized as follows. Section 2 provides a brief literature review on previous studies and relevant theory. Section 3 will explain the data and methodology used in this research and will outline and explain the studied model. Section 4 presents the summary statistics and the empirical results. Section 5 concludes and discusses.

2. Theory and literature review

In this section, a literature review on previous studies and relevant theory will be presented. First, some related findings on prior studies concerning the topic will be discussed and related theory will be exemplified. Then, with this theory in mind, the expectations follow logically and the hypotheses can be stated.

2.1 Earlier studies on bank risk taking

A large body of literature has examined how managerial ownership affects corporate strategy and risk taking. Standard agency theories suggests already decades that ownership structure influences corporate risk taking (Jensen & Meckling, 1976; John, Litov, & Yeung, 2008), but empirical findings differ over different industries, periods and proxies for risk taking.

In an important paper, Saunders et al. (1990) found a positive relation between insider ownership of top management and bank risk taking. They hypothesized that managers who own a larger part of the bank, have incentives to take higher risk than managers who own only a minor part of the bank. In support of this hypothesis, they found that this positive relation is significant during the 1979-1982 period. Looking at a different period, Chen, Steiner and Whyte (1998) found an opposite result (Niu, 2010). Anderson and Fraser (2000) found that managerial shareholdings are positively related to total and firm specific risk in the late 1980s when the industry was under considerable financial stress. However, following legislation in 1989 and 1991 designed to reduce risk taking and also reflecting substantial improvements in bank franchise value, managerial shareholdings and total and firm specific risk became negatively related in the early 1990s. In contrast; systematic risk was, in this study, unrelated to managerial ownership in both periods (Anderson & Fraser, 2000). Also a study by Houston and James (1995) found that equity-based compensation is not structured to promote risk taking and indicates that risk taking cannot be controlled by rewarding equity to the managers.

A study conducted by Demsetz et al. in 1997, found that asset risk is higher at banks with positive insider ownership. This finding is consistent with the notion that managerial shareholdings work to align the interest of otherwise risk-averse managers with less risk-averse owners. The relationship between ownership structure and risk taking is significant only for the set of banks with relatively low franchise value (Demsetz et al., 1997). With these findings, this study emphasized the importance of franchise value for empirical testing relations between ownership structure and risk taking. This franchise value was already used by Keeley in 1990 and it was also used in a recent influential study by Laeven and Levine (2009). This franchise value was used as a control variable, but appeared to result in inconclusive results for Laeven and Levine (2009). Their study focused on the influence of ownership structure on risk taking behavior of individual banks and they found that bank risk is generally higher in banks that have large owners with substantial cash flow rights.

Other recent studies conducted on explaining bank risk taking found various results. While one study focused on creditor rights, information sharing and bank risk taking; they found that stronger creditor rights tends to promote bank risk taking (Houston, Lin, Lin, & Ma; 2010). Another study focused on the relation between risk taking and the financial crisis and they found that firms with higher institutional ownership took more risk prior to the crisis (Erkens, Hung, & Matos; 2012). Although there are studies that confirmed different theories, a study conducted in China in 2008 showed again that overarching theory and relations cannot be concluded immediately. This conclusion was taken, because the study found that managerial ownership has little effect on firms' equity risk (Zou & Adams, 2008).

While the above studies provide valuable insight into the relation between managerial ownership and bank risk taking, the findings are however conflicting. One reason why these conflicting results can arise is due to differences in the methodology used (Houston & James, 1995). It is however also possible that the differences are deeper rooted and can be explained by two different problems, which contain both their own theory. These two different problems are the agency problem and the moral hazard problem and will lead to two different hypotheses. These problems will be explained in the following paragraph.

2.2 Agency problem and moral hazard problem

This paragraph takes a closer look at both the agency problem and the moral hazard problem. It also shows how these problems are related and how they can offset each other, and how these problems are related to bank risk taking.

The first problem that I want to emphasize is the relation between the managers of the firm and its owners. The problem of this relation is called the agency problem and exists due to the separation of ownership and control. This problem was already studied by Berle and Means in 1932 and they pointed out the potential conflict of interest between corporate managers and dispersed shareholders when managers do not have an ownership interest in the firm. The agency relationship is defined as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some services on their behalf which involves delegating some decision making authority to the agent. If both parties to the relationship are maximizing their utility, there is a good reason to believe that the agent will not always act in the best interest of the principal (Jensen & Meckling, 1976). A good example is the study by Holmstrom and Costa (1986), which showed that career concerns rather than effort aversion can induce a natural incongruity in risk preferences between managers and stockholders. They also outlined the idea that managers are concerned about the impact of their decisions on their future careers and enjoy private benefits of control. This agency problem is accompanied with agency costs, which arise when the manager holds little stock in the bank and thus may seek to maximize his own utility instead of maximizing the value of the bank and thereby serving the interest of stockholders (the principals). The manager does not benefit to the same extent as stockholders from successful outcomes, but could suffer much damage to his

reputation and human capital investment from unsuccessful ventures (Sullivan & Spong, 2007). Next to the findings that the manager is concerned about his job and future career, managers who have built up a stock of firm-specific human capital and therefore have an undiversified stake in the firm that employs them may act in a risk-averse rather than value maximizing manner (Demsetz et al., 1997). This could lead to less risk taking by the manager and can result in underinvestment or entrenchment. It is also possible that the risk-averse manager choose to operate with higher capital or choose safer assets than shareholders would desire.

The agency problem can be solved by either costly monitoring the managers or by aligning his interest with that of the shareholders. Shareholders have a strong incentive to increase risk, because limited liability allows shareholders to keep all upside gains while sharing their losses with bondholders (Demsetz et al., 1997). Interest has to be paid to the bondholders in any case (whether the firm is (highly) profitable or loss generating) and the profit remaining can be distributed to the shareholders. This leads to the outlook that shareholders can expect profits after the bondholders are paid their interest and this promote the risk taking behavior of shareholders. This view is in line with findings from earlier studies that found that owners tend to advocate for more bank risk taking than managers and debt holders (Galai & Masulis, 1976; Demsetz & Lehn, 1985). Providing bank managers with more equity based compensation seems to be one way to encourage risk taking in banking, due to aligning the interest of the manager with that of the shareholder. However, bank managers may be encouraged to take on risk if on average such risk taking increases the value of their equity based compensation (which is the presumption of the moral hazard hypothesis) (Houston & James, 1995).

The moral hazard problem is the second problem that I want to emphasize in this study. The essence of this problem results in the end in taking excessive risk by the manager because he tries to achieve the highest profit possible. Previous studies claim that the compensation policies in banking are designed to encourage risk taking in order to maximize the put option feature of fixed rate of deposit insurance and are even higher when a particular bank appears to be too big to fail (Houston & James, 1995). The moral hazard problem associated with deposit insurance refers to the fact that depositors, being fully insured, have very weak incentives to monitor shareholders and prevent them from increasing risk (Merton, 1977). In contrast to the risk-averse manager who is affected by the agency problem, aligning the interest of the manager with that of the shareholder can result in a risk taking manager.

2.3 Expected relations and hypotheses

In this paragraph I develop two hypotheses regarding the relation between managerial ownership and bank risk taking, consistent with the theory explained in the previous paragraph. Based on the theory of the agency problem it is expected that as managerial ownership increases, the personal portfolio of the manager becomes less diversified and the manager becomes more risk averse and is more likely to pursue strategies aimed at mitigating the risk of the bank (Smith & Stulz, 1985). The

opposing theory, however, claims that managerial ownership solves the agency problem and is therefore widely used. This problem is solved by aligning the interest of the manager with that of the stockholder. This alignment results in an expectation that the manager will act as a manager as well as a stockholder. Due to the fact that it is expected that stockholders have an incentive to increase the risk of the firm resulting in a wealth transfer from bondholder to stockholder, the manager is expected to take more risk.

Morck, Schleifer and Vishny (1988) confirmed this problem and suggested that managers respond to two opposing forces and that the relation between ownership and value depends on which force dominates over any particular range of managerial equity ownership. The opposing forces described by Morck et al. (1988) work in the following way. Managers' natural tendency is to make choices and allocate the firm's resources in their own best interest, which may conflict with the shareholders (as explained previously). However, as managerial ownership increases, their interests are likely to coincide more closely with those of the outside shareholders (McConnell & Servaes, 1990). Morck et al. (1988) point out that it is not possible, a priori, to predict which force will dominate at any level of managerial equity ownership.

The above arguments lead to the following two hypotheses:

H1: An increase in managerial ownership will lead to a decrease in bank risk taking (risk aversion hypothesis)

H2: An increase in managerial ownership will lead to an increase in bank risk taking (risk taking hypothesis)

3. Data and research methodology

I build a new database to examine whether managerial ownership affects bank risk taking. To test the relation, data on the dependent and independent variables have to be obtained and the variables have to be constructed consistent with the methodology used in some influential previous studies. After clearly explaining the methodology, the models that will be tested in this study can be created and explained.

3.1 Data

To create a useful database with banks from the United States that contains the requested information, all the listed American banks from *Bankscope* are taken and matched with the database from *Execucomp*. These matches resulted in 120 banks[1] that contain sufficient data from both databases needed for this study throughout the period 2000-2010.

The data used in this study is compiled from four main sources:

1. Bank-level accounting information for all the banks considered in this study is obtained from the *Bankscope* database provided by *Bureau van Dijk*. The accounting data that is important for this study contain earnings and profit numbers from the profit and loss statements. Next to this, total assets, equity and debt are used from the balance sheet statements. Also data of the loan loss provisions will be taken into account. All accounting data represents end-of-year data.
2. Managerial ownership is obtained from *Execucomp*. This database contains the yearly managerial stockownership excluding options for the individual top executives/managers at each bank. Until 2006 there is a lot of data missing for the managerial stockownership, but this changed because of the fact that the Security and Exchange Commission (SEC) adopted new disclosure requirements in 2006 concerning, among other items, executive compensation (Fahlenbrach & Stulz, 2011). Starting from the end of 2006, banks are obligated to give their shareholders more insight in the compensation awarded to the top executives/managers. This resulted in the fact that the 2007-2010 period contains almost no missing data.
3. Shareholder ownership data is obtained from *Bureau van Dijk*. The data that will be obtained from this database is the presence and percentage of large shareholders and institutional ownership data. One problem however, is that this data is static and only the most recent data is available. The most recent data is for the year 2010 and these two variables will only be used in an independent 2010 model.
4. Market data is obtained from the Centre of Research in Security Pricing (*CRSP)*. The daily stock returns, monthly prices, and monthly shares outstanding are obtained. The daily stock

[1] A list of all the banks considered in this study for the total 2000-2010 period can be found in the appendix

returns are used to calculate the volatility of equity returns. The monthly stock prices and shares outstanding are used to calculate the yearly z-score.

The 120 banks that are taken into account for the period 2000-2010 resulted in 1231 bank-years observations, which contain sufficient accounting data to conduct the models in this study that use a dependent variable based on accounting data. Due to the fact that a few banks are already included in the dataset before they were listed and the fact that some delisted banks, that still publish their accounting data, are also included in the dataset; 20 bank-years observations have to be dropped when the models in this study use a dependent variable that is calculated with market data. This means that for the models that uses market data, 1211 bank-years observations are considered in this study. At last, it should be noted that this sample selection procedure did eliminate failed banks as well as acquired banks throughout the period 2000-2010. This means that the number of banks can be different throughout the years in the period 2000-2010 and this result in the creation of an unbalanced panel data set.

The data obtained and explained in this paragraph can now be used to calculate the dependent and independent variables. This will be done consistent with the theory and methodology from studies mentioned in the previous section.

3.2 Research methodology

To examine whether managerial ownership affects bank risk taking, different proxies for risk taking will be constructed. In this study, four different proxies for risk taking will be used and are explained hereafter. Next to explaining the proxies for risk taking, managerial ownership and the considered control variables will be outlined and the motivation for the research method will be explained.

3.2.1 Proxies for bank risk taking

1. Z-score

Bank risk is primarily measured using the z-score of each bank. Recent studies by Laeven and Levine (2009) and Houston et al. (2010) used this z-score and found that this score can be a good proxy for bank risk taking. In their studies they found some significant results regarding bank risk taking, when using the z-score as a proxy for risk taking, and they did not mention any experienced drawbacks when using the z-score. This z-score equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns, in formula:

$$z - score_t = \frac{(ROA_t + CAR_t)}{\sigma(ROA_{t-2,t-1,t})} \quad (1)$$

Where ROA is the rate of return (net income) on assets in year t, CAR is the ratio of equity to assets in year t, and $\sigma(ROA_{t\text{-}2,t\text{-}1,t})$ is an estimate of the standard deviation of the rate of return on assets of

the current year and the two previous years. All this data is measured using accounting data. As a measure of a bank's distance from insolvency (Roy, 1952), z-score has been widely used in the recent literature (Houston et al., 2010). A higher value indicates that the bank is more stable and is expected to take less risk. A lower z-score indicates that the bank is expected to take more risk and that its distance from insolvency is smaller. Because of the fact that the z-score is highly skewed, the natural logarithm of the z-score, which is normally distributed, will be used (Laeven & Levine, 2009). Using the natural logarithm of the z-score results in some additional drops in observations, this is due to the fact that the natural logarithm of a negative z-score cannot be calculated.

Besides studying the z-score, which is a composite measure of bank stability, the return on assets (ROA), the volatility of assets returns *σ(*ROA), and leverage (CAR) will be separately examined in order to get some sense about which component of the z-score is principally driving the relation between the independent variables and the z-score. This is done to understand the degree to which cross-bank differences in bank stability (z-score) are accounted for by differences in asset composition (Laeven & Levine, 2009).

In addition to the z-score as previously described (that needs at least 3 years of data), a yearly z-score will be calculated and tested in this study as a robustness test. Yet, only one study conducted in Japan by Konishi and Yasuda (2004) has used the yearly z-score as a proxy for bank risk taking. They studied the factors affecting bank risk taking and they found that franchise value (also known as Tobin's Q) increased bank risk taking. They, however, did not look at managerial ownership as a possible factor affecting bank risk, but they looked at the ownership of stable shareholders. This study will (to my knowledge) be the first study that uses the yearly z-score as a proxy for risk in an American banking sample and that studies the relation between managerial ownership and the yearly z-score as a proxy for risk taking. The following model is used to calculate the yearly z-score:

$$z - score = \frac{\sum_{j=1}^{12} \frac{\pi_j}{A_j} + \sum_{j=1}^{12} \frac{E_j}{A_j}}{S_r} \quad (2)$$

Where π_j is the estimated market value of total profits; E_j is the market value of total equity (share price multiplied by the number of shares outstanding); A_j is the market value of total assets (the subscript j denotes the month); S_r is the estimated standard deviation of π_j / A_j. The market value of total equity and total assets are averaged monthly. The estimated market value of total profits is:

$$\pi_j = c_j P_j - c_{j-1} P_{j-1}$$

Where c_j is the number of shares outstanding, and P_j is the share price of the last business day of the month *j*. The market value of total assets is:

$$A_j = E_j + L$$

Where *L* is the book value of total debt at the end of the fiscal year[2] (Konishi & Yasuda, 2004). Just like the z-score by Laeven and Levine (2009), the natural logarithm of the yearly z-score will be used, due to skewness in the normal yearly z-score.

2. Volatility of earnings

Next to these two z-scores, there are three other dependent variables that are calculated with the obtained accounting and market data and will be used as alternative proxies for bank risk taking.

The second proxy for bank risk taking in this study is the volatility of earnings and was (to my knowledge) used for the first time as a proxy for risk taking by Laeven and Levine (2009). They found that the key results on ownership were robust to using alternative measures of bank risk taking (including the volatility of earnings). They found that an increase in cash flow rights held by the large owner was associated with greater risk taking, robust for different risk taking proxies. Though, it should be mentioned that the results were somewhat weaker with earnings volatility than with other proxies for risk taking. The fact that this proxy was only used by Laeven and Levine (2009) and the fact that their study resulted in confirmed evidence, leads to the fact that it is interesting to use the volatility of earnings as a proxy for bank risk taking in this thesis. A related proxy for risk taking to the volatility of earnings is the volatility of net interest margin, which was used in a study by Houston et al. (2010). They found that creditor right is positively related to this proxy for risk taking. However, in this thesis the volatility of earnings will be used instead of the volatility of net interest margin. This will be done due to the fact that many banks in this study are expected to generate also income on other activities (transaction fees and investment banking) than on just generating a spread on lending and borrowing. The volatility of earnings equals the standard deviation of the ratio of total earnings before tax and loan loss provisions to average total assets over the considered period, in formula:

$$\sigma Earnings_t = \sigma \frac{Total\ earnings\ before\ tax\ and\ loan\ loss\ provisions_{t-2,t-1,t}}{Average\ total\ assets_{t-2,t-1,t}} \quad (3)$$

3. Loan loss provision ratio

The third proxy for bank risk taking in this study is the loan loss provision ratio. One recent study used this variable as an alternative measure for bank risk taking (Houston et al., 2010). They found that this proxy for risk shows results that are in accordance with findings obtained when other proxies for risk taking were used (Z-score and volatility of net interest margin). These findings indicate that the loan loss provision ratio can be used as a proxy for risk. However, other studies on risk taking did not use this ratio as a proxy for risk taking. This can either indicate that the ratio is not a good proxy for risk taking or that this ratio is considered as a relatively new proxy for risk taking. Laeven and Levine (2009) considered this variable in their study, but they used this ratio as a control

[2] Since the monthly data for the book value of total debt is not available, annual data is used assuming that the total debt remains the same throughout the year. Furthermore, since the book values do not necessarily approximate the market values, yearly Z-score is a limited proxy for insolvency risk (Konishi & Yasuda, 2004).

variable while testing their model. Although Laeven and Levine (2009) used the loan loss provision ratio as a control variable in their study, this ratio will not be used as a control variable in the models in this thesis due to multicollinearity. The loan loss provision ratio equals the yearly reported loan loss provision divided by the total assets for that year, in formula:

$$Loan\ loss\ provision\ ratio_t = \frac{Loan\ loss\ provision_t}{Total\ assets_t} \quad (4)$$

4. Volatility of equity returns

The fourth proxy for bank risk taking in this study is the volatility of equity returns. One advantage by using the volatility of equity returns as a dependent variable is that it is based on market, not accounting, data (Laeven & Levine, 2009). This advantage exists due the fact that the volatility is taken from equity returns. Equity prices (and returns) are market based, which means that expectations about the market and possible behavioral finance is included in these prices; something that is not included in accounting data. While market data is partly forward looking, accounting data looks only at historical results. By using the volatility of equity returns as an alternative proxy for risk taking, it will be simultaneously tested whether a market based proxy for risk is robust with the findings when accounting based proxies are used. Volatility of equity returns is a widely used proxy for risk taking in previous studies and sometimes led to significant results and results that were in accordance with results obtained when other proxies for risk taking were used (Demsetz et al., 1997; Zou & Adams, 2008; Laeven & Levine, 2009). These previous studies used either daily or weekly returns, but always used the annualized volatility. In this study the volatility of equity returns equals the annualized volatility of the daily returns in each fiscal year.

3.2.2 Managerial ownership

Managerial stockownership is a widely studied independent variable in previous studies (Chen et al., 2001; Laeven & Levine, 2009; Chesney et al., 2011). A previous study by Demsetz et el. (1997) found that insider ownership is positively related to risk, only when the franchise value is low. In their study they tested the relation between insider holdings and risk with different methods. They used linear specification and took the total percentage of insider ownership as an independent variable in one test. But in other tests, they grouped the insider holdings in order of size and performed piecewise linear specifications and indicator variable specification. A study by Anderson and Fraser (2000) concluded that managerial ownership can be related to risk taking either positively or negatively, dependent on the studied period. Consistent with prior studies, they defined management holdings as the aggregate percentage of shares held by all officers and directors of the bank as reported in *Compact Disclosure*. They took the aggregated percentage of managerial ownership as independent variable and this will be done also in this thesis. This leads to the fact that the managerial ownership for the individual banks during the period 2000-2010, contains the yearly aggregated stockownership

excluding options for each bank that is held by the top executives given by *Execucomp*[3] and is expressed as a percentage of total shares outstanding.

3.2.3 Control variables

Summing various relevant previous studies on bank risk taking led to the identification of a set of control variables that are interesting for this study. These control variables are interesting because they appeared to be explanatory and significant in several previous studies. The individual control variables will be exemplified and, consistent with previous studies, reasons for considering these variables are given.

Size

Bank size is the first and most considered control variable in previous studies on bank risk taking (Laeven & Levine, 2009; Houston et al., 2010; and Erkens et al., 2012). Size may play an important role in determining risk taking by banks, because larger banks are more capable of diversifying risk (both geographically and by industry) than small banks. Moreover, larger banks have greater access to capital markets and thus more flexibility to adjust to unexpected liquidity and capital shortfalls (Anderson & Fraser, 2000). This theory suggests that larger banks are expected to be less risky, but Demsetz and Strahan (1997) reported that large banks offset the potential benefits of diversification through adopting more risky loan portfolios and operating with more leverage. As a result, better diversification does not translate into reduction in total risk (Niu, 2010) and clear conclusions about the relation cannot be taken. Although there are studies which used proxies for size, like market capitalization (Chesney et al., 2011 and Haq & Heaney, 2012) or sales (King & Wen, 2011); the majority of the previous studies used total assets as a proxy for size (Saunders et al., 1990 and Anderson & Fraser, 2000). Consistent with these previous studies and other influential studies like Laeven and Levine (2009) and Houston et al. (2010), the natural logarithm of total assets will be used as a proxy for size (Saunders et al., 1990 and Anderson & Fraser, 2000). The natural logarithm is used to correct for skewness.

Too big to fail (TBTF)

Studies like Houston and James (1995) and Laeven and Levine (2009) took a TBTF-dummy into consideration as a control variable in their models. While Houston and James (1995) took the list of banks that were classified as TBTF from O'Hara and Shaw (1990) for assigning TBTF-dummy to the banks; Laeven and Levine (2009) assigned a TBTF-dummy to banks that accounted for more than 10% of the nation's deposits. A recent study on TBTF-banks by Demirgüc-Kunt and Huizinga (2010) indicated that three banks in the United States can be marked as TBTF and these banks will be considered as TBTF in this thesis. The considered banks are: Bank of America, JP Morgan and

[3] The data on compensation and stockownership from *Execucomp* contains top management and includes almost always the CEO and CFO.

Citigroup. These three banks will receive a dummy assignment of 1, while the other banks receive a value of 0. The TBTF-dummy is expected to be partly explained already by size and correlation between these two variables is expected. This should be taken into account when testing the models.

Leverage

Prior studies reported that differences in financial structure could account for observed variations in companies' equity risk (Hill & Stone, 1980), but the empirical impact of leverage on companies' equity risk is not clear from the literature (Zou & Adams, 2008). Smith and Watts (1992) provide evidence that high-growth companies are likely to finance their business with equity instead of debt in order to control for potential agency incentive conflicts. Such conflicts of interest can arise between shareholder and debtholder in the event of increased possibility of financial distress (Zou & Adams, 2008). This suggests that highly levered companies could have fewer investment opportunities than lowly levered companies, thereby lowering their equity risk. Next to this, leverage also makes a firm's earnings more volatile. Depending on the operating situation of the firm, leverage may make a firm's financial performance either better or worse (Zou & Adams, 2008). These previous findings indicate that leverage could be an important control variable in this study and following John et al. (2008), Zou and Adams (2008) and Erkens et al. (2012), leverage is measured as the ratio of total liabilities to total assets.

Tobin's Q

Keeley's (1990) adaption of Tobin's Q is seen as a proxy for health of the individual banking firms by previous studies (Anderson & Fraser, 2000) and is also called franchise value (Konishi & Yasuda, 2004) or charter value (Haq & Heaney, 2012). Tobin's Q ratio is calculated by adding the market value of equity with the book value of liabilities and divides this by the book value of assets (Keeley, 1990). Demsetz et al. (1997) indicated that the future profitability of the bank as a going concern will contribute to the numerator of this ratio but not much to its denominator (the numerator includes market value of equity, a price perceived by investors as the present value; future profitability is only partly included in the denominator as goodwill in the assets component). Thus Tobin's Q captures the present value of the bank as a going concern in a way that permits comparability across banks of different sizes (Demsetz et al., 1997). Keeley (1990) claims that declining franchise values in the 1960s and 1970s can explain the increased risk taking at banks during the 1980s. According to this study, the decline in franchise value led to a reduction in the cost of financial distress, and a corresponding increase in bank shareholders' desired level of risk in the 1980s (Demsetz et al., 1997). According to Niu (2010), franchise value refers to capitalized value of bank's future profits. Franchise value is lost when a bank fails. Thus, it provides banks with an incentive to take less risk (Marcus, 1984). However, a recent study found mixed evidence on the relation between charter value and bank risk taking (Haq & Heaney, 2012) and indicated that the relation is not totally clear yet. Next to investigating the relations between Tobin's Q and risk taking, Demsetz et al. (1997) studied the

interactions between ownership structure and franchise value. They found a positive relation between insider ownership and bank risk taking, but only at banks with a low franchise value. These previous studies indicate the importance of the franchise value and this value is measured in this thesis according to Keeley (1990) as:

$$Tobin's\ Q_t = \frac{Market\ value\ of\ equity_t + Book\ value\ of\ liabilities_t}{Book\ value\ of\ assets_t}$$

Large shareholder

By focusing on the presence of a large shareholder, both the incentives of owners towards risk and the ability of owners to influence risk is captured. Monitoring of managerial risk taking may come from the nature of ownership of the banks (Anderson & Fraser, 2000). If outside (non-managerial) ownership is sufficiently concentrated, outsiders have a strong incentive to keep managerial behavior in check (Demsetz et al., 1997). The study by Demsetz et al. (1997) found significant results for one of the three proxies for risk taking which suggested that an increase in large shareholders is expected to lead to more bank risk taking. In accordance with prior studies, I measure whether the bank has a large owner or whether the bank is widely held (Demsetz et al., 1997 and John et al., 2008). The large shareholder variable is measured as a dummy variable and equals 1 if a firm has a large owner with direct or indirect voting rights greater than 10% and a dummy variable equal to 0 otherwise. The 10% cutoff is based on prior studies such as Laeven and Levine (2009) and Erkens et al. (2012). If no shareholder holds 10% of the voting rights, the bank is classified as widely held. The percentage of ownership by the large shareholder is measured at the end of 2010 and is only obtained for this year.

Institutional ownership

To my knowledge, Erkens et al. (2012) conducted the first study on risk taking that included institutional ownership as an independent variable and found a positive and significant relation between institutional ownership and risk taking. I focus on institutional ownership because prior studies suggested that they serve important disciplining and monitoring roles (Gillan & Starks, 2007) and the findings by Erkens et al. (2012) confirmed this suggestion. Next to this, a related study on equity ownership and corporate value (McConnell & Servaes, 1990) found a significant positive relation between Tobin's Q and the fraction of shares owned by institutional investors and highlighted the importance of institutional ownership. Like Erkens et al. (2012), institutional ownership will be measured as the aggregated percentage held by institutional money managers (e.g. mutual funds, pension plans, and bank trusts).

3.3 The empirical model

After obtaining the data and constructing the variables, an empirical model can be outlined that will test the relation between managerial ownership and bank risk taking. Due to the different types of dependent variables as proxies for risk and the limited data availability of two independent variables, different models have to be specified and tested.

The following formal regression models can be tested using ordinary least squares (OLS)-techniques with *STATA*:

(1) $RISK = \beta_0 + \beta_1 MO_{it} + \beta_2 SIZE_{it} + \beta_3 TBTF_{it} + \beta_4 LEV_{it} + \beta_5 TOBINQ_{it} + \varepsilon_{it}$

(2) $RISK = \beta_0 + \beta_1 MO_{it} + \beta_2 SIZE_{it} + \beta_3 TBTF_{it} + \beta_4 LEV_{it} + \beta_5 TOBINQ_{it} + \beta_6 LS_{it} + \beta_7 IO_{it} + \varepsilon_{it}$

Where the following notations are used to define the variables in the empirical models:

RISK= Dependent variable and will either be z-score, volatility of earnings, loan loss provision, or volatility of stock return;

MO= Managerial ownership, aggregated percentage of shares held by top management;

SIZE= Bank size, natural logarithm of total assets;

TBTF= Too-big-to-fail, dummy variable (value of 1 when bank is considered TBTF, 0 otherwise);

LEV= Leverage, total debt divided by total assets;

TOBINQ= Tobin's Q (proxy for health of the bank), market value of equity plus book value of debt divided by book value of assets;

LS= Large shareholder, dummy variable (value of 1 when large shareholder is present (more than 10% of the voting right), 0 otherwise);

IO= Institutional ownership, aggregated percentage of shares held by institutional owners;

ε = The error term in the regression models.

The first model will be tested for the period 2000-2010 and the second model for the 2010 period. The proxies for *RISK* consist of four different dependent variables that will be tested for both the regression models, these are:

1. *Z-score*$_{i,(t-2,t-1,t)}$, which is calculated by taking the volatility calculated in the denominator over the current year and up till two years back. This means that the bank-year observations of the period 2000-2001 will not be considered in this regression (but will only be used to calculate the z-score of 2002). For example, the z-score for 2002 will be calculated by calculating the volatility of ROA of 2000, 2001 and 2002, and uses the ROA and CAR for the year 2002.

   The yearly z-score however, tested as a robustness check, will be calculated and tested for each bank-year observation. This is possible because the earnings volatility will be calculated

within a fiscal year, as described earlier. The risk taking proxy for the yearly z-score will look like: yearly z-score$_{it}$.

2. *Volatility of earnings*$_{i,(t-2,t-1,1)}$, which is calculated by taking the three-years volatility of the ratio: earnings before tax and loan loss provisions/average total assets. The volatility will be calculated using the current year ratio and up till two years back. This also means that the bank-year observations of the period 2000-2001 will not be considered in this regression (but will only be used to calculate the volatility of earnings for 2002).
3. *Loan loss provision ratio*$_{it}$, which is calculated as the yearly loan loss provision divided by the yearly total assets. All bank-year observations can and will be used when this dependent variable will be tested in the model.
4. *Volatility of stock return*$_{it}$, which is calculated by taking the annualized volatility of the daily stock returns for each year. All bank-year observations can and will be used when this dependent variable will be tested in the model.

4. Empirical results

The first paragraph of this section will give a closer look to the descriptive statistics of the studied dependent and independent variables. Next to this, pairwise correlations will be conducted on all of the considered variables. The second paragraph will test the regression models with different proxies for risk and interprets the findings. This section ends with robustness tests and additional analysis.

4.1 Descriptive statistics and correlation analysis

As shown in panel A of table 1, large variation exists in some of the bank risk measures. The standard deviation for ROA, CAR, σ(ROA), earnings volatility and loan loss provision ratio is, for example, relatively high compared to the mean of these variables. For example, the mean of ROA is 0.0109, while the accompanied standard deviation is 0.0228 and indicates that a one standard deviation change of ROA can already lead to a negative ROA. Looking at the minimum and maximum, there is also large variation and some outliers (like a maximum for equity volatility of 2.8625) can be identified. The z-score has a mean of 1.7034 and a median of 1.7385, which indicate that the observations are approximately normally distributed and there is almost no skewness (this was already expected, because this variable is already corrected for skewness and outliers through the use of the natural logarithm of the z-score). The standard deviation of 0.5392 for the z-score is not high (compared to its mean of 1.7934) and indicates that there is less variation in this measure compared to the other bank risk measures. Also the yearly z-score shows less variation compared to the other bank risk measures (also the natural logarithm was taken). The yearly z-score has a mean of 2.1754 and a median of 2.2052, which indicate normal distribution with a relatively low standard deviation of 0.2774.

Table 1:
Descriptive statistics of main regression variables.
This table reports descriptive statistics of bank risk measures (panel A) and explanatory variables (panel B) during the period 2000-2010, except for the variables: large shareholder and institutional ownership. These last two explanatory variables contain only 2010 observations.

	Number of observations	Mean	Standard deviation	Median	Minimum	Maximum
Panel A: Descriptive statistics of bank risk measures						
ROA	1231	0.0109	0.0228	0.0107	-0.2090	0.2111
CAR	1231	0.1139	0.1001	0.0952	0.0033	0.8978
σ(ROA)	991	0.0050	0.0104	0.0020	0.0000	0.1483
z-Score	981	1.7034	0.5392	1.7385	-0.4891	3.7245
Earnings volatility	991	0.0068	0.0139	0.0031	0.0001	0.2403
Equity volatility	1211	0.4137	0.2797	0.3228	0.1027	2.8625
Loan loss provision ratio	836	0.0071	0.0107	0.0030	-0.0042	0.0954
Yearly z-Score	1186	2.1754	0.2774	2.2052	0.8369	2.7772
Panel B: Descriptive statistics of the explanatory variables						
Managerial ownership	950	0.0262	0.0470	0.0096	0	0.4586
Size	1231	10.0589	0.7467	9.9191	8.4404	12.3617
TBTF dummy	1231	0.02681	0.1616	0	0	1
Leverage ratio	1231	0.8861	0.1000	0.1022	0.9048	0.9967
Tobin's Q	1214	1.1410	0.3624	1.0748	0.7009	5.1960
Large shareholder	116	0.3362	0.4745	0	0	1
Institutional ownership	116	0.6299	0.2217	0.6503	0	1

There are some other remarkable observations in panel A that needs a short explanation. As can be seen, the ROA has both positive and negative values. The minimum value of ROA (-0.2090) indicates that there are banks (at least one) that experienced negative results during the considered period. The minimum value for the z-score (-0.4891) contains a negative value, which occurs when the natural logarithm is taken from a normal z-score that has a value smaller than one. Panel A, also shows a negative minimum observation for the loan loss provision ratio. This indicates that there are banks (at least one), that overestimated their loan loss provision in previous years and added this back to pre-tax income in the current year. More descriptive statistics can be found in panel A, but these will not be further explained.

Panel B in table 1 (on the previous page) shows that managerial ownership in the considered banks contains large variation. The 950 bank-year observations on managerial ownership have a mean of 0.0262, a median of 0.0096 and a standard deviation of 0.0470. This indicates that there is large variation in the observations and that observations are skewed to the right, which means that there are more observations that contain small managerial ownership and a few observations that contain large managerial ownership. As explained earlier in this study, size is the natural logarithm of total assets and this is done to prevent the data from outliers. As can be seen in panel B, the mean of size equals the median by approximation and the standard deviation is relatively low. The mean of the leverage ratio (0.8861) shows that the total assets of the bank are on average financed by 88.61% liabilities. The minimum and maximum leverage ratio (respectively 0.1022 and 0.9967) indicates the presence of outliers; with a bank-year observation of assets that is only levered 10.22% to a bank-year observation that is levered 99.67% (more than 300 times its equity (1/(1-0.9967)= 303.0303). Tobin's Q has a mean of 1.1410, a standard deviation of 0.3624 and a median of 1.0748. This indicates that the market value of equity and the book value of liabilities are on average 14.10% higher than the book value of the assets. The minimum has a value of 0.7009 (so the company is traded in the equity market under its book value) and the maximum has a value of 5.1960 (which means that the company is traded for a price five times its book value). The observation of the large shareholder data in 2010 gives a mean of 0.3362, which indicates that 33.62% of the 116 banks contain at least one large shareholder (who owns more than 10% of the shares). The observation of the institutional ownership data in 2010 shows a mean of 0.6299, which indicates that the shares of the observed 116 banks are held on average for 62.99% by institutional owners. There are also banks that are not held by institutional owners and there are banks that are wholly owned (shown by the minimum of 0 and the maximum of 1).

Besides the descriptive statistics of the bank risk measures and explanatory variables over the considered period 2000-2010, a closer look is given to the yearly mean of the key variables considered in this study. Table 2 (on the next page), shows that managerial ownership diminished on average from 0.0324 in 2000 to 0.0151 in 2010. Top management held on average around 3.00% of

the shares during the period 2000-2008, while this declined to 1.51% in 2010. The z-score was on average smaller during the period 2008-2010, than during the period 2002-2007. This can probably be caused by the financial crisis that started at the end of 2007. As explained earlier, a lower z-score indicate less distance from insolvency and also more risk taking. Another important feature for this study is the increase in the loan loss provision ratio during the period 2000-2010. Table 2 shows an average ratio for loan loss provision of 0.33% in 2000 and an average ratio of 1.26% in 2010. This increase started in 2007 and is probably caused by the financial crisis.

Table 2:
Yearly mean of key variables.
This table reports yearly mean of the key variables: managerial ownership, z-score and loan loss provision ratio over the period 2000-2010. The z-score is calculated as the natural logarithm of the calculated z-score and observations are found for the period 2002-2010. Managerial ownership and loan loss provision ratio are expressed in scientific notations.

	Managerial ownership	z-Score	Loan loss provision ratio
Yearly mean of key variables			
2000	0.0324		0.0033
2001	0.0282		0.0050
2002	0.0285	1.7918	0.0043
2003	0.0295	1.8463	0.0034
2004	0.0289	1.9206	0.0020
2005	0.0277	1.9534	0.0020
2006	0.0290	1.9260	0.0019
2007	0.0286	1.7765	0.0037
2008	0.0296	1.4364	0.0110
2009	0.0194	1.3330	0.0183
2010	0.0151	1.4152	0.0126

Next to the descriptive statistics, a correlation matrix is obtained to get some first impression about the relation between the main variables considered in this study. The correlation matrix is also obtained to check which proxies for risk are related and which independent variables are correlated with each other. If the dependent variables appear to be highly correlated, this could indicate consistency in the proxies for risk taking. However, if two or more of the independent variables are highly correlated, a statistical phenomenon called multicollinearity can be present and a multicollinearity check is recommended. The correlation matrix can be found in table 3 (on the next page) and the most important findings will be explained.

Table 3 shows that the leverage ratio is negatively correlated with a statistically significant correlation coefficient of -0.6934 for ROA, -1.0000 for CAR and -0.3633 for σ(ROA). The -1.0000 correlation between leverage ratio and CAR exist because these variables are totally opposite ratios of each other. The leverage ratio is negatively correlated with earnings volatility (-0.3993) and this finding is significant. If a closer look is given to the relation between the z-score and managerial ownership, a significant negative correlation can be found. This gives a first impression that managerial ownership can be an explaining factor in bank risk taking and the negative relation could indicate that higher managerial ownership leads to a lower z-score (which means more risk taking). Other correlations between independent and dependent variables appear to be small or insignificant and will not be further elaborated.

Table 3:
Correlation matrix of main regression variables.

This table reports the correlations between the main regression variables. The correlation matrix contains correlations between: the components of the z-score (ROA, CAR, and σ(ROA)), the dependent variables (z-score, earnings volatility, equity volatility, loan loss provision ratio, and yearly z-score), and the independent variables (managerial ownership, size, TBTF dummy, leverage ratio, Tobin's Q, large shareholder, and institutional ownership). The sample consists of all included banks over the total period 2000-2010 for all variables except large shareholder and institutional ownership (These variables contain only observations for the year 2010). *p*-values denoting the significance level of each correlation coefficient are in parentheses. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	ROA	CAR	σ(ROA)	z-Score	Earnings volatility	Equity volatility	Loan loss provision ratio	Yearly z-Score	Managerial ownership	Size	TBTF dummy	Leverage ratio	Tobin's Q	Large shareholder	Institutional ownership
ROA	1.0000														
CAR	0.6934***	1.0000													
	(0.0000)														
σ(ROA)	-0.2060***	0.3633***	1.0000												
	(0.0000)	(0.0000)													
z-Score	0.2977***	0.0105	-0.5721***	1.0000											
	(0.0000)	(0.7428)	(0.0000)												
Earnings	-0.1889***	0.3933***	0.9565***	-0.5165***	1.0000										
volatility	(0.0000)	(0.0000)	(0.0000)	(0.0000)											
Equity volatility	-0.3377***	-0.0328	0.3771***	-0.5506***	0.3368***	1.0000									
	(0.0000)	(0.2538)	(0.0000)	(0.0000)	(0.0000)										
Loan loss	-0.7004***	-0.0629*	0.6434***	-0.6329***	0.6604***	0.6699***	1.0000								
provision ratio	(0.0000)	(0.0690)	(0.0000)	(0.0000)	(0.0000)	(0.0000)									
Yearly z-Score	0.2899***	0.0015	-0.3783***	0.5475***	-0.3377***	-0.7827***	-0.6077***	1.0000							
	(0.0000)	(0.9598)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)								
Managerial	0.0896***	0.0543*	0.0110	-0.0624*	0.0023	0.0119	-0.0657*	-0.0368	1.0000						
ownership	(0.0057)	(0.0946)	(0.7539)	(0.0757)	(0.9470)	(0.7138)	(0.0806)	(0.2623)							
Size	-0.0790***	-0.1305***	0.0040	-0.2045***	-0.0059	0.0697**	0.0926***	-0.0027	-0.2052***	1.0000					
	(0.0055)	(0.0000)	(0.9011)	(0.0000)	(0.8526)	(0.0153)	(0.0074)	(0.9251)	(0.0000)						
TBTF dummy	-0.0213	-0.0549*	-0.0220	-0.0597	-0.0152	0.0068	0.0047	-0.0059	-0.0978***	0.4566***	1.0000				
	(0.4562)	(0.0541)	(0.4890)	(0.0617)	(0.6327)	(0.8133)	(0.8918)	(0.8393)	(0.0025)	(0.0000)					
Leverage ratio	-0.6934***	-1.0000***	-0.3633***	-0.0105	-0.3933***	0.0328	0.0629*	-0.0015	-0.0543*	0.1305***	0.0549*	1.0000			
	(0.0000)	(0.0000)	(0.0000)	(0.7427)	(0.0000)	(0.2538)	(0.0690)	(0.9598)	(0.0946)	(0.0000)	(0.0541)				
Tobin's Q	0.6950***	0.6560***	0.0857***	0.0862*	0.1122***	-0.1339***	-0.1578***	0.1307***	0.1012***	-0.1901***	-0.0474*	-0.6560***	1.0000		
	(0.0000)	(0.0000)	(0.0072)	(0.0072)	(0.0004)	(0.0000)	(0.0000)	(0.0000)	(0.0018)	(0.0000)	(0.0986)	(0.0000)			
Large	0.0106	0.0727	0.2046**	-0.1090	0.1745*	0.1933**	0.1859*	-0.1903**	0.1859**	-0.1908**	-0.1160	-0.0727	0.0435	1.0000	
shareholder	(0.9101)	(0.4381)	(0.0276)	(0.2526)	(0.0610)	(0.0384)	(0.0552)	(0.0416)	(0.0498)	(0.0402)	(0.2151)	(0.4381)	(0.6433)		
Institutional	0.0970	0.1258	0.1201	-0.0483	0.1294	-0.2921***	-0.0835	0.2550***	0.0441	0.2269**	-0.0736	-0.1258	-0.2187**	-0.2068**	1.0000
ownership	(0.3003)	(0.1785)	(0.1991)	(0.6129)	(0.1662)	(0.0015)	(0.3926)	(0.0059)	(0.6446)	(0.0143)	(0.4324)	(0.1785)	(0.0183)	(0.0259)	

When a closer look is given to the correlations between the dependent variables, table 3 shows both negative and positive correlations. Earnings volatility, equity volatility and loan loss provision ratio are positively correlated with each other. A positive correlation also holds for z-score and yearly z-score. However, the z-score and yearly z-score are negatively correlated with the other proxies for risk. This negative relation is logical (consistent with previous studies and expectations), because of the fact that the z-score is in fact an inverse for risk taking. For example, higher earnings volatility indicates more risk taking, but in contrast, a lower z-score indicates more risk taking. The significant positive correlation coefficient of 0.5475 between the z-score and the yearly z-score indicates that the yearly z-score can probably be used as a proxy for the z-score to obtain robust results. The loan loss provision ratio appears to be significantly correlated with other dependent variables. The loan loss provision ratio is, for example, negatively correlated with the z-score with a correlation coefficient of -0.6329 and positively correlated with earnings volatility (0.6604) and equity volatility (0.6699). Another relatively high negative correlation exists between the yearly z-score and equity volatility (-0.7827). These relatively high correlations between the dependent variables could indicate that the different proxies for risk and relations are consistent with each other.

Between the independent variables there are some significant correlations, as can be seen in table 3 (on the previous page). It appears that leverage ratio and Tobin's Q are significant negatively correlated with a correlation coefficient of -0.6560. Also, size and TBTF-dummy are significant positively correlated with a correlation coefficient of 0.4566 and confirms the (expected) relation between these two variables. These correlations will be kept in mind during the conduction of the regressions (when including the variables simultaneously in a regression) and multicollinearity checks will be conducted when there is evidence for the presence of multicollinearity (Verbeek, 2004).

After obtaining descriptive statistics of the main regression variables and the correlation matrix, the empirical models can be tested in the following paragraph.

4.2 Regression results

In this paragraph, the both models will be tested for the four different proxies of bank risk taking. The z-score (and its individual components) will be tested first and will be followed by the volatility of earnings, loan loss provision ratio and the volatility of stock return.

4.2.1 Components of z-score as proxy for bank risk taking

First, the individual components of the z-score will be tested as the dependent variable to understand the degree to which cross-bank differences in bank stability (z-score) are accounted for by differences in asset composition.

The overarching message from the first four regressions presented in table 4, is that managerial ownership, size, leverage and Tobin's Q can partly explain ROA with significant results.

Table 4

Components of the z-score: ROA, CAR, and σ(ROA).

This table presents regression results of the components of the z-score as indicators for bank risk taking. The independent variables considered in these regressions are: managerial ownership, size, TBTF, leverage, and Tobin's Q, for the period 2000-2010; and includes large shareholder dummy and institutional ownership data for the year 2010. The sample consists of 950 observations during the period 2000-2010 and 112 observations for the period 2010. Dependent variable in regressions 1, 2, 3, and 4 is ROA. Dependent variable in regressions 5 and 6 is CAR, and the dependent variable in regressions 7 and 8 is σ(ROA). Regressions 1, 2, 3, 5, 7 are conducted over the period 2000-2010 and regressions 4, 6, and 8 are conducted for the period 2010. The estimation is based on OLS regressions. *T*-values are in parentheses and *F*-statistic is for testing the hypothesis that all coefficients are zero. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	ROA	ROA	ROA	ROA	CAR	CAR	σ(ROA)	σ(ROA)
Managerial	0.0184*	0.0123	0.0184*	0.1095*	-0.0753	-0.3263	0.0072	-0.0232
ownership	(1.66)	(1.12)	(1.66)	(1.85)	(-1.37)	(-1.02)	(0.91)	(-0.42)
Size	0.0025***		0.0027***	0.0066***	-0.0107**	-0.0066	0.0006	-0.0019
	(3.49)		(3.23)	(2.66)	(-2.60)	(-0.49)	(1.13)	(-0.81)
TBTF		0.0038	-0.0012	-0.0073	0.0010	0.0027	-0.0017	0.0042
		(1.35)	(-0.37)	(-0.69)	(0.07)	(0.05)	(-0.75)	(0.42)
Leverage	-0.0803***	-0.0786***	-0.0803***	-0.1346***			-0.0605***	-0.0768***
	(-12.28)	(-11.98)	(-12.27)	(-7.53)			(-13.03)	(-4.56)
Tobin's Q	0.0339***	0.0335***	0.0339***	0.0061*	0.2069***	0.0342*	-0.0093***	-0.0043
	(17.74)	(17.49)	(17.74)	(1.69)	(30.88)	(1.75)	(-7.01)	(-1.25)
Large				-0.0018		0.0197		0.0066**
shareholder				(-0.54)		(1.11)		(2.13)
Institutional				0.0006		0.0866**		0.0085
ownership				(0.08)		(2.10)		(1.17)
F-statistic	398.79***	391.94***	318.77***	10.30***	257.69***	1.33	36.37***	4.60
Adjusted R^2	0.6264	0.6223	0.6261	0.3696	0.5197	0.0173	0.1776	0.1852
Observations	950	950	950	112	950	112	820	112

From the third regression in table 4, it appears that managerial ownership (0.0184), size (0.0027), and Tobin's Q (0.0339) are positively related to ROA with significance values differing from 10% to 1%. This means that it is expected, in this sample, that higher managerial ownership, size, and Tobin's Q leads to a higher ROA. The significant negative regression coefficient for leverage indicates that an increase in leverage leads to less ROA. The results can be interpreted as follow: a one standard deviation change in managerial ownership (0.0470) is associated with a change in ROA of 0.0009 (=0.0470*0.0184) in regressions 1 and 3 and 0.0051 (=0.0470*0.1095) in regression 4, where the mean of ROA is 0.0109 and the standard deviation is 0.0228. Leverage is negatively related to ROA and from regression 3 in table 4 it follows that one standard deviation change in leverage (0.1000) is associated with a change in ROA of -0.0080 (=0.1000*-0.0803). As a closer look is given to the adjusted R-squared, the value of 0.6264 for regression 1 indicates that 62.64 percent of the variation of the data in this sample is explained by this model. The interpretation of the other variables and coefficients for the regressions 1-4 works in the same way, but will not be further explained.

Regression 5 in table 4 (on the previous page) indicates that size is significantly negatively related to CAR, with a coefficient of -0.0107. This means that a change of one standard deviation in size (0.7467) is negatively associated with a change in CAR of -0.0080 (=-0.0107*0.7467), where the mean of CAR is 0.1139 and the standard deviation is 0.1001. This negative relation indicates that firms with more assets (bigger size) have a lower CAR, which means that they are higher leveraged. The regression coefficient of Tobin's Q appears to be 0.2069 and is highly significant. From this result it can be expected that Tobin's Q is related to CAR and a higher Tobin's Q leads in this sample to a higher CAR. This could mean that a higher value for Tobin's Q (which is, consistent with previous studies, expected to be a proxy for health of individual banks) is expected to lead to higher capital ratios of the banks. Regression 6 indicates that institutional ownership is positively related to CAR at the 5% significance level. This indicates that a higher percentage of institutional ownership is expected to be associated in this sample with a higher CAR (so less leverage) and this could demonstrate that institutional investors are interested in banks that are less leveraged. Leverage is not used in these regressions as independent variable, because the expectation that CAR and leverage are inverse-measures for the composition of the assets of a bank is confirmed by collinearity checks in STATA (which confirmed the presence of collinearity) (Verbeek, 2004).

Regression 7 indicates a significant negative relation between Tobin's Q and the volatility of ROA. This means that it is expected, in this sample, that a higher value for Tobin's Q is expected to lead to lower volatility of ROA. A remarkable finding of the last regression in table 4 (regression 8) is that the presence of a large shareholder positively influences the volatility of ROA with a regression coefficient of 0.0066. A one standard deviation change in large shareholder (0.2217), in this regression, is associated with a change in σ(ROA) of 0.0015 (=0.2217*0.0066), where the mean of σ(ROA) is 0.0050 and the standard deviation is 0.0104.

By testing the components of the z-score in multiple regressions, it appeared that multiple independent variables have explanatory relations with the components of the z-score. These first findings can indicate that managerial ownership and the other control variables are possibly related with the z-score and this will be tested in the next subparagraph.

4.2.2 Z-score as proxy for bank risk taking

The first model, which takes the z-score as a proxy for bank risk taking, can be found in table 5 (on the next page). The first regression starts with managerial ownership and controls for size. This model appears to be significant and shows a significant negative relation between managerial ownership and the z-score. This negative relation indicates that higher managerial ownership will result (in this sample) in a lower z-score, which means that the banks will on average take more risk in this regression. The coefficient can be interpreted as follows: a one standard deviation change in managerial ownership (0.0470) is associated with a change in z-score of -0.0589 (=0.0470*-1.2538), where the mean of z-score is 1.7034 and the standard deviation is 0.5392. Also size is negatively

related to the z-score with a regression coefficient of -0.1642. This means that a one standard deviation change in size (0.7467) is associated with a change in z-score of -0.1226 (=0.7467*-0.1642). This negative relation in the sample between size and z-score indicates that bigger banks have a significantly lower z-score and will take more risk. The adjusted R-squared of 0.0477 indicates that this regression model explains 4.77% of the variation in the data of the dependent variable.

Table 5

Z-score as proxy for bank risk taking.

This table presents regression results of the z-score as proxy for bank risk taking. The independent variables considered in these regressions are: managerial ownership, size, TBTF, leverage, and Tobin's Q, for the period 2000-2010; and includes large shareholder dummy and institutional ownership data for the year 2010. The sample consists of 811 observations during the period 2000-2010 and 108 observations for the period 2010. Regressions 1 till 4 are conducted over the period 2000-2010 and regression 5 is conducted over the year 2010. The estimation is based on OLS regressions. *T*-values are in parentheses and *F*-statistic is for testing the hypothesis that all coefficients are zero. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Variable	Z-score	Z-score	Z-score	Z-score	Z-score
Managerial ownership	-1.2538***	-1.2548***	-1.2572***	-1.3324***	0.5053
	(-3.00)	(-3.01)	(-3.01)	(-3.19)	(0.24)
Size	-0.1642***	-0.1863***	-0.1879***	-0.1826***	-0.0882
	(-6.27)	(-6.23)	(-6.18)	(-6.01)	(-0.99)
TBTF		0.1833	0.1845	0.1735	0.1161
		(1.53)	(1.53)	(1.45)	(0.31)
Leverage			0.0529	0.4712*	-0.7280
			(0.31)	(1.92)	(-1.12)
Tobin's Q				0.1663**	-0.0342
				(2.38)	(-0.27)
Large shareholder					-0.1621
					(-1.35)
Institutional ownership					-0.2958
					(-1.01)
F-statistic	21.30***	15.00***	11.26***	10.19***	0.68
Adjusted R^2	0.0477	0.0493	0.0482	0.0537	-0.0212
Observations	811	811	811	811	108

The second, third and fourth model in table 5 adds stepwise additional independent variables to the model and leads to a significant model. The fourth regression has a coefficient of -1.3324 for managerial ownership, a coefficient of -0.1826 for size, a coefficient of 0.4712 for leverage and a coefficient of 0.1663 for Tobin's Q (all four variables are significant in this model). The first two relations are in accordance with the finding from the first regression on the z-score. The positive relation between managerial ownership and risk taking is in accordance with previous studies like Saunders et al. (1990) and Demsetz et al. (1997). The positive relation found between size and risk is in accordance with Demsetz and Strahan (1997), who found that although larger banks have more diversification opportunities they are likely to take on more risk. The positive relation between leverage and z-score appears to be significant with a coefficient of 0.4712. This means that a one standard deviation change in leverage (0.1000) is associated with a change in z-score of 0.0471 (=0.1000*0.4712). This relation in fact indicates that a higher leverage ratio will result in a higher z-score, which means that the banks distance from insolvency is bigger and is expected to take less

risk. So from the results in this sample it follows that banks with a higher leverage ratio are taking less risk. The relation between Tobin's Q and z-score appears to be significant and positively related in the fourth regression. The coefficient of 0.1663 can be interpreted as follows: a one standard deviation change in Tobin's Q (0.3624) is associated with a change in z-score of 0.0603 (=0.1663*0.3624).

The fifth regression in table 5 (on the previous page) is conducted for the year 2010 and takes large shareholder dummy and percentage of institutional ownership into account. The findings on this regression appear to be non-significant for both the total model as well as for the individual independent variables. Due to the non-significance, the model cannot be interpreted with confidence. The coefficients for large shareholder and institutional ownership are not significant but they appear to be near-significant and could give an indication about the relation between the two variables and risk in other possible models and proxies for risk taking. The relation between large shareholder and z-score, and institutional ownership and z-score, appears to be negative and could indicate that the presence of a large shareholder and a higher percentage of institutional ownership leads to more risk taking.

4.2.3 Alternative measures for bank risk taking

While the focus of this study examines the z-score of individual banks during the studied period as proxy for bank risk taking, this study will be extended by using alternative measures for bank risk taking as well. Table 6 (on the next page) contains regressions conducted during the period 2000-2010 and the year 2010, with the three alternative proxies for bank risk taking (volatility of earnings, loan loss provision ratio, and volatility of stock return).

The first two regressions in table 6 (on the next page) use the volatility of earnings as a proxy for risk taking and are conducted respectively over the period 2000-2010 and 2010. Although the models appear to be significant, managerial ownership is not significant in these models and the relation cannot be interpreted with confidence. Leverage is highly significant in the first regression and contains a negative relation to risk, with a regression coefficient of -0.0828. Tobin's Q appears to be also negatively related to risk, with a regression coefficient of -0.0118. These findings indicate that it is expected in this sample that a higher leverage ratio and a higher Tobin's Q value leads to less risk taking.

The second regression confirms the previously found negative relation between leverage and risk for the year 2010. This regression also indicates that it is expected that the presence of a large shareholder significantly increases the volatility of earnings with a regression coefficient of 0.0070. Interpreting this coefficient indicates that a one standard deviation change in large shareholder (0.4745) is associated with a change in volatility of earnings of 0.0033 (=0.4745*0.0070), where the mean of volatility of earnings is 0.0068 and the standard deviation is 0.0139. This could indicate, in this sample, that the presence of a large shareholder leads to more risk taking. The adjusted R-

squared for the first regression (total period 2000-2010 model) is 0.1957, which means that the regression explains 19.57% of the data in the dataset. Compared to the adjusted R-squared for the model that used the z-score as a proxy for risk (0.0537), this value for the adjusted R-squared is relatively high.

Table 6

Volatility of earnings, loan loss provision ratio, and volatility of stock return as proxy for bank risk taking.

This table presents regression results of the volatility of earnings, loan loss provision ratio, and volatility of stock return as a proxy for bank risk taking. The independent variables considered in these regressions are: managerial ownership, size, TBTF, leverage, and Tobin's Q, for the period 2000-2010; and includes large shareholder dummy and institutional ownership data for the year 2010.
The first regression tests volatility of earnings as dependent variable and the sample includes 820 observations during the period 2000-2010. The second regression tests volatility of earnings as dependent variable and the sample includes 112 observations during the year 2010. The third regression tests loan loss provision ratio as dependent variable and the sample includes 709 observations during the period 2000-2010. The fourth regression tests loan loss provision as dependent variable and the sample includes 103 observations during the year 2010. The fifth regression tests volatility of stock return as dependent variable and the sample includes 948 observations during the period 2000-2010. The sixth regression tests volatility of stock return as dependent variable and the sample includes 111 observations during the year 2010. The estimation is based on OLS regressions. *T*-values are in parentheses and *F*-statistic is for testing the hypothesis that all coefficients are zero. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	Volatility of earnings	Volatility of earnings	Loan loss provision ratio	Loan loss provision ratio	Volatility of stock return	Volatility of stock return
Managerial	0.0062	-0.0046	-0.0203*	-0.1023**	0.1946	-1.8752**
ownership	(0.60)	(-0.06)	(-1.92)	(-2.34)	(0.92)	(-2.39)
Size	0.0007	-0.0022	0.0005	-0.0026	0.0076	-0.0781**
	(0.93)	(-0.73)	(0.69)	(-1.30)	(0.48)	(-2.38)
TBTF	-0.0012	0.0065	-0.0025	0.0020	-0.0268	0.0474
	(-0.41)	(0.50)	(-1.09)	(0.25)	(-0.44)	(0.34)
Leverage	-0.0828***	-0.1389***	0.0228**	0.1024***	-0.3153**	0.6852***
	(-13.61)	(-6.31)	(2.06)	(2.74)	(-2.47)	(2.88)
Tobin's Q	-0.0118***	-0.0061	-0.0082***	-0.0020	-0.1713***	-0.0126
	(-6.77)	(-1.36)	(-3.95)	(-0.73)	(-4.55)	(-0.25)
Large shareholder		0.0070*		0.0036		0.0968**
		(1.74)		(1.38)		(2.21)
Institutional		0.0095		0.0024		-0.2164**
ownership		(1.00)		(0.40)		(-2.11)
F-statistic	40.84***	7.24***	4.94***	2.59**	4.62***	4.69***
Adjusted R^2	0.1957	0.2825	0.0271	0.0986	0.0188	0.1901
Observations	820	112	709	103	948	111

The second alternative measure for bank risk taking in table 6 is the loan loss provision ratio for the banks. These regressions (regression three and four in table 6) show a negative relation between managerial ownership and the loan loss provision ratio.

In the third regression; managerial ownership is significant negatively related with a coefficient of -0.0203, which means that a standard deviation change in managerial ownership (0.0470) is associated with a change in the loan loss provision ratio of -0.0010 (=0.0470*-0.0203), where the mean of the loan loss provision ratio is 0.0071 and the standard deviation is 0.0107.

In the fourth regression, this coefficient is -0.1023 and implicates that higher managerial ownership is expected to result in a lower loan loss provision ratio, which means that risk taking by the bank will decrease. This finding is however contradictory with a previous finding where the z-

score was taken as a proxy for bank risk taking and indicated a positive relation between managerial ownership and risk taking. The significant positive relation between leverage and loan loss provisions ratio indicates that it is expected that higher leveraged banks are more likely to take risk. This finding is in accordance with the previous finding where the z-score was taken as a proxy for bank risk taking, but in contrast to the negative relation between leverage and volatility of earnings as proxy for risk taking. In regression 3, Tobin's Q appears to be significant positively related to the loan loss provision ratio. This is in accordance with the previous relations found between Tobin's Q and z-score and volatility of earnings as proxy for risk taking. The adjusted R-squared of regression 3 in this table (0.0271) is, compared to the adjusted R-squares of the first regression in this table (0.1957) and of the previous z-score model (0.0537), relatively low.

The third alternative measure of bank risk taking in table 6 (on the previous page) is the volatility of stock return and is tested by regression five and six.

The fifth regression shows a significant negative relation between leverage and volatility of stock return. This indicates that it is expected that higher leveraged banks takes less risk, which is in contrast with the earlier findings obtained with the z-score model. Tobin's Q appears to be significant negatively related in this sample to the volatility of stock return. This finding is consistent with findings from the alternative risk proxies and indicates that a higher value of Tobin's Q leads to less risk taking.

The sixth regression presents a significant model with five significant independent variables. The relation between managerial ownership and volatility of stock return appears to be negative with a regression coefficient of -1.8752. This means that a one standard deviation change in managerial ownership (0.0470) is associated with a change in volatility of stock return of -0.0881 (=0.0470*-1.8752). This negative relation indicates that higher managerial ownership is expected to result in a decrease of volatility of stock return and this means that banks are expected to take less risk. This finding is in contrast to previous regressions which used the z-score as a proxy for risk. The negative relation between size and volatility of stock return indicates, in contrast to the findings using z-score as proxy for risk, that bigger firms are expected to take less risk. The coefficient of -0.0781 for size, indicates that the volatility of stock return change by -0.0583 (=0.7467*-0.0781) when size changes by one standard deviation (0.7467). The presence of a large shareholder in the regression appears to be positively related to the volatility of stock return, which indicates that the presence of a large shareholder is expected to significantly increase bank risk taking. The coefficient of 0.0968 for large shareholder indicates that the volatility of stock return increases by 0.0968 when at least one large shareholder can be identified. The relation between institutional ownership and the volatility of stock return appears to be negative with a regression coefficient of -0.2164. This means that a one standard deviation change in institutional ownership (0.2217) is associated with a change in volatility of stock return of -0.0480 (=0.2217*-0.2164). From this relation it can be concluded that higher institutional ownership is expected to lead to lower volatility of stock return

and thus promotes lower bank risk taking. The adjusted R-squared of 0.1901 for regression 6 is, compared to the adjusted R-squares of models for the same period using z-score (-0.0212) or loan loss provision ratio (0.0986), relatively high.

The regressions in table 6, which used three alternative measures for bank risk taking, resulted in inconclusive findings. While previous regressions found that when the z-score was taken as a proxy for risk, an increase in managerial ownership was expected to increase bank risk taking. The significant regressions which used alternative measures for bank risk taking, found that an increase in managerial ownership is expected to decrease bank risk taking in this sample.

These inconclusive findings support further analysis which will be done after the robustness test for the z-score. Although there was no significant relation between managerial ownership and volatility of earnings in the total period, it is however possible that there exist significant relations for individual years within this period. It is also possible that regressions within the total period for the alternative proxies for risk taking, will lead to findings which are consistent with the z-score as proxy for risk taking.

4.3 Robustness test: alternative measure of z-score

In this paragraph, a robustness test will be conducted for an alternative measure of the z-score. The regressions conducted using the z-score, resulted in findings that managerial ownership and the z-score are negatively related. This finding suggests that an increase in managerial ownership leads to an increase in bank risk taking in this sample. One limitation of this z-score from Roy (1952) is that it needs multiple years of data to calculate the z-score. Konishi and Yasuda (2004) tried to solve this problem by introducing a yearly z-score. Although they found significant and promising results with their yearly z-score, no follow up studies on bank risk taking used this measure. Due to the significant findings with the use of the z-score which support the risk taking hypothesis, this thesis will use the yearly z-score as an alternative measure of the z-score and test whether the findings are robust.

The first regression in table 7 (on the next page) shows that a regression of the 932 observations during the tested period 2000-2010, does not result in a significant relation between managerial ownership and the yearly z-score. However, leverage and Tobin's Q appears to be both significant and positively related to the yearly z-score. These findings are in accordance with the use of the z-score. The positive regression coefficient for leverage of 0.3907 indicates that, a one standard deviation change in leverage (0.1000) is associated with a change in yearly z-score of 0.0391 (=0.1000*0.3907), where the mean of the yearly z-score is 2.1754 and the standard deviation is 0.2774.

Table 7

Yearly z-score as proxy for bank risk taking.

This table presents regression results of the yearly z-score as proxy for bank risk taking. The first regression is conducted for the period 2000-2010 and contains 932 observations. The other regressions are conducted for the individual years within the period 2000-2010 and contain varying numbers of observations. The independent variables considered in these regressions are: managerial ownership, size, TBTF, leverage, and Tobin's Q, for the period 2000-2010; and includes large shareholder dummy and institutional ownership data for the year 2010 in regression 12 only. The estimation is based on OLS regressions. *T*-values are in parentheses and *F*-statistic is for testing the hypothesis that all coefficients are zero. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variable	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score	Yearly Z-score
Year	2000-2010	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Managerial	-0.2817	-1.1987**	-1.9455***	-0.4461	-0.8024**	-0.6120	-0.6325*	-0.5410*	-0.3492	-0.6789**	0.8716	2.0310**
ownership	(-1.44)	(-2.23)	(-2.76)	(-0.65)	(-2.36)	(-1.29)	(-1.88)	(-1.69)	(-0.92)	(-2.25)	(1.14)	(2.59)
Size	0.0126	-0.0637	0.0051	-0.0008	0.0330	0.0527	0.1003	0.0315	0.0019	-0.0514*	0.0163	0.0391
	(0.85)	(-1.40)	(0.10)	(-0.02)	(1.26)	(1.42)	(4.01)	(1.20)	(0.06)	(-1.80)	(0.39)	(1.19)
TBTF	-0.0239	0.0658	-0.0917	-0.1233	0.0257	-0.2510*	-0.0490	-0.1181	0.1117	-0.0475	-0.0778	-0.0022
	(-0.43)	(0.61)	(-0.64)	(-0.79)	(0.27)	(-1.79)	(-0.53)	(-1.06)	(0.87)	(-0.39)	(-0.44)	(-0.02)
Leverage	0.3907***	0.4129	-0.2170	0.6029	-0.5651**	0.0518	-0.7626**	0.6492**	0.1614	0.3821	-0.3561	-0.4162*
	(3.29)	(0.60)	(-0.45)	(1.48)	(-2.05)	(0.13)	(-2.39)	(2.39)	(0.58)	(1.53)	(-0.94)	(-1.75)
Tobin's Q	0.1732***	0.0674	-0.0864	0.3042	-0.1359	0.0458	-0.1728	0.1267	0.0752	0.2383	0.0276	0.0149
	(4.95)	(0.48)	(-0.50)	(1.29)	(-1.54)	(0.38)	(-1.93)	(1.57)	(1.10)	(2.30)	(0.23)	(0.30)
Large shareholder												-0.0915**
												(-2.09)
Institutional												0.1552
ownership												(1.51)
F-statistic	5.27***	1.10	1.91	0.76	2.22*	1.09	6.37***	2.21*	0.68	2.85**	1.03	2.63**
Adjusted R^2	0.0224	0.0113	0.0867	-0.0218	0.0809	0.0058	0.2587	0.0558	-0.0144	0.0757	0.0015	0.0942
Observations	932	44	49	58	70	76	78	103	114	114	114	111

The positive regression coefficient for Tobin's Q of 0.1732 indicates that a one standard deviation change in Tobin's Q (0.3624) is associated with a change in yearly z-score of 0.0628 (=0.1732*0.3624). These findings are in accordance with previous results (regression 4 on the z-score tested in table 5) and suggests that a higher value for leverage and Tobin's Q leads to less risk taking (a higher value of yearly z-score) in this sample.

However, in contrast to the negative relation found by regression 4 in table 5 between managerial ownership and z-score, no significant relation is found in the regression model over the total period 2000-2010, when the yearly z-score is used as a proxy for risk taking. It is however possible that there exist significant relations between managerial ownership and yearly z-score, but that these relations can only be found by testing the model for individual years within the total period 2000-2010. This is why yearly regressions are conducted in table 7 (on the previous page) and the obtained results will be shortly described.

The regressions, using the yearly z-score, are conducted for the individual years within the period 2000-2010 and can be found in table 7 (on the previous page). Nine out of eleven regressions conducted for the individual years, suggest a negative relation between managerial ownership and yearly z-score. Seven out of eleven regressions contain significant relations between managerial ownership and yearly z-score. Six of the seven significant regressions confirm the negative relation between managerial ownership and yearly z-score, which was already found with the use of z-score. Four of the six regression models contain a significant model and can be interpreted with confidence. Only the regression conducted for the year 2010 resulted in a positive relation between managerial ownership and yearly z-score. Overall, it can be assumed that an increase in managerial ownership will leads to a lower yearly z-score and indicates more risk taking in this sample.

Table 7 also presents the regression results for the control variables, but it appears that some regression models are not significant as shown by the F-statistic results. It is remarkable that size appears to be non-significant, because previous studies found significant relations between size and risk taking (Anderson & Fraser, 2000) and also the regressions in the previous paragraph (that used the z-score) found a significant negative relation between size and z-score. Regression results on leverage appears to be both positive and negative in different individual years and will not be further described. Tobin's Q appears to be non-significant for the individual years, which is in contrast to the positive relation Tobin's Q has with the yearly z-score for the total period model. The significant regression model for the year 2010 finds a negative regression coefficient of -0.0915 for the presence of a large shareholder. This means that the presence of a large shareholder reduces the yearly z-score by -0.0915. This indicates that it is expected for the year 2010 in this sample that the presence of a large shareholder leads to more risk taking by the individual banks.

The significant findings for the individual years within the period 2000-2010 for the yearly z-score indicate that it is possible that significant relations exist for individual years, even if the total period model resulted in non-significant findings. In the next paragraph, these individual year regressions will also be conducted for the two proxies for bank risk taking that resulted in non-significant results earlier in this study. These proxies are volatility of earnings and volatility of stock return.

4.4 Further analysis

4.4.1 Yearly regressions of the alternative measures for bank risk taking

The regressions conducted over the period 2000-2010 which used the volatility of earnings and volatility of stock return as proxy for risk taking, resulted in non-significant findings. It is however still possible that there exist relations between managerial ownership, its control variables and these proxies for risk taking for individual years within this total period sample. These individual year regressions will be conducted in the same way as done in table 7 and results will be explained.

First, regressions for the volatility of earnings as a proxy for risk taking will be conducted for the individual years and the results are shown in table 8 (on the next page). The regressions result in statistical models (except for the year 2008), which means they can be interpreted with confidence. The three regression coefficients for managerial ownership that appears to be significant in the regressions for the years 2002, 2004, and 2005, show positive relations between managerial ownership and volatility of earnings. Next to this, seven of the nine regressions indicate a positive relation between managerial ownership and volatility of earnings (either significant or non-significant). Overall, this indicates that there exist a positive relation between managerial ownership and volatility of earnings for individual years within the total period sample, even though the total period model resulted in non-significant findings. This finding is in accordance with previous findings using the z-score in the total period model and for six years using the yearly z-score. The overarching message is that: an increase in managerial ownership leads to more risk taking in this sample.

Furthermore, these regressions suggest for the years 2002, 2003, and 2007, that size is positively related to volatility of earnings. Regressions for the other years appear to be non-significant. This finding is in accordance with a previous finding where the z-score was used as a proxy for risk taking. These findings suggest that it is expected that an increase in size will lead to more risk taking by the banks. Leverage appears to be significantly negatively related to the volatility of earnings for eight of the nine individual year regressions. This suggests that it is expected that an increase in leverage will lead to less risk taking by the banks in this sample (in accordance with z-score results). Results on Tobin's Q value are mixed for the individual years and show a positive relation between Tobin's Q and earnings volatility for three out of the four statistically significant regression coefficients. Results for the year 2010 are already explained in table 6 and support the expectation that the presence of a large shareholder will lead to more risk taking for this sample. This finding was also significantly proved by Demsetz et al. (1997).

Remarkable is the relatively high adjusted R-squared value for the models which contain significant coefficients for managerial ownership (adjusted R-squared of 0.7397 for 2002, 0.6596 for 2004, and 0.7116 for 2005) in contrast to R-squared values for the total period model (0.1957) and other individual year regressions without significant coefficients for managerial ownership (a highest R-squared of 0.3664 for 2007).

Table 8

Yearly regressions for volatility of earnings as proxy for bank risk taking

This table presents regression results of the volatility of earnings as proxy for bank risk taking. The regressions are conducted for the individual years within the period 2002-2010 and contain varying numbers of observations. The independent variables considered in these regressions are: managerial ownership, size, TBTF, leverage, and Tobin's Q, for the period 2002-2009; and includes large shareholder dummy and institutional ownership data for the year 2010 in regression 9 only. The estimation is based on OLS regressions. *T*-values are in parentheses and *F*-statistic is for testing the hypothesis that all coefficients are zero. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	Volatility of earnings	Volatility of earnings	Volatility of earnings	Volatility of earnings	Volatility of earnings	Volatility of earnings	Volatility of earnings	Volatility of earnings	Volatility of earnings
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010
Managerial ownership	0.0283**	-0.0032	0.0256***	0.0234***	0.0124	0.0061	0.0109	0.0008	-0.0046
	(2.40)	(-0.35)	(3.79)	(2.84)	(1.36)	(0.61)	(0.51)	(0.01)	(-0.06)
Size	0.0019**	0.0010*	0.0004	0.0005	0.0003	0.0019**	0.0014	-0.0017	-0.0022
	(2.20)	(1.81)	(0.77)	(0.96)	(0.42)	(2.36)	(0.66)	(-0.54)	(-0.73)
TBTF	-0.0031	-0.0022	0.0005	0.0003	0.0008	-0.0009	0.0005	0.0016	0.0065
	(-1.25)	(-1.07)	(0.31)	(0.16)	(0.25)	(-0.28)	(0.06)	(0.12)	(0.50)
Leverage	-0.0760***	-0.0123	-0.0149***	-0.0212***	-0.0252***	-0.0239***	-0.0445**	-0.1994***	-0.1389***
	(-5.22)	(-1.64)	(-2.88)	(-3.07)	(-3.31)	(-3.13)	(-2.52)	(-7.77)	(-6.31)
Tobin's Q	-0.0100	0.0005	0.0040**	0.0052***	0.0015	0.0032*	-0.0070	-0.0342***	-0.0061
	(-1.48)	(0.24)	(2.61)	(2.66)	(0.68)	(1.72)	(-0.95)	(-4.50)	(-1.36)
Large shareholder									0.0070*
									(1.74)
Institutional ownership									0.0095
									(0.52)
F-statistic	29.41***	3.73***	29.68***	38.01***	10.79***	13.84***	1.81	13.00***	7.24***
Adjusted R^2	0.7397	0.1737	0.6596	0.7116	0.3331	0.3664	0.0351	0.3449	0.2825
Observations	51	66	75	76	99	112	113	115	112

Second, regressions for the volatility of stock return as a proxy for risk taking will be conducted for the individual years and the results are shown in table 9 (on the next page). The relation between managerial ownership and the volatility of stock return as a proxy for risk appeared to be non-significant for the total period and negatively related in the year 2010. In contrast to this finding, table 9 finds contradictory results for the relation between managerial ownership and the volatility of stock return in the regressions conducted for the individual years.

Table 9

Yearly regressions for volatility of stock return as proxy for bank risk taking

This table presents regression results of volatility of stock return as proxy for bank risk taking. The regressions are conducted for the individual years within the period 2000-2010 and contain varying numbers of observations. The independent variables considered in these regressions are: managerial ownership, size, TBTF, leverage, and Tobin's Q, for the period 2000-2009; and includes large shareholder dummy and institutional ownership data for the year 2010 in regression 11 only. The estimation is based on OLS regressions. *T*-values are in parentheses and *F*-statistic is for testing the hypothesis that all coefficients are zero. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Variable	Volatility of stock return	Volatility of stock return	Volatility of stock return	Volatility of stock return	Volatility of stock return	Volatility of stock return	Volatility of stock return	Volatility of stock return	Volatility of stock return	Volatility of stock return	Volatility of stock return
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Managerial	-0.0854	0.9681**	0.3972	0.4681	0.4602***	0.1866*	0.2866***	-0.0234	1.0986***	-1.1926	-1.8752**
ownership	(-0.16)	(2.16)	(1.15)	(2.99)	(4.32)	(1.68)	(2.70)	(-0.13)	(3.03)	(-1.14)	(-2.39)
Size	-0.0162	-0.0302	0.0086	-0.0129	-0.0415***	-0.0420***	-0.0404***	-0.0301**	0.1266***	0.1074*	-0.0781**
	(-0.36)	(-0.98)	(0.34)	(-1.07)	(-5.02)	(-5.08)	(-4.64)	(-2.03)	(3.70)	(1.88)	(-2.38)
TBTF	0.0039	0.1084	0.0890	0.0259	0.0265	-0.0054	0.0248	-0.0263	-0.0669	0.0070	0.0474
	(0.04)	(1.21)	(1.12)	(0.58)	(0.84)	(-0.17)	(0.67)	(-0.42)	(-0.45)	(0.03)	(0.34)
Leverage	0.8004	0.3405	-0.0656	0.2226*	0.2927***	0.3359***	-0.1015	0.1709	-0.5295*	0.7076	0.6852***
	(1.15)	(1.12)	(-0.32)	(1.75)	(3.19)	(3.18)	(-1.15)	(1.26)	(-1.77)	(1.36)	(2.88)
Tobin's Q	0.2155	0.1092	-0.0372	0.0657	0.0637**	0.0771**	-0.0284	0.0210	-0.3112**	0.0379	-0.0126
	(1.52)	(0.99)	(-0.32)	(1.61)	(2.34)	(2.60)	(-1.08)	(0.63)	(-2.50)	(0.23)	(-0.25)
Large shareholder											0.0968**
											(2.21)
Institutional											-0.2164**
ownership											(-2.11)
F-statistic	0.65	1.54	0.69	2.48**	11.71***	10.43***	8.01***	1.54	5.71***	2.55**	4.69***
Adjusted R^2	-0.0399	0.0493	-0.0272	0.0946	0.4133	0.3769	0.2539	0.0233	0.1713	0.0643	0.1901
Observations	47	53	60	72	77	79	104	115	115	114	111

Table 9 shows that seven of the eleven individual year regressions lead to significant models. Four of these seven significant regression models advocate for a positive relation between managerial ownership and volatility of stock return. Only the significant regression model for the year 2010 finds a negative relation between managerial ownership and volatility of stock return. The overarching message from the significant regressions is in accordance with previous findings in this study, which support the risk taking hypothesis over the risk aversion hypothesis.

Relations between size, leverage, Tobin's Q and the dependent variable (volatility of stock return) appears to contain inconclusive evidence and the relations will not be further described. The regression model for the year 2010 was already described in paragraph 4.2 and emphasized the positive relation between the presence of a large shareholder and the volatility of stock return and the negative relation between institutional ownership and the volatility of stock return. This means that it is expected in this sample that the presence of a large shareholder leads to more risk taking, while an increase in institutional ownership leads to less risk taking.

4.4.2 Total period regressions using year dummies

Instead of a total period regression or individual year regressions, it is also possible to include year dummies in a total period regression for the various proxies for risk taking and this will be done in table 10 (on the next page). The advantage of this model is that it estimate one total period model (in contrast to regressions for individual years), but it takes differences in risk taking throughout the years into account. Because of the fact that this study contains 9 years of data observations for the first 2 regressions and 11 years of data observations for the remaining 3 regressions; 8 year-dummies are added to the first 2 regressions and 10 year-dummies are added to the remaining 3 regressions. The first 2 regressions use the year 2002 as base year, while the remaining 3 regressions use the year 2000 as base year.

The first regression in table 10 (on the next page) confirms previous findings that were obtained when the z-score was used as a proxy for risk taking. The negative relation between managerial ownership and z-score confirms the expectation in this sample that higher managerial ownership leads to more risk taking when year dummies are included in the total period regression model. This model also confirms the negative finding between size and z-score, which indicate that the increase in size of a bank is expected to lead to more risk taking.

When a closer look is taken to the dummy variables, it can be noted that when a dummy variable of 1 is assigned to the years 2008, 2009, or 2010 the z-score of the bank decreases. A decrease in the z-score indicates a closer distance to insolvency, which means that it is expected in this sample that bank risk taking increased in the years 2008, 2009, and 2010. The dummies for the years 2002-2007 appear to have a positive relation with the z-score (either significant or non-significant). This means that it is expected in this sample that bank risk taking was lower during the run up to the crisis. Overall, the model appears to be significant and with an adjusted R-squared of 0.2254 (in contrast to the adjusted R-squared of 0.0537 for the total period model using z-score, this is relatively high), 22.54% of the data in this dataset can be explained by the regression model.

Regression 2 and 3 in table 10 contains the volatility of earnings and loan loss provision ratio as dependent variable. These regressions appear to contain a significant model, but do not have significant regression coefficients for managerial ownership. This is why the coefficients for managerial ownership will not be interpreted.

Table 10

Z-score, volatility of earnings, loan loss provision ratio, volatility of stock return, and yearly z-score as proxy for risk taking including year dummies.

This table presents regression results of z-score, volatility of earnings, loan loss provision ratio, volatility of stock return, and yearly z-score as proxy for risk taking including year dummies. The dependent variable in regression 1 is the z-score. Dependent variable in regression 2 is the volatility of earnings. Dependent variable in regression 3 is the loan loss provision ratio. Dependent variable in regression 4 is the volatility of stock return. Dependent variable in regression 5 is the yearly z-score. The regressions are conducted for the period 2000-2010 and contain varying numbers of observations. The independent variables considered in these regressions are: managerial ownership, size, TBTF, leverage, Tobin's Q, and year dummies. Regression 1 and 2 uses the year 2002 as base level for the year dummies. Regression 3, 4, and 5 uses the year 2000 as base level for the year dummies. The estimation is based on OLS regressions. *T*-values are in parentheses and *F*-statistic is for testing the hypothesis that all coefficients are zero. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Variable	Z-score	Volatility of earnings	Loan loss provision ratio	Volatility of stock return	Yearly z-score
Managerial ownership	-1.5771***	0.0113	-0.0130	0.2657**	-0.4411***
	(-4.15)	(1.12)	(-1.41)	(1.99)	(-3.12)
Size	-0.1749***	0.0006	0.0012**	-0.0000	0.0192*
	(-6.35)	(0.89)	(1.98)	(-0.00)	(1.80)
TBTF	0.1188	-0.0005	-0.0021	0.0163	-0.0544
	(1.09)	(-0.16)	(-1.09)	(0.43)	(-1.34)
Leverage	-0.0820	-0.0757***	0.0302***	0.2132***	-0.0157
	(-0.36)	(-12.64)	(3.17)	(2.59)	(-0.18)
Tobin's Q	-0.0239	-0.0092***	-0.0025	0.0242	0.0229
	(-0.37)	(-5.32)	(-1.35)	(0.98)	(0.88)
Dummy 2001			0.0023	-0.1149***	0.1491***
			(1.09)	(-3.05)	(3.61)
Dummy 2002			0.0014	-0.0914**	0.1606***
			(0.72)	(-2.49)	(4.02)
Dummy 2003	0.0720	-0.0014	0.0004	-0.2077***	0.2759***
	(0.80)	(-0.58)	(0.22)	(-5.89)	(7.20)
Dummy 2004	0.1305	-0.0015	-0.0012	-0.2449***	0.2803***
	(1.49)	(-0.63)	(-0.61)	(-7.05)	(7.44)
Dummy 2005	0.1615*	-0.0014	-0.0013	-0.2505***	0.3455***
	(1.85)	(-0.58)	(-0.65)	(-7.24)	(9.21)
Dummy 2006	0.1715**	-0.0017	-0.0014	-0.2492***	0.4047***
	(2.06)	(-0.79)	(-0.72)	(-7.54)	(11.28)
Dummy 2007	0.0134	-0.0010	0.0002	-0.1221***	0.2116***
	(0.16)	(-0.44)	(0.11)	(-3.73)	(5.96)
Dummy 2008	-0.3270***	0.0038*	0.0078***	0.3688***	-0.0781**
	(-3.99)	(1.75)	(4.18)	(11.18)	(-2.18)
Dummy 2009	-0.4361***	0.0075***	0.0142***	0.3754***	-0.2129***
	(-5.31)	(3.44)	(8.07)	(11.35)	(-5.94)
Dummy 2010	-0.3586***	0.0060***	0.0010***	-0.0307	0.0123
	(-4.36)	(2.77)	(5.44)	(-0.93)	(0.34)
F-statistic	19.13***	21.48***	19.09***	100.13***	61.73***
Adjusted R^2	0.2254	0.2453	0.2771	0.6109	0.4946
Observations	811	820	709	948	932

The relation between size and risk taking for the third regression suggests that size is accompanied with more risk taking, which is in accordance with the findings by regression 1 in this table. The dummy variables for the years 2008, 2009, and 2010 appear to be significant and positively related to volatility of earnings and loan loss provision ratio. This indicates that it is expected in this sample that

when a dummy variable of 1 is assigned to the years 2008, 2009, or 2010, risk taking increased. The relation between the dummy variables for the period 2000-2007 and the proxies for risk (volatility of earnings and loan loss provision ratio) appears to be negative. Although this finding is non-significant, it indicates that banks took less risk during the run up to the crisis.

Regression 4 in table 10 (on the previous page) tests the relation between the independent variables and volatility of stock return and the model appears to be highly significant. It appears that managerial ownership is positively related to the volatility of stock return with a regression coefficient of 0.2657, which indicates that it is expected in this sample that higher managerial ownership leads to more risk taking. Except for the year 2010 dummy, all the other year dummies appear to be significantly related to the volatility of stock return. The dummies for the years 2000 up to 2007 appear to be negatively related to risk taking, while the year dummies for 2008 and 2009 appear to be positively related to risk taking. This indicates that it is expected in this sample that banks took less risk in the run up to the crisis and took more risk during the crisis. Regression 4 contains an adjusted R-squared of 0.6109, which implicates that 61.09% of the variation in the data of the dependent variable can be explained by this regression model. This value is relatively high compared to the other adjusted R-squared values in table 10 and previous models.

Regression 5 in table 10 shows a negative relation between managerial ownership and the yearly z-score. This indicates that it is expected in this sample that an increase in managerial ownership leads to more risk taking by the bank. The positive relation between size and yearly z-score indicates that an increase in size is expected to lead to less risk taking, which is in contrast to the findings when the z-score or loan loss provision ratio were used as a proxy for risk taking. In accordance to regression 4, this model finds the same results regarding the year dummies. The year dummies appear to lead to less risk taking during the period 2000-2007, but to more risk taking during the period 2008-2009. These year dummy coefficients show a clear difference between risk taking by the banks in the run up period to the crisis and the crisis period.

Overall, the regressions in table 10 confirm statistically that there exists a positive relation between managerial ownership and bank risk taking. This finding is robust when both the z-score, volatility of stock return and yearly z-score are used as a proxy for risk taking. Another overarching message from the regressions in this table is that banks appear to show risk aversion behavior during the period 2000-2007, while they show risk taking behavior during the period 2008-2010. One possible reason to interpret this observation is that banks found themselves in financial problems after the start of the crisis in 2007 and taking even more risk was their answer.

4.4.3 Allowing for an interaction: Tobin's Q (franchise value)

One other additional analysis will be conducted in this thesis, due to an interesting finding by a previous study. The results will shortly be interpreted and compared with earlier findings from this study.

A study conducted by Demsetz et al. (1997) on the relation between managerial ownership and bank risk taking resulted in the first study that identified an interesting interaction effect. They considered the interaction between franchise value and insider holding in their model of bank risk. The conflict between owners and managers, at least with respect to the choice of risk, may be less severe at high franchise value banks because shareholders (along with managers) see high costs to financial distress. Consequently, they expected that the relationship between ownership structure and risk taking to be weakest at high franchise-value banks. They expected the relationship to be strongest at low franchise-value banks, where the risk preferences of owners and managers are most likely to diverge. They concluded that the relationship between ownership structure and risk appeared to be significant only at low-franchise value banks; those where moral hazard problem are most severe and where conflicts between owner and manager risk preferences are therefore strongest (Demsetz et al., 1997).

The interaction effect will be tested by splitting the sample into low- and high-franchise value subsamples, which is in accordance with Demsetz et al. (1997). The sample median will be used to divide the sample into two equal subsamples that includes low- and high-franchise values.

Table 11 (on the next page) presents the results when the regression allows for an interaction. First, a closer look is given to the franchise value. The franchise value exhibit a tighter relationship with proxies for risk for low-franchise value banks than for high-franchise value banks. All the regression coefficients for the franchise value appear to be significant and all the relations suggests that higher franchise value is expected to lead to less risk in the subsample in panel A. Since low franchise value banks are closer to insolvency, it is not surprising that the effect of a change in franchise value is more important for the low franchise value subsample (Demsetz et al., 1997). Regression coefficients for franchise value in panel B appear to be less significant and contain contradicting results.

Table 11 does not show marked differences between the effects of managerial ownership in the low- and high-franchise value subsamples. Using the z-score as a proxy for risk taking, results in a positive relation between managerial ownership and risk taking, for both the low- and high-franchise value subsamples. Five of the six significant coefficients for managerial ownership in the different regression models, support the risk taking hypothesis over the risk aversion hypothesis. The other regressions that used alternative proxies for risk taking in table 11 report inconclusive findings and non-significant relations. These inconclusive findings concerning the effects of managerial ownership are in contrast to the conclusion found by Demsetz et al. (1997), which suggests that there are significant differences between banks with low- and high-franchise values.

Table 11

Z-score, volatility of earnings, loan loss provision ratio, volatility of stock return, and yearly z-score as proxy for risk taking; allowing for an interaction.

This table presents regression results of z-score, volatility of earnings, loan loss provision ratio, volatility of stock return, and yearly z-score as proxy for risk taking; allowing for an interaction. The dependent variable in regression 1 is the z-score. Dependent variable in regression 2 is the volatility of earnings. Dependent variable in regression 3 is the loan loss provision ratio. Dependent variable in regression 4 is the volatility of stock return. Dependent variable in regression 5 is the yearly z-score. The regressions are conducted for the period 2000-2010 and contain varying numbers of observations. The independent variables considered in these regressions are: managerial ownership, size, TBTF, leverage, and Tobin's Q. Panel A present results on the subsample that contains banks with a low franchise value. Panel B present results on the subsample that contains banks with a high franchise value. The estimation is based on OLS regressions. *T*-values are in parentheses and *F*-statistic is for testing the hypothesis that all coefficients are zero. *, **, *** Represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Variable	(1) Z-score	(2) Volatility of earnings	(3) Loan loss provision ratio	(4) Volatility of stock return	(5) Yearly z-score
Panel A: Low franchise value (Tobin's Q)					
Managerial ownership	-1.8189***	0.0345**	-0.0294**	0.2657	0.0177
	(-3.24)	(2.00)	(-2.43)	(0.90)	(0.07)
Size	-0.0901**	0.0010	-0.0026***	-0.0569***	0.0825***
	(-2.51)	(0.89)	(-3.16)	(-3.00)	(5.20)
TBTF	0.1402	-0.0007	0.0002	0.0092	-0.0690
	(1.11)	(-0.18)	(0.07)	(0.14)	(-1.28)
Leverage	-2.1465***	-0.1556***	0.0611***	1.5764***	-1.1371***
	(-4.87)	(-11.88)	(4.81)	(7.18)	(-6.16)
Tobin's Q	7.3517***	-0.0847***	-0.1651***	-5.4230***	4.4479***
	(14.38)	(-5.44)	(-14.29)	(-19.99)	(19.62)
F-statistic	48.17***	44.59***	45.13***	81.58***	78.72***
Adjusted R^2	0.3356	0.3145	0.3428	0.4366	0.4305
Observations	468	476	424	521	515
Panel B: High franchise value (Tobin's Q)					
Managerial ownership	-1.3335***	0.0081	0.0027	0.4009***	-0.7682***
	(-3.02)	(1.03)	(0.28)	(2.92)	(-3.90)
Size	-0.1243***	0.0005	0.0036***	-0.0303**	0.0253
	(-3.26)	(0.73)	(6.41)	(-2.49)	(1.45)
TBTF	0.1216	-0.0014	-0.0042**	0.0172	-0.0505
	(0.69)	(-0.44)	(-1.97)	(0.31)	(-0.64)
Leverage	-0.1733	-0.0322***	-0.0220**	0.0529	0.0095
	(-0.73)	(-7.63)	(-2.17)	(0.67)	(0.08)
Tobin's Q	-0.1648**	0.0019	0.0061***	0.0463**	-0.0360
	(-2.47)	(1.60)	(4.92)	(2.02)	(-1.10)
F-statistic	5.08***	43.75***	11.68***	5.64***	5.10***
Adjusted R^2	0.0563	0.3839	0.1583	0.0516	0.0470
Observations	343	344	285	427	417

5. Conclusion, limitations and future research

Here, general conclusions are taken and answers to the research problem are provided. Furthermore, possible limitations to the research will be emphasized and ideas for future research will be discussed.

5.1 General conclusions

This thesis conducted a study to the relation between managerial ownership and bank risk taking with different proxies for risk taking. From the empirical studies it appeared that the percentage of ownership held by top management diminished from an average of 3.24% in 2000 to an average of 1.51% in 2010. It also appeared that the average z-score decreased after 2007 and the loan loss provision ratio increased after 2007, which could indicate that banks are taking more risk after the start of the financial crisis.

The research question in this study sounds: *What is the effect of managerial ownership on bank risk taking?*

At first, it should be noted that the effect of managerial ownership on bank risk taking differs depending on what risk measure is used as the dependent variable. The use of the normal logarithm of the z-score as proxy for risk taking resulted in a negative relation between managerial ownership and z-score. This is in accordance with previous findings (Saunders et al., 1990; Demsetz et al., 1997), which confirmed the finding that it is expected that an increase in managerial ownership leads to more risk taking and the risk taking hypothesis is confirmed. The use of alternative measures for risk taking resulted at first in significant negative relations between managerial ownership and risk taking. Both the loan loss provision ratio and volatility of stock return as proxy for risk taking in the total period model (2000-2010), resulted in a negative relation between managerial ownership and risk taking, which is in accordance with one opposing previous finding by Anderson and Fraser (2000).

However, when these two proxies for risk taking are used as dependent variables in regressions which are conducted for individual years within the period 2000-2010, positive relations between managerial ownership and risk taking are found. These additional analyses indicated that relations can differ during different periods, which is in accordance with a study by Anderson and Fraser (2000).

As a robustness test, the yearly z-score from Konishi and Yasuda (2004) was used as an alternative measure of the z-score. A total period regression resulted in a non-significant negative relation between managerial ownership and the yearly z-score. However, nine of the eleven individual year regressions resulted in a negative relation between managerial ownership and yearly z-score and six of these negative relations are significantly confirmed. This finding indicated that it is expected that an increase in managerial ownership leads to more risk taking (which is in accordance with the finding that used the normal z-score as proxy for risk taking).

Further analysis resulted in regressions on all proxies for risk taking that included year dummies. Three of the five proxies for risk appeared to be significant and a positive relation between managerial ownership and risk taking was confirmed by these regressions. Allowing for an interaction for Tobin's Q value resulted, in contrast to previous findings by Demsetz et al. (1997), in contradicting and non-significant relations between managerial ownership and risk taking.

Overall, the different regressions in this study resulted in support for the risk taking hypothesis over the risk aversion hypothesis. Different proxies for risk found that managerial ownership leads to more bank risk taking in this sample.

Furthermore, some conclusions can be taken about the relations between the control variables and bank risk taking. The effect of Size, TBTF dummy, and leverage differs depending on what risk measure is used as the dependent variable. These findings are in accordance with previous studies that concluded that relations between size, leverage, and risk taking differs due to different proxies for risk and studied periods (Anderson & Fraser, 2000; Zou & Adams, 2008). The relation between franchise value (Tobin's Q) and risk taking appears to be negative in most of the regressions. This indicates that it is expected that a higher franchise value leads to less risk taking. This finding is in accordance with previous studies (Demsetz et al., 1997; Niu, 2010), which concluded that companies with lower franchise value are closer to insolvency and are expected to take more risk. A clear (mostly significant) positive relation appears to exist between the presence of a large shareholder and bank risk taking. This relation is in accordance with previous studies (Demsetz et al., 1997; Anderson & Fraser, 2000; Laeven & Levine, 2009). The relation between the percentage held by institutional owners and bank risk taking appears to be positive for the majority of the conducted regressions, but the findings are not significant. Erkens et al. (2012) found a significant and positive relation between institutional ownership and risk taking, but this finding could not significantly be confirmed with the findings in this thesis.

5.2 Limitations and future research

Although it appeared from the results of this study that it is expected that managerial ownership and risk taking are positively related, the relation is not crystal clear and some caveats and limitations are appointed. The relation between managerial ownership and risk taking can be influenced by endogeneity. Reverse causality can indicate that managerial ownership is influenced by bank risk taking as well. Chen and Steiner (1999) found this causal relation and concluded that managerial ownership is positively related to risk, but also that risk is a significant and positive determinant of the level of managerial ownership. For example, banks that are likely to take more risk, could prefer paying their managers in the form of stockownership and this will automatically leads to the fact that higher managerial stockownership is related to more risk taking. Also the positive relation between the percentage held by institutional owners and risk taking can be influenced by reverse causality. It

could be possible that institutional investors prefer banks that are likely to take more risk, instead of the assumption that a higher percentage of institutional investors lead to more risk taking. Next to this, it is also possible that the relations are stronger when other types of regressions are considered (for example quadratic relations or additional interactions).

Additionally, the risk taking variables are only proxies for risk taking and there are more proxies that could be studied and could possibly lead to other conclusions. This study focused on managerial stockownership, but managers are also motivated by other (non-)financial means. These other motivations than only stockownership could be a limitation to this study; for example options can be taken into consideration and can lead to different conclusions.

Future research is advised to confirm the positive relation between managerial ownership and bank risk taking by expanding the study to an international context and include additional proxies for risk taking. It is also advised to take other additional independent variables into account and not only focus on stockownership, but also take other types of compensation into account. If future research will be conducted in Europe or in an international context and find robust results, this could provide interesting information that could probably help solving the current banking crisis. Managers should be provided with incentives that are in the interest of all stakeholders and not only stockholders. It appeared from this study that aligning the interest of the managers with that of the stockholders (by increasing managerial stockownership), results in more risk taking. Stockholders could benefit from risk taking by increasing possible gains; in contrast, stakeholders are probably more likely to profit from less risk taking and continuity of the banks. With this finding I want to advise future research to take a closer look at ways to provide the managers with incentives that could be beneficial to all stakeholders.

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Appendix

A1 List of banks included in the sample

1	American Express Company	61	Marshall & Ilsley Corporation
2	Anchor BanCorp Wisconsin Inc	62	Metlife, Inc.
3	Associated Banc-Corp.	63	Morgan Stanley
4	Astoria Financial Corporation	64	Nara Bancorp, Inc
5	Bancorpsouth, Inc.	65	National Penn Bancshares, Inc.
6	Bank Mutual Corporation	66	NBT Bancorp, Inc.
7	Bank of America Corporation	67	New York Community Bancorp, Inc
8	Bank of Hawaii Corporation	68	NewAlliance Bancshares Inc
9	Bank of New York Mellon Corporation	69	Northern Trust Corporation
10	Bank Of The Ozarks Inc	70	Northway Financial, Inc
11	BankAtlantic Bancorp	71	Old National Bancorp
12	BB&T Corporation	72	PacWest Bancorp
13	Boston Private Financial Holdings Inc	73	People's United Financial, Inc
14	Brookline Bancorp Inc	74	Pinnacle Financial Partners, Inc.
15	Capital One Financial Corporation	75	PNC Financial Services Group Inc
16	Cascade Bancorp	76	Popular, Inc
17	Cathay General Bancorp Inc	77	Privatebancorp, Inc.
18	Center Financial Corporation	78	Prosperity Bancshares, Inc
19	Central Pacific Financial Corp.	79	Provident Financial Services, Inc.
20	Charles Schwab Corporation	80	Prudential Financial Inc
21	CIT Group, Inc	81	Raymond James Financial Inc
22	Citigroup Inc	82	Regions Financial Corporation
23	City Holding Company	83	Republic Bancorp Inc.
24	City National Corporation	84	Republic First Bancorp, Inc.
25	Columbia Banking System, Inc.	85	S & T Bancorp, Inc.
26	Comerica Incorporated	86	Signature Bank
27	Commerce Bancshares, Inc.	87	Simmons First National Corporation
28	Community Bank System, Inc.	88	SLM Corporation-Sallie Mae
29	Cullen/Frost Bankers, Inc	89	State Street Corporation
30	Dime Community Bancshares, Inc	90	Sterling Bancorp
31	E*Trade Financial Corporation	91	Sterling Bancshares, Inc
32	East West Bancorp, Inc	92	Sterling Financial Corporation
33	Fifth Third Bancorp	93	Stifel Financial Corp
34	First BanCorp	94	SunTrust Banks, Inc.
35	First Commonwealth Financial Corp.	95	Susquehanna Bancshares, Inc.
36	First Financial Bankshares, Inc	96	SVB Financial Group
37	First Financial Corporation	97	SWS Group Inc
38	First Horizon National Corporation	98	Synovus Financial Corp
39	First Midwest Bancorp, Inc	99	T. Rowe Price Group, Inc
40	First Niagara Financial Group, Inc	100	TCF Financial Corporation
41	FirstMerit Corporation	101	TD Ameritrade Holding Corporation
42	Flagstar Bancorp Inc	102	Texas Capital Bancshares, Inc

43	FNB Corporation	103	Tompkins Financial Corp
44	Franklin Resources, Inc.	104	TrustCo Bank Corp of NY
45	Frontier Financial Corporation	105	Trustmark Corporation
46	Fulton Financial Corporation	106	UMB Financial Corporation
47	Glacier Bancorp, Inc	107	Umpqua Holdings Corporation
48	Hancock Holding Company	108	United Bankshares, Inc.
49	Hanmi Financial Corporation	109	United Community Banks, Inc
50	Heartland Financial USA, Inc.	110	US Bancorp
51	Home Bancshares, Inc.	111	Valley National Bancorp
52	Hudson City Bancorp Inc	112	Washington Federal Inc
53	Huntington Bancshares Inc	113	Webster Financial Corp
54	Independent Bank Corp.	114	Wells Fargo & Company
55	International Bancshares Corporation	115	Westamerica Bancorporation
56	Jefferies Group Inc	116	Whitney Holding Corporation
57	JP Morgan Chase & Co.	117	Wilmington Trust Corporation
58	KeyCorp	118	Wilshire Bancorp, Inc.
59	Legg Mason Inc	119	Wintrust Financial Corporation
60	M&T Bank Corporation	120	Zions Bancorporation