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LEVERAGE AND PERFORMANCE OF BANKS DURING THE FINANCIAL CRISIS

A paper looking at the leverage impact on performance of U.S. banks during the recent financial crisis.

Abstract

A lot of theoretical papers have been written about the link between leverage and performance of firms. In this paper I empirically research if highly leveraged banks outperformed lowly leveraged banks in the recent financial crisis and before the crisis in the United States. The results are clear to say that highly leveraged banks perform better than lowly leveraged banks in the period before the crisis. However, during the crisis there are no significant differences observed between the two groups. It is however shown that big banks outperform small banks in the period prior to the crisis and that small banks outperform big banks during the crisis. More research has to be done to see the relationship of bank size and bank leverage and how this influences bank performance prior and during crises.

1. Introduction

After the fall of Lehman Brothers, many papers have been written about possible causes of the financial crisis. Consequences of the crisis have been that many banks had major problems with their liquidity. Throughout the world, many large banks have seen most of their equity destroyed by the crisis that started in the U.S. subprime sector in 2007 and governments have had to infuse capital in banks in many countries to prevent outright failure (Beltratti & Stulz, 2009).

Without governments infusing capital in banks, those banks would have most likely gone into bankruptcy because of the banking panic that arose. A banking panic occurs when bank debt holders suddenly demand that banks convert their debt claims into cash to such an extent that the banks suspend convertibility of their debt into cash or act collectively to avoid suspension of convertibility by issuing clearing-house loan certificates. If this only happens to one particular bank, this is called a bank run (Calomiris & Gorton, 1991).

This means that if a bank has a high leverage ratio and therefore a low amount of equity relative to its debt, they will sooner run into trouble when a bank run or banking panic occurs. Government have therefore developed rules to make sure a bank always has a healthy amount of equity. In America the Securities and Exchange Commission developed the net capital rule and implemented this is 1942. Back then there was an exemption for firms who had their own net capital rules. In 1975 this exemption was repealed and the net capital rule from then on applied to all broker-dealers. The SEC's net capital rule limits the leverage that a firm can take on in its proprietary trading. It is designed to protect the customers and creditors of a brokerage firm from losses and delays that can occur when a firm fails. Because broker-dealers typically have many outstanding contracts with each other, the rule also provides essential protection for other brokerage firms and the markets as a whole (Poser, 2009).

In this paper I empirically test if banks with a high leverage ratio before the crisis performed worse during the recent financial crisis than banks with a low leverage ratio before the crisis. I also add robustness checks to see if there is a survivor-bias and/or a specialization-bias.

2. Capital requirements

As I try to find out what influence the loosening of capital requirements and the higher leverage have on the performance of U.S. banks during the credit crisis, it is first important to find out what the capital requirements in the U.S. were before the crisis. Research has already been done on this subject with some very interesting findings as I describe here.

Banks have capital requirements to protect depositors, other stakeholders, and the government safety net. During the 1990s and until 2004, these capital requirements in the U.S. were specified by the U.S. implementation of the 1988 Basel Accord, an international agreement that is better known as "Basel I". Basel I specifies two minimally acceptable

capital ratios: Tier 1 capital must be 4% of risk-weighted assets or more and total capital (Tier 1 and Tier 2 together) must be 8% of risk-weighted assets or more. U.S. supervisors imposed a third minimum equity ratio which requires banks to have a minimum ratio of Tier 1 capital to unweighted assets of 4% (for some banks this is 3%). This third requirement is better known as the "leverage requirement" (Berger, DeYoung, Flannery, Lee & Öztekin, 2008).

Most bankers argue that the regulation on their permissible leverage and the minimum level of leverage that is required by regulators reduces their ability to compete because equity is far more expensive than debt finance. You would expect that banks will have a capital ratio that is close to their required minimum capital ratio, because of this competition argument. However, since the early 1990s the largest U.S. banks have maintained ratios significantly above the regulatory minimums (Berger et al., 2008). There are several motives and reasons for banks to hold more capital than needed for regulatory reasons. They might have used the high earnings they had since the 1990s to stockpile capital so they had a hedge against having to raise new equity on short notice (Myers & Majluf, 1984). Banking organizations with acquisition plans may maintain extra capital to have some equity available if attractive investment opportunities arise. Banking organizations with more volatile earnings choose higher equity capital ratios (Gale & Ogur, 2005). Banks with customers that are more sensitive to default risks should also hold extra capital. Asset size of a bank also might influence the banks' preferred capital ratios. Finally, firms with more valuable charters tend to hold more equity for protection of their future profit streams (e.g. Marcus, 1984; Keeley, 1990; Demsetz et al., 1996; Hellmann et al., 2000)

Berger et al. (2008) find that U.S. banking firms have a target capital ratio that even exceeds the most stringent regulatory requirements and that their sample bank holding companies actively manage their capital ratios. They also find strong evidence for a decrease

in target capital ratio for bigger bank holding companies and an increase of target capital ratio with bank holding companies' retail deposit franchises.

3. Leverage impact on performance

After looking at the capital requirements and what I can find in the existing literature about this subject, it's also important to understand what impact leverage has on performance.
In the literature written about this, there are mixed opinions. Some say that debt financing boosts firm performance and some say that debt financing hurts firm performance.

Modigliani and Miller (1958) are the ones that instigated the discussion about leverage in firms. Modigliani and Miller's second proposition states that the expected stock return increases with leverage following the equation $E[Re] = E[Ra] + d/e\ (E[Ra] - E[Rd])$, where E[R] is the expected return, e is equity, a is total assets and d is debt. This equation states that the higher the leverage ratio, the higher the expected return of equity will be. Since this paper, many models have suggested debt-related costs and debt-related benifits. Most of the debt-related costs are costs that are related to the bankruptcy process. Both direct bankruptcy costs (Haugen and Senbet, 1978) and indirect bankruptcy costs (Opler and Titman, 1984). Opler and Titman (1984) find that highly leveraged firms lose market share in economic downturns to their competitors that are less leveraged. Three possible reasons are given for this phenomenon, namely customer driven losses, competitor driven losses and manager driven losses. Customer driven losses occur when there is reluctance by customers to do business with the highly leveraged firms. Competitor driven losses occur when financially strong and stable firms try to take advantage of distress periods to act aggressively in an effort to drive out the weaker competitors, also shown by Bolton and Scharfstein (1990). These two have a negative effect on firms, while the third one can have a positive effect on firms. When highly leveraged firms efficiently downsize their firm in response to a downturn, this can have

positive effects on the firm itself and these market share losses are called manager driven losses**.** Their findings are that highly leveraged firms lose substantial market share to their less leveraged competitors and have lower operating profits in economic downturns. This is consistent with their hypothesis that the losses in sales are partially customer driven and competitor driven rather than driven by cost-cutting managers that optimally downsize their firm in declining industries. The (negative) effects of customer and competitor driven losses are bigger than the (positive) effects of manager driven losses.

Brander and Lewis (1986) show that in an oligopoly, a leveraged firm might act more aggressively because of limited liability. What this means is that in firms with more debt, they pursue output strategies that lower returns in bad states and that raise returns in good states. Stakeholders ignore further losses in bankruptcy states, because only the bondholders are affected in case of a bankruptcy. Stakeholders will lose their money in case of a bankruptcy anyway. The bondholders are the residual claimants in case of a bankruptcy, not the stakeholders. Therefore, the managers (as agents of the stakeholders) will take on too risky strategies. Brander and Lewis therefore show that debt hurts a firm in an oligopoly, because of the limited liability effect.

Campello (2006) finds that debt both hurts and boosts a firm's performance. Moderate firm debt get firms market share gains at the expense of industry rivals. Excessive firm debt is associated with market share losses. The "leverage effect" he speaks of is that firms with higher debt than their rivals' average debt expand their sales in the future relative to those rivals. This effect is nonmonotonic, meaning that after a certain threshold, more debt will lead to sales underperformance. He finds that incremental debt has close to no performance consequences for firms with a relative low leverage. He also finds that leader firms underperform their rivals in concentrated markets when those leaders leverage exceeds their industry standard. Follower firms outperform their rivals when those followers leverage

exceeds their industry standard. In less concentrated industries, firm leadership has a much weaker effect on the impact of leverage on performance.

To realise what happens to firms and their actions in times of recessions and booms, one should first look into some basic ideas that were found out long ago. Pigou (1927) and Keynes (1939) already had ideas that firms will behave more competitively during booms, which implies that increases in demand because of the boom will not have much effect on prices, and therefore large effects on output. In times of recessions, firms behave less competitively and output prices rise relative to marginal costs (i.e., markups rise) and real factor prices fall. In times of booms, exactly the opposite happens. Markups of price over marginal cost are therefore countercyclical. Chevalier and Scharfstein (1996) find that a firm's price is more countercyclical in case it is more liquidity constrained. They also find that their price is also more countercyclical when their rivals are more liquidity constrained. This suggests that capital-market imperfections make liquidity constrained firms to lower markups in case of a boom and to increase markups during recessions. Even unconstrained firms increase their markups in recessions, if their constrained rivals increase their markups. This countercyclical movement of the prices may amplify the effects of demand shocks on their output. For example, in times of recessions these firms acting countercyclical increase their prices which amplifies the demand shocks and makes the firm perform even worse.

Campello (2003) finds that mark-ups are more countercyclical in industries where industry debt is high. This is consistent with the model used by Chevalier and Scharfstein (1996). Also consistent with Chevalier and Scharfstein are the cyclical dynamics that Campello finds, where firms relying heavily on external financing are more likely to cut their investment in market share building when there are negative demand shocks. The competitive outcomes resulting from these actions depend on the industry rivals' financial structure and their own financial structure. Campello (2003) also shows that debt financing has a negative

effect on firm sales growth (relative to industry sales growth) in industries where rival firms are relatively unlevered during recessions. These effects are not observed during booms or in high debt industries.

4. Size impact on performance

Another factor that is worth looking into is the impact of firm size on performance, which is in the literature being discussed as economies of scale. If there is a positive relation between company size and economies of scale, bigger firms should be more productive and profitable. Results of the studies that look into the relation between size and economies of scale have been mixed, some say there is a negative relation and some say there is a positive relation. Scherer (1980) finds there is a negative relation between size and economies of scale, but on the other hand, Haldi and Whitcomb (1967) find there is a positive relation between size and economies of scale. Even after knowing these inconsistent findings, many economics still assume there indeed is a positive relation between size and economies of scale (Sawyer, 1981). These reduction of costs as output expands have many sources, I discuss three of them that Sawyer (1981) explains as some of the most important sources of unit cost reduction. One of them is the "principle of bulk transactions". The costs, associated with a sale or purchase, don't rise proportionally with the scale a transaction has. The larger the scale of the transaction, the smaller the relative transaction costs. Another source of unit cost reduction has to do with specialisation and division of labour. Employees are more efficiently used and become more productive when there is a division of labour. The last source I discuss is the source that Haldi and Whitcomb (1967) label as "stochastic increasing returns". Manufacturing plants always have "spare parts" ready if there are machines that break down. Under the assumption that machines break down randomly, factories with more machines relatively have to have less "spare parts". Since these researches are done on manufacturing

firms, one can doubt if this is applicable to the banking sector. Berger and Mester (1999) and Stiroh (2000) find strong evidence of increasing returns to scale for big US commercial banks during the 1990s. Boyd and Runkle (1992) wrote a paper on the size and performance of banking firms where they test two theories that say that bigger banks have a competitive advantage over smaller banks. The modern intermediation theory predicts that large intermediary firms are more cost-efficient because they are less likely to fail than small firms. This theory says that efficiency gains are related to size. The other theory, deposit insurance theory, predicts size related subsidies and distortions. This is the case because regulatory treatment of banking firms is not symmetric by size. Large bank failures are more likely to cause macroeconomic problems, and therefore large bank failures are more feared than small bank failures. Because of the policy of "Too big to fail", all liabilities of very large banks (banks that are "too big to fail") are formally or informally guaranteed. Small bank failures result in creditors losing their money, large bank failures result in bank bailouts if the bank is large enough to be classified as too big to fail. Government insurance is more valuable for large banks than for the rest of the industry (Boyd & Runkle, 1992). According to Boyd & Runkle (1992) it is not possible to clearly differentiate between a competitive advantage due to a high subsidy rate (deposit insurance theory) and one due to technical efficiency (modern intermediation theory). They test the joint predictions of both the deposit insurance theory and the modern intermediation theory and they find only limited support for either theory. Their results suggest an inverse relationship between the size of a banking firm and the volatility of asset returns. But they find no evidence that large banks are less likely to fail than small banks. They actually show that large banks are more likely to fail in the period 1971-1980. They do present a possible answer to why this is the case: there might be inverse relationships between size and the rate of return on assets and between size and the ratio of equity to assets. What this means is that large banks are systematically less profitable if you look at asset

returns and large banks are systematically more highly levered. Other research about large banks and their performance can be found in the book "Too Big to Fail: The Hazards of Bank Bailouts" written by Feldman and Stern (2004). They explain that the roots of the Too Big to Fail (TBTF) problem lie in the expectations creditors have. Uninsured creditors of systematically important large banks expect to receive protection from the government if their bank fails. These expectations of creditors lead banks that are considered as TBTF by their creditors to take on too much risk and waste resources (moral hazard problem). Feldman and Stern (2004) conclude that the costs of too big to fail protection exceed the benefits of too big to fail protection. Maybe even more interesting is the review essay that Mishkin (2006) wrote about the book of Feldman and Stern. He says that there indeed is a too big to fail problem in the banking sector, but that Feldman and Stern overstate their case that TBTF is the central problem for bank regulation and supervision. The moral hazard problem however, is a source of discrepancy between big and small banks. Therefore performances of TBTF banks might be influenced by size because the TBTF banks take on too much risk and waste resources as stated by Feldman and Stern (2004).

5. Data description

To get the data I need I used the Wharton Research Data Services (WRDS) to find data on banks through the Bureau van Dijk Bankscope database. I look at US banks where data can be found about the total liabilities, total assets and return on average equity. In first case, I do not take into account what specialisation a bank has. To make sure there are no outliers in my dataset, I only take the banks that had a Return on Average Equity (ROAE) that was between -42.73 and 34.68. This means I only take the banks that were not in the top 1 percent or the bottom 1 percent with respect to return on average equity. I go with the performance indicator ROAE because this is a measure of return of a company on average equity, and this can give an accurate depiction of a certain company's (or in this case bank's) corporate profitability. It

is an adjusted version of the normal return on equity (ROE), which is also a good measure of company profitability. The difference is that in ROAE the denominator that is used is the average shareholders' equity, where in ROE the denominator is the shareholders' equity. This is better for industries where shareholders' equity change considerably during a certain fiscal year. In economic crises as the financial crisis of the late 2000's, there is a possibility that shareholder' equity will change considerably within a fiscal year. If this does not happen and the shareholders' equity does not change much during the fiscal year, the ROE and ROAE should be quite similar. As an indicator of leverage ratio, I go with the debt-asset ratio that is easily calculated as total debt divided by total assets if both these numbers are in the dataset.

To compare the highly leveraged banks with the low leveraged banks, I make two groups of banks over the data I had from banks in 2002. One group of banks (high leveraged banks) are the top 25% leveraged banks from the dataset and the other group (low leveraged banks) are the bottom 25% leveraged banks from the dataset. I also included a top 10% leveraged group and a bottom 10% leveraged group to compare them with. After dividing the groups by leverage ratio, I merge the database with the observations from the complete dataset. This gives me the observations of all banks in the different groups (top 25%, bottom 25%, top 10%, bottom 10%) from 2002 until 2009.

Because the difference in performance between banks might be quite substantial if a certain bank is bigger than the other, I also repeat these tests for banks classified as big banks (which will be the top 25% banks in total assets in the year 2002). Also I add a test to see if the top 10% biggest banks in total assets in 2002 have significantly different results in ROAE as the 90% smallest banks in total assets in 2002. I repeat this test with the 25% biggest and 25% smallest banks in total assets in 2002.

The crisis period as defined by Beltratti & Stulz is from the middle of 2007 until the end of 2008. They themselves thought this crisis period was controversial, but they had

insufficient data to expand the 2008 to a point further in the future. This means that the data I use for my "before the crisis" period is the data from 2002 until 2006. The data I use for the crisis period is the data from 2007, 2008 and 2009, which may be controversial because the first half of 2007 wasn't part of the crisis period of Beltratti & Stulz. Since I have no data from the first half of 2007, I cannot include this data in the "before the crisis". I include the data from 2009 as data from the crisis period because their might be a delayed effect of the crisis that influences the performance of banks in 2009. Since I don't have the data for 2010, I cannot check if the delay is still there after 2009.

6. Data

The numbers I am interested in are the indicator for leverage and the indicator for performance. The indicator for leverage is easy to calculate in SAS, the data program I use for the tests, because I have the numerical outcomes of total liabilities and total assets of all banks in the dataset downloaded from WRDS. I divide the total liabilities by the total assets to get the debt-to-assets ratio which I need to form the different leverage groups. The performance indicator, Return on Average Equity (ROAE), can be found in the dataset directly. I focus on the mean of the return on average equity to do further calculations with.

In Table 1.1 you can see that the performance of the top 25% leveraged firms is better before the crisis period than the performance of the bottom 25% leveraged firms and that the performances of high leveraged and low leveraged firms are getting closer together towards 2009. To see if the differences in numbers observed is a significant difference, I perform a T-test in SAS to find the confidence intervals for the mean of the ROAE of both leverage groups. After these T-tests, I find the confidence intervals that specify the range of values within the mean may lie. In mathematical terms it is given by $\bar{x} \pm t_{1-\frac{\alpha}{2},N-1} \frac{s}{\sqrt{N}}$ where N is the number of valid observations and s is the sample deviation of the observations. In SAS they

use an alpha (confidence level) of .95. Meaning that in 95% of the cases, the mean of the chosen variable will lie between the two confidence levels. If the confidence interval for the high levered and low levered banks does not show an overlay, it means the two are significantly different. For our table this means that the high levered banks significantly outperform the low levered banks in the period 2002-2007, and there are no significant differences in the period 2008-2009. In Graph 1.1 you can see this even more clearly. It shows that the differences are significant until 2007 and after that it shows that the numbers are insignificantly different. You can however see a pattern that the low leveraged firms relatively (and in this case in 2009 also absolutely) perform better than the high leveraged firms in 2008 and 2009.

In Table 1.2 you can see the results of the same tests on a dataset where the groups are the top 10% levered banks and the bottom 10% levered banks. It has similar results in that the differences are significant between 2002-2007 and no significant differences between the means in 2008 and 2009. Comparing these numbers with the ones of table 1.1 shows us another interesting difference. This is shown in Table 1.3 and Table 1.4, here it is clear that the 25% highest leveraged banks and the 10% highest leveraged banks have no significantly different means. However, the 10% lowest leveraged banks have significantly lower means than the 25% lowest leveraged banks in 7 of the 8 years of data.

I recalculate my findings for big banks (top 25% banks in asset size in 2002) because size might be an important influence on performance. In Table 1.5 and Graph 1.5 you can see the results when I perform the test for the 25% highest levered banks and the 25% lowest levered banks. Although the results look slightly different than before (in 2008 the 25% high levered have a lower mean of ROAE than the 25% low levered banks have), the results stay the same. In the period before the crisis period the high levered big banks significantly outperform the low levered big banks and in the crisis period no significant differences are

observed. In Table 1.6 and Graph 1.6 you can see that for the 10% level, the results stay the same as before. In the case of the 25% biggest banks, there is not a significant change seen as in Table 1.4 was the case. The 10% lowest leveraged banks don't have significantly lower means than the 25% lowest leveraged banks in most years, this is only the case in year 2002.

As seen in Table 1.7 and Graph 1.7, there is no statistically significant difference between the means of the 25% highest leveraged banks and the 10% highest leveraged banks. For the 25% lowest leveraged banks compared with the 10% lowest leveraged banks, you can see in Table 1.8 and Graph 1.8 that the means of the 10% lowest leveraged group is lower, but only in 2002 this was a statistically significant difference.

In Table 1.13 and Graph 1.13, it is shown that the 10% biggest banks outperform their smaller competitors (90% smallest banks) in the full period before the crisis. In the first year of the crisis period, 2007, there is no significant difference but the pattern that is seen continues so they are being outperformed by their smaller competitors in the years 2008 and 2009. In Table 1.14 and Graph 1.14, you can see almost the same thing happening for the 25% biggest banks and the 25% smallest banks. In the period before the crisis, the bigger banks outperform the smaller banks. In the 10% biggest – 90% smallest test there are insignificant differences in 2007, but in the 25% biggest – 25% smallest test there are insignificant differences. In the first year of the crisis, the 25% biggest banks still outperform the 25% smallest banks, but the trend can be seen that they are losing returns faster than their smaller competitors. This trend continues into 2008 and 2009, where the 25% smallest banks significantly outperform the 25% biggest banks (in 2009).

7. Robustness checks

There could be a survivor-bias that influences the outcomes of my data analysis, meaning that the results may change if I only take into account banks that did not go bankrupt in the

observation period. I use a robustness check to see if this is a relevant factor. After checking the numbers from Table 1.9 and Table 1.1, the conclusion is that my dataset with only survivors has no significant differences with my dataset of survivors and non-survivors. There seems to be no survivor-bias in case of 25% levels (Table 1.9 and Table 1.1 are similar) and in case of 10% levels (Table 1.10 and Table 1.2 are similar).

Another robustness checks I do is for specialisations of banks. There might be a specialisation-bias, meaning that it could potentially matter if you would take all types of banking firms or only commercial banks. After checking the number from Table 1.11 and Table 1.1, the conclusion is that my dataset with only commercial banks has no significant differences with my dataset of all banks (except for two very small significant differences in year 2008 for 25% low and in year 2007 for 10% high). There seems to be hardly any specialisation-bias in case of 25% levels (Table 1.11 and Table 1.1 are almost similar) and in case of 10% levels (Table 1.12 and Table 1.2 are almost similar).

8. Link to literature

To link the data I find to existing literature, I first look at what existing literature would expect the outcomes of my tests be in the period before the crisis (2002-2006). Modigliani and Miller (1958) expect that high leveraged banks perform better in the period before the crisis as is readable in their second proposition. Brander and Lewis (1986) state that firms with more debt would pursue strategies that raise returns in good states, so they expect the high leveraged banks to outperform the less leveraged competition before the crisis hit. Because of the "leverage effect" explained earlier, Campello (2006) expects that high leveraged firms outperform their lowly leveraged rivals before the crisis. The countercyclical movement of markups explained by Chevalier and Scharfstein (1996) make them expect the same as all the ones mentioned above, they too expect high leveraged banks to perform better

before the crisis as their less leveraged competition. To see what current literature would expect of my results for the crisis period (2007-2009), I look at Opler and Titman (1984), Brander and Lewis (1986), Chevalier and Scharfstein (1996) and Campello (2003). All have the same ideas of what would happen with high leveraged banks in times of financial distress. Indirect bankruptcy costs (Opler and Titman, 1984), limited liability effect (Brander and Lewis, 1986) and the idea of countercyclical markups (Chevalier and Scharfstein, 1996 and Campello, 2003) all make them expect the highly leveraged banks to perform worse during the recent crisis.

So what are the conclusions in my tests and is this in agreement with the findings of the researchers cited above? My findings were indeed in agreement with the findings of current literature, at least for the period from 2002-2006. In this period, my data says that the highly leveraged banks significantly outperform their less leveraged competitor banks. My data from the crisis period (2007-2009) however, does not show a significant difference of the means of the return on average equity between the highly leveraged group and the lowly leveraged group.

In Table 1.1, you can however see a pattern that the low leveraged firms relatively (and in this case in 2009 also absolutely) perform better than the high leveraged firms in 2008 and 2009. These results seem to go towards a situation where the low leveraged firms will outperform the highly leveraged firms in the following years. There seems to be a lag in the performance effects after the beginning of the financial crisis in 2007. Economic lags aren't unusual in the economic world, as seen in the paper by Friedman (1961) where he explains the existence of a long and variable lag on monetary policy. He is also convinced that this is the case for more policies made by the government.

Scherer (1981) finds that big banks have a negative relation with economies of scale, therefore he would expect the big banks to be outperformed by small banks before the crisis.

Haldi and Whitcomb (1967) and Sawyer (1981) find a positive relation of firm size and economies of scale, so they would expect the big banks to outperform the small banks before the crisis. Because of the two theories by Boyd and Runkle (1992), modern intermediation theory and deposit insurance theory, they expect that bigger banks outperform smaller banks before the crisis. Feldman and Stern (2004) and their too big to fail-problem (moral hazard) suggests that the very large banks are outperformed by their smaller rivals in the period before the crisis and the crisis period itself.

So what were the conclusions in my tests and is this in agreement with the findings of the researchers cited above? My data shows that big banks outperform the smaller banks in the period before the crisis, following the theory of Haldi and Whitcomb (1967) and Boyd and Runkle (1992). These two theories did not say anything about the performances predicted in economic downturns. The theory of Feldman and Stern (2004) is correct in predicting that large banks are outperformed by smaller banks in periods of crisis.

9. Conclusion

A lot of research has been done about the size and leverage of firms and their performance in the 1990s and 2000s. Most of these papers agree that highly leveraged firms outperform their less leveraged competition and that that highly leveraged firms perform worse than lowly leveraged firms in times of economic downturns. This paper empirically researches if these predictions are correct in the U.S. banking sector in the time period of 2002 until 2009 (before and during the recent financial crisis). The results of the period before the crisis are as expected, highly leveraged banks significantly outperform lowly leveraged banks in the time period of 2002-2006. No significant differences are seen in the crisis period (2007-2009). However, there is a pattern observed that highly leveraged banks are affected more in returns by the crisis. Therefore it should be wise for future research to look at a larger time period to

see if this pattern creates significant differences in 2010 and 2011. According to my research, there is no significant survivor-bias or specialisation-bias observed, but it is plausible that firm size has a big influence on the results. My data shows that bigger banks outperform smaller banks in the period before the crisis, and that smaller banks outperform bigger banks in the crisis period. Future research should look to the exact influence of bank size on both bank performances in crisis periods as in 'normal' periods. Also the influence of bank size on the leverage ratios of banks should be further researched. As Boyd and Runkle (1993) state: there might be an inverse relationship between size and the ratio of equity to assets. In other words, bigger banks might be systematically more highly leveraged.

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Tables

Here is the part of the thesis where all my tables and graphs will be shown and explained.

Table 1.1 – ROAE of 25% highest and lowest leveraged banks.

	25% High			**25% Low**		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	12.679	12.36943	12.059	6.9596	6.658665	6.3578
2003	12.715	12.44039	12.166	7.2933	7.032474	6.7716
2004	12.545	12.26578	11.987	7.9685	7.734872	7.5012
2005	13.011	12.7214	12.431	8.4723	8.237864	8.0034
2006	12.33	12.01591	11.701	8.3311	8.067453	7.8038
2007	10.08	9.724302	9.3684	7.5402	7.263646	6.9871
2008	5.7068	5.213965	4.7211	4.8661	4.487028	4.1079
2009	3.2624	2.687396	2.1124	3.7632	3.334895	2.9066

Graph 1.1 – ROAE of 25% highest and 25% lowest leveraged banks.

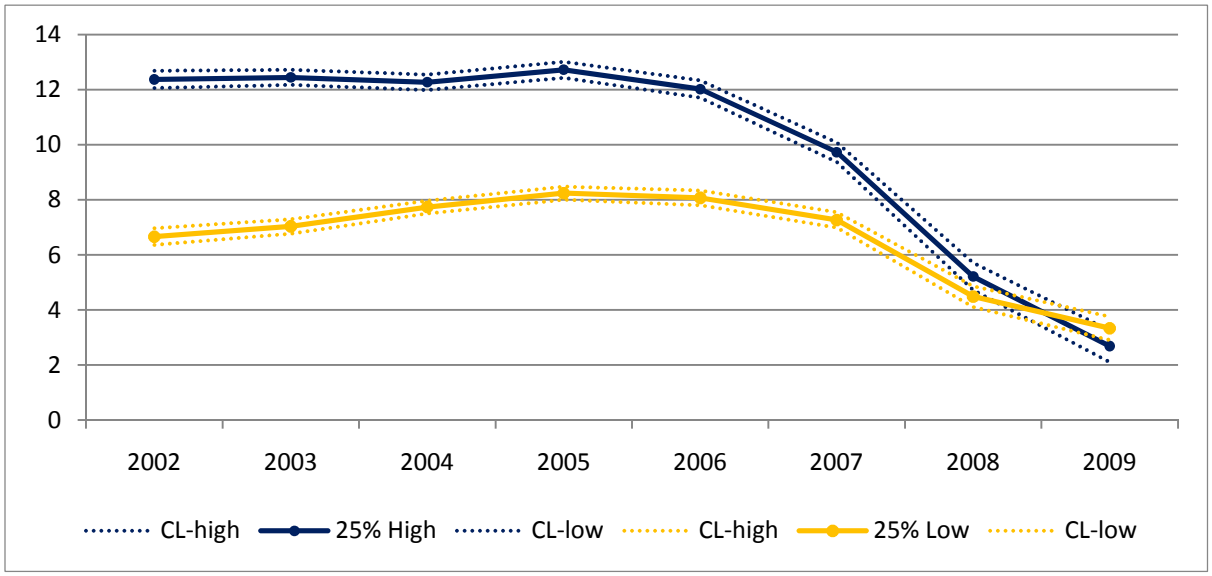

Table 1.2 – ROAE of 10% highest and 10% lowest leveraged banks.

	10% High			10% Low		
	CL-low	Mean	CL-high	**CL-low**	Mean	CL-high
2002	11.068	11.70995	12.352	3.5978	4.203738	4.8097
2003	11.614	12.15294	12.691	4.5769	5.099391	5.6219
2004	11.414	11.93854	12.463	5.7651	6.224096	6.6831
2005	11.678	12.22226	12.767	6.6222	7.054634	7.4871
2006	10.917	11.51907	12.121	6.3876	6.86616	7.3447
2007	8.2576	8.940363	9.6232	5.6658	6.145484	6.6251
2008	3.3344	4.275363	5.2163	2.455	3.135315	3.8156
2009	1.8878	2.879199	3.8706	1.387	2.156622	2.9262

Graph 1.2 – ROAE of 10% highest and 10% lowest leveraged banks.

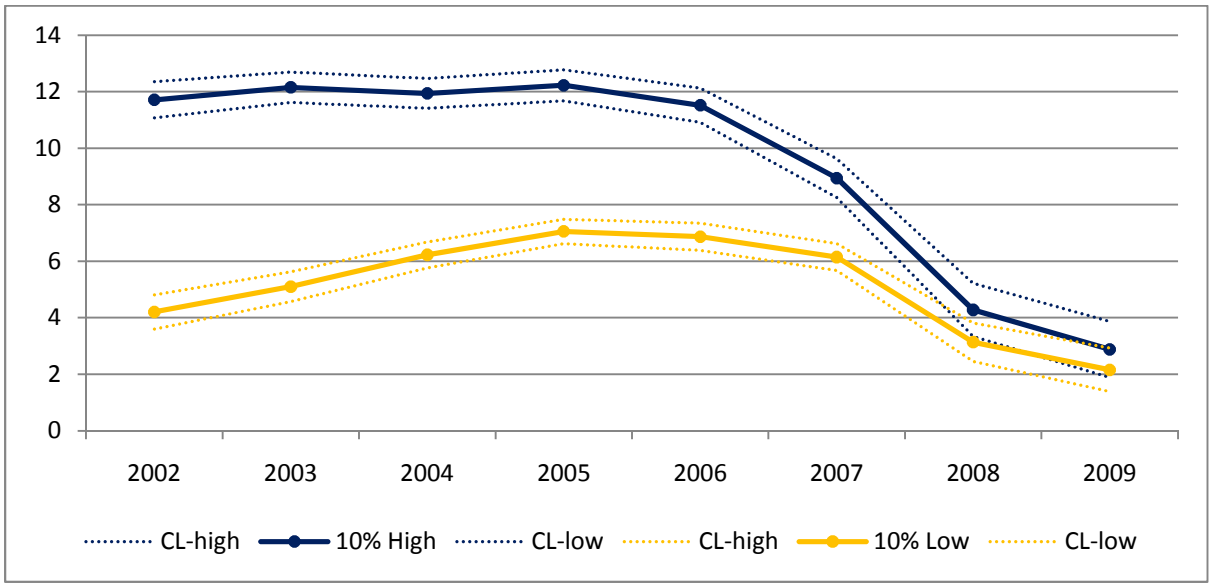

Table 1.3 – ROAE of 25% highest and 10% highest leveraged banks.

	25% High			10% High		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	12.679	12.36943	12.059	12.352	11.70995	11.068
2003	12.715	12.44039	12.166	12.691	12.15294	11.614
2004	12.545	12.26578	11.987	12.463	11.93854	11.414
2005	13.011	12.7214	12.431	12.767	12.22226	11.678
2006	12.33	12.01591	11.701	12.121	11.51907	10.917
2007	10.08	9.724302	9.3684	9.6232	8.940363	8.2576
2008	5.7068	5.213965	4.7211	5.2163	4.275363	3.3344
2009	3.2624	2.687396	2.1124	3.8706	2.879199	1.8878

Graph 1.3 – ROAE of 25% highest and 10% highest leveraged banks.

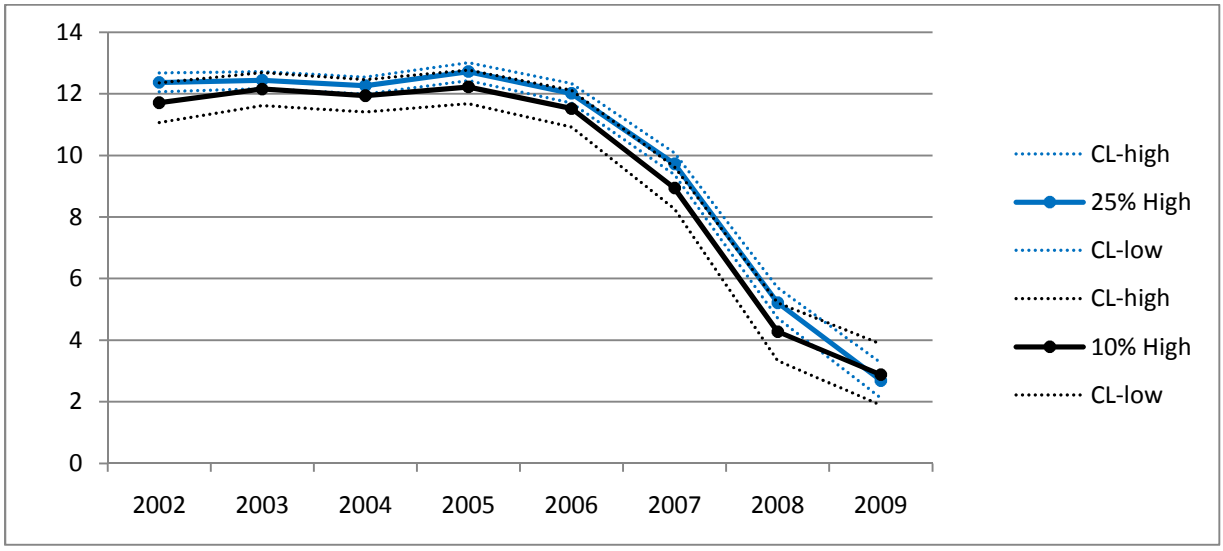

Table 1.4 – ROAE of 25% lowest and 10% lowest leveraged banks.

	25% Low			10% Low		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	6.9596	6.658665	6.3578	4.8097	4.203738	3.5978
2003	7.2933	7.032474	6.7716	5.6219	5.099391	4.5769
2004	7.9685	7.734872	7.5012	6.6831	6.224096	5.7651
2005	8.4723	8.237864	8.0034	7.4871	7.054634	6.6222
2006	8.3311	8.067453	7.8038	7.3447	6.86616	6.3876
2007	7.5402	7.263646	6.9871	6.6251	6.145484	5.6658
2008	4.8661	4.487028	4.1079	3.8156	3.135315	2.455
2009	3.7632	3.334895	2.9066	2.9262	2.156622	1.387

Graph 1.4 – ROAE of 25% lowest and 10% lowest leveraged banks.

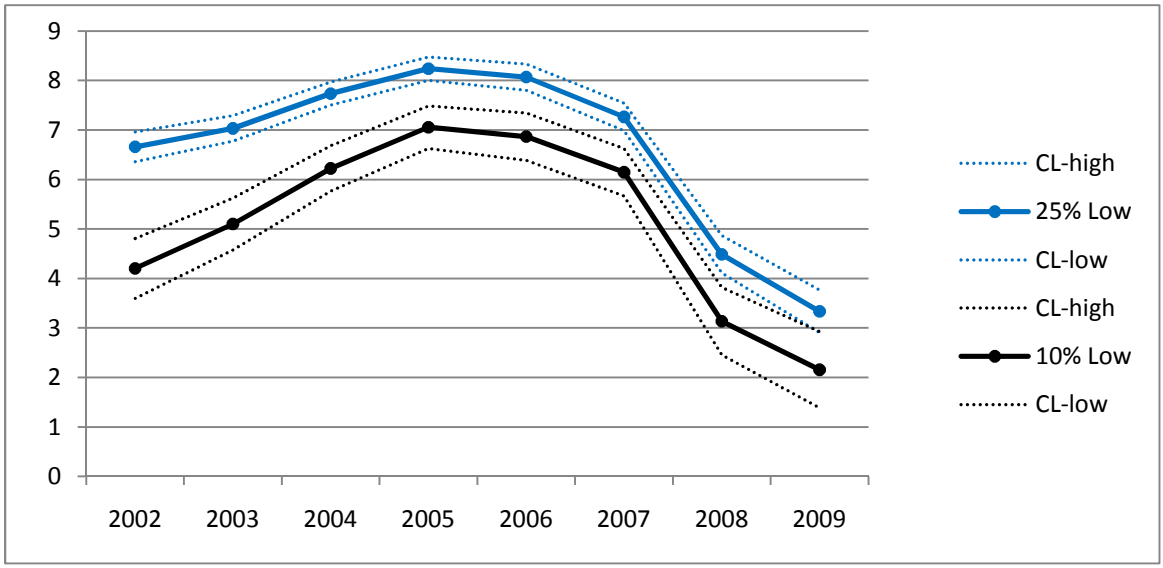

Table 1.5 – ROAE of 25% highest and 25% lowest leveraged big banks.

	25% High			**25% Low**		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	14.433	13.77409	13.116	10.734	10.19704	9.66
2003	14.091	13.48968	12.888	10.662	10.13093	9.6
2004	13.635	13.02651	12.418	11.045	10.52039	9.9962
2005	13.62	12.96504	12.31	10.656	10.17736	9.6983
2006	13.115	12.43422	11.753	10.954	10.35238	9.7512
2007	9.4754	8.628792	7.7821	9.1392	8.429522	7.7199
2008	3.668	2.281717	0.8954	3.8056	2.685763	1.5659
2009	2.4838	1.09299	-0.298	3.2954	2.050829	0.8063

Graph 1.5 – ROAE of 25% highest and 25% lowest leveraged big banks.

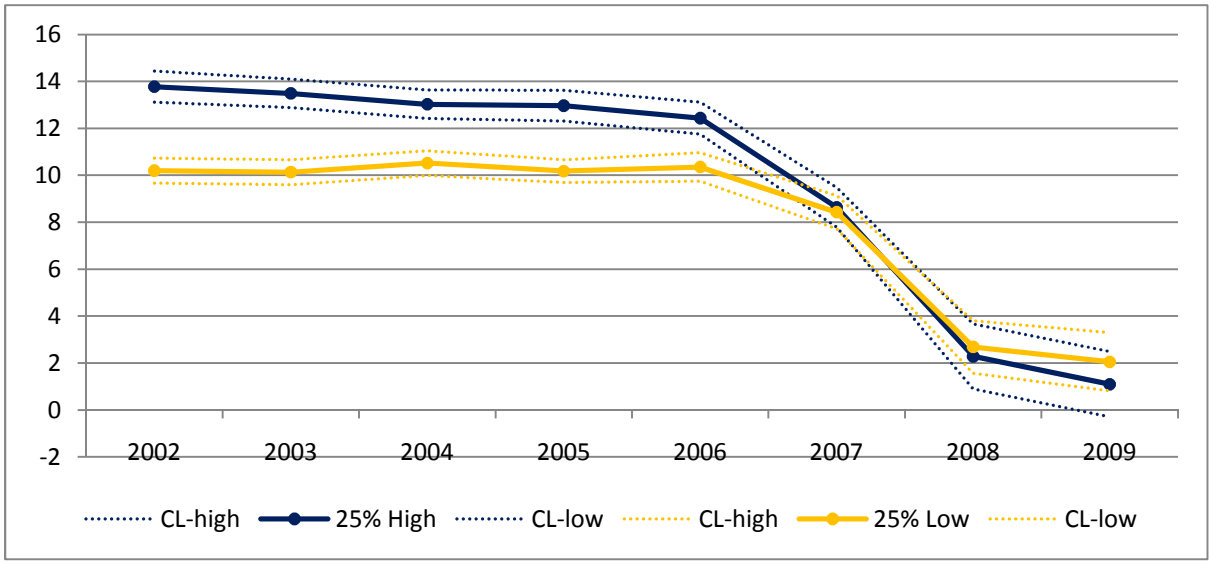

Table 1.6 – ROAE of 10% highest and 10% lowest leveraged big banks.

	10% High			10% Low		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	14.467	13.20445	11.942	9.4965	8.503246	7.51
2003	14.662	13.50487	12.348	10.135	9.27788	8.4208
2004	13.489	12.31761	11.146	10.791	9.848737	8.9066
2005	13.671	12.52989	11.389	9.7689	8.915829	8.0628
2006	13.727	12.44641	11.166	11.001	9.988188	8.9757
2007	9.5532	8.045526	6.5379	9.267	8.011935	6.7569
2008	4.2115	1.830855	-0.55	3.8265	2.025714	0.2249
2009	3.873	1.124412	-1.624	2.9033	0.822571	-1.258

Graph 1.6 – ROAE of 10% highest and 10% lowest leveraged big banks.

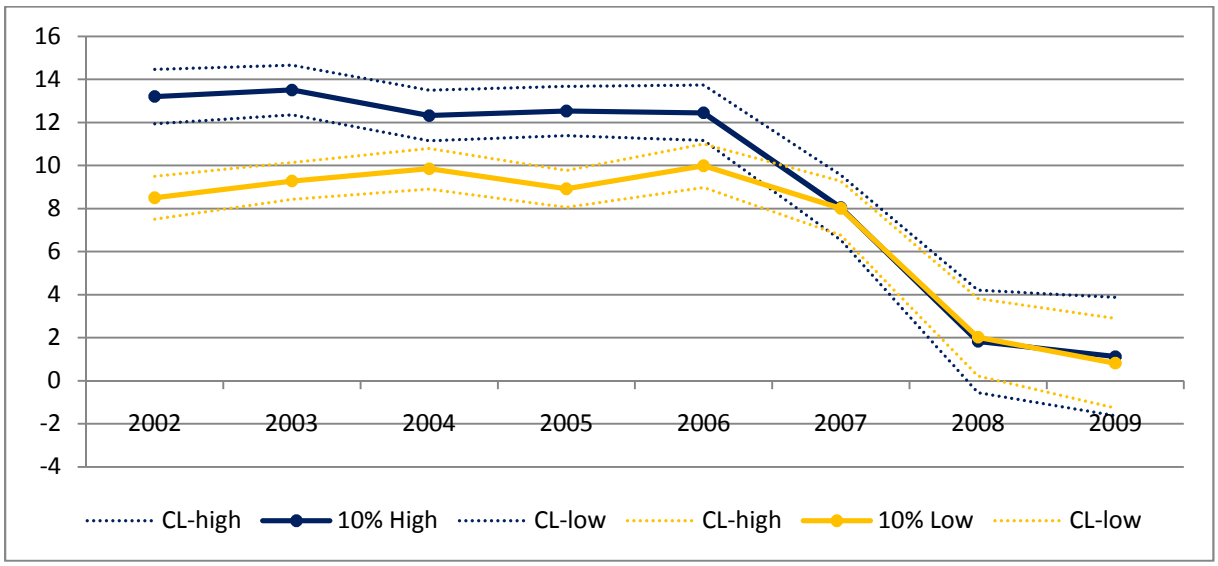

Table 1.7 – ROAE of 25% highest and 10% highest leveraged big banks.

	25% High			10% High		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	14.433	13.77409	13.116	14.467	13.20445	11.942
2003	14.091	13.48968	12.888	14.662	13.50487	12.348
2004	13.635	13.02651	12.418	13.489	12.31761	11.146
2005	13.62	12.96504	12.31	13.671	12.52989	11.389
2006	13.115	12.43422	11.753	13.727	12.44641	11.166
2007	9.4754	8.628792	7.7821	9.5532	8.045526	6.5379
2008	3.668	2.281717	0.8954	4.2115	1.830855	-0.55
2009	2.4838	1.09299	-0.298	3.873	1.124412	-1.624

Graph 1.7 – ROAE of 25% highest and 10% highest leveraged big banks.

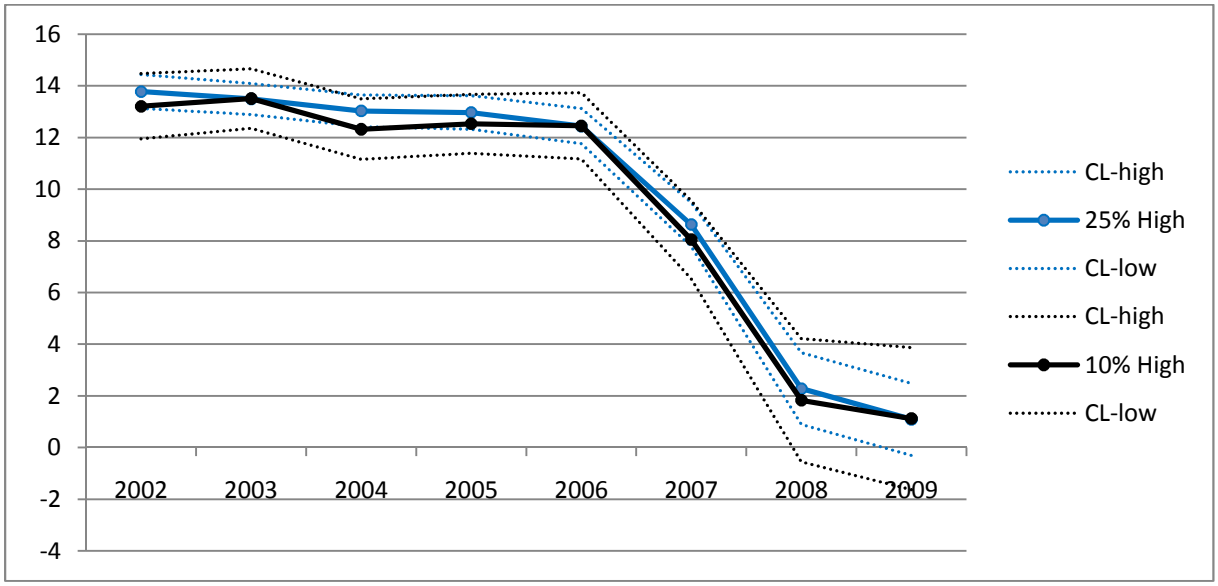

Table 1.8 – ROAE of 25% lowest and 10% lowest leveraged big banks.

	25% Low			10% Low		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	10.734	10.19704	9.66	9.4965	8.503246	7.51
2003	10.662	10.13093	9.6	10.135	9.27788	8.4208
2004	11.045	10.52039	9.9962	10.791	9.848737	8.9066
2005	10.656	10.17736	9.6983	9.7689	8.915829	8.0628
2006	10.954	10.35238	9.7512	11.001	9.988188	8.9757
2007	9.1392	8.429522	7.7199	9.267	8.011935	6.7569
2008	3.8056	2.685763	1.5659	3.8265	2.025714	0.2249
2009	3.2954	2.050829	0.8063	2.9033	0.822571	-1.258

Graph 1.8 – ROAE of 25% lowest and 10% lowest leveraged big banks.

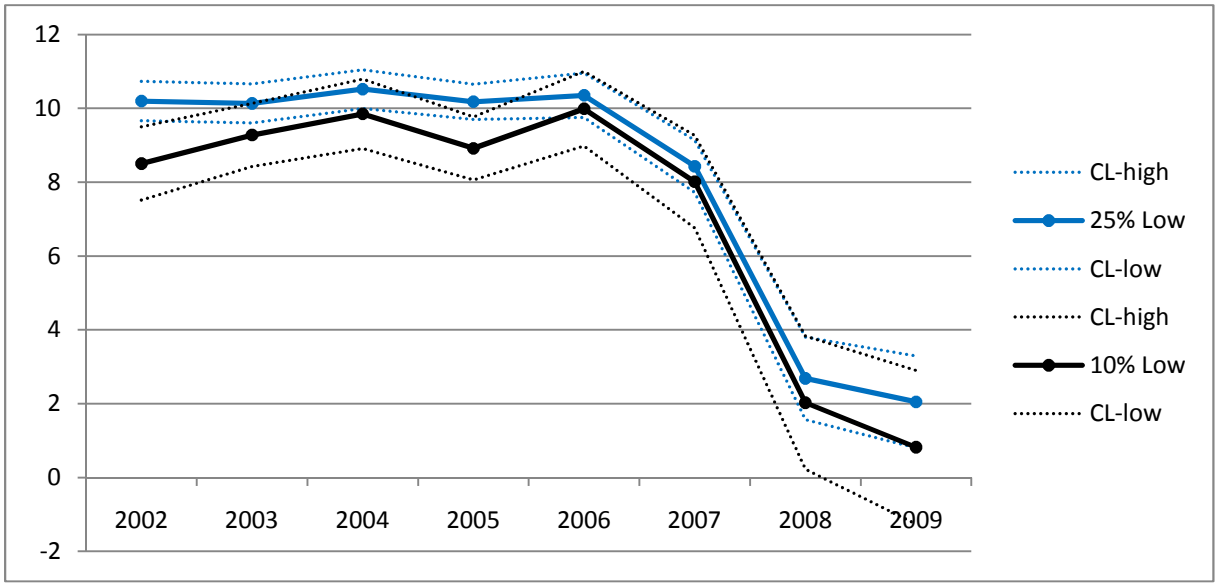

Table 1.9 – ROAE of 25% highest and 25% lowest leveraged surviving banks.

	25% High			25% Low		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	12.973	12.5965	12.22	6.9634	6.626062	6.2887
2003	13.017	12.68288	12.349	7.2426	6.959989	6.6774
2004	12.854	12.52512	12.196	7.9561	7.699978	7.4439
2005	13.213	12.88434	12.556	8.4297	8.180883	7.9321
2006	12.74	12.40961	12.08	8.3571	8.091024	7.8249
2007	10.887	10.54509	10.203	7.7618	7.494139	7.2265
2008	6.9182	6.472773	6.0273	5.6217	5.288444	4.9552
2009	3.2378	2.655476	2.0731	3.8346	3.418321	3.002

Graph 1.9 – ROAE of 25% highest and 25% lowest leveraged surviving banks.

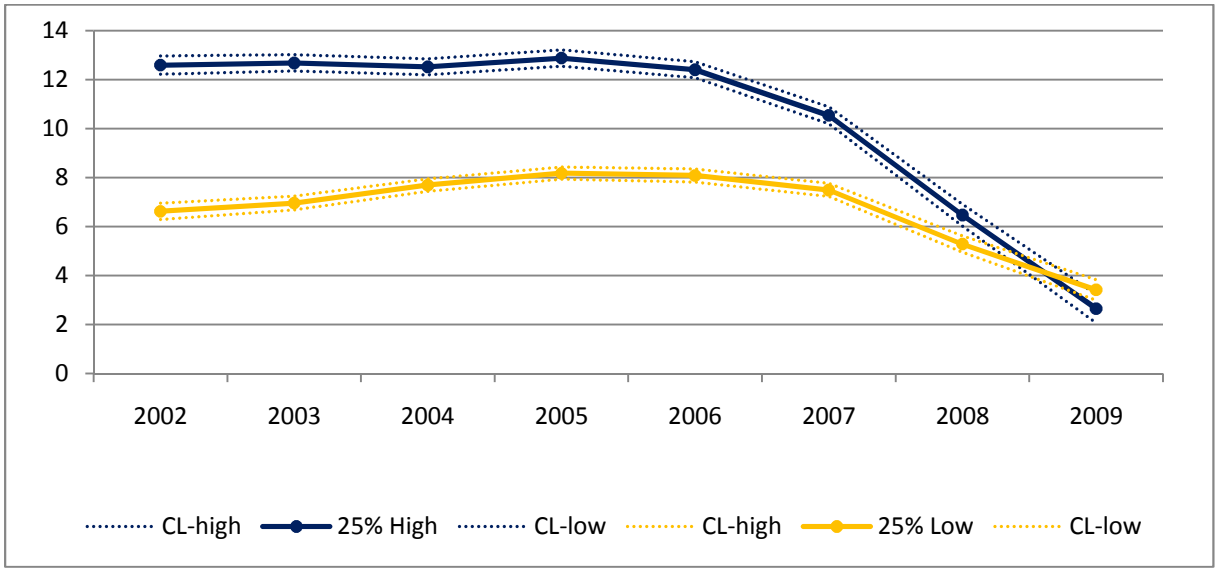

Table 1.10 – ROAE of 10% highest and 10% lowest leveraged surviving banks.

	10% High			10% Low		
	CL-high	Mean	CL-low	CL-high	Mean	CL-low
2002	12.642	11.82831	11.014	4.3999	3.716572	3.0332
2003	12.766	12.07899	11.392	5.2183	4.660237	4.1022
2004	12.604	11.95105	11.298	6.4174	5.926493	5.4356
2005	12.841	12.20406	11.567	7.2879	6.860506	6.4331
2006	12.369	11.75077	11.132	7.267	6.79248	6.3179
2007	10.489	9.853621	9.2184	6.8547	6.410063	5.9654
2008	6.6986	5.824841	4.9511	4.6903	4.12	3.5497
2009	3.6657	2.643977	1.6222	2.8788	2.134771	1.3907

Graph 1.10 – ROAE of 10% highest and 10% lowest leveraged surviving banks.

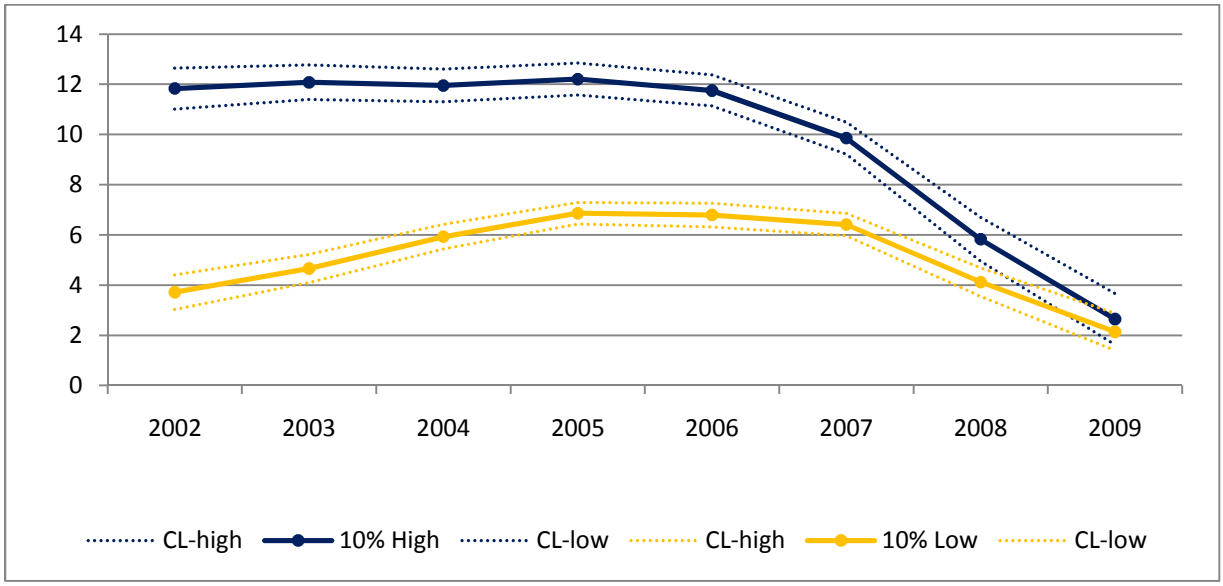

Table 1.11 – ROAE of 25% highest and 25% lowest leveraged commercial banks.

	25% High			25% Low		
	CL-high	Mean	CL-low	CL-high	Mean	CL-low
2002	12.908	12.53243	12.157	6.8394	6.496965	6.1545
2003	12.958	12.63859	12.319	7.2126	6.921755	6.6309
2004	12.83	12.50009	12.171	8.1028	7.84235	7.5819
2005	13.182	12.84128	12.5	8.7801	8.519193	8.2583
2006	12.719	12.36632	12.014	8.7874	8.516718	8.2461
2007	10.706	10.32196	9.9379	8.0602	7.77087	7.4816
2008	6.6812	6.151997	5.6228	5.71	5.32365	4.9373
2009	4.245	3.624807	3.0046	4.586	4.15929	3.7326

Graph 1.11 – ROAE of 25% highest and 25% lowest leveraged commercial banks.

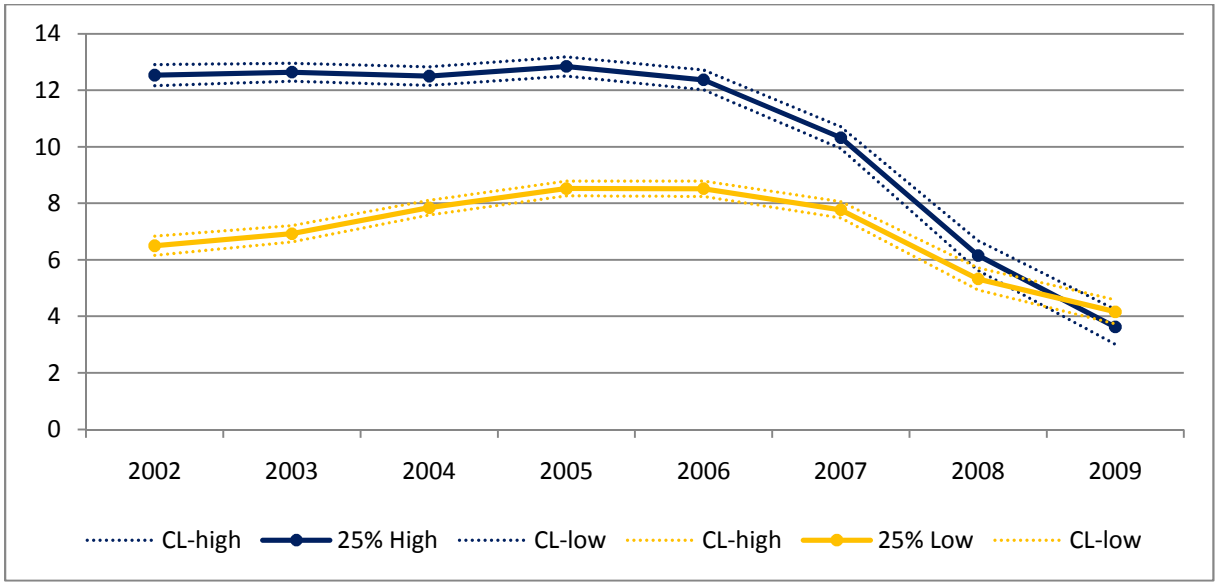

Table 1.12 – ROAE of 10% highest and 10% lowest leveraged commercial banks.

	10% High			**10% Low**		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	12.824	12.12615	11.428	4.9539	4.33524	3.7166
2003	13.055	12.48765	11.92	5.4878	4.965101	4.4424
2004	13.025	12.45474	11.884	6.9161	6.455323	5.9945
2005	13.293	12.69977	12.106	7.8705	7.427172	6.9839
2006	12.996	12.36817	11.741	7.7785	7.314225	6.85
2007	10.993	10.31945	9.646	7.0683	6.609747	6.1512
2008	6.6424	5.734799	4.8272	4.6651	4.023047	3.381
2009	4.775	3.794514	2.8141	3.899	3.177036	2.455

Graph 1.12 – ROAE of 10% highest and 10% lowest leveraged commercial banks.

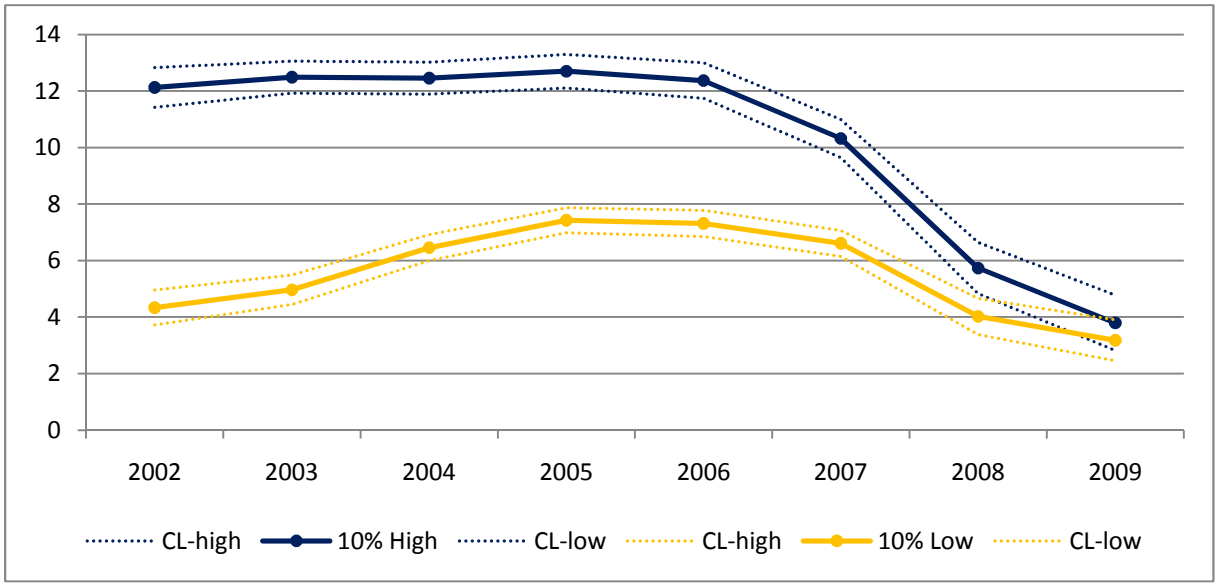

Table 1.13 – ROAE of 10% biggest and 90% smallest banks.

	10% biggest			90% smallest		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	13.469	13.06829	12.667	10.303	10.14893	9.9945
2003	13.14	12.76982	12.399	10.313	10.17388	10.035
2004	12.975	12.56641	12.158	10.634	10.5004	10.367
2005	13.201	12.81057	12.421	11.217	11.07818	10.939
2006	12.752	12.3128	11.874	10.721	10.56497	10.409
2007	9.3194	8.740091	8.1608	9.3624	9.198855	9.0353
2008	3.2735	2.300105	1.3267	5.9689	5.749084	5.5293
2009	2.2069	1.185861	0.1648	3.831	3.575811	3.3207

Graph 1.13 – ROAE of 10% biggest and 90% smallest banks.

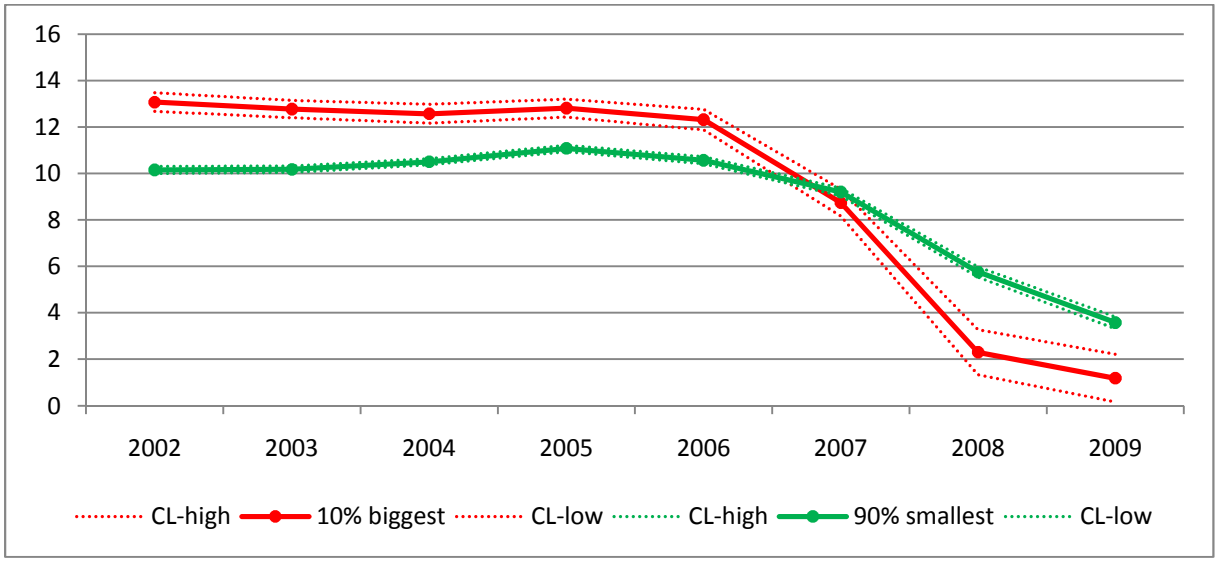

Table 1.14 – ROAE of 25% biggest and 25% smallest banks.

	25% biggest			25% smallest		
	CL-high	Mean	**CL-low**	CL-high	Mean	**CL-low**
2002	12.821	12.57514	12.329	7.4102	7.066606	6.723
2003	12.46	12.2259	11.992	7.8796	7.583376	7.2872
2004	12.438	12.20151	11.965	8.7484	8.464217	8.1801
2005	12.771	12.52407	12.277	9.391	9.111147	8.8313
2006	12.38	12.10827	11.836	9.1016	8.804029	8.5064
2007	10.023	9.701715	9.3807	8.1833	7.868672	7.5541
2008	4.3663	3.847817	3.3293	5.9679	5.585857	5.2038
2009	2.3065	1.725138	1.1438	4.5742	4.153959	3.7337

Graph 1.14 – ROAE of 25% biggest and 25% smallest banks.