

*Understanding the risk of stocks
during the subprime crisis:
A theoretical approach*

Bachelor thesis

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Abstract

This thesis investigates two related subjects, namely both the progress and the determinants of the risk during the subprime crisis. With regard to the progress of the crisis, three important dates will be tested. The results seem to confirm the validity of these dates. With the determinants of the risk there will be emphasized on leverage and size. The results show that during the peak of the subprime crisis leverage and size did not had a significant impact on the change of the risk. An alternative model is then presented with variables that are crisis-related. The tests of these variables turn out to be all positive at only the peak of the crisis.

1. Introduction

Stocks all over the world experienced large price declines for the past three years. The stock prices of companies in the financial sector began to drop by large amounts starting from mid-2007. Since October 2008 also the stocks of non-financial companies began to follow this pattern. This bad stock performance began in the financial sector and was mainly caused by large write-offs of so called subprime mortgage loans on the balance sheets of large financials in the USA. The write-offs were disastrous for the financial health of these institutions Since the financial sector is an integral part of the macro economic performance, other non-financial companies also began to experience problems. Banks didn't trust each other anymore and refused to lend to each other. This, and some other reasons, pushed the banks on the edge of maintaining their capital requirements. When news came out that the write-offs were larger than expected, some important banks were forced to ask the government for additional capital. These events caused the lending in the USA to freeze and thereby caused the decline of the aggregate demand, the consumer confidence, the investment level of companies and the tax income of the government. A global recession was born.

It seems that the crisis developed in stages and it is questionable whether the risk of some specific companies changed during these different stages of the crisis. This thesis investigates the progress and the structure of the risk of stocks around the following main question: How did the risk structure of financials changed during the crisis, compared to other non-financial stocks? To support and answer the main question, three hypotheses will be presented and tested. The first hypothesis gives a few important dates and will test the change of the risk on these dates. The second hypothesis will then test whether leverage and size had impact on the risk during the different stages of the crisis. The third hypothesis tries

to give an alternative method of predicting risk changes in times of crisis. The causes and consequences of the crisis will be presented in section 2. Section 3 explains the construction of the hypotheses and section 4 will provide the tests and interpretation of the results for the hypotheses. Section 5 provides a brief summary of what has been found and will furthermore put all the hypotheses together and construct general conclusions.

2 The causes and consequences of the crisis

The subprime mortgage crisis is not standing alone on itself, but is rather a complex combination of events. An understandable, but yet a detailed description of the sub-prime crisis is given by professor Martin F. Hellwig in his article “Systemic risk in the financial sector: An analysis of the subprime-mortgage financial crisis” (2009). He described how different theories and events interacted with each other and ultimately caused a recession. Just like many other academia he emphasized his research on the failure of the system. In order to understand the interaction of the causes provided by professor Hellwig, a good understanding is needed of the subprime market and his characteristics. This discussion, together with the history of the sub-prime market, will be provided in section 2.1 and 2.2. Sector 2.3 explains why the crisis didn’t immediately caused a crisis in industries other than the financial sector. The findings in this section will be used to construct a time-line of important dates. These dates will be used to construct the hypotheses in section 3.

2.1 Subprime and the moral hazard in the securitization process

Professor Hellwig begins with explaining the importance of securitization due to maturity mismatch in the real-estate finance. Lenders usually have short investment horizons, while borrowers need long-term loans in order to finance their real-estate. To bring these two together, securitization is theoretically a perfect tool for allocating the risks of the presence of maturity mismatches. Securitization begins almost always with a bank providing mortgages. These mortgages are then transferred to entities specialized in securitization, called special purpose vehicles. These special purpose vehicles make securities out of the mortgages and issue them in packages in order to refinance the mortgage loans. These securities are called “mortgage backed securities” and come in different forms and structure, because of the induction of the information problems (Hellwig, 2009, pp. .

There were two kinds of mortgages that were securitized, namely the prime and the subprime mortgages. The difference was to find mainly in the risk of the down payments and default rates. Prime mortgages contained large down payments, low default risks and reliable credit histories of the borrowers. On the other hand, subprime mortgages were more risky, because of the lack of certainty of payments and defaults.

In contrast to the case of simple direct mortgage lending, the process of securitization results in a larger amount of intermediaries. Ashcraft describes in his article “Understanding the Securitization of Subprime Mortgage Credit” for the Federal Reserve Bank of New York that the securitization process is subject to seven frictions, of which five of them caused the crisis (2008, pp. 3-11). The first friction that Ashcraft and Schuermann described was between the borrower and the originator, who can be seen as a broker or an intermediary. In the context of this friction, the borrower don’t know his financial options, and even though this was known, it was hard to choose the best option. This friction made the so called “predatory lending” possible, which means that originators use this information asymmetry in their own interest and as a consequence are not optimizing the interests of the borrowers. The second friction is between the originator and the arranger. Because the originator contracted the borrower, it had more information of the borrower than the arranger. The originator has financial incentives to use this information advantage in their own interest, and thereby damaging the interests of the arranger. The originator can also engage in a conspiracy with the borrower against the arranger. In this case, the originator gets its fee the borrower gets its mortgage when it wasn’t possible if the arrangement was made directly with the arranger. The third friction assumes that that the arranger has more information than the third parties, and thereby could provoke adverse selection by keeping the good mortgages and selling the bad mortgages. The sixth friction is between the asset manager and the investor who buys the securitized assets on the initial offering. These two actors have biased incentives and could be exploited because of information asymmetries. The asset manager has an incentive to make as many as possible transactions and could thereby conflict with the interest of the investor who wants good quality of information of the securitized mortgages. Because of the professionalism of the asset manager, he knows more than the investor. This moral hazard problem could thereby end up in inefficient trades of the investors. The seventh and last friction is found in the relation between the investors and the credit rating agencies (Ashcraft and Schuermann, 2008, pp. 3-11). Since the credit rating agencies are paid by the arrangers and not by the investors, the ratings to the investors could be biased because of the conflict of interest between the arrangers and the investors. The arrangers are the sellers of the

securitized assets and the investors are the buyers. This moral hazard problem also results in inefficient trades of investors.

The mentioned five frictions and possible other frictions represents the complexity of the securitization process and the difficulty of providing adequate regulation. The frictions also represent the many conflicts of interests and moral hazard problems. Trades and transactions are performed in the securitization process, but would not been performed when there were no information asymmetries or conflicts of interests. Borrowers got mortgages when they shouldn't, arrangers and investors bought and sold mortgages based on biased analysis and recommendation. This stimulated the trade of mortgage backed securities and pushed up the price above its real economic value. This continued until 2006, when the prices in the housing market started to diminish. The next sections will explain why this ambiguous lending caused a crisis, and ultimately a global crisis.

2.2 The history of subprime lending

At the end of the 90's securitization of mortgages were in hands of the US semi-governmental banks Fannie Mae and Freddie Mac. Because of their connection with the government, investors believed that the default risks of these banks were minimal and that the quality of the securitized mortgages were high. Fannie Mae and Freddie Mac guaranteed the payments of the mortgages to the investors and they believed this because of the government backed up for the two banks (Hellwig, 2009, pp. 145-147).

At the beginning of the second millennium this situation changed because of the entrance of non-governmental suppliers of MBS. These financial institutions didn't guarantee the payments and offered low quality securitized sub-prime mortgages, rather than the high quality prime mortgages. This led to an overall worsening of the mortgage quality; subprime mortgages were 9% of total mortgages in 2000, but rose to a level of 40% in 2006. Depressed stock markets, together with the search for better returns and yields, were even more triggering the securitization of subprime mortgages (Hellwig, 2009, p. 131).

2.3 Governance, market failure, regulation and the transformation to a global crisis

As mentioned earlier, the governance structure of the securitization of mortgages was weak and there were incentives for some players to act in their own interest. By doing that, they

added additional risks to the financial system as a whole. The arrangers and originators for example did not have any stake in the mortgages, thus they had incentives to sell mortgages on volume and less on quality (Ashcraft and Schuermann, 2008, pp. 3-11). The entrance of competitors in the MBS market and the quest for finding higher yields made investors blind for the risks. The rising prices of real estate covered these risks for a long time, but went visible when the real-estate prices started to decline during 2006.

In august 2007 investors were surprised when the IMF warned them about the bubble in the real-estate market. The credit rating agencies like S&P and Moodies downgraded the ratings of mortgage backed securities. The uncertainty about the causes of the creation and collapsing of the bubble, together with the warnings of the IMF and the credit rating agencies, have led the investors to sell their MBS assets. The banks also decided to take their hands of these securities (Hellwig, 2009, p. 131). Heavy reliance on credit rating agencies and panic were the reasons for this behavior. However, the reported losses on mortgage backed securities were too small to explain the worldwide recession. It is rather a series of repercussions that have led to a global decline of economic activity.

The first chain in the series of reactions are the reliance on credit rating agencies and panic of investors (Ashcraft and Schuermann, 2008, pp. 61-65). This was caused by a deeper and more sophisticated process of information asymmetries. Because the warning and the sudden credit downgrades of mortgage backed securities came as a surprise, nobody knew the risks anymore. In an attempt to deal with the risks of these securities, investors either started to rely blindly on the credit analysts or decided to dump the securities. Both actions lead to a price decrease, since dumping securities and following negative credit analysis recommendations are demand decreasing.

The next reaction explains professor Hellwig with the model of information asymmetry, first published by the Nobel prize winner Akerlof (1970). This model discusses how information asymmetries play an important role in explaining the failure of markets in determining the economically "right" price. In the market of MBS such thing happened. There was a big gap of information between the market and the investors. This gap caused the investors to be unsure about the quality of the mortgage backed securities and thereby couldn't value these securities. The only way an investor wanted to buy the securities is when a discount is given on the estimated present value. This discount can be seen as a compensation of the risk of not knowing the quality and the right price. This process that Akerlof described leads to a price lower than the present value of mortgage backed securities.

Professor Hellwig confirms this by doing some simple calculations. The markets failed because of hidden information asymmetry that became known.

Information asymmetries still don't explain why a small financial crisis turned into a global recession, because the MBS market was relatively small compared to for example the markets for equities and bonds. The transition can partly be explained by the next chain, namely fair value accounting. The rules of accounting of financial institutions are focused on recording balance sheet items on their fair value (Alfredson, 2005, pp. 166-189). Briefly explained, fair value accounting means that assets and liabilities need to be recorded on the financial statements based on their current market price. If a market price is lower or higher than the book value of a particular balance sheet item, a correction need to be taken. This correction will be immediately booked into the income statement as a loss or profit and will affect the net income. In other words; a lower market price of an assets will immediately result in a lower net income, a lower value of the assets and as a consequence a lower value of equity and share price. A lower equity value is directly related to the regulatory capital requirement of the banks. If a bank violates the capital requirement, lending is not an option any more, which indicates financial distress since lending and borrowing is the bank's core business. We see that a failure of the relatively small market of MBS leads to the crash of the equity of banks, because of fair value accounting (Hellwig, 2009, p. 132). Because of the large write-offs many banks didn't had any more reserves. They needed to borrow additional funds from other financial institutions, but since these banks also were in financial distress they were even more cautious in lending to other financial institutions. This lack of trust caused the overnight lending to other banks to freeze and thereby losing the possibility to solve the problems with their capital requirements. Another reason why the capital requirements were quickly violated was the sudden bank-run by customers of the banks, caused by the lack of trust in the financial system. This caused the reserves of the banks to erode even faster.

It is interesting, in the context of a negative net income caused by fair value accounting, to reflect to the work of professor Sloan. In his article "Do Stock Prices Fully Reflect Information in Accruals and Cash Flows about Future Earnings?" he discusses the effect of accruals on the share prices (1996). He concluded that accruals are less persistent than cash flows, but investors are to naïve to realize that. As a consequence, investors value the accrual part of the net income as they were persistent into the future. This results in overvalued stocks or in undervalued stocks for the opposite case. The banks experienced negative accruals in the form of the write-offs of the subprime mortgages, but since the

accruals were one-time and not telling anything about the persistence of the operations, they did not need to be taken into account for future forecasting and valuation. Sloan proves that investors still extrapolate these negative accruals into the future. This effect, in combination with the Akerlof theory, could also have resulted to a quick erosion of the equity of the banks.

When the severe financial distress came to light during November 2008, the world reacted shocked and other non-financial stocks and important Asian and European stock markets reacted negatively. This caused the process of writing off losses on the balance sheet to be repeated again, but then in larger numbers. Banks are an important factor in the economic system. The collapse of large banks would thereby cause a serious crisis. The US government reacted on this by providing a large amount of financial aid to the banks in order to maintain capital requirements of the banks. Governments didn't have additional funds for this kind of finance, and they were forced to borrow on the capital markets and cut into the tax budget. This, and much more macroeconomic effects that were the results of the failure of the banks, made the aggregate demand level to decrease. The world also reacted negatively, because the US banks are located all over the world and the US economy accounts for roughly 25% of the world production. The recession was a fact.

Important authorities in the world realized that it was time to intervene. Large amounts of capital support went to important system banks. The government for example paid a total amount of 700 billion dollar to the financial institutions. The Federal Reserve paid an additional amount of 6.4 trillion dollar (CNN.com, 2009). In this way the important financial institutions on which whole economies rely on were saved from bankruptcy. Also other measurements than bailouts were taken in order to stimulate and recover the trust in the economy and the liquidity of the financial markets. Many Asian economies experienced such a large economic growth in the past years, that this crisis didn't affect them much. These Asian economies still experienced growth and this had a positive effect on the foreign demand of the goods of the countries affected by the crisis. By March 2009, the countries affected by the crisis started to show signs of recovery. The downward trend on the stock markets demolished and became an upward trend.

3. Hypotheses

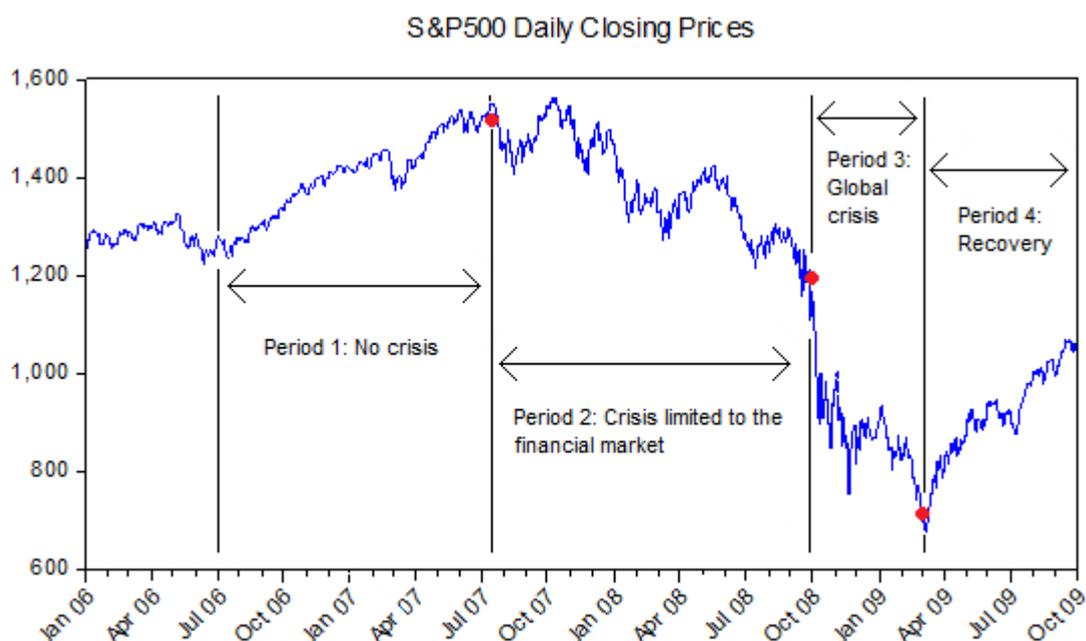
This section introduces three hypotheses. The first hypothesis is about the progress of the crisis through time. It assumes that the crisis took place in stages and gives the dates. The second hypothesis assumes that important firm specific variables did not matter to the risk of the stocks when the crisis was at his peak. The third hypothesis tries to give an alternative approach to the forecasting of risk in times of crisis caused by system failure.

3.1 Hypotheses 1: Separation of stages

Hypothesis 1: The risk of the financial institutions should increase when the crisis was limited to the financial sector, stay stable or increase in the peak and in the recovery period of the crisis. The risk of non-financial companies should stay stable in the period of limited crisis to the financial market and increase in the period of the peak and decrease or stay stable in the recovery period.

With the description of the crisis of section 2 in mind, a separation of important stages can be made. Figure 1 plots the price of the S&P500 from 2006 to November 2009. The changes (breakpoints or BP's) in this figure of July 2007, November 2008 and march 2009 confirm the important events described in section 2. With these three dates, a dissection of four periods can be made. The subsections of this section will explain the properties of these periods and why the risk should change or not change in these stages.

Figure 1 – The separation of important periods during the crisis



3.1.1 Period 1: Before the crisis

This period is characterized by a stable market index with low volatility, because of the absence of disturbing factors like in this case problems with subprime MBS. The risk of the financial sector should also be stable and should have low volatility. When the problems with the subprime MBS came to light in July 2007, the financial institutions seem to face problems which weren't known before this announcement. This knowledge should have led to an increase in overall risk for the financial sector. Figure 1 confirms this, because at July 2007 there is a transition from an upward trend to a downward trend. July 2007 is an important point in time, because from that date the problems with subprime mortgages came to light.

3.1.2 Period 2: Crisis limited on the financial market

The second period is the period where financial institutions began to write off the subprime MBS on their balance sheet. As described earlier, this began on July 2007 when the problems with subprime MBS came to light. The write-offs should cause an increase in the risk of the financial institutions. Since other non-financial stocks had nothing to do with the write-offs in the financial market, the risk of non-financial stocks should not change in this period. Also, many didn't expect that the limited crisis on the financial market can have an impact on the general economic performance and thereby on non-financial stocks. As the time in this period passed by, the process described in section 2 proceeded, with more write-offs as a consequence. This explains why the downward trend is calm and not aggressive. Another explanation for the smoothness of the downward trend is the exclusion of non-financial stocks in the crisis limited to the financials market. This period came to an end in October 2008, when the write-offs still continued to occur and got to a level that concerned many.

3.1.3 Period 3: Global crisis

The third period is characterized with aggressive downward stock price movements. According to figure 1, the aggressive decline begins at the beginning of October 2008, when the S&P500-index experienced a decline in value of about 30% in just two weeks. After that, the decline continued with large amounts in short periods. The reason for this impressive decline is that the limited financial crisis had more implications than assumed. This is described in section 2 as a failure of the financial system. Since the financial system is an

important part of the world economy, a failure of this system would cause a crisis and an overall stock price decrease. In October 2008 financial institutions began to experience problems with their capital requirements and faced bankruptcy. These developments shocked the world, because from then on many thought that banks could only get bankrupt in theory, but not in practice. Panic and dumping of assets was the result.

The risk of the financial institutions should increase even more, or stay stable when the risk already changed in period 2. Non-financial stocks should experience a higher risk, because the importance of the financial system is crucial for non-financial companies to maintain for example their operations, finance and customers. The crash ended in March 2009, when stocks were at their lowest levels.

3.1.4 Period 4: Recovery

The aid of the governments all over the world helped to bring stability in the trust of the financial system. Investors and consumers processed the shock of the crisis and got more confident about the future. The financial market became stable again, given the financial aid of the government and other measurements. In the beginning of 2009 the stock market was at its lowest level in years. Investors believed this level was too low given the new circumstances. Many started again to invest in the stock market. With the financial market stabilized there was more space for the economy to recover. This recovery began on March 2009 and proceeded gradually, because no certainty was guaranteed and good news, together with bad news came from time to time.

The risk of the financial institutions should be stable or experience a small increase, because the impact of the financial institutions was large and it should take time for them to recover. The risk of the non-financial companies should stay stable or decline, because the stability has returned and since they did not possess any MBS assets, they were not experiencing additional risks.

3.2 Hypothesis 2: Leverage and size

Hypothesis 2: Firm specific determinants of the risk like leverage and size are not adequate in times of severe crisis or failure of the financial system.

3.2.1 Beta as a risk measure

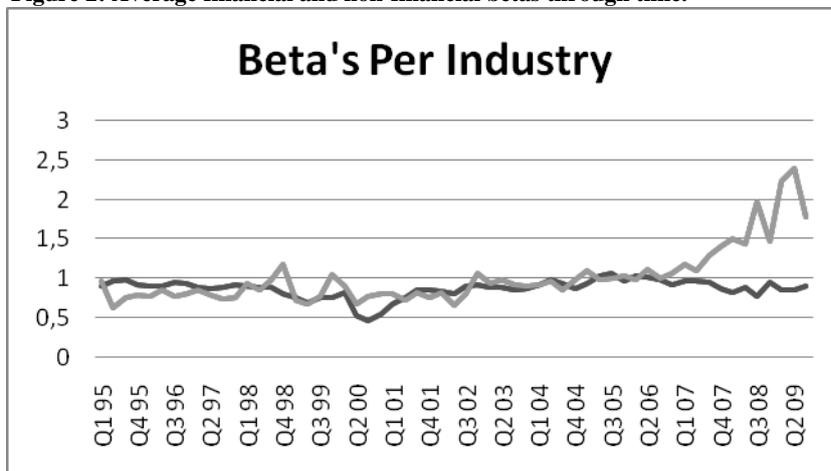
The risk in this thesis is measured in equity beta, which plays an important role in the CAPM model. This pricing model states that there is only one optimal portfolio of stocks and as a consequence, all investors will hold this portfolio (Markowitz, 1959) . Since the investors are the market, everybody holds the market portfolio. In that case, the return of an individual stock needs only to be compensated in relation to the sensitivity of the market. This sensitivity is measured and estimated by a regression between the individual stock returns and the returns of the market, or a well diversified portfolio as a replica of the market portfolio. The higher the beta, the higher the return on equity that investors want for a specific company. This implies that the investors want a higher return on equity, to be compensated for additional risk. In this context, the beta acts as a risk measure (Sharpe, 1964).

As it is inconsistent to assume constant risk of a company through time, it is also not realistic to assume a constant beta through time (Fabozzi and Francis, 1978). Bos and Newbold researched the time-varying property in the beta of stocks and came to the conclusion that several micro and macro economic conditions influenced the change of betas. Beta is thereby not determined on its own, but is rather the product of different determinants of a firms risk (1984). A research about the influence of external events is provided by Taufiq Choudhry (2002). In his paper he investigates the impact of the Asian financial crisis in 1997 on the time-varying property of beta. The results of Choudhry gave evidence of influence of the crisis to the betas.

Although the CAPM model is intuitive and theoretical right, there are fundamental assumptions that are not always realistic to assume. The authors Bodie, Kane and Marcus, of the book “investments” described a set of assumptions that are holding the CAPM model. These assumptions are rationality of investors, identical holding periods, no taxes and transaction costs, investors are mean-variance optimizers, analysis is conducted on the same way and investments are limited to a universe of publicly traded financial assets (2008, pp.294-296). These assumptions are only present in special cases. Especially the assumption of rationality is a relevant part of the set of assumption to consider investigating in the context of the subprime crisis. When the conclusion of the hypotheses is provided in section 5, there will be a detailed discussion about the validity of the CAPM model in relation to the set of assumption underlying this model. Central to this discussion are the implications of the flaws of the model to the results of the hypotheses in this thesis.

Although the assumptions of the CAPM model are not always realistic, it provides a good indication of the risk. Figure 2 shows the quarterly average progress of the beta through time for non-financial firms and for financial institutions from 1995 to 2009. This graph supports the use of the CAPM model, because it shows an increase in risk for the financial institutions when the crisis began. The non-financial companies have as expected an average beta close to one, because it is a close replica of the market. However, the average beta of the financial institutions are more volatile. This graph proves the time-varying property of beta, because it is not stable over time. It also confirms the findings in section 2, because the beta of the financial institutions began to increase substantially from 2007 to 2009.

Figure 2: Average financial and non-financial betas through time.



3.2.2 Leverage and size

The risk of a firm is an important measure and is used by many professionals like risk managers, researchers and investors. Yet, it is not an easy parameter to measure and to forecast, because it is influenced by a numerous amount of factors. Two important and well researched factors of influence on the risk are leverage and size. The research of the effect of leverage on the risk of a company begins with the research of Modigliani and Miller (1958). They provided a theoretical model for choosing the right capital structure. This model showed that in a perfect world of no taxes, transaction costs and information asymmetry, leverage should not influence the firm value. The risk of a firms assets is constant in this perfect world, because additional leverage leads to a higher cost of capital due to increased risk, but this high cost of equity is compensated with the smaller portion of equity to the total assets. When the assumption of taxes is relaxed, there is an incentive to use debt over equity because of the presence of a tax shield, caused by the deductibility of interest expenses. On

the other hand, adding additional debt in the firm causes the firm to experience financial distress costs. Together with agency costs, there is a trade-off of using debt instead of equity (Berk and DeMarzo, 2007, pp. 491-520). In this thesis the risk of a company's stock is measured, which is actually the company's equity. As mentioned earlier, Modigliani and Miller proved that leverage increases the cost of equity due to increased risk of the concerning company. If we assume the risk-free rate and the market risk premium constant in the context of the CAPM, the beta should increase when the cost of equity increases due to adding additional leverage. In other words; adding additional leverage should increase the equity beta. This relation is intuitive since the equity beta measures the risk of equity and leverage increases this risk. Although there is a positive effect of leverage in the form of a tax shield, this effect does only alter firm value but not the risk. Maroney, Naka and Wansi (2004) studied the effect of leverage on the beta during the Asian crisis in 1997. They provided a new model that captures the effect of increased leverage due to a crisis.

Size is also an important determinant of risk. Chan and Chen (1988) for example found that size had an influence on the process of generating returns. Also, Fan and Liu (2008) proved that sorting firms on their characteristics uncovers firm-specific information, which can be used for more accurate estimations of risk. Size was one of the variables and turned out to be useful to improve the accuracy of the risk measure. A more relevant research is found in the article of Banz (1980), where he referred to the "size effect" as a extra risk for small companies compared to larger companies. Banz concluded that size is an anomaly that is not explained by the CAPM model. In other words; size has a negative relation with the magnitude of the beta. The higher the size, the lower the beta, the lower the risk. The intuition of this relation is that larger firms tend to survive economic downturns more often than smaller firms. Also, larger firms have economies of scale and scope, and are often more diversified in their portfolio of operations, what reduces their risk exposure.

3.3 Hypothese 3: Alternative model

Hypothesis 3: The risk of a firm in times of crisis or system failure is explained by variables that caused the crisis or system failure, rather than standard determinants of risk like leverage and size.

This hypothesis states that in times of crisis firm specific determinants of risk should not influence the risk anymore. Other crisis-related elements should determine the magnitude of the risk change, because the crisis-related elements are the determinants of the crisis and

therefore also the determinant of a firm's risk. Firm specific risk elements do also not matter in times of crisis, because the financial system on which financial institutions rely is not reliable anymore. In context of the financial crisis, we expect for example a firm who is all equity financed and has a large market value to have a low risk when there is no presence of a crisis. However, when there is a crisis related to securitized mortgages, we expect companies with a large amount of these securitized mortgages on their balance sheets to experience a great increase in risk, even if they are all equity financed and have a large market value. That is, the financial system should take care of bad mortgages and value them correctly. A good value of these assets does not lead to sudden large write-offs and no additional risk should be introduced. However, when it turns out that the market valued the securitized assets wrong, additional risk is introduced since this component was thought to be taken care of in the systemic risk.

If the hypothesis is right, we expect that the crisis-related elements like subprime mortgages and loan loss provisions to have a significant influence on the risk change when the crisis was at his peak, beginning at October 2008. This is the second transition in figure 2. The first transition should show no significant relation between the risk changes and the crisis-related elements, because there was not yet a crisis. The same counts for the period of recovery. If right, this hypothesis gives an alternative model of predicting a firm's risk during times of crisis or system failure.

4. Methodology and results

This section provides a detailed explanation of the used models for every hypotheses. After the discussion of the models, the results will be presented.

4.1 Hypothesis 1

4.1.1 Risk measure

As mentioned earlier, the risk is measured in beta, which is a product of a regression between the individual stock return as the dependent variable, and the market return as the independent variable. The returns are used on a daily basis and are calculated as followed

$$R_{i,t} = (CP_{i,t} - CP_{i,t-1}) / CP_{i,t-1} \quad (1)$$

With $R_{i,t}$ = The return of the stock in t. $CP_{i,t}$ = The closing price of the stock in t. $CP_{i,t-1}$ = The closing price of the stock in one day before t. The risk of a company measured in beta is calculated by the following model

$$R_i^{S1} = \alpha_i + \beta_i R_M + \varepsilon_i \quad (2)$$

With $R_{i,t}$ = The return of the stock in t. β_i = The sensitivity of stock i with the market, or the risk.

4.1.2 The model and samples

In order to test hypothesis 1, the Chow test is used. It is an econometric test that is designed to detect any violations of the assumption of parameter stability in the OLS regression method (Brooks, 2002, pp. 198-204). If the test is positive, an alteration of the sample is needed in order to get a better predictor of the parameter. The reason of a parameter change is an important event that influenced the independent variable or parameter permanently from that time on. In relation to this thesis, the important dates are the dates found in section 2, namely July 2007, October 2008 and March 2009. The test statistic is

$$F = \text{Test statistic} = \frac{RSS_i^{S12} - (RSS_i^{S1} + RSS_i^{S2})}{RSS_i^{S1} + RSS_i^{S2}} \times \frac{T - 2k}{k} \sim F(k, T - 2k) \quad (3)$$

With RSS_i^{S12} = The RSS obtained from the whole sample, RSS_i^{S1} = The RSS obtained from the first subsample, RSS_i^{S2} = The RSS obtained from the second subsample, T = number of observations and k = the number of regressors in the unrestricted regression.

The numerator of the test gives the difference of the fit of the regression without the sample separation and the sum of the fit of the regressions with the sample separation. If a beta changed through time because of the crisis, the RSS of the sub samples together should be lower than the RSS of the whole sample, because the regressions of the sub samples should explain the movements of the stock with the market better because of the change of beta. The more the beta changed because of the crisis, the more the difference of fits will be

and the higher the test statistic will be, which results in a higher significance of change of the betas.

The RSS variables used in formula 1 are the residual sum of squares obtained from a regression similar to formula 2. For each company the following regressions are performed to obtain the RSS variables

$$R_i^{S1} = \alpha_i^{S1} + \beta_i^{S1} R_M^{S1} + \varepsilon_i^{S1} \quad (4)$$

$$R_i^{S2} = \alpha_i^{S2} + \beta_i^{S2} R_M^{S2} + \varepsilon_i^{S2} \quad (5)$$

$$R_i^{S12} = \alpha_i^{S12} + \beta_i^{S12} R_M^{S12} + \varepsilon_i^{S12} \quad (6)$$

Where R_i =The stock return of stock i obtained from formula 1, R_M =The rate of return of the market, measured as the rate of return on the S&P β_i =the sensitivity of the individual stock return with the market return. Basically, formula 2 and 3 are the regressions on the data of the sub samples of the closing prices before and after the crisis (S1 and S2), respectively.

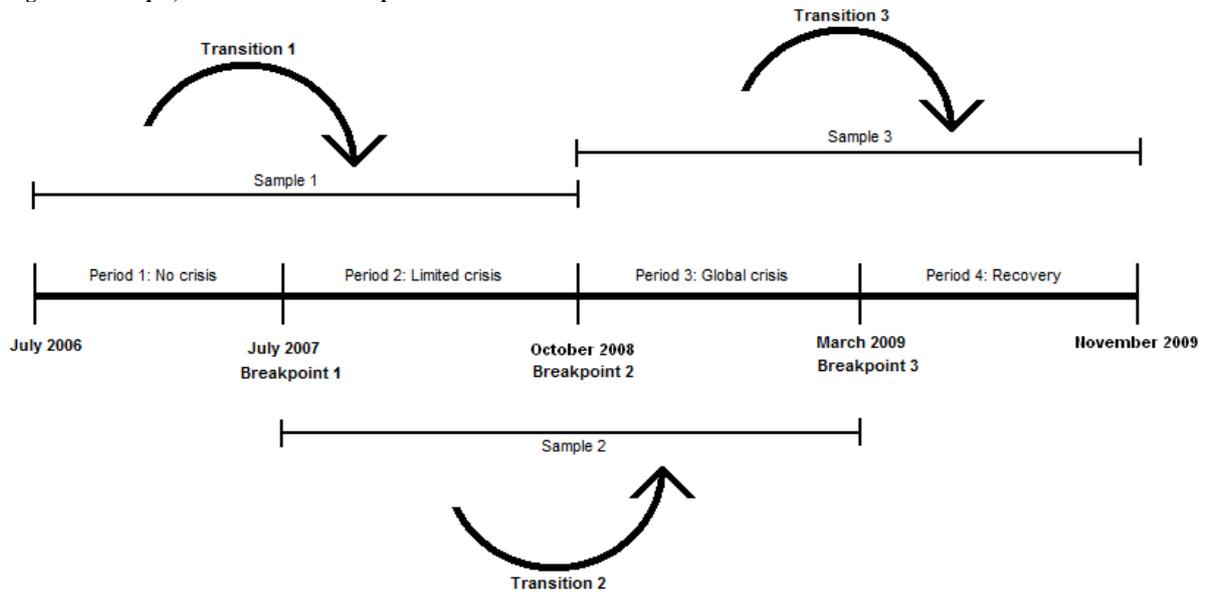
Formula 3 is the regression on the combined data of the sub samples.

The Chow test can give two outcomes, namely parameter stability (H0) and no parameter stability (H1). The first possibility states that the parameter over the whole sample is stable, and no alteration of the sample is needed. This indicates that $\beta_i^{S1} = \beta_i^{S2} = \beta_i^{S12}$; the event or date didn't had any impact on the parameter. The second possibility states the opposite. When this is the case it means that $\beta_i^{S1} \neq \beta_i^{S2}$; the parameters of the subsamples are significant different from each other and a separation of the whole sample is needed. This also means that the event had a significant impact on the parameter.

The parameters in the Chow test can be seen as the beta of the CAPM model. This makes the risk the subject of this test. The sample will be cut into two samples on the dates where the three events of section 2 happened. Thus, the test is also about the impact of the events on the risk of a firm. An illustration of this is given in figure 2. The first sample is taken from July 2006 to October 2008 (period 1 and period 2 together). The subsamples of that sample are acquired by cutting the sample at July 2007, when the IMF came with the warning. The second and third samples are taken from July 2007 to March 2009 (period 2 and period 3 together) and from October 2008 to October 2009 (period 3 and period 4 together). The breakpoints that determine the subsamples are in the second sample October

2008 when the global crisis began, and in the third sample March 2009 when the recovery started.

Figure 2 – Sample, transitions and breakpoints



The sample consists of 91 companies, of which are 60 financial institutions and 31 non-financial institutions. For every company, there is a sample of daily closing prices for the period starting from July 2006, ending in November 2009. The subsamples and their breakpoints are illustrated in figure 3. All the data in this thesis is obtained from DataStream at the FEB faculty of the University of Amsterdam. The market portfolio is replicated by using the S&P500 index, because this index is big and well-diversified. The test in this thesis are performed by using the software packages Eviews and Excel. The data and the samples used in this hypothesis will also be used in hypotheses 1 and 2.

4.1.3 Results

The results of the chow test are presented in table 1. These are descriptive statistics and are a summary of the tables in appendix 1. The results for the financial institutions in transition 1 and 2 are convincing, because they show the pattern described in the hypothesis. 78% of the financial institutions changed because of transition 1, and 73% changed in transition 2. 100% of the companies changed because of either transition 1 or transition 2. This means that all the financial institutions faced difficulties during the crisis. During transition 1, only 13% of the non-financial companies experienced change in risk, because the problems in transition 1 didn't affect the non-financial companies, but only the financial institutions. In transition 2,

65% of the non-financial companies had a change in risk. Appendix 1 shows that during transition 2 primarily the companies in the basic materials industry, the oil gas industry and the consumer goods industry experienced risk increases. These industries are commonly seen as cyclical industries, since they are identified as the first change in de value chain, or are directly dependent of consumers spending. In this context it is logic to state that these companies will experience risk increase the first. In the third transition, 65% of the non-financial companies faced risk changes. Since the average change was -9,40, there can be concluded that the changes in risk were downward.

Table 1: Outcome of the chow test as a percentage of total sample

	Alpha=0,05	Transition 1	Transition 2	Transition 3	Transition 1 and 2
Financial institutions	significant risk change	0,78	0,73	0,73	1
	no significant risk change	0,22	0,27	0,27	0
	Average change	63,1%	-1,2%	44,6%	
Non-financial companies	significant risk change	0,13	0,65	0,65	
	no significant risk change	0,87	0,35	0,35	
	Average change	-12,9%	21,1%	-9,4%	

The average change of beta in transition 1 is 63,1% for financial institutions and -12,9% for non-financial companies. This confirms the hypothesis, because it states that the crisis began with financial institutions and only the risk of financial institutions should therefore show a risk increase. The average risk change during the global crisis in transition 2 showed a small decrease for the financial institutions of -1,2%, and a increase in risk for the non-financial companies of 21,10%. This also confirms the hypothesis, because the financial institutions were already experiencing risk increases for the past year, when the crisis was only present in the financial sector. When the crisis went global, the non-financial companies began to experience additional risk for the first time. The risk increase for the non-financial companies and the stable risk of the financial institutions in transition 2 confirms this. In transition 3, the non-financial companies showed an average decrease in risk of -9,40%. Since transition 3 is the recovery period, this is what is expected. The only remarkable result in this table is the large increase in average beta of financial institutions of 44,6%. This is not what is expected, since it is the recovery period where risk should stay stable or decrease.

4.2 Hypotheses 2

4.2.1 The model

The second hypotheses tests whether leverage and size had any impact on the risk during the different stages of the crisis. To accomplish this, the dissection of periods in figure 1 is used. The following models are constructed

$$\text{Model 1: } \% \Delta \beta_{12} = \alpha_1 + \beta_1 LEV + \beta_2 MV \quad (7)$$

$$\text{Model 2: } \% \Delta \beta_{23} = \alpha_2 + \delta_1 LEV + \delta_2 MV \quad (8)$$

$$\text{Model 3: } \% \Delta \beta_{34} = \alpha_3 + \lambda_1 LEV + \lambda_2 MV \quad (9)$$

With $\% \Delta \beta$ = The percentage of risk change between the periods in the subscription, LEV = The leverage measured in equity divided by debt, MV = The total market value measured in thousands.

The models are the same, but they are applied to different periods. Model 7 is used to test the influence of leverage and size on the transition of the risk from a period with no crisis to a period of a crisis limited on the financial market. Models 8 and 9 do the same, but then for the other transitions showed in figure 2. As explained in section 2, leverage is expected to have a negative effect on the risk and size is expected to have a positive effect on the risk. Since the leverage variable measures the equity as a fraction of debt, there should be a negative relation between the changes of the risk. The higher the risk change, the lower the ratio of equity to debt, because debt increases the risk of bankruptcy and default on debt. Firms with a low equity to debt ratio should then experience higher risk changes in times of crisis compared to firms with high equity to debt ratios. The same negative relation is expected to be the case to the relation between the change of the risk and the firm size. The higher the firm size, the lower the risk change in times of crisis.

If the results confirm the hypothesis, models 7 and 9 should show parameters significant different than zero. Model 8 should show insignificant parameters, because the hypothesis states that the firm specific variables are no adequate predictors of the risk in times of crisis or system failure. This should be the case, since model 8 is applied to the period where the crisis was on his peak.

4.2.2 Results

The results of the tests are presented in table 3. The table is divided into financial institutions and non-financial firms. There is also a division into the three models. As mentioned before, the different models measure the influence of leverage and size on the risk of companies in the different periods of the crisis. Model 1 of the financial institutions show a significant relation between the risk change and leverage and size. This is expected, because model 1 measures the relation of leverage and size in the period when there was no global crisis. On the other hand, model 2 shows no significant relation of leverage and size on the change of beta during the period of global crisis. This is also expected, because the subject of the period is the global crisis. Model 3 should show a significant relation between leverage and size for the same reason as for model 1. This is only true for leverage and not for size. Still, model 3 as a whole has good explanatory power since the F-statistic is significant.

Table 2: Results of regressions of leverage and market value on the change of beta, within the different samples (transitions)

Financial Firms						
	Model 1		Model 2		Model 3	
	Leverage	Size	Leverage	Size	Leverage	Size
Coefficient	-0,911	4,00E-06	0,011	-1,56E-06	-0,562	1,94E-06
Prob. of coefficient	0,01	0,01	0,95	0,27	0,01	0,56
F-statistic	8,97		0,66		3,78	
Prob. of F-statistic	0,00		0,52		0,03	
Non-Financial Firms						
	Model 1		Model 2		Model 3	
	Leverage	Size	Leverage	Size	Leverage	Size
Coefficient	-0,409	5,64E-07	0,331	-9,50E-07	-0,198	-1,22E-06
Prob. of coefficient	0,03	0,08	0,46	0,40	0,46	0,13
F-statistic	3,36		0,49		2,13	
Prob. of F-statistic	0,04		0,61		0,13	

For the non-financial firms, the same pattern as the financial institutions is expected to be followed. This is true for model 1 and 2, since leverage and size did matter when there was just a crisis limited on the financial market and did not matter when there was a global crisis. Model 3 of the non-financial companies show other results than expected, because the coefficients and the model are not significant. Since model 3 represents the recovery period and not a crisis, leverage and size should be significant according to the hypothesis. The reason for this could be that the governmental aid didn't occur in the non-financial sector. As a consequence, the crisis manifested longer in the non-financial sector. It also could be that the crisis experienced a longer peak because of the downward spiral that the recession

caused. The significant leverage coefficients for all the models and the financial and non-financial firms are as expected all negative. On the other hand, the size coefficients are almost all positive when they should be negative because of the size-effect.

4.3 Hypothesis 3

4.3.1 The model

Hypothesis 3 tries to give an alternative measure of risk during a crisis or system failure. These alternative measures should be crisis-related. In order to test this hypothesis, four crisis-related variables are used. The first variable is the presence and the size of mortgage backs securities on the balance sheet. This is the variable that makes the most sense, since the crisis began with these securities. The higher the value of this variable on the balance sheet of a company, the higher the risk increase. The second variable is the gain or loss on the disposal of assets. This is also an appropriate measure, since almost all the disposed assets of a financial institution in the crisis was sold with a loss. The lower the gain on the disposed assets, the more likely it will be that the company owned low quality financial assets, the higher the risk because of the low quality assets. The third variable is the absolute value of the disposed assets. This variable is crisis-related, because during the chaos in the peak of the crisis, the financial institutions began to dump their low quality assets in large numbers. If a financial institution didn't possess such low quality assets, no disposal is needed. In this context, the disposal functions as a signal of the possession of undervalued assets. The more a company disposed their assets in the period of severe crisis, the more they should experience risk. Loan loss provisions as a percentage of total loans is the last variable. The intuition behind the crisis-related property of this variable is that in times of crisis financial institutions experience more defaults on the loans because of for example the high unemployment rates. Financial institutions whom are experiencing a larger rate of provisions for loan losses to total loans are exposed to more risk. The higher this percentage, the higher the risk. The models are constructed as followed

$$\text{Model 1: } \% \Delta \beta_{12} = \alpha + \beta X \quad (10)$$

$$\text{Model 2: } \% \Delta \beta_{23} = \alpha + \delta X \quad (11)$$

$$\text{Model 3: } \% \Delta \beta_{34} = \alpha + \lambda X \quad (12)$$

With $\% \Delta \beta$ = The percentage of risk change between the periods in the subscription, and X=one of the four mentioned crisis-related variables.

The three models are estimated for every of the four crisis related variables. Model 1 and model 3 should show no significant parameter, since the corresponding periods and transitions were not in the peak of the crisis. Only model 2 should show significant parameters, because it measures the relation of the risk change to the crisis-related variables in the transition of a crisis limited on the financial market to a global crisis.

4.3.2 Results

Table 3 displays the results of the test of hypothesis 3. All the variables in the peak of the crisis (transition 2) show up positive. Also, with a significance level of 5%, all the variables were significant different than zero in this period. Except for the loan loss provision as a percentage of total loans, in the period of recovery and in the early stage of the crisis none of the variables seem to be significant different than zero (transitions 1 and 3). These results indicate that the crisis-related variables only have influence on the risk of financial institutions in times of severe crisis, and no influence when the crisis is not yet occurred or when the crisis is dealt with. This summary confirms the hypothesis since it states that in times of severe crisis, only crisis-related variables should matter. Firm specific risk determinants show up non-significant in hypothesis 2, when the crisis is at his peak. This conclusion supports hypothesis 3. Risk modeling of financial institutions in times of crisis should thereby be focused on crisis-related variables, instead of the traditional determinants of risk like leverage and size.

	Mortgage backed securities	Gain/loss on disposal of assets	Asset disposal	Loan loss prov.% of total loans
Transition (model) 1				
Coefficient	3,00E-09	-4,39E-07	1,08E-07	4,81E-01
Prob. of coefficient	0,792	0,302	0,326	0,007
Transition (model) 2				
Coefficient	2,03E-09	5,89E-07	1,12E-07	4,28E-02
Prob. of coefficient	0,020	0,012	0,000	0,031
Transition (model) 3				
Coefficient	-1,20E-09	1,59E-07	-4,82E-08	4,47E-02
Prob. of coefficient	0,542	0,662	0,237	0,262

Table 3: Regression coefficients of independent variables, regressed on the beta changes in different changes of the crisis.

The only variable that does not confirm hypothesis 3 is the loan loss provision as a percentage of total loans, in the period of a crisis limited to the financial market. The variable is significant but according to the hypothesis it should be insignificant. The reason for this result is that this variable could also be firm specific and thereby could also have an influence on the risk in times of no crisis or system stability. The loan loss provision variable summarizes an important operational aspect of a financial institution, namely the adequacy of their lending procedures and their ability to deal with moral hazard and adverse selection problems. This is the core business and could therefore be considered as a variable that always is a determinant of the risk of a financial institution.

5. Conclusion

5.1 Summary

The results presented in section 4 confirm the corresponding hypotheses, except for some deviations that can be clarified by simple reasons. The first hypothesis tries to give a clear view of how the crisis transformed through time. In order to test the progress of the crisis, one needs to know the causes and the consequences of the crisis. These causes and consequences are discussed in section 2, with help of existent literature. The outcome of the literature study gives three important points in time that describe the subsequent trends. With these three dates, four periods can be separated. The first period is the period when there was no crisis. The second period was the period of a crisis on the financial market. The third and fourth periods are characterized with a period of a global crisis and a period of recovery, respectively. Hypothesis 1 uses these findings and tests on risk changes of the financial and non-financial stocks. The dates found in the literature study are used to separate the samples, because these dates indicate important transitions. The results show significant risk changes on the transitions found in the literature study. For the financial companies, the risk changed for more companies than for the non-financial companies. Although not every company showed a significant risk change on the transition, the majority did. Hypothesis 1 can thereby be confirmed and as a consequence there can also be concluded that the dates or transitions are relevant points in time for the description and understanding of the crisis.

The second hypothesis states that the traditional determinants of risk are not applicable in times of severe crisis or system failure. It builds further on hypothesis one. The traditional determinants used in this thesis are leverage and size. The risk of companies in the

second transition, between a period of a crisis limited on the financial market and a period of global crisis, is expected to not be influenced by these traditional risk measures. The results confirm this hypothesis, since the variables had only a significant impact on the risk change in times of no global crisis. In other words; during the peak of the crisis there was no influence of leverage and size on the risk change.

The third hypothesis uses the conclusion of the second hypothesis. It presents an alternative model of predicting risk changes in times of severe crisis. If the traditional risk determinants aren't applicable in times of severe crisis, what is? The hypotheses gives a logic explanation by recommending the usage of crisis-related variables for forecasting risk changes in times of crisis. If the recommendation is true, the crisis-related determinants should only show significant impact on risk change during the period and transition of global crisis. The results confirm the hypotheses by showing only a significant impact of the four crisis-related variables during the period of a global crisis. The crisis-related variables are not significant in the other periods. Hypothesis three is thereby also confirmed.

5.2 Implications

The results are convincing since they support the hypotheses for the most important part. The hypotheses have a logical order. First there is an attempt to get a grasp on the transformations within the crisis. Once this is clear, the factors of influence on the risk are defined. When it turns out that these factors seem not to be adequate in times of crisis, a new model is presented. The results of the second and third hypotheses are complementary. The second hypothesis states that leverage and size don't have influence on risk in times of crisis, and the third hypothesis tries to define a new model of forecasting risk changes, but only if the second hypotheses is right. The presence of the third hypothesis means that the second hypothesis is confirmed. It also means that the important determinants of leverage and size do not matter in particular situations. This is in contrast to what the existing literature describes.

An important consequence of the findings are the implications of forecasting of risk. If leverage and size is still used to forecast risk in times of crisis, a biased estimate will be the result. Since risk measures in the form of the CAPM beta is frequently used in valuation, capital budgeting and risk management, all these applications will also be biased when it is based on the risk measure in the period of the subprime crisis. There can also be concluded that there is no general model of risk modeling and risk forecasting, but rather a continues

alteration of important risk factors that are facing the companies. In this context, investors should not base their valuations on general contemporary models, but on carefully chosen models which explain the influences on the risk in that period of time or in the period of the forecasting horizon. There must be searched for factors of influence of the risk, beyond the general factors. Even systemic elements must be considered, since for example the financial system seems to fail in regulating itself or by the government. With this in mind, basing on past risk measurements is ambiguous because of the continuous change of risk. Risk measurements must therefore be based on the future and not on the past performance of risk.

On the other hand, there could also be a failure of the risk measure of the CAPM model which could bias the previous conclusion of uselessness of general models for risk measure. As cited in section xx, the CAPM model is based on assumptions. These assumptions can all be pinned down to the assumption of rational behavior. If this assumption is released, then investors are no mean-variance optimisers and will base their investment selections on other criteria. This will result in other portfolio selection between investors with the same risk but other returns. The whole derivation and logic of the CAPM will then be obsolete. There is an objection to this reasoning, because the efficient market will detect this arbitrage and trade on it, which causes the mispricing to be corrected. Hence, in theory there are only a few rational investors required to make the market efficient and the prices to be reflecting the right economic value. Still, the argument of the failure of the CAPM during the subprime crisis can hold. First, the crisis came as a surprise to many. Investors thought that they were working on a rational basis, but they were facing the contrary when the crisis took place. Even the investors that were acting on a rational bases, saw the crash of the market without even knowing what exactly happened. This naturally causes panic, which is not a form of rational behavior. Security prices could therefore not be based on the pricing of the CAPM, because the most important assumption of this model does not hold any more in this situation. Second, because of the surprise effect and the absence of rationality, no one knew what to expect anymore. Even rational investors cannot be sure about the future, because the consequences of the crisis were not objective, but rather based on subjective visions of how the crisis will evolve. This is true, because irrational behavior on a large scale can have an impact on future economic performance. Since irrational behavior is harder to make inferences about compared to rational behavior, the future becomes more uncertain when the portion of irrational investors to total investors increases. In a sense, the boundary of rational and irrational behavior got faded away. In this context, the CAPM model is not useful anymore for the measure of risk and would therefore bias the results in this thesis. This is a

debate between the advocates and the opponents of the EMH. The advocates of the EMH will believe in the CAPM and will therefore support the findings in this thesis. That is, if they agree with the methodology. However, the opponents of the EMH will discard the rationality of the CAPM and therefore the use of the risk measure used in this thesis. As a consequence, they will also discard the findings. If agreed with the methodology, the opponents and the advocates of the EMH will draw different conclusions out of the results of this thesis. The advocates of the EMH will conclude that markets are still efficient, but risks are not always a function of leverage as size. The opponents however conclude that the CAPM failed to summarize the risk because of the lack of rationality. The results of the alternative model still indicate rationality during the crisis, because there are significant relations to relevant variables. This could be seen as a shift of relevant determinants of risk, rather than a failure of the CAPM. Yet, this is also debatable and it is therefore a discussion that is still held in the academic world. The way the results of this thesis can be summarized are therefore dependent on which view one has on the EMH.

Appendix 1 Chow test results and beta changes within the sample: non-financial companies

Name	Sample 1		Sample 2		Sample 3		
	chow p-value	Beta change	chow p-value	Beta change	chow p-value	Beta change	
ALCOA	0,41	-9%	0,00	61%	0,60	6%	Basic materials
DOW CHEMICAL	0,97	-2%	0,00	0%	0,00	71%	
E I DU PONT DE NEMOURS	0,39	-15%	0,00	30%	0,00	28%	
FREEMONT-MCMOR.CPR.	0,26	-23%	0,05	29%	0,76	-7%	
NEWMONT MINING	0,00	-79%	0,00	362%	0,01	-63%	
PRAXAIR	0,38	-17%	0,00	31%	0,02	-19%	
ALTRIA GROUP	0,92	-4%	0,86	7%	0,00	-58%	Consumer goods
ARCHER-DANLS.-MIDL.	0,41	-20%	0,00	30%	0,01	-23%	
COCA COLA	0,12	-30%	0,00	52%	0,02	-39%	
COLGATE-PALM.	0,63	12%	0,00	42%	0,01	-38%	
FORD MOTOR	0,09	68%	0,46	-17%	0,54	0%	
PEPSICO	0,25	-23%	0,00	48%	0,02	-37%	
PHILIP MORRIS INTL.			0,38		0,00	-53%	
PROCTER & GAMBLE	0,01	-36%	0,00	50%	0,83	-7%	
3M	0,98	-1%	0,95	1%	0,00	41%	Industrials
BOEING	0,18	-22%	0,03	29%	0,48	8%	
CATERPILLAR	0,31	-20%	0,03	17%	0,00	53%	
EMERSON ELECTRIC	0,47	-12%	0,11	15%	0,84	1%	
GENERAL ELECTRIC	0,00	54%	0,02	-16%	0,00	67%	
UNION PACIFIC	0,12	-21%	0,11	-15%	0,01	48%	
UNITED PARCEL SER.	0,12	-23%	0,02	24%	0,17	19%	
UNITED TECHNOLOGIES	0,44	-12%	0,96	1%	0,43	12%	
CHEVRON	0,90	-2%	0,00	40%	0,00	-27%	Oil & Gas
CONOCOPHILLIPS	0,91	-5%	0,00	37%	0,01	-22%	
EXXON MOBIL	0,47	-13%	0,00	23%	0,00	-30%	
SCHLUMBERGER	0,77	-12%	0,19	18%	0,00	12%	
DOMINION RES.	0,77	-9%	0,30	14%	0,07	-27%	Utilities
DUKE ENERGY	0,33	-21%	0,32	19%	0,15	-25%	
EXELON	0,36	-20%	0,00	37%	0,00	-50%	
FPL GROUP	0,89	-5%	0,02	31%	0,00	-41%	
SOUTHERN	0,01	-36%	0,23	21%	0,01	-41%	

Appendix 2 Chow test results and beta changes within the sample: financial institutions

Name	Sample 1		Sample 2		Sample 3	
	chow p-value	Beta change	chow p-value	Beta change	chow p-value	Beta change
AFLAC	0,03	37%	0,02	34%	0,00	75%
ALLSTATE	0,00	61%	0,00	61%	0,79	9%
AMERICAN EXPRESS	0,00	47%	0,00	-23%	0,00	75%
AMERICAN INTL.GP.	0,00	335%	0,00	-39%	0,14	37%
APARTMENT INV.& MAN.'A'	0,09	32%	0,08	17%	0,00	46%
BB&T	0,00	101%	0,00	-40%	0,00	87%
BANK OF AMERICA	0,00	139%	0,13	-10%	0,00	57%
BOSTON PROPERTIES	0,25	19%	0,10	19%	0,00	52%
CAPITAL ONE FINL.	0,00	80%	0,00	-25%	0,00	101%
CME GROUP	0,04	48%	0,02	-23%	0,58	14%
CHUBB	0,00	50%	0,01	-22%	0,76	-2%
CINCINNATI FINL.	0,00	75%	0,02	-16%	0,27	7%
CITIGROUP	0,00	93%	0,37	-2%	0,28	17%
COMERICA	0,00	91%	0,00	-32%	0,00	74%
DISCOVER FINANCIAL SVS.	0,33		0,08	-19%	0,00	81%
E*TRADE FINANCIAL	0,15	55%	0,00	-43%	0,10	54%
FEDERATED INVRS.'B'	0,03	46%	0,12	-17%	0,40	14%
FIFTH THIRD BANCORP	0,00	136%	0,06	-29%	0,00	95%
FIRST HORIZON NATIONAL	0,00	157%	0,00	-48%	0,01	44%
FRANKLIN RESOURCES	0,44	12%	0,01	-16%	0,06	20%
GENWORTH FINANCIAL	0,00	182%	0,12	26%	0,99	-2%
HCP	0,02	41%	0,06	24%	0,01	37%
HOST HOTELS & RESORTS	0,03	45%	0,00	35%	0,00	54%
HUDSON CITY BANC.	0,00	68%	0,00	-26%	0,00	91%
HUNTINGTON BCSH.	0,00	171%	0,12	-29%	0,03	81%
INTERCONTINENTAL EX.	0,27	25%	0,07	-16%	0,14	-23%
JP MORGAN CHASE & CO.	0,00	54%	0,00	-29%	0,00	85%
JANUS CAPITAL GP.	0,23	19%	0,06	-13%	0,00	61%
KEYCORP	0,00	119%	0,13	-16%	0,02	50%
KIMCO REALTY	0,35	-2%	0,05	25%	0,00	56%
LINCOLN NAT.	0,00	65%	0,04	37%	0,02	54%
M&T BK.	0,00	57%	0,00	-40%	0,00	120%
MBIA	0,02	147%	0,03	-34%	0,02	55%
MARSHALL & ILSLEY	0,00	145%	0,01	-31%	0,00	118%
MASTERCARD	0,42	13%	0,09	-20%	0,23	-13%
METLIFE	0,00	58%	0,61	11%	0,00	59%
MORGAN STANLEY	0,26	22%	0,00	34%	0,01	-23%
NORTHERN TRUST	0,00	34%	0,43	-2%	0,07	-10%
PNC FINL.SVS.GP.	0,00	66%	0,62	-9%	0,00	107%
PEOPLES UNITED FINANCIAL	0,00	84%	0,00	-35%	0,05	-12%
PLUM CREEK TIMBER	0,02	36%	0,89	-2%	0,00	38%
PRINCIPAL FINL.GP.	0,00	69%	0,01	31%	0,07	30%
PRUDENTIAL FINL.	0,00	72%	0,00	48%	0,01	44%
PUBLIC STORAGE	0,07	10%	0,84	5%	0,01	33%
REGIONS FINL.NEW	0,00	184%	0,00	-46%	0,05	69%
SLM	0,00	154%	0,35	-15%	0,10	45%
CHARLES SCHWAB	0,32	-2%	0,00	-23%	0,17	22%
SIMON PR.GP.	0,09	16%	0,51	8%	0,00	48%
STATE STREET	0,08	28%	0,78	-2%	0,04	41%
SUNTRUST BANKS	0,00	116%	0,05	-28%	0,00	112%
T ROWE PRICE GP.	0,01	27%	0,00	-24%	0,00	44%
BANK OF NEW YORK MELLON	0,01	44%	0,09	-12%	0,24	8%
TORCHMARK	0,08	29%	0,00	42%	0,00	76%
TRAVELERS COS.	0,00	56%	0,00	-24%	0,28	-13%
US BANCORP	0,00	130%	0,01	-26%	0,00	131%
VENTAS	0,11	8%	0,00	36%	0,20	22%
VORNADO REALTY TST.	0,23	17%	0,42	10%	0,00	60%
WELLS FARGO & CO	0,00	99%	0,08	-19%	0,00	96%
XL CAP.'A'	0,00	187%	0,26	21%	0,55	20%
ZIONS BANCORP.	0,00	161%	0,00	-42%	0,00	141%

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