UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

BACHELOR THESIS
FINANCIAL ECONOMICS

Macroeconomic Forces and Their Effects on the Swedish Banking Sector

An Econometric Study

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ABSTRACT

After the bankruptcy of Lehman Brothers in September 2008 international capital markets trembled of uncertainty and investors did not know where the markets were heading. The market turmoil also had an impact on Sweden and especially on the banking sector due to the interdependence of international financial markets. Some Swedish banks were granted support through a guarantee program that was offered by the Swedish government. The Swedish banking sector is relatively unique in an international comparison when looking at the degree of market concentration. Four large banks, "The Big Four", dominate the market and have a market share of more than 80%. These are Swedbank, SEB, Nordea and Handelsbanken. The purpose of this thesis was to investigate to what extent a set of macroeconomic factors presented on a daily basis could be used to explain the stock performance of these banks before and after the crash of Lehman Brothers by comparing similarities and differences between the four banks. The macroeconomic factors whose impact were analysed were changes in CDS-spreads as a proxy for default risk, Swedish T-bills, the Stockholm OMX 30 Index, the SEK/Euro exchange rate, the Amihud illiquidity measure as a proxy for growth in industrial production, Swedish term structure of interest rates and unanticipated changes in oil price. The empirical work was done by constructing an econometrical multifactor model by using daily data for the variables over the years 2005-2012 where adjustments to data issues such as heteroskedasticity and autocorrelation were made by using Newey-West estimators.

The results showed that there were both differences and similarities in the impact of the macroeconomic factors on the four bank stocks. Swedbank and SEB were clearly more affected by changes in CDS-spreads than for example Handelsbanken even though the statistical significance fell after the Lehman Brothers crash. The reason for this might be that the risk exposure of the banks changed after the crash. In the cases where changes in the SEK/Euro were statistically significant it affected stock returns negatively. The reason for this might be the higher borrowing costs when borrowing in Euro. Handelsbanken distinguished themselves from the others and was the only bank for which changes in T-bills had a positive correlation with stock returns after the crash. This suggests that the market viewed the Handelsbanken stock as a substitute for Swedish T-bills after the crash with lower risk than the other bank stocks. In addition, this was confirmed by analysing the market risk for each of the stocks after the Lehman Brothers bankruptcy. The results showed that the stock performance of each bank was more dependable on the overall market performance during the period after the crash. The Handelsbanken stock turned out to have the lowest degree of market risk followed by Nordea, Swedbank and SEB.

TABLE OF CONTENTS

1. INTRODUCTION

In this section the background, scope and aim of this thesis will be presented

1.1 BACKGROUND

The bankruptcy of Lehman Brothers in September 2008 can be viewed as the starting point for one of the most severe global financial crises since the Great Depression in the early thirties. The fact that one of the world's major investment banks collapsed caused the global financial markets to tremble of great uncertainty of where the markets were heading. The collapse of Lehman Brothers combined with the following uncertainty had effects that transmitted all over the world, leading to a global recession of monstrous magnitude.

At the same time in Sweden the government had great concerns dealing with problems within the Swedish banking sector in the wake of the bankruptcy of Lehman brothers. Many of the banks struggled for their daily survival in an environment and time characterized by both anxiety and protectionism. For instance, the Swedish National Debt Office had to step in as owner for Carnegie, one of the major investment banks in Scandinavia, until the markets were stabilized. The larger commercial banks in Sweden, especially Swedbank, lost customers to banks of smaller size due to the growing uncertainty. The basis for the uncertainty in the case of Swedbank largely had its explanation in the bank's extensive operations in the Baltic States.

The financial crisis that broke out after the Lehman Brothers bankruptcy had a severe impact on the global economy and this in turn had an effect on the performance of individual corporations. This type of macroeconomic factors can be used to explain the performance of an individual company. But it is not certain whether the same macroeconomic factors will have similar causal effects on various corporations. The explanation for this may lie within firm specific factors such as size, industry and risk exposure, even though variations within the same industry might occur.

The Swedish banking sector largely differs from other international banking markets, such as the German banking industry. Wissén and Wallgren (2009) state in their article about the Swedish financial sector that the four largest banks in Sweden together have a market share of more than 80% of the total banking industry in Sweden compared to the German banking sector where Deutsche Bank, which is one of the larger banks in the world, only has a market share of 5%. The Swedish banking sector is so to speak more concentrated in the number of actors, than for example the German sector. The four Swedish banks that Wissén and Wallgren discuss in their article are Swedbank, Nordea, Handelsbanken and SEB and for the sake of simplicity they will be referred to as the "Big Four" in the rest of the thesis.

Since Sweden is a small open economy and the Swedish banking sector exhibits such a high degree of concentration in the number of actors one could intuitively imagine that global macroeconomic factors should have an impact on the performance on Swedish corporations in general and, thereby, an effect on the performance of the Big Four. But it is questionable if the same macroeconomic factors have the same causal effects or the same magnitude and statistical significance on each of the Big Four. In this thesis the focus will lie on the analysis of the impact of chosen macroeconomic factors on the stock performance of the Big Four. Chen, Roll and Ross (1986) present a number of macroeconomic factors that affects stock returns when they try to explain economic forces that have an impact on stock markets. These factors will be the basis for this analysis but with some adjustments made to enable the use of daily data. One factor that will be analyzed is the counterparty default risk, where a Credit Default Swap will be used as a proxy. This is interesting due to recent events in the global economy, where the ongoing European sovereign-debt crisis might have put more focus on the risk of default within the financial markets than earlier. Also the crisis that occurred after the collapse of Lehman brothers might have had an impact on the macroeconomic effects on stock performances. Therefore the Lehman Brothers crash will be set as the delimiter for what will be called before and after the crisis in this thesis. The other factors whose impact will be investigated are the performance of the overall stock market, fluctuations in SEK/Euro exchange rates, unanticipated changes in oil price, changes in the interest rate of Swedish T-bills, changes in the term structure of Swedish interest rates and changes in Amihud's measure, included as a proxy for growth in industrial production.. These factors and their possible impact will be explained in more detail in the theory section of this thesis.

1.2 AIM

As mentioned in the introduction SEB, Swedbank, Nordea and Handelsbanken are commonly referred to by media and others as the Big Four. It would therefore not be unreasonable to believe that their risk exposure should be somewhat alike. The financial sector and especially the banking sector are in many ways different from other sectors such as food, garment and manufacturing. Even though banks in many ways differ from other sectors when it comes to products and services that are offered to customers, the connection between banks and all of these industries cannot be ignored. Banks are more than other corporations exposed to the performance of these companies because their business idea basically is to support companies and other institutions with liquidity in the form of lending activities and acquisition of corporate and government bonds. One risk associated with this is something called *counterparty risk*, which can be described as the risk that counterparties will not be able to repay what they owe the bank. The risk that a company defaults is undoubtedly higher in times of economic instability and uncertainty. Because a bank's main operations lie within the field of lending and borrowing, the default of many borrowers at the same time would certainly harm the performance of the bank. Based on this, a bank is reasonably very dependent on the financial climate and by that, banks' stock performances highly depend on the performance of some important macroeconomic factors. This lays the foundation for what this thesis is built upon and so the purpose of the thesis has its basis in this theory.

"The purpose of this thesis is to examine to what extent macroeconomic factors presented on a daily basis can be used to explain and compare the individual performance of four bank stocks before and after the crash of Lehman Brothers."

1.3 Scope

This is an econometrical study that focuses exclusively on the stock returns for the Big Four over the years 2005-2012. Stock returns will be studied without adjustments for dividends or seasonality. The reason why this study focuses on the Swedish banking sector is due to its unique characteristics compared to international banking sectors and also because of the close interdependence between international banks all over the world. The results of this thesis will only be valid for the stocks that have been analyzed, even though the results may lead to further discussions. The factors examined in this thesis do not themselves explain all of the variation in stock returns. However, they are selected on the basis of previous empirical works and literature combined with economic reasoning and they all represent important economic factors that are believed by the authors of this thesis to affect stock returns. The reason for this is that the limit has to be set somewhere and creating a model with too many variables may lead to difficulties in analyzing causal effects. No firm-specific factors will be accounted for in the econometrical analysis. The reason for this is that this thesis is based on the macroeconomic theory of Chen, Roll and Ross (1986). The main objective is to compare differences and similarities of the macroeconomic effects between the different banks before and after the crisis.

2. Literature Review

In this section literature and theories on which this thesis is based are presented

2.1 Multi-factor Models

There are many factors that affect the expected returns of a particular stock. These factors could be firm or sector specific which means that they are specific for a particular company or industry. A good example of a firm specific factor could be that the performance of a company changes due to a new CEO. But there are also factors that have an effect on the performance of all firms. These factors are called systematic or macroeconomic factors, for example GDP growth or exchange rates. Factors like these affect all companies but still different companies can have a different degree of sensitivity to a particular macroeconomic factor. The type of model that is being tested in this thesis is a multiple-factor model which means that several factors are included as explanatory variables. The factors that will be tested are those presented in the introduction. The model has the following properties

$$r_i = \alpha_i + \sum_{K=1}^{K} b_{ik} F_K + e_i \qquad \textbf{(2.1)}$$

where r_i is the rate of return of asset i, α_i a constant, b_{ik} the factor sensitivity for asset i of factor k, $F_K$is the factor k and e_i is a random error term. It lies within the nature of the model that the number of explanatory variables is unknown and have to be empirically tested for. This could be exercised through a statistical and econometrical analysis by testing the statistical significance of the variables. A famous multi-factor model for explaining stock returns is the arbitrage pricing theory (Ross, 1976). In this model the number of factors is unknown and the model is therefore said to be a K factor model. The model assumes that capital markets are perfectly competitive and that investors always prefer more to less wealth. The main aim of the model is to test the significance and the magnitude of the factor sensitivity for a particular asset. By determining relevant factors for a certain stock or asset, it is possible to spot mispriced assets in the financial markets and investors will then try to exploit these opportunities to make profits. Over the years several studies within the subject have been made where researchers have tested the statistical significant effects of various explanatory variables on stock returns. Some factors seem to be problematic to find empirically consistent answers to. For example Reinganum (1981) found that firm size is a significant explanatory variable when explaining asset returns, a factor that was found insignificant by Ross (1983). Chen, Roll and Ross (1986) find five factors significant in their famous paper. Firstly, in their empirical research, they found the monthly growth in industrial production to be significant. This growth rate is expressed as an index of the business cycle in the economy. The second factor they find significant is the change in default risk premium. This is measured as the change in the default risk premium on the financial markets over a specific time period. They also find yield curve which can be defined as the term structure between long and short term interest rates on government bonds over time statistically significant. The three factors mentioned are considered to be highly significant but they also find unanticipated inflation and changes in expected inflation significant but more weakly. The conclusion that can be drawn from their results is that unanticipated inflation and changes in expected inflation have a smaller statistical significance than the growth in industrial production; changes in default risk premium and the yield curve when explaining stock returns. These results are confirmed by Conner and Korajczyk (1993).

2.2 Efficient Market Hypothesis

In the efficient market hypothesis, market efficiency is a measure of the degree of how well relevant information is incorporated into asset prices. A central part of this thesis is to empirically test what effects a specific set of macroeconomic factors have on the stock returns of four Swedish banks. Researchers have long tried to find possible explanations to stock price movements by trying to observe patterns in historical pricing data. The British statistician Maurice Kendall was not able to reveal any patterns that could be used for stock price predictions in his analysis of economic time series in 1953 (Kendall, 1953). When these results were presented they were interpreted as a proof that price movements on international stock markets to a high degree moved randomly and chaotically due to psychological factors. Subsequently, researchers later changed their view on Kendall's results. Bodie states that random stock price movements is an indication of that the market is well-functioning (Bodie et. al, 2011). That means that if it is not possible to find any patterns in stock price movements based on all relevant information, the market is efficient and only unexpected events have an impact on asset prices. For instance when a listed company releases its quarterly report and the company has performed worse than expected, the stock price tends to fall, and vice versa. These shocks are immediately reflected in asset prices if the market is informational efficient. That means that daily shocks cause immediate reflections in stock prices.

2.3 Characteristics Of Dependent Variables

The focus of this section is to present certain characteristics of all dependent variables used in this thesis. All information is collected from annual reports from 2004 to 2011.

2.3.1 Swedbank

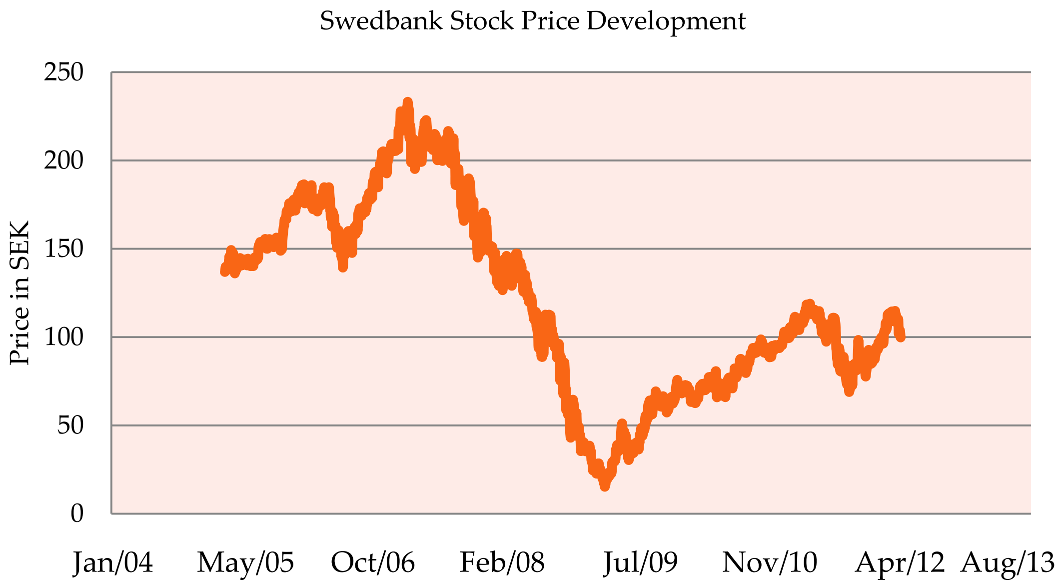

FIGURE 2.1

Swedbank's core business lies within serving private customers as well as small and medium sized companies especially in their home markets Sweden, Estonia, Lithuania and Latvia. Today Swedbank has approximately 4 million clients in Sweden and 3.8 million clients in the Baltic States.

With a pronounced strategy that focuses on internationalization determined by the members of the board in the early 2000, Swedbank continued to increase their presence in the Baltics States in 2005 through the acquisition of one of the leading banks in the region. Hansa Bank became part of the Swedbank group and the economic outlook for the Baltics was nothing but positive at this time. The economic growth continued throughout the year of 2006 and an agreement was concluded regarding the acquisition of the Ukrainian Bank TAZ-Kommerzbank. This was a further step associated with the banks internationalization process which smoothed well in times of economic growth and financial stability. At this time the company's focus on Eastern Europe was unquestionable. Although financial markets trembled during 2007, Eric Stålberg, President of the Board, proudly asserted it as the bank's best year so far. The year after would be recognized as a year characterized by financial issues, defaults and uncertainty about the future, as one of the leading banks in the Baltic States Swedbank had to face the significant negative effect the financial disease had on those markets. Of course this was to be reflected in the stock price which declined in value by approximately 75% over 2008. Swedbank was severely affected by the new financial climate. In November 2008 the Swedish National Debt Office granted Swedbank's application to take part of the guarantee program which was a promise by the Swedish State to step in as guarantor in case Swedbank would not be able to fulfill its obligations.

If 2007 was one of Swedbank's most successful years in history, 2009 was on the other hand one of the worst years for the bank so far. Banks with a high level of risk exposure was harmed more than others by the financial crisis and Swedbank was at this time maybe the Swedish bank with the highest level of risk exposure. Much of the risk can be derived from operations in the Baltic States. Lending activities following the years from 2005 to 2008 in these countries is according to Michael Wolf, CEO, one explanation why Swedbank suffered in some ways more than other Swedish banks from the financial crisis. It was not only hurtful to the balance sheet but also the public reputation of the bank was harmed.

After the crisis it seems like Swedbank realized more than ever the importance of solid finances and risk management. After the trembling period Swedbank reduced their overall risk exposure. Even some core values were reformulated.

This tells the story of a bank that suffered from mistakes and maybe learned something from a period that could have ended even more dramatically than it did.

2.3.2 SEB

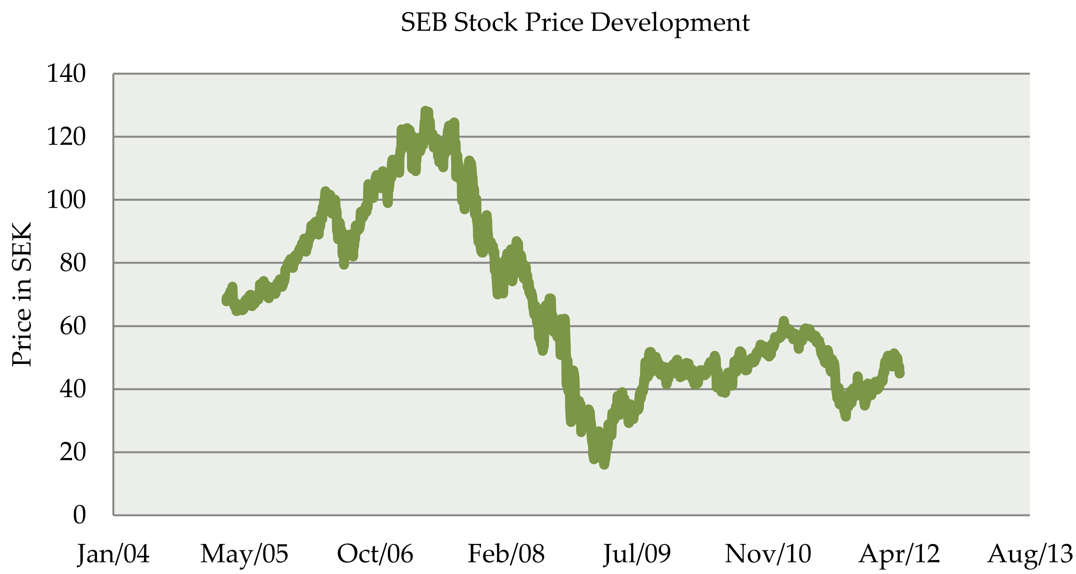

FIGURE 2.2

In Sweden and the Baltic states SEB offers a wide range of financial services. The focus in Denmark, Finland, Norway and Germany is on corporate and investment banking. The international characteristic of SEB is reflected in their presence in over 20 countries.

With over 4 million clients and 17,000 employees worldwide SEB is a major player in the Swedish banking sector. SEB focuses its businesses towards corporate and institutional clients as well as retail banking. The acquisition of the Ukrainian Bank Agio in 2004 was part of SEB's strategy to expand their businesses to Eastern Europe. Annika Falkengren became CEO of SEB in 2005 and the same year Marcus Wallenberg took on the role as president of the board after Jacob Wallenberg. That year half of SEB's earnings were generated on the Swedish market while the rest were generated abroad. At this time the economic outlook was positive both for the bank and the economy as a whole. The SEB stock had experienced great growth both in 2004 and 2005. This was to continue even in 2006 with a 33% increase in stock value. The prospects of the future were positive even though Marcus Wallenberg raised some concern over the American economy. At this time SEB could offer all of their banking services in Sweden, Germany, Estonia, Lithuania and Latvia.

After several years with positive returns, the economic downturn during the second half of 2007 had a negative effect on the SEB stock. The stock decreased by 24% mostly due to problems with the American sub-prime market. This gave rise to uncertainty among market participants and widened credit spreads on financial derivatives. Increased spreads forced SEB to realize valuation losses in fixed income portfolios. The credit loss ratio for the year was 0.11%, an increase by 0.03% compared to the year before. Problems continued throughout the year of 2008 with the bankruptcy of Lehman Brothers as the main incident. Credit loss ratios peaked and reached 0.30%, a significant increase compared to previous years. Due to concerns in the Baltics, SEB increased their capital reserves to be able to face further defaults.

After the crisis SEB focused on enhancing their balance sheet and to retain liquidity within the company. When one could hope for some stability in the world economy new concerns rose on financial markets in 2010.

2.3.3 NORDEA

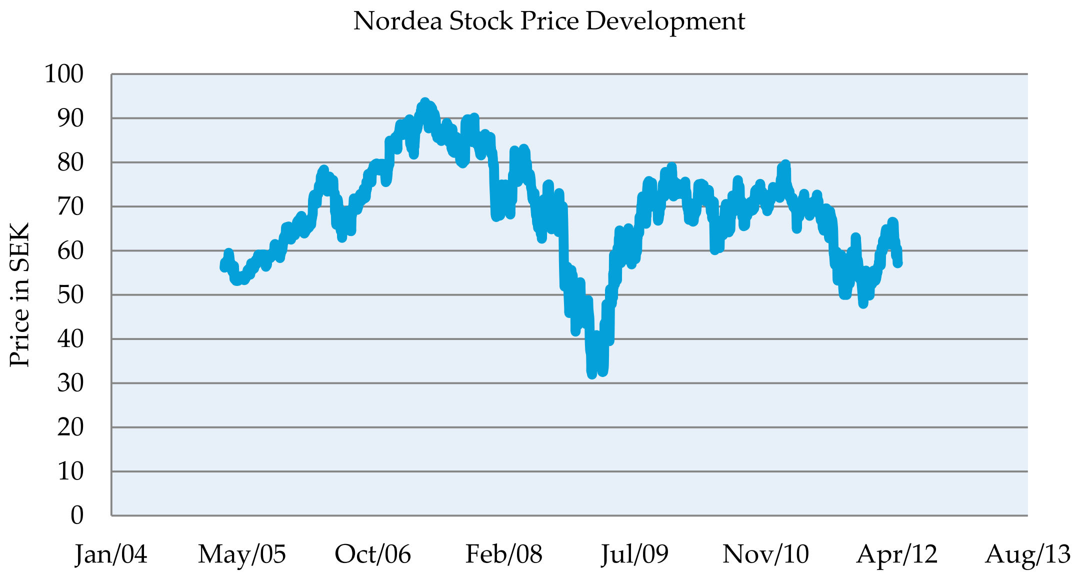

FIGURE 2.3

After the completion of the merger of four major banks resident in the Nordic banking sector year 2000, Nordea became the largest financial group in Northern Europe with more than eleven million clients in the Baltic Sea Region. Their main operations lie within commercial banking and they have approximately 1400 branches in the Nordic countries and in the emerging markets in Eastern Europe. The Swedish state and other Swedish institutions are some of the more influential shareholders but the Sampo group is the single largest shareholder. The years that followed after the merger were characterized by efforts to make the new bank operate like a single unit on the cross-border banking markets by taking advantage of the size, scale and scope of Nordea. This was done by reducing costs and increasing efficiency by outsourcing non-core activities like the divestment of real estate assets in 2004. In 2005 the bank increased its activities in Poland, Russia and the Baltic States but the main focus was still put on the Nordic countries where more than 90% of their operations lie and Sweden was the market where the highest growth rate in the bank’s operations was expected. Since the bank mainly has its operations in Sweden, Denmark, Norway and Finland their activities are affected by changes in the foreign exchange rates of all the domestic currencies of these markets. In year 2007 the financial markets were dominated by turmoil due to the sub-prime loans in the US but Nordea was only exposed to those loans to a limited extent and stood relatively stable. Nordea handled the market uncertainty by focusing more on the relatively more sound and secure Nordic banking sector and by slowing down their proceedings of their activities on the markets in Eastern

Europe. This was done mainly to remain their AA credit rating. The expectations for the upcoming 2008 were that the Nordic GDP growth rate would slow down and that the macroeconomic environment would be highly uncertain and therefore they expected some net loan losses for 2008. In 2008 the turmoil on the financial markets continued with the crash of Lehman Brothers but still Nordea ended the year with a positive profit that was 1% higher than the previous year. Their managing of the crisis was continued by cutting costs and slowing down expansion. Instead they chose to focus on their current clients. During the year Nordea's borrowing costs were among the lowest of the largest European banks due to Nordea's high credit rating. In 2009 and 2010 Nordea's share of capital raised on long-term funding increased as part of their strategy to keep their high credit rating.

2.3.4 HANDELSBANKEN

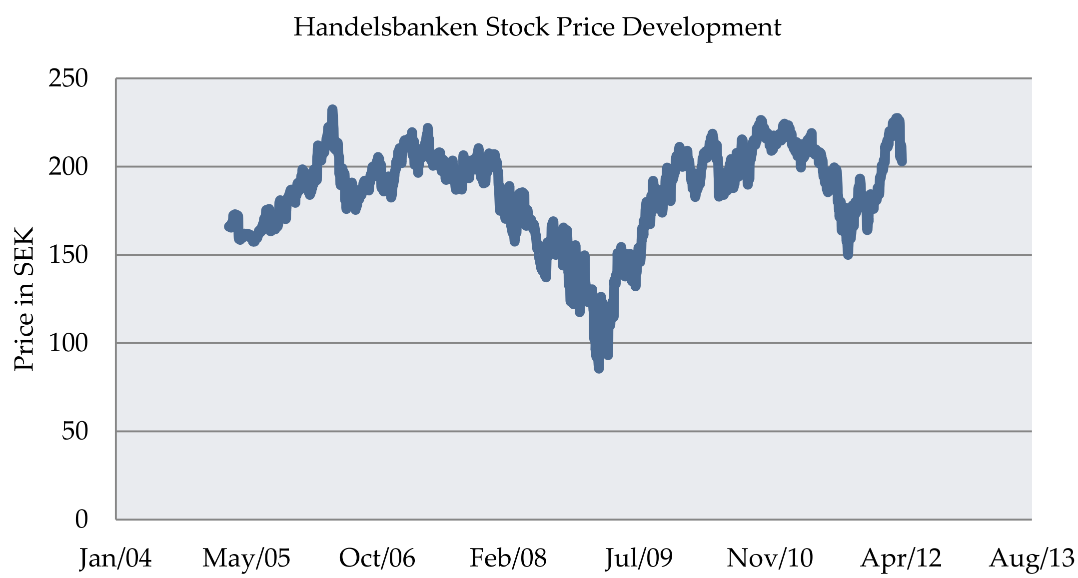

FIGURE 2.4

Handelsbanken is a Stockholm based bank formed in 1871 whose stock currently is the oldest one traded on the Stockholm OMX. The bank mainly operates in its five home markets Sweden, Norway, Denmark, Finland and the UK. Apart from the five main markets they have business activities in 22 countries worldwide with approximately 11,000 employees. Handelsbanken has a relatively decentralized organizational structure that put much of the decision making and the customer responsibility on the individual bank offices. The two largest shareholders are the investment trust company Industrivärden and the employee-owned foundation Oktogonen.

In 2004 the bank took advantage of the low market interest rates and the rising house prices in Sweden which resulted in a 13% increase in their total mortgage loan portfolio. The following year was a good year for Handelsbanken with big profits. A trend that they spotted was that the government finances developed better in the Nordic countries than in the rest of the Euro zone and the Swedish stock market rose by 33%. In 2006 they opened one single branch in Estonia which they saw as a relatively risky emerging market with possible future business opportunities. The second half of 2007 was characterized by market turmoil due to the events in the US. Despite the market disturbances Handelsbanken made a profit that was 13% larger than the year before, largely due to the sale of the pension company SPP. The turbulence of international capital markets continued in 2008 which lead to larger credit losses for the bank that year. But the profits were still on a relatively high level due to a large inflow of customers from other banks due to the crisis which raised the profits by 4%. Even though financial markets were characterized by uncertainty about the future, Moody's and Standard & Poor's regarded Handelsbanken as solid. At the end of the year the Swedish stock market closed at 42% down and the Handelsbanken stock lost 39% of its value. Handelsbanken did not receive any economic support from the Swedish government during the crisis and in 2009 Handelsbanken had a positive net lending to the Swedish state. In 2010 and 2011 the European debt crisis played a big role on the international capital markets but Handelsbanken had no direct exposure to any states or banks with large debt issues. Handelsbanken continued their international expansion and today they have more than 700 branches in more than 20 countries.

2.4 Macroeconomic Factors and Proxies

In this thesis the goal is to test the effects of seven independent variables on the stock returns of four Swedish commercial banks. One factor that will be put in the center of the analysis is the default risk measured by a Credit Default Swap index. This financial derivative is used by investors to hedge against the default risk exposure that arises in financial markets. This risk could arise due to both changes in firm specific and macroeconomic factors. Intuitively, there are of course other factors that affect stock returns apart from the default risk. When the only explanatory variable used in the model is default risk the importance of default risk will possibly be overestimated. To reduce this bias other explanatory variables are included in the model to capture some of the explanatory effect. This gives more precise estimates and it is then possible to receive more interesting results when analyzing differences and similarities between the four banks. Since the Credit Default Swap is reported daily the other factors used in the model are based on daily data as well. A problem with this is that it is not possible to receive daily data for variables such as GDP which normally is reported on a monthly basis. Therefore various proxies have been used for factors which are not reported daily. Factors and proxies are presented in the following section.

2.4.1 A MEASURE OF AGGREGATED FINANCIAL DISTRESS IN THE EUROPEAN ECONOMY

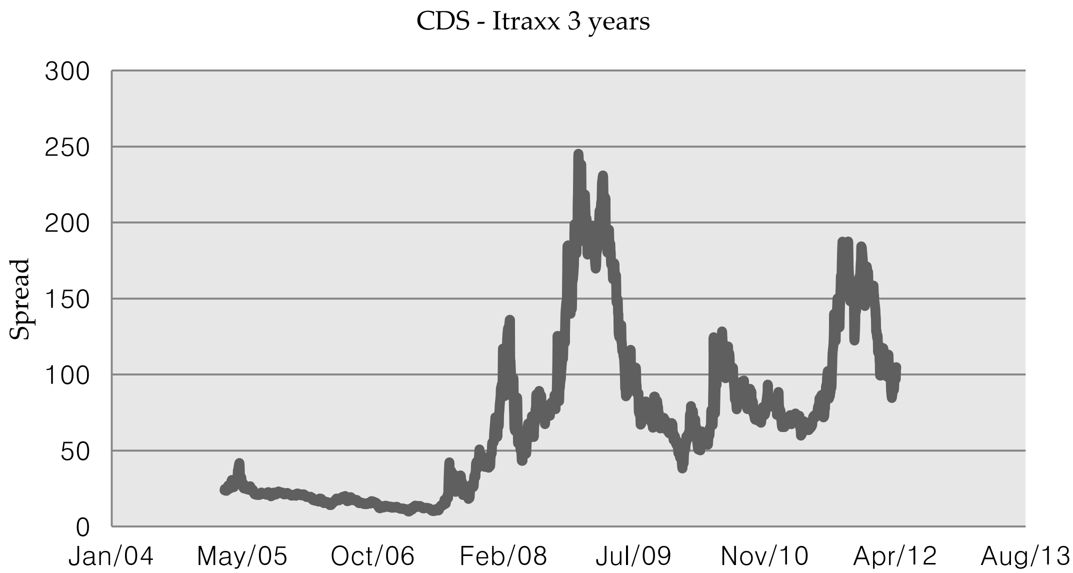

FIGURE 2.5

One way companies and governments can raise capital is by issuing bonds. The buyer of a bond is exposed to two main risks, interest rate risk and default risk. A bond issue can be viewed as a money loan by a company and if the company defaults no, or at least not all money will be repaid to the owner of the bond. The buyer of the bond, the creditor, can buy insurance to hedge himself against default risk. One such credit derivative is called a Credit Default Swap (CDS). Such swaps are usually traded OTC (Over the Counter) and issued by banks or financial institutions. The buyer of insurance obtains the right to sell bonds issued by the company for their face value when a credit event occurs, and the seller of insurance is obligated to buy the bonds for their face value. Standard terms for a contract are usually between one and ten years. Imagine that the same investor that bought the bond also buys a Credit Default Swap to hedge against default risk. First of all the investor will receive coupon payments from the bond issuer, but he will also have to pay a premium to the seller of default protection. The cost of protection is referred to as the CDS spread. The spread can be thought of as an insurance premium paid for any other type of insurance. John C. Hull (2011) addresses some of the problems with credit default swaps that many regulators became very concerned about during the credit turmoil that started in August 2007. The danger with credit default swaps is that, as with other types of derivatives, that it is a zero sum game. One person's gain is another person's loss. In the case of a credit event such as a bankruptcy the seller of protection has to compensate the buyer of protection for the loss. According to Hull, trading in many credit derivatives ceased during the turmoil in 2007 and 2008. Although, trading continued in credit default swaps due to the way they are constructed. Compared to many other credit derivatives, credit default swaps are very straightforward in the way they insure the buyer of the contract from default risk. When Lehman Brothers declared their bankruptcy in September 2008 there was a huge number of outstanding CDS -contracts with reference to the big entity. There were predictions that some sellers of protection would not be able to reimburse their obligations and that further bankruptcies would occur.

Even though everything went smoothly on the day of settlement the systematic risk caused by credit default swaps raised concerns with regulators all around the world.

Market participants have developed indices that track different credit default swap spreads. One such index is iTraxx Europe. It is one of the most traded CDS indices and comprises 125 equally weighted entities. Entities included in iTraxx Europe are comprised from European companies ranked by Moody's, Fitch or S&P. Companies with a grade corresponding to a BBB grade with negative outlook is excluded from the index. The highest ranked entities from the auto, industrial, consumer, energy, TMT and financial sectors are included. ITraxx Europe is traded on its spread and therefore mimics its underlying instruments (Markit Group Limited).

Jacobs, Karagozoglu and Peluso (2010) discuss in their article the relationship between CDS-spreads and credit ratings. They state in their article that CDS-spreads represent the pure compensation for taking on credit risk of the underlying entity. Their findings suggest that credit ratings made by credit agencies not always correspond with relative riskiness of a reference entity. They suggest that the market prices risk with CDS-spreads sooner than rating agencies do with their ratings. Hull (2011) suggests that so called real world default probabilities estimated using actual default data do not give an appropriate value of default risk. Implied default probability from CDS-spreads provides a risk neutral default probability which is usually higher than the real-world default probabilities. Risk neutral default probabilities are used to value credit default swaps because it incorporates systematic risk. Hull means that a financial institution that sells credit protection must evaluate this risk as well, because it is exposing itself not only to real world default probabilities but also non-diversifiable risks. Hull states that when the economy does badly more companies default and spreads on CDS tend to increase. For the purpose of this thesis the CDS-spread will act as a measure of credit risk and financial distress. The objective is to analyze how equity returns for the four big Swedish banks reacts to daily changes in CDS-spreads before and after the Lehman Brothers crash in September 2008.

2.4.2 A PROXY FOR INDUSTRIAL PRODUCTION

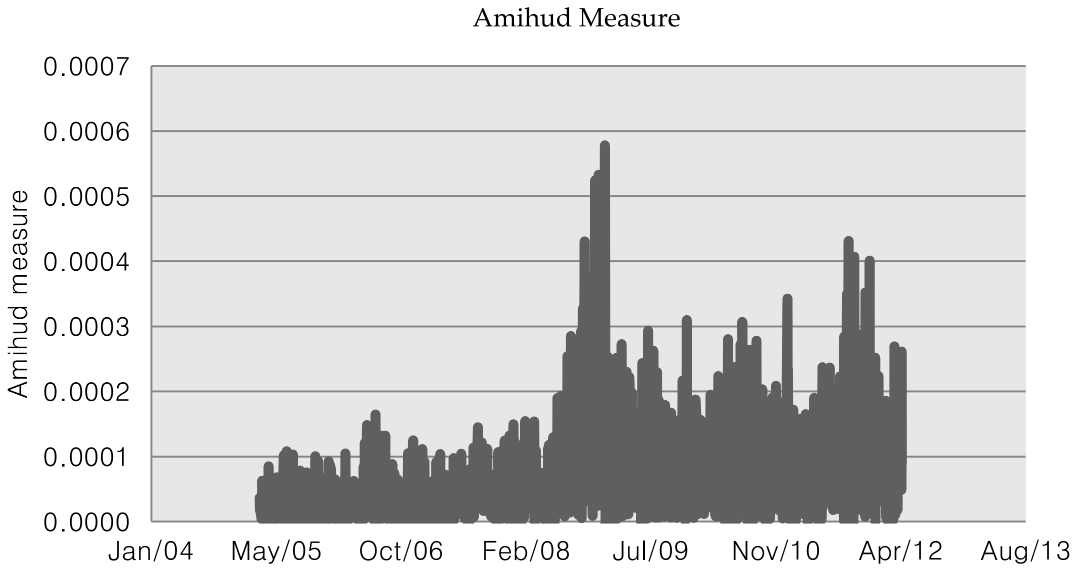

FIGURE 2.6

Growth in industrial production is often measured in GDP growth which is periodically reported for different countries. One macroeconomic factor that Chen, Roll & Ross found to have a statistically significant impact on American stock returns was a monthly reported index of industrial production in the US (1986). They also used monthly changes in stock price. In this thesis the focus lies on investigating possible relationships between stock returns and macroeconomic factors on a daily basis. It is therefore problematic to use monthly reported GDP data as a measure for the development of the real economy. Naes, Skjeltorp & Odegaard find that stock market liquidity can be used as a good proxy for growth in industrial production by analyzing data in Norway and the US over the years 1947-2008 (2010). Their data set consists of data for more than 60 years which covers both upturns in the economy and ten recessions. The relationship they find between stock market liquidity and the business cycle is strongly significant and reveals information about the performance of the real economy. The measure for stock market illiquidity that is used in their study is the Amihud measure (Amihud, 2002). It has the following properties

$$ILLIQ_{iy} = 1/D_{iy} \sum_{t=1}^{Diy} |R_{iyd}|/VOLD_{ivyd} \quad \textbf{(2.2)}$$

where D_{iy} represents the number of days for which the data set spans, $|R_{iyd}|$ represents the return of stock i in absolute terms and $VOLD_{ivyd}$ is the total trading volume of the market of investigation measured in units of currency. The resulting $ILLIQ_{iy}$ gives a measure of the daily price impact of the flow of orders which measures illiquidity. The measure provides a daily measure for market illiquidity and consequently a proxy variable for the business cycle and the growth in industrial production.

2.4.3 Oil Price

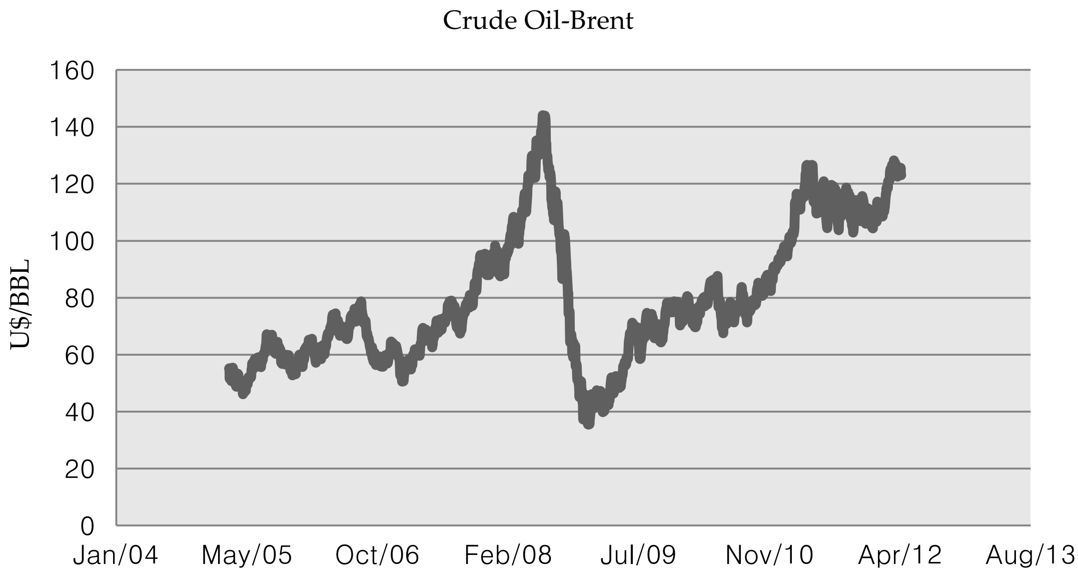

FIGURE 2.7

The price of oil is one of the macroeconomic factors that Chen, Roll & Ross test for in their analysis of economic forces that affect stock prices (1986). They hold oil price as one of the systematic factors that is argued to have an impact and influence on stock returns and therefore they include it in their model. Oil is both used as an input in the production process and in the supply chain and a change in the price of oil thereby has a direct effect on production and transportation costs. This in turn has an impact on prices paid by customers which adds to the inflation. Thus, higher oil prices might lead to higher inflation. Obviously other inputs and production factors have an effect on the rate of inflation but since oil is used to such an extent it is one of the more influential factors in the economy. However, Blanchard and Gali (2007) find that the impact of oil price shocks on inflation drastically has changed character since the 70's oil crisis. They find that after 1984 oil prices have had a significantly smaller effect on the rate of inflation and the growth in GDP has remained relatively more stable than before 1984. In their article, three possible explanations to this matter are presented. Firstly, they spot an international trend leading toward more flexible labor markets which allows companies to vary their inputs to a larger extent compared to a more inflexible labor market. Secondly, central banks worldwide have changed their policies and now focus more on keeping the inflation rate at a more stable level. For instance, the Swedish Central Bank got its 2 percentage inflation goal in 1993. Thirdly, they spot that the share of oil used in the production and in the overall economy has declined since the 1970's. In a report from the Swedish Energy Agency (2011) it is clear that so is the case also for Sweden since the overall use of oil has decreased by approximately 60% since then. But still the usage of oil sums up to roughly 30% of the total energy consumption in Sweden which gives it a significant importance for the domestic economy.

2.4.4 A Proxy For Market Performance

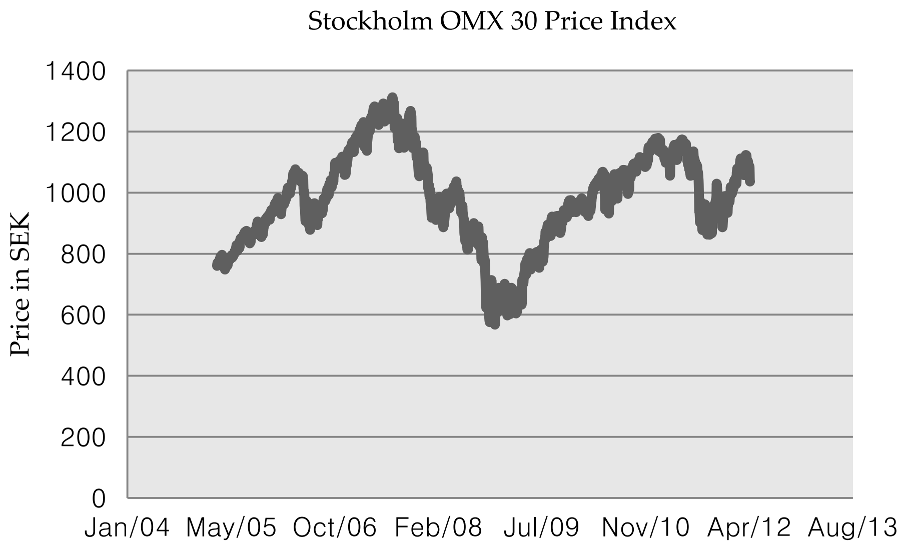

FIGURE 2.8

When an investor undertakes an investment she can use differentiation of her portfolio to reduce firm-specific risk and thereby reduce the overall portfolio risk. Firm-specific risk, also often referred to as unsystematic risk, can be completely diversified away by adding extra assets, diversifying internationally or investing in different asset classes. Even though the investor has reduced her unsystematic risk through diversification her portfolio is still exposed to market or systematic risk such as interest risk, political risk, instability in the financial system etc. According to the capital asset pricing model an investor should be rewarded by taking on extra market risk (Sharpe, 1964). The market risk premium an investor achieves when taking on additional systematic risk is the overall return of the market minus the risk-free rate times the market beta of the stock relevant for the investment. On the other hand, investors do not get awarded for taking on unsystematic risk since that risk can be diversified away. Usually a market index is used as a proxy for the market performance. Chen, Roll & Ross (1986) use two indices of the New York Stock Exchange to represent the market performance in their empirical research of forces that affect stock returns. One of the most commonly used indices is the S&P 500 that represents the American stock market and the index contains 500 companies that should be representative for the overall market. Since this study focuses on four Swedish stocks the Stockholm OMX 30 index is used as a proxy for the market performance in Sweden.

2.4.5 A Proxy For the Risk-Free Rate

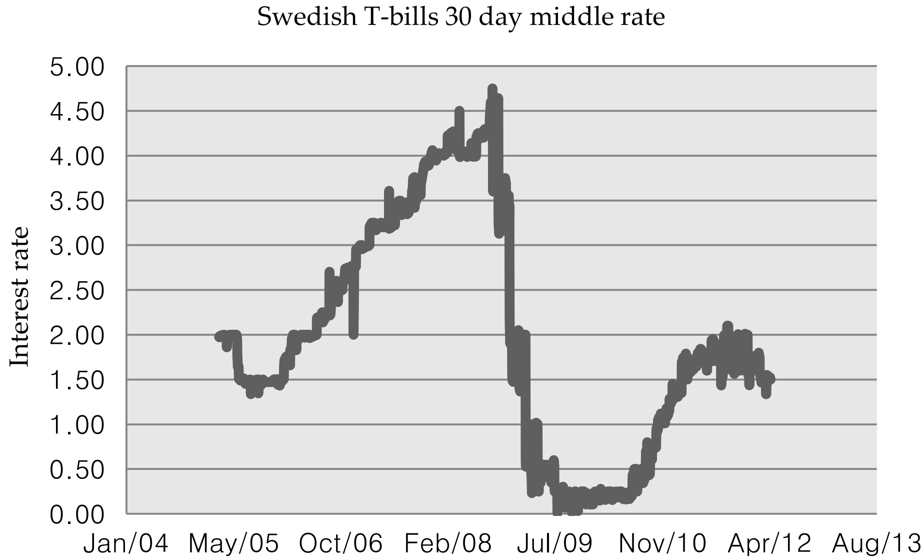

FIGURE 2.9

The risk-free interest rate is defined as the interest rate that can be achieved without exposing the invested funds to any risk. According to basic microeconomic theory, the opportunity cost for an investment is the best alternative use of funds (Perloff, 2011). That means that when an investment decision is being made one has to compare the expected returns of the investment to the second best investment. An opportunity cost can be seen as a foregone opportunity if the funds are used to finance another investment and a foregone opportunity has to be viewed as an economic cost even though it might not be considered as a cost in the books. When an investor evaluates the expected returns of an investment or a business project she has to be able to compare its expected returns to a benchmark of some sort. If the expected return of a business project is lower than the return of a risk-free investment it would be irrational to undertake that investment based on microeconomic utility theory (Perloff, 2011). But if the expected return of an investment is higher than the risk-free rate it would be worth considering the investment, even when taking risk into account. The risk-free rate can be viewed as an opportunity cost since when the economy does poorly the financial risk of investing in risky assets increases and risk averse investors tend to put their money in the risk free asset. If the economy does well investors tend to put their money into risky assets. Chen, Roll & Ross (1986) use US Treasury Bills with a maturity of one month as a proxy for the risk-free rate in their model and they find a statistically significant impact on the returns of the stocks that they analyze. Since the Big Four have most of their operations in Sweden and the stocks used in the analysis are traded at the Stockholm OMX, Swedish Treasury Bills with a maturity of one month are used to represent the risk-free rate throughout this thesis.

2.4.6 Term Structure Of Interest Rates

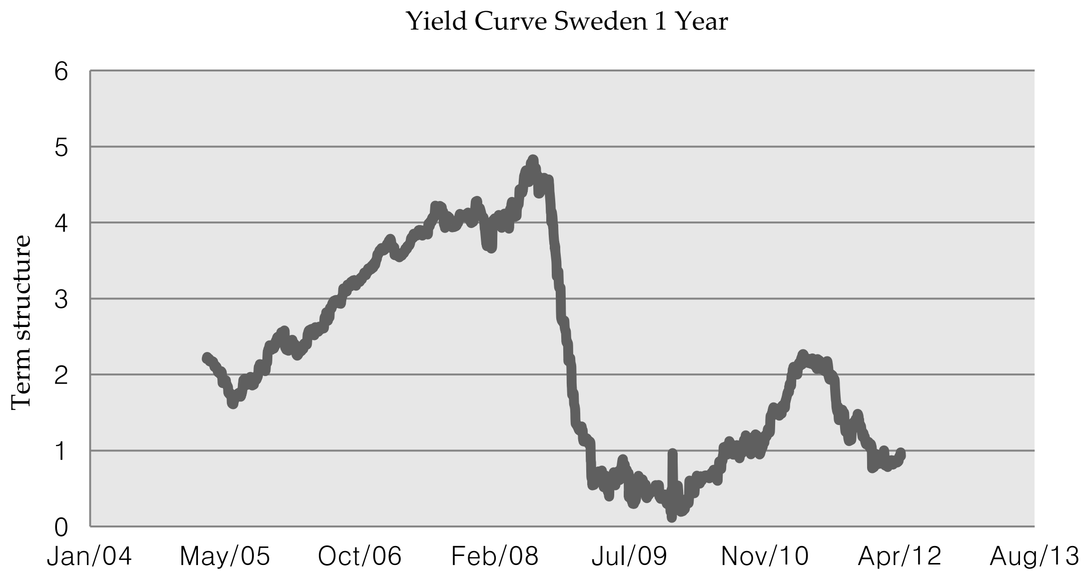

FIGURE 2.10

The term structure of interest rates reveals the relationship between short and long term interest rates. To be more precise the term structure of interest is the relationship between interest rates and their maturities. This connection is usually summarized by practitioners using a yield curve. When long term rates are higher than short term rates, the term structure is upward sloping and when short-term rates are higher than long-term rates it is downward sloping. The yield curve is a main tool in fixed income trading because it reflects believes about future short-term rates. Investors can then use it as a benchmark for their own expectations of future interest rates. The shape of the term structure is composed by three basic components. The first one is the real rate of interest investors require for forgoing the use of their money. The second component is prospects of future inflation. An investor thinking of lending money for a longer period of time will have to consider the risk that inflation will reduce the value of the money and therefore demand compensation for this. Accordingly, expectations that inflation will be high in the future will put pressure on long-term interest rates which will tend to be higher than short-term interest rates. The third component comes from interest rate risk faced by bond holders. Investors will recognize the risk and demand compensation due to higher interest rate risk for long term bonds than for short term bonds.

Bodie et al. (2011) discuss the way yield curves are interpreted by many market professionals as warning signals of impending rate increases. They state that this could be used as a good predictor of the business cycle as a whole. The idea has its foundation in the fact that long-term rates tend to rise in anticipation of an expansion in the economy. The investor can then interpret a steep upward sloping yield curve as a signal telling that the probability of a recession in the next year is low, at least in contrast to the scenario when investors observe a steep downward sloping yield curve. A scenario indicating a downward sloping yield curve might be associated with an impending recession.

2.4.7 EXCHANGE RATE

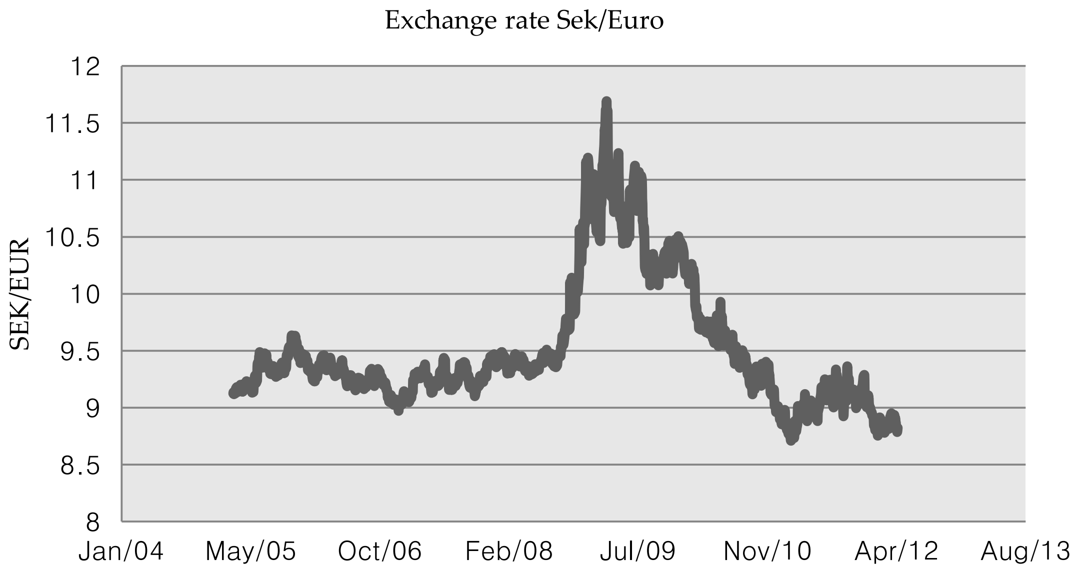

FIGURE 2.11

Daily changes in the exchange rate between the Swedish Krona and Euro are included as an explanatory variable in the empirical analysis of this thesis. The exchange rate is an important factor as it affects the competitiveness of the industry within the respective countries. An appreciation of the Swedish Krona relative to the Euro will cause problems for Swedish producers that must compete with producers in the Euro zone. Since their products become relatively more expensive the consequence is a loss of sales for Swedish exporters. Such a downgrade in sales will cause concern not only for those particular exporters but even for their subcontractors. Bodie et al. (2011) talk about the complications for the Japanese economy associated with the financial crisis of 2008. The Japanese yen was by many investors viewed as a safe haven during this tumbling period. The sharp appreciation of the Japanese Yen caused the Nikkei stock market index to fall by 50% even before the financial crisis had been fully reflected in global stock prices. The importance of the strength of the Swedish krona for the domestic economy as a whole makes it an obvious factor to include in the analysis of stock returns for the four Swedish banks.

3. METHODOLOGY

This section covers the working process in which the analysis of this thesis has been established. The analysis is based on econometric theory which is a very wide topic and therefore the focus of this section is on the econometric methodology used especially for this analysis.

3.1 DATA

Data used in this thesis is daily time series data running from 21st of March 2005 to 5th of April 2012. The analysis is divided into three sections. One section covers the whole period and consists of 1775 daily observations. The two remaining data sections were created by dividing the whole period into two parts. One section includes daily data before the Lehman Brothers crash and one section includes daily data after the Lehman Brothers crash. The sample collected before the crash includes 877 observations and the sample collected after the crash includes 898 observations. The two samples consist of an almost equivalent amount of observations. This makes it relevant to compare the results from the first period to the second period. The data is sorted to only consist of days when our dependent variables are traded on the Swedish stock market.

Data for this thesis has been collected using the database Datastream available at the Gothenburg University library. Datastream is a database provided by the Thomson Reuters Group. Datastream provides current and historical time series data on stocks, stocks indices, commodities, bonds, futures, options, interest rates, derivatives and other economic data.

A potential criticism to our data is that it has not been adjusted for stock splits or inverse stock splits that may have occurred during the period of interest, neither has it been adjusted for dividend pay-outs that affects stock returns on that particular date.

The dependent variables in our analysis are stock returns calculated using formula 3:1, which is a standard method for calculating returns between adjacent periods

$$r_i = \frac{(P_t - P_{t-1})}{P_{t-1}} \qquad \textbf{(3:1)}$$

where r_i is the return of asset *i*, P_t the price of the asset at time *t* and P_{t-1} the price of the asset at time *t-1*. There are other methods to calculate a change in a variable between two periods. For example it is possible to do the calculations by taking the natural logarithm of the value for the second period minus the natural logarithm of the value for the first period to get an approximate value of the change between the two periods. But since the way the returns are calculated by using formula 3:1 is more precise for larger changes, that method has been used throughout this analysis.

The CDS that has been used is the iTraxx Europe index with a maturity of 3 years. As a market proxy the Stockholm OMX 30 Index has been used. Daily changes in the SEK/Euro exchange rates have been used as a foreign exchange rate. Swedish T-bills with a maturity of 1 month are used as a proxy for the risk free rate and the Brent crude oil price in dollars per barrel is used as oil price. The term structure of interest rates is represented by a Swedish yield curve with a constant maturity of 1 year. Changes in the independent variables CDS-spreads, OMX 30 Index, SEK/Euro exchange rates, interest rates of Swedish T-bills and term structure of interest rates have all been calculated in the same manner as the bank stock returns. The changes in oil price have been calculated differently since the model aims to capture the effect that unanticipated changes in the price of oil has on the returns of the bank stocks. This is done by using an autoregressive model of order one

$$Oil\ price_t = \beta_0 + \beta_1 Oil\ price_{t-1} + u_t \quad \textbf{(3:2)}$$

where $Oil\ price_t$ is the oil price at time t, β_0 a constant, β_1a sensitivity measure, $Oil\ price_{t-1}$ the oil price at time *t-1* and u_t a random error term that represents the unanticipated change in the price of oil. Since the aim of the model is to capture the causal effect of unanticipated changes in oil price, the error term u_t is the factor that gets to represent the oil price in the model used in this thesis.

The Amihud measure has been calculated by using the formula presented in section 2.4.2. But since the focus lies on macroeconomic factors and not firm specific factors, illiquidity for the Swedish stock market is used instead of illiquidity for particular stocks. This market illiquidity has been calculated by using the absolute returns of the OMX 30 index and the total OMX 30 turnover. These values have then been used to calculate the Amihud measure on a daily basis. Since it is standard to multiply the received value for Amuhud's measure by one million it has also been done.

All statistical analyses are carried out using STATA. STATA is a statistical software developed by StataCorp and are used for statistical analysis, graphics and custom programming.

3.2 Econometrical Analysis

3.2.1 Empirical analysis

Wooldridge (2009) describes econometrics as a method based upon the development of statistical methods for estimating economic relationships, testing economic theories and evaluating and implementing policies in businesses and governments. Econometrics can for example be used to study the effect of governmental policies on GDP or inflation. Researchers can then catch a causal relationship between an independent variable used to describe changes in a dependent variable. The application of the econometrical science in this thesis is to investigate how some macroeconomic variables affect stock returns for four Swedish banks. It is natural that econometricians have borrowed techniques from mathematical statisticians and applied it on economic theory. One of these techniques is the method of multiple and simple regression used as the mainstay in both of these sciences.

3.2.2 Regression Analysis

The econometrical analysis of this thesis has its foundation in the theory of simple and multiple regressions. A simple regression describes the effect of one x variable, also known as an independent variable, on the dependent variable y. The dependent variable is throughout this paper represented by daily stock returns of one of the four Swedish banks, analyzed in this paper. A simple regression equation is

$$y = \beta_0 + \beta_1 x_1 + u \qquad \textbf{(3:3)}$$

In the equation β_0 is a constant and β_1 is a slope parameter between y and x. The main interest of the analysis is to capture the effect a change in the x variable has on the dependent variable y holding the factors in u fixed. The variable u in the equation represents an error term and includes all factors that affect y except x_1. One application of a simple regression model in this thesis could for example be to test how changes in CDS-spreads affect stock returns. CDS-spreads are then used as the only explanatory variable represented by the x_1-variable in equation (3:3). Of course changes in CDS-spreads are not the only factor that affects changes in stock returns for the bank stocks. To make the analysis more accurate it is straightforward to include more explanatory variables. The equation is then developed into a multiple regression. The equation is defined as

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + u \qquad \textbf{(3:4)}$$

The interpretation of the beta values are the same as it is for the simple regression model with the only difference that when the effect of a change in one variable is estimated ceteris paribus is assumed, that means, holding all other variables constant. The multiple regression model is used in this thesis to capture and analyze effects of more macroeconomic factors that may affect stock returns for the "Big four". Factors previously included in the error term are instead included as explanatory variables in the original model. It would be impossible to include every variable affecting stock returns in one single model and some factors are therefore still included in the error term u. Because the objective of this analysis is to focus on macroeconomic factors it is not unrealistic to assume that corporate specific factors are included in the error term. Examples of such factors are a range of financial ratios, insider trading, and corporate structure etcetera. Other reasons why results may differ between banks are differences in such corporate structures and the individual risk factors that banks are exposed to.

This subsection has established the main ingredients for the econometrical analysis used in this thesis. The next subsections explain how these estimates are calculated. Several tests for violation of assumptions crucial for the use of such estimation methods are described and discussed together with methods to adjust for such problems.

3.2.3 Estimating the Model

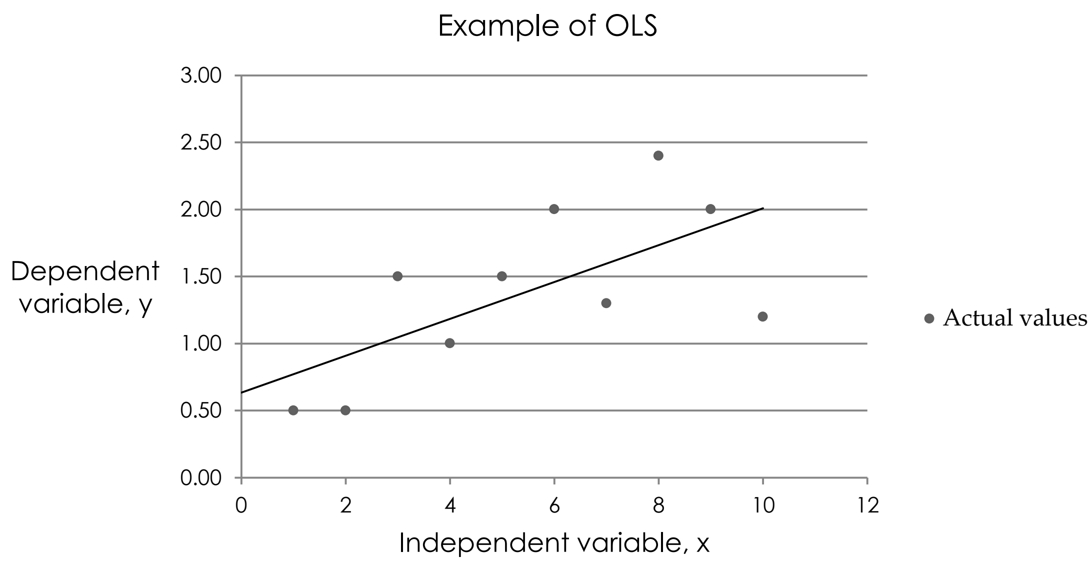

FIGURE 3.1

In the previous subsection the basics of multiple regression and simple regression were discussed. One way of doing this is to use a method referred to as OLS (Ordinary Least Squares). The ordinary least square estimate is obtained by minimizing the sum of squared residuals. The mathematical derivation of the estimates is not relevant for the understanding of this thesis. For this purpose, it is more important to understand the basic interpretation of the OLS-estimation process. This is why a more general explanation of OLS is described in this subsection.

As mentioned above OLS minimize the sum of squared residuals. A residual can be thought of as the difference between the actual value in table (3:1) and the estimated line. OLS estimates a straight line as table (3:1) indicates. The estimation process estimates values on the Y-variable based on values of the X-variables so that the sum of squared differences (sum of squared residuals) between the predicted line and the actual values is as small as possible. Actual values are represented by the actual stock returns for each bank that is subject to analysis. The predicted line is stock returns estimated using the seven economic factors in focus for this thesis. The residuals can be thought of as the error term described in subsection 3.2.2. If actual values are above the regression line OLS underestimates the actual value of stock returns and if actual values are below the regression line OLS overestimates stock returns. It is crucial to understand that although all variables under analysis are measured over time, time is not the dependent variable in this case. The X-variable represents economic macro factors and the regression line is calculated based on changes in those factors rather than changes over time. This does not exclude the fact that time may affect returns, but this analysis does not measure the causal effect of time on stock returns.

3.2.4 How To Interpret the Results

Much of the interpretation in econometrics is based on hypothesis testing. One such test is the t-statistic test about the significance of a single parameter in the model. The hypothesis test is built upon the H_0-hypothesis that the coefficient of $\beta_j = 0$. The alternative hypothesis, generally referred to as H_1, is that the coefficient of β_j is not equal to zero. That means that the analysed factor does affect the dependent variable. The choice of whether to accept or reject the null hypothesis includes a rejection rule based on a chosen significance level. The significance level used in this type of tests is represented as the probability of a "Type 1 Error". The type 1 error is to reject the null hypothesis when it is in fact true. One can then interpret the significance level as the probability of rejecting the null hypothesis when it is in fact true. In finance it is conventional to use a significance level of 5%. When deciding whether to reject the null hypothesis or not one has to compare the significance level to some appropriate value. One such value is called the P-value and will be reported along with all regression printouts throughout this thesis. It is therefore fundamental to understand the meaning of the P-value to fully understand these printouts. P-values are obtained by first calculating a value called t-value. The P-value is a probability value based on the calculated t-value. A more detailed explanation is not necessary for the general understanding of this thesis. For a more detailed explanation on how to calculate these values please see Wooldridge (2009). For interpretation purposes it is crucial that the standard errors are correctly calculated. Standard errors are obtained from the variance of the regression. Incorrectly calculated standard errors cause problems for the interpretation of a single parameter. Such problems may for example be heteroskedasticity. The P-value is the smallest significance level at which the null hypothesis can be rejected. Equivalently it is the largest significance level at which the null hypothesis cannot be rejected. To further clarify, if a variable receive a P-value equal to 0.10 (10%), one can reject the null hypothesis at 10% significance level, but not at 5%. The analyzed variable can then not be declared significant on 5%. Further, a P-value equal to 0.001 (0.1%) can reject the null hypothesis at 5% significance level. The variable would then be declared significant at 5% significance level.

3.2.5 Modeling problems

Omitted variable bias

If first estimating the simple regression model using only CDS-spreads as the explanatory variable, one obvious problem is that other relevant factors that may also affect stock returns are not controlled for. The resulting problem that will occur is that the coefficient on CDS-spreads will suffer from omitted variable bias. If it will be upward or downward bias depends partly on the correlation between the omitted variable and the CDS-spreads and the effect the omitted variable has on the explanatory variable. For example, omitting the OMX 30-index might cause the coefficient on CDS-spreads to be downward biased. This comes from the fact that when CDS-spreads go up, returns on the OMX 30-index tend to go down. CDS-spreads and OMX 30-index returns are so to speak negatively correlated. Then, if positive returns on the OMX 30-index have a positive effect on stock returns this causes CDS-spreads to be negatively biased when omitting returns on the OMX 30-index from the regression. Not only does the sign of the bias cause concerns in econometric work, but also the size of the bias. Small values of the bias do not generally cause very much problems. Large values of the bias cause much more concern and then the model is underspecified. A model with CDS-spreads as the only explanatory variable is clearly underspecified. Including six more variables in the model makes the results less likely to be biased due to omitted variables. The choice of explanatory variables in this model is a result of economic reasoning based on academic reports and financial theory. The main focus is to analyze what causes stock returns to move on a daily basis and it is therefore necessary to restrict the model in some way. A crucial assumption when estimating models using OLS is that the error term has an expected value equal to zero given any values on the explanatory variables. It is equivalent to saying that all explanatory variables are uncorrelated with the error term. This assumption is also of great importance when testing for autocorrelation. Details regarding this will be covered in a separate subsection.

MULTICOLLINEARITY

Another problem that may occur when estimating multiple regressions is multicollinearity between the explanatory variables in the model. One obvious example of multicollinearity is when using both dollar and dollar in thousands as explanatory variables. The correlation between these two variables will without any exception equal one. Some degree of correlation between the explanatory variables causes no problems and can without serious consequences be ignored. Thus, what would cause problem is the case of perfect correlation between any of the explanatory variables. The case of no perfect correlation is necessary when estimating beta values using OLS.

It is quite straightforward to test for multicollinearity between the explanatory variables. In the appendix there are three correlation matrices that indicate the correlation between the explanatory models subject for this thesis. No perfect correlation or any correlation close to perfect is found, though some correlation is found. To adjust for multicollinearity one can exclude one variable in the regression and eliminate the problem. This may on the other hand cause the model to suffer from omitted variable bias discussed in the previous subsection. Another way of managing such problem is to obtain more observations in the regression or simply ignore the problem. For this thesis the most appropriate method is to ignore the problem since no high correlation between any of the explanatory variables was found (Appendix).

HETEROSKEDASTICITY

In subsection 3.2.4 the importance of correctly calculated standard errors was elucidated. One fundamental assumption on which the calculation of t-values is based on is the homoscedasticity assumption. In econometrics homoscedasticity means that the errors in a regression model have constant variance conditional on the explanatory variables. A violation of this assumption causes the model to suffer from heteroskedasticity. Since OLS standard errors are based directly on the variances of the model, an implication of heteroskedasticity is that these standard errors are no longer valid when estimating t-values and P-values of the model. Unfortunately this problem cannot be solved using large sample sizes. Fortunately other adjustments for heteroskedasticity exist and one such method is discussed in this thesis.

To decide whether to adjust for heteroskedasticity or not one must decide if the heteroskedasticity is a problem for the particular model. It is sometimes suggested that tests for misspecifications of the model, and adjustments for such misspecifications should be done before testing for heteroskedasticity. Examples of such misspecifications might be to include a variable in *level-form* instead of *log-form* or omitting the square of any variable that might be significant. For the purpose of this thesis such tests have not been considered appropriate. The main objective of this thesis is to analyze differences between four dependent variables. Re-specifying a particular model based on each dependent variable would make the comparison between the four banks difficult to interpret and the purpose of this paper would not be fulfilled.

It is then straightforward to test for heteroskedasticity. There are several different tests that can be performed to conclude that heteroskedasticity is present in the sample. One well-known test for heteroskedasticity is the Breush-Pagan/Cook-Weisberg test that can be performed automatically when using a statistical software package such as STATA that is used in this analysis (Manual, STATA 12). When performing this test the null hypothesis of equal error variances is being tested against the hypothesis that there is heteroskedasticity in the sample. This is done by first running a regression on the model for which heteroskedasticity shall be tested for. In the second step the predicted values and the square of the residuals have to be calculated and the residuals are rescaled by giving them means of one. The change in scale is done mainly to enable the calculation of the test-statistic. After the rescaling the predicted values are regressed on the rescaled squared residuals and the chi-square test-statistic is calculated. The null is rejected for large chi-square values, which means that there is heteroskedasticity present in the sample. If the test fails to reject the null hypothesis heteroskedasticity is not a problem.

AUTOCORRELATION

The time-series data for stocks and other assets used throughout this study has been reported on a daily basis over the whole period of investigation. When a stock is being traded on a stock exchange its price fluctuates constantly and the price at the end of the trading day is the price at which the stock is being traded at in the beginning of the next. Intuitively, yesterday's stock price affects at which price level the stock is being traded for today and at which price level it will be traded for in the future. The question is only how large this effect is and if it could be a problem. In econometrics and statistics this phenomenon is called autocorrelation or serial correlation which means that there is correlation between the error terms between two adjacent periods in time. The first-order autocorrelation between two different time periods has the following formula

$$u_t = \rho u_{t-1} + \varepsilon_t \qquad \textbf{(3:5)}$$

where u_t is the error term at time t, ρ the slope coefficient, u_{t-1} the error term at time t-1 and ε_t a random error term for the first-order autocorrelation formula. Autocorrelation is a common feature when time-series data is being used in an econometrical analysis. One issue that might occur when autocorrelation is present is that OLS will not be the best estimation method and the true variance will be underestimated. This in turn leads to t-values that will overestimate the statistical significance when performing statistical tests and the danger with this is that it can lead to the rejection of the null hypothesis even though it is in fact true. Just as for heteroskedasticity, there are numerous ways to test for autocorrelation. The method that is used in this analysis is the Durbin-Watson Alternative Test for Autocorrelation performed automatically in STATA (Manual, STATA 12). In the Durbin-Watson alternative test the null hypothesis of no serial correlation is tested against the alternative hypothesis that first-order autocorrelation is present.

The null hypothesis is rejected for large values of the chi-square test-statistic which suggests that there is autocorrelation. For small values of the test-statistic the null is not rejected which states that serial correlation not is an issue.

3.2.6 Adjustments to Modeling Problems

The data sets for the whole period 2005-2012, the period before the Lehman Brothers crash and the period after the crash have all been tested for multicollinearity by constructing correlation matrices. These matrices are presented in the appendix table A.27-A.29. The conclusion is that even though some correlation between certain variables exists, no high degree of multicollinearity is present in any of the three periods and therefore multicollinearity is not an issue that has been corrected for.

The data sets for the three periods have all been tested for heteroskedasticity by using the Breush-Pagan/Cook-Weisberg test and for autocorrelation by using the Durbin-Watson Alternative Test for autocorrelation. These tests are described in more detail in previous sections. The results from these tests are presented in the appendix. To adjust for heteroskedasticity and autocorrelation lagged Newey-West estimators and Newey-West standard errors have been used. These adjustments are automatically calculated by STATA (Manual, STATA 12). In those cases where only heteroskedasticity and not autocorrelation has been present Newey-West estimators without lags have been used to adjust for it. When both autocorrelation and heteroskedasticity have been present Newey-West estimators with one lag have been used. Tables and results are presented in more detail in the appendix.

4. RESULTS & ANALYSIS

In this section empirical results are presented and analyzed. The analysis is based on what have been discussed in the theory section. Results presented are adjusted for heteroskedasticity and when indicated also adjusted for autocorrelation. Newey-West standard errors are used in all of the following regressions. For the joint-significance test a p-value is reported.

SWEDBANK

	Before Crash			After Crash			Whole Period		
	Value	*Std. error*	*p-value*	*Value*	*Std. error*	*p-value*	*Value*	*Std. error*	*p-value*
Variables									
CDS	-0.026	0.010	0.012	-0.033	0.024	0.158	-0.028	0.012	0.022
OMX 30 Index	1.113	0.043	0.000	1.397	0.079	0.000	1.283	0.051	0.000
SEK/Euro Exchange rate	-0.084	0.142	0.554	-0.177	0.197	0.369	-0.219	0.164	0.180
Swedish T-Bills	0.005	0.013	0.671	0.005	0.004	0.144	0.005	0.004	0.133
Yield Curve	0.032	0.037	0.384	0.005	0.005	0.299	0.007	0.005	0.260
Amihud Measure	16.54	15.43	0.284	-12.07	11.76	0.305	-2.57	8.940	0.774
Oil price	0.000	0.000	0.193	0.001	0.001	0.309	0.001	0.000	0.060
	Statistics			Statistics			Statistics		
Adjusted for autocorrelation	Yes			No			No		
Joint Significance (F-test)	0.000			0.000			0.000		

TABLE 4.1

As mentioned earlier in this thesis Swedbank was a bank that exposed themselves more than others to the Baltic States. Equivalent with this, Swedbank's stock returns reveal a high correlation with variations in CDS-spreads. Before the default of Lehman Brothers in 2008, variations in CDS-spreads had a significant negative effect on Swedbank's stock returns even at 2% significance level. The value of the coefficient is negative even after the crash and the coefficient magnitude remains at an equivalent level. It is also interesting that for the whole periods it turns out to have a very significant effect on stock returns. Thus, after the crash variations in CDS-spreads are less significant and can only be accepted at a 16% significance level. An increase in CDS-spreads is equivalent with higher beliefs of counterparty defaults within the European Union. An increase in beliefs of counterparty default then has a negative effect on stock returns for Swedbank. For the whole period variations in CDS-spreads are clearly significant even at 3%, which is particularly interesting because this period includes 1775 observations. Further, OMX 30 is significant for all periods which are quite what could be expected as Swedbank is included in this index. The coefficient on the SEK to Euro rate for all periods under investigation reveals an interesting relationship. An appreciation of the Euro relative to the SEK leads to an increase in the SEK/Euro rate. From the perspective of a Swedish export oriented company an appreciation of the Euro, which is equivalent with a depreciation of the SEK would be favorable for the company's sales due to the fact that their products would be relatively cheaper compared to their foreign competitors. On the other hand companies that depend on input factors bought on the international market could be harmed by a weaker Swedish currency. Factors mentioned above could in an efficient market be directly reflected in the stock price due to changed beliefs of future cash flows. For Swedbank, a weaker Swedish currency has a negative effect on stock returns but the effect only reveals some significance for the whole period. While the CDS gets less significant after the crash the Swedish T-Bill variable gets more significant. For the whole period daily variation in T-Bills indicates a P-value of 13.3%. The other interest rate variable, the yield curve, is not particularly significant for any period. However, it tends to be more significant after the crash. Amihud's measure as a proxy for industrial production is not significant for any of the investigated periods. Daily changes in oil price only indicate some significance when it is analyzed for the entire period.

SEB

	Before Crash			After Crash			Whole Period		
Variables	*Value*	*Std. error*	*p-value*	*Value*	*Std. error*	*p-value*	*Value*	*Std. error*	*p-value*
CDS	-0.023	0.009	0.007	0.010	0.022	0.656	-0.011	0.011	0.291
OMX 30 Index	1.231	0.041	0.000	1.610	0.079	0.000	1.470	0.052	0.000
SEK/Euro Exchange rate	-0.234	0.141	0.097	-0.198	0.204	0.333	-0.283	0.172	0.099
Swedish T-Bills	-0.006	0.013	0.633	-0.001	0.003	0.584	-0.001	0.003	0.636
Yield Curve	0.0396	0.036	0.276	-0.001	0.002	0.813	-0.003	0.003	0.896
Amihud Measure	34.21	12.528	0.006	-1.786	11.373	0.875	5.174	8.657	0.550
Oil price	-0.000	0.000	0.112	0.001	0.000	0.003	-0.000	0.000	0.847
	Statistics			Statistics			Statistics		
Adjusted for autocorrelation	No			Yes			Yes		
Joint Significance (F-test)	0.000			0.000			0.000		

TABLE 4.2

One obvious difference between Swedbank and SEB is the significance of Amihud's measure before the crash. It is clearly significant before the crash with a P-value equal to 0.006 but not significant at all the period after. Amihud's measure is an illiquidity measure which in this analysis measures illiquidity on the OMX 30-index. The positive sign on the coefficient on Amihud's measure tells that investors awarded the SEB stock with some kind of market illiquidity premium before the crash but not after. The stock increased drastically in value before the crash but decreased even more after the crash. According to this, a possible explanation is that investors had strong beliefs and confidence in the SEB-stock before the crash but as weaknesses in SEB's strategy were clearly revealed during the crisis investors may have lost their confidence for the stock and by that, the award for market illiquidity disappeared. Variation in OMX 30 index is significant for SEB as well which is not very surprising. Another variable that is significant at 10% before the crisis but not after is the SEK/Euro exchange rate. One possible explanation is that SEB after the crash re-allocated some of their international risk exposure and thereby lost some dependency on the exchange rate to Euro. Variations in Swedish T-Bills show no significant results for any of the three periods. Although, the yield curve is not significant for any period it shows some tendency to be even less significant after the crash than before. Oil price becomes more significant after the Lehman Brothers crash although it is not significant for the whole period and the economic significance is very low. When it comes to the proxy for default risk, spreads on Credit Default Swaps are extremely significant before the Lehman Brothers crash but not significant at all the period after. There can be various reasons to this, but a potential explanation is the way SEB exposed themselves to risk before and after the bankruptcy of Lehman Brothers. The comparison between SEB and Swedbank is obvious in this case as they both, before the crash, focused a lot on expanding their activities in the Baltic States.

NORDEA

	Before Crash			After Crash			Whole Period		
Variables	*Value*	*Std. error*	*p-value*	*Value*	*Std. error*	*p-value*	*Value*	*Std. error*	*p-value*
CDS	-0.003	0.007	0.643	-0.001	0.015	0.958	-0.001	0.008	0.891
OMX 30 Index	1.036	0.034	0.000	1.294	0.054	0.000	1.213	0.035	0.000
SEK/Euro Exchange rate	0.030	0.108	0.779	-0.191	0.110	0.083	-0.237	0.089	0.007
Swedish T-Bills	-0.005	0.011	0.634	-0.000	0.001	0.725	-0.000	0.001	0.712
Yield Curve	0.027	0.029	0.352	-0.003	0.001	0.021	-0.003	0.002	0.043
Amihud Measure	29.28	9.932	0.003	13.70	6.755	0.043	14.80	5.402	0.006
Oil price	-0.000	0.000	0.189	-0.000	0.000	0.925	-0.000	0.000	0.407
	Statistics			Statistics			Statistics		
Adjusted for autocorrelation	No			Yes			No		
Joint Significance (F-test)	0.000			0.000			0.000		

TABLE 4.3

As for both Swedbank and SEB the performance of the OMX 30 index has a highly significant effect on the stock returns of Nordea in all periods. This is no surprise since individual stock returns usually have some degree of correlation with the performance of the overall stock market, both internationally and on domestic stock markets. In the period before the crash the SEK to Euro exchange rate has no significant effect on the stock returns of Nordea. This drastically changes the period after as the table indicates a P-value equal to 0.083. Although it is not significant at the standard significance level used in financial economics of 5%, the change is notable. For the whole period it is also significant at 1% significance level with a negative sign on the coefficient. A depreciation of the Swedish currency therefore has a negative effect on Nordea's stock returns. This might be because of higher borrowing costs when borrowing in Euro. Investors can then interpret this as a negative factor on future revenues with a resulting decline in stock price. Compared to Swedbank and SEB it is clear that Nordea is very different when it comes to the statistical significance of Credit Default Swap-spreads. Variations in CDS-spreads show no significant result explaining returns on the Nordea stock. However, it follows the same pattern as it gets even less significant after the Lehman crash. Interesting is the highly significant effect an increase in yield curve has on Nordea's stock returns after the crash. With a P-value corresponding to 0.021 and a negative sign on the coefficient this reveals a negative relationship between stock returns and yield curve. As a main tool in fixed income trading the yield curve reveals market beliefs about future short term interest rates. In times of economic growth the yield curve tends to be upward sloping as long term rates are higher than short term rates. The yield curve can be used to predict the probability of a future recession. In such scenario a downward sloping yield curve is a sign of increased probability of a future recession. Then short term rates are higher than long term rates. As the table above indicates, a positive change in yield curve makes the yield curve more upward sloping and causes the Nordea stock price to decline. This is contradictory to the theory just described as the yield curve functioning as a predictor of economic recession. The period from just before the Lehman Brothers crash to the end of the investigated period has to most part been characterized by problems on financial markets. In times when the economic environment is uncertain investors abandon more risky assets such as stocks and search for non-risk, or at least less risky assets such as treasury bills. This is referred to as a flight-to-quality. Swedish treasury bills are one asset that is considered as quality by investors. High demand on Swedish T-Bills put downward pressure on short term interest rates leading to an upward sloping yield curve. If investors choose T-Bills before stocks the increased demand for T-Bills will be reflected in a decreased demand for stocks resulting in a price decline. If assuming that long-term rates stayed at equivalent levels as this happened, it can explain why a positive change in yield curve had a negative effect on stock returns for Nordea as investors chose risk-free investments before stocks. Amihud's measure is included as a proxy variable for industrial production, or more precise it is a proxy variable for market illiquidity, and is highly significant when explaining changes in Nordea stock returns. Amihud (2002), tests whether market illiquidity positively affects stock excess returns, which is so to speak the stock return in excess of Treasury bill rates. He suggests that if investors anticipate higher market illiquidity they will tend to price stocks so that they generate higher returns. Basically this suggests that stock returns include a premium for market illiquidity. In this thesis one single measure of Amihud is used on all four bank stocks and is calculated on the OMX 30 index. Consequently, the measure can be interpreted as an illiquidity measure for the market on which Nordea is traded and investors trading on this market positively award the Nordea stock for this market illiquidity. Whether this is because Nordea has a market beta close to one indicating co-movement between the OMX 30 index and the stock itself or that the market simply awards Nordea more than others for market illiquidity is ambiguous. Another possible explanation is that in times when overall market illiquidity is higher, the demand increases for more liquid assets. In general stocks of larger corporations are more liquid than stock of smaller corporations. Since Nordea, as described in the theory section is the largest bank of these four, it is possible that the size of Nordea has a positive effect on the Nordea stock liquidity. This makes the liquidity risk associated with the Nordea stock lower than for other stocks that suffer from lower liquidity. It is then possible that when the overall stock market illiquidity increases, the demand for more liquid stocks rises and thereby the demand for the Nordea stock goes up. This puts an upward pressure on the stock price. Oil price is not significant for any of the three periods.

HANDELSBANKEN

	Before Crash			After Crash			Whole Period		
	Value	*Std. error*	*p-value*	*Value*	*Std. error*	*p-value*	*Value*	*Std. error*	*p-value*
Variables									
CDS	-0.009	0.008	0.229	0.021	0.014	0.122	0.005	0.008	0.510
OMX 30 Index	0.913	0.036	0.000	1.108	0.044	0.000	1.032	0.032	0.000
SEK/Euro Exchange rate	0.022	0.121	0.856	-0.295	0.129	0.023	-0.279	0.105	0.008
Swedish T-Bills	0.006	0.099	0.559	0.001	0.001	0.039	0.001	0.001	0.052
Yield Curve	0.011	0.030	0.707	-0.020	0.002	0.415	-0.002	0.003	0.485
Amihud Measure	17.268	9.187	0.061	7.961	7.303	0.276	10.502	5.594	0.061
Oil price	0.000	0.000	0.864	0.000	0.001	0.650	0.000	0.000	0.368
	Statistics			Statistics			Statistics		
Adjusted for autocorrelation	No			No			Yes		
Joint Significance (F-test)	0.000			0.000			0.000		

TABLE 4.4

Contrary to the other three banks Handelsbanken reveals a different pattern when it comes to the significance of changes in CDS-spreads before and after the crisis. Although the CDS is not even significant at 10% significance level it gets more significant after the crisis. Also the SEK/Euro exchange rate is much more significant after the default of Lehman Brothers indicated by a P-value equal to 0.023. Also changes in the Swedish T-Bill rate reveal the same pattern. Amihud's measure is significant at 6% significance level before the crisis but not after. It is unquestionable that Handelsbanken is in some ways different from the others. When it comes to risk exposure Handelsbanken has not exposed themselves to the Baltic States in the same way as SEB and Swedbank. The positive value on the coefficient on CDS after the crash should not be taken too seriously as its confidence interval (appendix) covers positive as well as negative values. Maybe the most interesting difference between data covering the period before the crash and data after the crash is the change in significance of the T-bill rate. As mentioned earlier in this thesis Handelsbanken did not suffer as much losses as other banks from the financial crisis of 2008. Actually Handelsbanken lent money to the Swedish State during these times. Earlier in this chapter a scenario referred to as flight-to-quality was described. It emphasizes investors risk aversion and willingness to invest in quality assets in times of economic uncertainty. The positive sign even after looking at the confidence interval (appendix) reveals that Handelsbanken's stock returns was positively correlated with changes in the Swedish T-Bill rate. A rise in the T-Bill rate is correlated by a rise in stock returns. This gives rise to a possible explanation that after the crash of Lehman Brothers, Handelsbanken was one stock which investors considered as a possible substitute to the T-Bill when returning to the stock market. Although the stock was definitely harmed by the tough financial climate, the market did not punish the stock to the same extent as it harmed other banks. One reason could be that investors viewed the stock as a quality asset at least comparable to other Swedish bank stocks.

5. Discussion & Conclusion

With a pronounced purpose to examine the effect of some macroeconomic factors on four Swedish bank stocks, the conclusion is much what could be expected in the sense that macroeconomic factors do affect stock returns. Additionally interesting are the changes in significance levels over the two focus periods on which most emphasize have been put. Differences also exist between the different banks both in respect to the significance level and the sign and magnitude of the coefficients. Some possible explanations for this were discussed in the analysis section. It is obvious that the common view of the "Big Four" as one entity is no longer valid because the differences between them cannot be ignored. SEB and Swedbank were clearly more affected by changes in CDS-spreads than for instance Handelsbanken, although Swedbank's and SEB's dependence of CDS-spreads decreased after the default of Lehman Brothers. Nevertheless, it is interesting that the effect on Swedbank still had some significance after the crash whereas the effect on SEB after the crash was almost none. It seems like presence in the Baltic States is a common factor for the banks that were affected most by changes in CDS-spreads. If this simply can be derived from their operations in these regions or if it is connected to an overall view on risk by the banks is ambiguous. If the former is true it would be a good explanation to why the significance of CDS-spreads decreased after the crash as these banks later on emphasized more on having solid finances.

A bank which distinguished itself from the others was Handelsbanken. The Swedish T-bill rate turned out to be significant for Handelsbanken after the crash but not before. The significance of Swedish T-Bills increased drastically after the crash due to a flight-to-quality. Compared to the other banks Handelsbanken was the only bank for which changes in T-Bill rates were significant with a positive sign on the coefficient. Adding the fact that CDS-spreads did not have a significant effect on Handelsbanken leads to the conclusion that the stock was considered by investors as less risky than the others. Of course the stock was affected by the overall market which is further proved by its significant dependency on the OMX 30 index. Although it recovered some time after the worst period and today trades at levels equivalent before the sub-prime crisis and the Lehman Brothers crash. The same thing cannot be said about Swedbank or SEB. A measure of systematic risk which is commonly used in finance and portfolio management is the market beta of a stock. A stock with a high market beta is more affected by market volatility than stocks with a low market beta. A value of one indicates perfect correlation with the market. According to the tables in the previous section it is obvious that the market beta[1] is significant at 1% significance level for all banks in all periods. What can be noted is that the value is higher for all banks after the crash than before. This conducts the conclusion that all stocks are more dependent on the overall market performance after the crash than they were before. The systematic risk, even referred to as the market risk, differs across different banks. This further strengthens the previous discussion in this section about clear differences between the banks. According to this measure the bank with the highest market risk is SEB with a beta value equal to 1.610 after the crash, followed by Swedbank, Nordea and Handelsbanken. Again, Handelsbanken turns out to be the least risky stock of these four.

[1] Market beta is represented by the coefficient on OMX 30-index which is presented in tables in section 5 "Results & Analysis"

The SEK/Euro-rate varies in significance level between banks and periods. The exchange rate is not of specific interest to explain stock movements for Swedbank, but it shows some interesting patterns for the other three banks. It is significant at 10% for SEB the whole period and the period before the crash but not the period after. The results for Nordea differ in the sense that the SEK/Euro variable is not significant at all the period before the crash but significant at 10% the period after and even at 1% when looking at the whole period. Similar results as those for Nordea are presented for SEB with no significance before the crash but significance at 3% level after the crash and at 1% level for the whole period. All results that have been referred to as significant at any level reveal a negative correlation between increased SEK/Euro-rate and stock returns. That means a depreciation of the SEK causes stock returns to fall. The reason to why this happens is not determined in this thesis since it can have a number of possible explanations. One could be that as the Swedish currency depreciates it gets more expensive for Swedish banks to borrow money in Euro which negatively affects their future earnings. Another possible explanation is that when investors choose to invest their money outside of Sweden, downward pressure is added to both the stock price and the SEK due to decreased demand of investing in Sweden. Additionally, what is interesting is that Handelsbanken and Nordea show the same pattern when it comes to changes in significance levels before and after the crash, while SEB shows the opposite pattern. Differences between the banks are even here confirmed. It would not be unreasonable to believe that one reason for this might have something to do with SEB's activities in Germany.

To summarize, it is clear that banks certainly are affected by changes in the economic environment. This was concluded by Chen, Roll and Ross (1986). What has been concluded here is that it is possible to look at other proxies for macroeconomic development than the ones examined in their work. This has been made possible much due to the development of financial derivatives. One such derivative is a CDS which has been examined here. The empirical method used in this thesis is based on historical data and even though it consists of a substantial number of observations it should be mentioned that historical data cannot fully be used to predict the future. That historical data cannot at all times predict future events is proved by the differences in significance levels of many factors before and after the Crash of Lehman Brothers. Factors that are used in this thesis to describe stock variations are not generally what really cause stock prices to move. Important is what these factors actually represent. To create a model that more precisely describes a company's returns requires a well performed analysis of the specific characteristics of that company as different characteristics affect how various companies react to different factors. The purpose of this thesis was to examine to what extent macroeconomic factors presented on a daily basis could be used to explain the individual performance of four bank stocks before and after the crash of Lehman Brothers. The empirical study clearly indicates that a clear correlation between macroeconomic factors and stock returns exists but also that large differences exist between different banks. A possible criticism to the results is that even though results are statistically significant, the values of the coefficients are sometimes very low which questions the economic significance of the results. But more importantly, it points out important differences between the big four Swedish banks and questions the view of them as a single entity referred to as "The Big Four".

PROPOSALS FOR FURTHER RESEARCH

To deepen the understanding of what factors that cause stock prices to rise or fall, an interesting subject for further empirical research could be to capture the impact of firm-specific factors on the stock returns of these banks. This could preferably be undertaken by a more in-depth analysis of the characteristics of individual corporations through analyzing financial statements. By doing this kind of analysis it would be possible to determine the financial health of a bank in a way that could not be done through an econometrical analysis of macroeconomic factors.

Another interesting matter would be to do the same test that was done in this thesis on smaller sized banks and global investment banks.

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7. APPENDIX: ECONOMETRICAL STUDY

7.1 CORRELATION BETWEEN DEPENDENT VARIABLES

To find out to what extent stock returns are correlated a correlation matrix was generated using STATA. Results are presented in Table A.1.

TABLE A. 1

	swedbank	nordea	seb	handel~n
swedbank	1.0000			
nordea	0.6870	1.0000		
seb	0.8084	0.7573	1.0000	
handelsban~n	0.6601	0.7555	0.7410	1.0000

The results indicate that some correlation between the dependent variables exists. The regression is run on the whole period and includes 1775 observations. This is only to illustrate that there is a relationship between the dependent variables. Because this is simply for illustration purposes no results for the periods before and after the crash are presented here.

7.2 REGRESSION ON ONE VARIABLE

The starting point in many econometrical works is simply to run the regression on one variable to see how the explanatory variable affects the independent variable. This is illustrated in the four tables that follow. Usually it is not enough to only use one variable when trying to explain variations in the explanatory variable. One problem that may occur when doing this is omitted variable bias. The method used in the following regressions is OLS (Ordinary Least Squares).

A negative sign on the coefficient indicates a negative relationship between CDS-spreads and stock prices. That is, an upward movement in CDS-spreads causes stock returns to be negative and a positive sign means that a positive change in CDS-spreads is followed by an increase in stock returns.

The explanatory variable is changes in CDS-spreads and the regression is run on all periods and all dependent variables. Commentaries do not follow after each regression but later in this appendix regressions with more variables are presented and if comparing these regressions with those that are done here, it is obvious that the results differ both in significance and magnitude of the coefficient.

TABLE A. 2: SWEDBANK ONLY ON CDS BEFORE THE CRASH

Source	SS	df	MS		
				Number of obs	= 877
				F(1, 875)	= 127.69
Model	.043207846	1	.043207846	Prob > F	= 0.0000
Residual	.296076374	875	.000338373	R-squared	= 0.1274
				Adj R-squared	= 0.1264
Total	.33928422	876	.000387311	Root MSE	= .01839

swedbank	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.1371806	.0121397	-11.30	0.000	-.161007	-.1133542
_cons	.0001653	.000622	0.27	0.791	-.0010556	.0013862

TABLE A. 3: SWEDBANK ONLY ON CDS AFTER THE CRASH

Source	SS	df	MS		
				Number of obs	= 898
				F(1, 896)	= 184.76
Model	.21756648	1	.21756648	Prob > F	= 0.0000
Residual	1.05508509	896	.00117755	R-squared	= 0.1710
				Adj R-squared	= 0.1700
Total	1.27265157	897	.001418787	Root MSE	= .03432

swedbank	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.3291789	.0242173	-13.59	0.000	-.3767082	-.2816497
_cons	.0012256	.0011456	1.07	0.285	-.0010228	.0034739

TABLE A. 4: SWEDBANK ONLY ON CDS FOR THE WHOLE PERIOD

Source	SS	df	MS		
				Number of obs	= 1775
				F(1, 1773)	= 282.38
Model	.221515237	1	.221515237	Prob > F	= 0.0000
Residual	1.39084929	1773	.000784461	R-squared	= 0.1374
				Adj R-squared	= 0.1369
Total	1.61236453	1774	.000908886	Root MSE	= .02801

swedbank	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.226846	.0134994	-16.80	0.000	-.2533225	-.2003696
_cons	.0007517	.0006654	1.13	0.259	-.0005533	.0020567

TABLE A. 5: NORDEA ONLY ON CDS BEFORE THE CRASH

Source	SS	df	MS		
Model	.026181351	1	.026181351	Number of obs =	877
Residual	.20589053	875	.000235303	F(1, 875) =	111.27
				Prob > F =	0.0000
Total	.232071881	876	.000264922	R-squared =	0.1128
				Adj R-squared =	0.1118
				Root MSE =	.01534

nordea	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.1067843	.0101234	-10.55	0.000	-.1266532	-.0869153
_cons	.000689	.0005187	1.33	0.184	-.000329	.0017071

TABLE A. 6: NORDEA ONLY ON CDS AFTER THE CRASH

Source	SS	df	MS		
Model	.143815808	1	.143815808	Number of obs =	898
Residual	.635099996	896	.000708817	F(1, 896) =	202.90
				Prob > F =	0.0000
Total	.778915804	897	.000868357	R-squared =	0.1846
				Adj R-squared =	0.1837
				Root MSE =	.02662

nordea	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.2676328	.018789	-14.24	0.000	-.3045083	-.2307573
_cons	.000561	.0008888	0.63	0.528	-.0011834	.0023054

TABLE A. 7: NORDEA ONLY ON CDS FOR THE WHOLE PERIOD

Source	SS	df	MS		
Model	.142212518	1	.142212518	Number of obs =	1775
Residual	.868793596	1773	.000490013	F(1, 1773) =	290.22
				Prob > F =	0.0000
Total	1.01100611	1774	.000569902	R-squared =	0.1407
				Adj R-squared =	0.1402
				Root MSE =	.02214

nordea	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.18176	.0106692	-17.04	0.000	-.2026856	-.1608344
_cons	.0006659	.0005259	1.27	0.206	-.0003655	.0016972

TABLE A. 8: SEB ONLY ON CDS BEFORE THE CRASH

Source	SS	df	MS		
Model	.049357023	1	.049357023	Number of obs =	877
Residual	.302905725	875	.000346178	F(1, 875) =	142.58
Total	.352262748	876	.000402126	Prob > F =	0.0000
				R-squared =	0.1401
				Adj R-squared =	0.1391
				Root MSE =	.01861

seb	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.1466175	.0122789	-11.94	0.000	-.1707171	-.1225179
_cons	.0004771	.0006292	0.76	0.449	-.0007578	.0017119

TABLE A. 9: SEB ONLY ON CDS AFTER THE CRASH

Source	SS	df	MS		
Model	.217460175	1	.217460175	Number of obs =	898
Residual	1.09456696	896	.001221615	F(1, 896) =	178.01
Total	1.31202714	897	.001462684	Prob > F =	0.0000
				R-squared =	0.1657
				Adj R-squared =	0.1648
				Root MSE =	.03495

seb	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.3290985	.0246663	-13.34	0.000	-.3775088	-.2806881
_cons	.0008493	.0011668	0.73	0.467	-.0014408	.0031393

TABLE A. 10: SEB ONLY ON CDS FOR THE WHOLE PERIOD

Source	SS	df	MS		
Model	.231194582	1	.231194582	Number of obs =	1775
Residual	1.43314098	1773	.000808314	F(1, 1773) =	286.02
Total	1.66433556	1774	.000938182	Prob > F =	0.0000
				R-squared =	0.1389
				Adj R-squared =	0.1384
				Root MSE =	.02843

seb	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.2317492	.0137031	-16.91	0.000	-.2586251	-.2048732
_cons	.0007127	.0006754	1.06	0.291	-.000612	.0020374

TABLE A. 11: HANDELSBANKEN ONLY ON CDS BEFORE THE CRASH

Source	SS	df	MS
Model	.022786261	1	.022786261
Residual	.202949079	875	.000231942
Total	.225735341	876	.000257689

Number of obs	877
F(1, 875)	98.24
Prob > F	0.0000
R-squared	0.1009
Adj R-squared	0.0999
Root MSE	.01523

handelsban~n	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0996203	.0100508	-9.91	0.000	-.1193468	-.0798938
_cons	.000352	.000515	0.68	0.494	-.0006588	.0013628

TABLE A. 12: HANDELSBANKEN ONLY ON CDS AFTER THE CRASH

Source	SS	df	MS
Model	.091582029	1	.091582029
Residual	.513559532	896	.000573169
Total	.605141561	897	.000674628

Number of obs	898
F(1, 896)	159.78
Prob > F	0.0000
R-squared	0.1513
Adj R-squared	0.1504
Root MSE	.02394

handelsban~n	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.2135704	.0168957	-12.64	0.000	-.2467303	-.1804106
_cons	.0009059	.0007993	1.13	0.257	-.0006627	.0024745

TABLE A. 13: HANDELSBANKEN ONLY ON CDS FOR THE WHOLE PERIOD

Source	SS	df	MS
Model	.100538984	1	.100538984
Residual	.730463875	1773	.000411993
Total	.831002859	1774	.000468435

Number of obs	1775
F(1, 1773)	244.03
Prob > F	0.0000
R-squared	0.1210
Adj R-squared	0.1205
Root MSE	.0203

handelsban~n	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.1528258	.0097831	-15.62	0.000	-.1720133	-.1336382
_cons	.0006619	.0004822	1.37	0.170	-.0002839	.0016076

7.3 GENERATING UNANTICIPATED CHANGE IN OIL-PRICE

Results that are presented in the tables above probably suffer from omitted variable bias. A natural step is then to include more explanatory variables. The variable referred to in the data section as unanticipated change in oil-price is generated using an Auto Regressive Model of Order One. The first step is to generate lagged variables for oil prices. Secondly the AR 1 model is run with oil price as the dependent variable and the one day lagged variable as the explanatory variable. The same principle is followed for all periods. For illustration purposes a regression is presented but only for one period. When this is done for the whole period results are as follow:

TABLE A. 14

Source	SS	df	MS		
				Number of obs =	1775
				F(1, 1773) =	.
Model	997234.794	1	997234.794	Prob > F =	0.0000
Residual	4834.51702	1773	2.72674395	R-squared =	0.9952
				Adj R-squared =	0.9952
Total	1002069.31	1774	564.864324	Root MSE =	1.6513

Oil	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Lagged_Oil	.9982027	.0016506	604.75	0.000	.9949654	1.00144
_cons	.1819282	.1376675	1.32	0.187	-.0880794	.4519358

It is clear from the table that one day lagged oil is highly significant and that it according to the R-square measure explains 99.52% of the variation in oil price. The variable of interest is the error term from this regression. That is so to speak the variation in oil-price which is not explained by the model. The following step is to use a simple command in STATA to predict this variable. When the error term is generated it can be included as one of seven explanatory variables that are to be tested.

7.4 A MULTIFACTOR MODEL

The method used to run the multifactor model with seven explanatory variables is OLS. P-values for CDS-spreads are for many banks very different when including more variables. Results will not be further discussed or analyzed in this section because further tests and adjustments need to be done before it is possible to conduct an appropriate analysis of the results. These tests and adjustments are to be presented in this appendix.

TABLE A. 15: SWEDBANK ESTIMATED USING OLS BEFORE THE CRASH

Source	SS	df	MS
Model	.194724992	7	.027817856
Residual	.143097847	868	.000164859
Total	.337822839	875	.000386083

Number of obs	876
F(7, 868)	168.74
Prob > F	0.0000
R-squared	0.5764
Adj R-squared	0.5730
Root MSE	.01284

swedbank	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0260434	.0092701	-2.81	0.005	-.0442379	-.0078489
OMX_Index_Re	1.11276	.0372153	29.90	0.000	1.039718	1.185803
SEK_EURO_Re	-.0837695	.1571167	-0.53	0.594	-.3921426	.2246036
SWE_TBill_Re	.0053168	.0175079	0.30	0.761	-.029046	.0396796
YieldCurve_Re	.0323062	.0420829	0.77	0.443	-.0502899	.1149022
amihud2002	16.54325	10.96017	1.51	0.132	-4.968293	38.05479
u_Oil	-.0004103	.0002846	-1.44	0.150	-.0009689	.0001482
_cons	-.0011253	.0006439	-1.75	0.081	-.0023892	.0001385

TABLE A. 16: SWEDBANK ESTIMATED USING OLS AFTER THE CRASH

Source	SS	df	MS
Model	.696272997	7	.099467571
Residual	.576378576	890	.000647616
Total	1.27265157	897	.001418787

Number of obs	898
F(7, 890)	153.59
Prob > F	0.0000
R-squared	0.5471
Adj R-squared	0.5435
Root MSE	.02545

swedbank	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0334885	.0211758	-1.58	0.114	-.0750489	.0080719
OMX_Index_Re	1.397467	.0572038	24.43	0.000	1.285197	1.509737
SEK_EURO_Re	-.1770145	.1462427	-1.21	0.226	-.4640353	.1100062
SWE_TBill_Re	.0051349	.0023152	2.22	0.027	.000591	.0096788
YieldCurve_Re	.0055311	.0055308	1.00	0.318	-.0053239	.0163861
amihud2002	-12.0675	10.39435	-1.16	0.246	-32.4678	8.3328
u_Oil	.0005732	.000491	1.17	0.243	-.0003905	.0015369
_cons	.0012571	.0013254	0.95	0.343	-.0013442	.0038583

TABLE A. 17: SWEDBANK ESTIMATED USING OLS FOR THE WHOLE PERIOD

Source	SS	df	MS		
Model	.88340787	7	.126201124	Number of obs =	1775
Residual	.728956661	1767	.000412539	F(7, 1767) =	305.91
Total	1.61236453	1774	.000908886	Prob > F =	0.0000
				R-squared =	0.5479
				Adj R-squared =	0.5461
				Root MSE =	.02031

swedbank	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0276888	.0110103	-2.51	0.012	-.0492835	-.0060942
OMX_Index_Re	1.283137	.0363343	35.31	0.000	1.211875	1.3544
SEK_EURO_Re	-.2191416	.1036973	-2.11	0.035	-.4225238	-.0157594
SWE_TBill_Re	.0053211	.0018409	2.89	0.004	.0017105	.0089317
YieldCurve_Re	.0061762	.0043971	1.40	0.160	-.002448	.0148003
amihud2002	-2.565655	6.847802	-0.37	0.708	-15.9963	10.86499
uoil	.0006766	.0003108	2.18	0.030	.0000671	.001286
_cons	.0000365	.0006844	0.05	0.958	-.0013058	.0013787

TABLE A. 18: NORDEA ESTIMATED USING OLS BEFORE THE CRASH

Source	SS	df	MS		
Model	.156637609	7	.022376801	Number of obs =	876
Residual	.073698143	868	.000084906	F(7, 868) =	263.55
Total	.230335752	875	.000263241	Prob > F =	0.0000
				R-squared =	0.6800
				Adj R-squared =	0.6775
				Root MSE =	.00921

nordea	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0033941	.0066527	-0.51	0.610	-.0164513	.0096632
OMX_Index_Re	1.035727	.0267075	38.78	0.000	.9833083	1.088146
SEK_EURO_Re	.0303576	.1127546	0.27	0.788	-.1909458	.2516611
SWE_TBill_Re	-.005418	.0125645	-0.43	0.666	-.0300784	.0192424
YieldCurve_Re	.0272224	.0302007	0.90	0.368	-.0320525	.0864974
amihud2002	29.28401	7.865551	3.72	0.000	13.84628	44.72173
u_Oil	-.0002911	.0002042	-1.43	0.154	-.000692	.0001097
_cons	-.0011106	.0004621	-2.40	0.016	-.0020176	-.0002036

TABLE A. 19: NORDEA ESTIMATED USING OLS AFTER THE CRASH

Source	SS	df	MS
Model	.561827064	6	.093637844
Residual	.21708874	891	.000243646
Total	.778915804	897	.000868357

Number of obs	898
F(6, 891)	384.32
Prob > F	0.0000
R-squared	0.7213
Adj R-squared	0.7194
Root MSE	.01561

nordea	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	.0009931	.0129625	0.08	0.939	-.0244474	.0264336
OMX_Index_Re	1.303172	.0348377	37.41	0.000	1.234798	1.371545
SEK_EURO_Re	-.1799212	.0895416	-2.01	0.045	-.3556581	-.0041842
SWE_TBill_Re	-.0004572	.0014201	-0.32	0.748	-.0032443	.0023299
YieldCurve_Re	-.0038176	.0033877	-1.13	0.260	-.0104665	.0028312
u_Oil	-.0000849	.0003002	-0.28	0.777	-.0006741	.0005043
_cons	-.0003072	.0005234	-0.59	0.557	-.0013344	.00072

TABLE A. 20: NORDEA ESTIMATED USING OLS FOR THE WHOLE PERIOD

Source	SS	df	MS
Model	.713056411	7	.101865202
Residual	.297949703	1767	.000168619
Total	1.01100611	1774	.000569902

Number of obs	1775
F(7, 1767)	604.11
Prob > F	0.0000
R-squared	0.7053
Adj R-squared	0.7041
Root MSE	.01299

nordea	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0010853	.0070392	-0.15	0.877	-.0148912	.0127207
OMX_Index_Re	1.212922	.0232294	52.22	0.000	1.167362	1.258481
SEK_EURO_Re	-.2374981	.0662961	-3.58	0.000	-.3675251	-.1074711
SWE_TBill_Re	-.0004687	.0011769	-0.40	0.690	-.002777	.0018396
YieldCurve_Re	-.003138	.0028112	-1.12	0.264	-.0086516	.0023757
amihud2002	14.80156	4.37796	3.38	0.001	6.215038	23.38809
uoil	-.0001859	.0001987	-0.94	0.350	-.0005755	.0002038
_cons	-.0011077	.0004375	-2.53	0.011	-.0019658	-.0002495

TABLE A. 21: SEB ESTIMATED USING OLS BEFORE THE CRASH

Source	SS	df	MS
Model	.236907398	7	.033843914
Residual	.114120401	868	.000131475
Total	.351027799	875	.000401175

Number of obs	876
F(7, 868)	257.42
Prob > F	0.0000
R-squared	0.6749
Adj R-squared	0.6723
Root MSE	.01147

seb	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0233479	.0082785	-2.82	0.005	-.0395961	-.0070997
OMX_Index_Re	1.230886	.0332343	37.04	0.000	1.165656	1.296115
SEK_EURO_Re	-.2340571	.1403096	-1.67	0.096	-.509443	.0413287
SWE_TBill_Re	-.00639	.015635	-0.41	0.683	-.0370769	.0242969
YieldCurve_Re	.0396398	.0375812	1.05	0.292	-.0341208	.1134004
amihud2002	34.2088	9.787742	3.50	0.000	14.99839	53.41921
u_Oil	-.0004154	.0002541	-1.63	0.103	-.0009142	.0000834
_cons	-.0016116	.0005751	-2.80	0.005	-.0027403	-.000483

TABLE A. 22: SEB ESTIMATED USING OLS AFTER THE CRASH

Source	SS	df	MS
Model	.848115848	6	.141352641
Residual	.463911291	891	.000520664
Total	1.31202714	897	.001462684

Number of obs	898
F(6, 891)	271.49
Prob > F	0.0000
R-squared	0.6464
Adj R-squared	0.6440
Root MSE	.02282

seb	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	.0093891	.018949	0.50	0.620	-.0278007	.046579
OMX_Index_Re	1.608958	.050927	31.59	0.000	1.509007	1.708909
SEK_EURO_Re	-.1991161	.1308952	-1.52	0.129	-.4560148	.0577827
SWE_TBill_Re	-.0013757	.0020759	-0.66	0.508	-.00545	.0026985
YieldCurve_Re	-.0004738	.0049523	-0.10	0.924	-.0101934	.0092457
u_Oil	.0014019	.0004388	3.19	0.001	.0005407	.0022632
_cons	-.0002321	.0007651	-0.30	0.762	-.0017337	.0012694

TABLE A. 23: SEB ESTIMATED USING OLS FOR THE WHOLE PERIOD

Source	SS	df	MS
Model	1.06763824	7	.152519749
Residual	.596697322	1767	.000337689
Total	1.66433556	1774	.000938182

Number of obs	1775
F(7, 1767)	451.66
Prob > F	0.0000
R-squared	0.6415
Adj R-squared	0.6401
Root MSE	.01838

seb	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0112415	.0099616	-1.13	0.259	-.0307792	.0082962
OMX_Index_Re	1.469668	.0328733	44.71	0.000	1.405193	1.534143
SEK_EURO_Re	-.283648	.0938196	-3.02	0.003	-.4676571	-.099639
SWE_TBill_Re	-.0012323	.0016656	-0.74	0.459	-.004499	.0020343
YieldCurve_Re	-.0003293	.0039783	-0.08	0.934	-.008132	.0074733
amihud2002	5.174106	6.195515	0.84	0.404	-6.977203	17.32542
uoil	-.0000625	.0002812	-0.22	0.824	-.000614	.0004889
_cons	-.0005361	.0006192	-0.87	0.387	-.0017505	.0006783

TABLE A. 24: HANDELSBANKEN ESTIMATED USING OLS BEFORE THE CRASH

Source	SS	df	MS
Model	.123902495	7	.017700356
Residual	.101170225	868	.000116556
Total	.225072719	875	.000257226

Number of obs	876
F(7, 868)	151.86
Prob > F	0.0000
R-squared	0.5505
Adj R-squared	0.5469
Root MSE	.0108

handelsbanken	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0093101	.0077946	-1.19	0.233	-.0246086	.0059885
OMX_Index_Re	.9128199	.0312919	29.17	0.000	.8514033	.9742365
SEK_EURO_Re	.022	.1321089	0.17	0.868	-.2372903	.2812904
SWE_TBill_Re	.0057834	.0147212	0.39	0.695	-.0231099	.0346768
YieldCurve_Re	.0113139	.0353847	0.32	0.749	-.0581356	.0807635
amihud2002	17.26806	9.215677	1.87	0.061	-.8195529	35.35568
u_Oil	.0000392	.0002393	0.16	0.870	-.0004304	.0005089
_cons	-.0008522	.0005414	-1.57	0.116	-.0019149	.0002105

TABLE A. 25: HANDELSBANKEN ESTIMATED USING OLS AFTER THE CRASH

Source	SS	df	MS
Model	.406640533	6	.067773422
Residual	.198501028	891	.000222785
Total	.605141561	897	.000674628

Number of obs	898
F(6, 891)	304.21
Prob > F	0.0000
R-squared	0.6720
Adj R-squared	0.6698
Root MSE	.01493

handelsbanken	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	.0203085	.012418	1.64	0.102	-.0040634	.0446804
OMX_Index_Re	1.152073	.0310056	37.16	0.000	1.091221	1.212926
SWE_TBill_Re	.0015153	.0013578	1.12	0.265	-.0011496	.0041802
YieldCurve_Re	-.0011489	.0032341	-0.36	0.723	-.0074962	.0051985
amihud2002	6.711644	6.085703	1.10	0.270	-5.23234	18.65563
u_Oil	.0000561	.0002871	0.20	0.845	-.0005073	.0006196
_cons	-.0005682	.0007766	-0.73	0.465	-.0020924	.0009559

TABLE A. 26: HANDELSBANKEN ESTIMATED USING OLS FOR THE WHOLE PERIOD

Source	SS	df	MS
Model	.52989667	7	.075699524
Residual	.301106189	1767	.000170405
Total	.831002859	1774	.000468435

Number of obs	1775
F(7, 1767)	444.23
Prob > F	0.0000
R-squared	0.6377
Adj R-squared	0.6362
Root MSE	.01305

handelsbanken	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	.0050042	.0070764	0.71	0.480	-.0088747	.0188831
OMX_Index_Re	1.032125	.0233521	44.20	0.000	.9863239	1.077925
SEK_EURO_Re	-.2789827	.0666463	-4.19	0.000	-.4096966	-.1482687
SWE_TBill_Re	.0014375	.0011832	1.22	0.225	-.000883	.0037581
YieldCurve_Re	-.0018635	.002826	-0.66	0.510	-.0074063	.0036792
amihud2002	10.50236	4.401089	2.39	0.017	1.870466	19.13424
uoil	.0001854	.0001997	0.93	0.353	-.0002063	.0005772
_cons	-.000737	.0004398	-1.68	0.094	-.0015996	.0001257

7.5 Test for Multicollinearity

To test for multicollinearity a simple correlation matrix is presented. Multicollinearity is a common problem in econometrical works but it is generally accepted as long as there is no perfect correlation between any explanatory variables.

TABLE A. 27: TEST FOR MULTICOLLINEARITY BEFORE THE CRASH

	CDS_Re	OMX_In~e	SEK_EU~e	SWE_TB~e	YieldC~e	ami~2002	u_Oil
CDS_Re	1.0000						
OMX_Index_Re	-0.3940	1.0000					
SEK_EURO_Re	0.0328	-0.1394	1.0000				
SWE_TBill_Re	0.0611	-0.0148	-0.0175	1.0000			
YieldCurve~e	-0.0994	0.0997	-0.1883	0.0309	1.0000		
amihud2002	0.0176	-0.0504	0.0654	0.0581	-0.0297	1.0000	
u_Oil	0.0172	0.0129	-0.0689	0.0053	0.0443	-0.0683	1.0000

TABLE A. 28: TEST FOR MULTICOLLINEARITY AFTER THE CRASH

	CDS_Re	OMX_In~e	SEK_EU~e	SWE_TB~e	YieldC~e	ami~2002	u_Oil
CDS_Re	1.0000						
OMX_Index_Re	-0.5093	1.0000					
SEK_EURO_Re	0.2367	-0.4408	1.0000				
SWE_TBill_Re	-0.0542	0.0317	-0.0278	1.0000			
YieldCurve~e	-0.0674	0.0550	-0.0992	0.0499	1.0000		
amihud2002	0.0269	0.0794	0.0177	-0.0006	-0.0547	1.0000	
u_Oil	-0.1247	0.0022	0.0642	0.0188	-0.0113	-0.0849	1.0000

TABLE A. 29: TEST FOR MULTICOLLINEARITY THE WHOLE PERIOD

	CDS_Re	OMX_In~e	SEK_EU~e	SWE_TB~e	YieldC~e	ami~2002	uoil
CDS_Re	1.0000						
OMX_Index_Re	-0.4497	1.0000					
SEK_EURO_Re	0.1581	-0.3665	1.0000				
SWE_TBill_Re	-0.0346	0.0259	-0.0265	1.0000			
YieldCurve~e	-0.0511	0.0493	-0.0961	0.0508	1.0000		
amihud2002	0.0142	0.0475	0.0193	0.0202	-0.0379	1.0000	
uoil	-0.2054	0.3127	-0.2164	0.0312	0.0270	-0.0207	1.0000

According to the correlation matrix there are no severe problems with multicollinearity.

7.6 TEST FOR HETEROSKEDASTICITY

In this section a test for heteroskedasticity is performed. The test characteristics are described in more detail in the methodology section and results summarized for all examined periods are presented in table A.30.

TEST DETAILS

Breush-Pagan/Cook-Weisberg test for heteroskedasticity

Test type: Chi-Square
Significance level: 5%
H0: Constant variance (no heteroskedasticity)
H1: No Constant variance (heteroskedasticity)
Rejection Rule: Reject H0, for P-values above 0.05

TABLE A. 30

Dependent Variable	Chi-Square	P-Value	Reject H0 at 5% significance?	Heteroskedasticity?
Before Crash				
Swedbank	42.42	0.0000	Yes	**Yes**
Nordea	47.01	0.0000	Yes	**Yes**
SEB	38.59	0.0000	Yes	**Yes**
Handelsbanken	15.97	0.0254	Yes	**Yes**
After Crash				
Swedbank	15.39	0.0313	Yes	**Yes**
Nordea	45.48	0.0000	Yes	**Yes**
SEB	78.41	0.0000	Yes	**Yes**
Handelsbanken	26.15	0.0005	Yes	**Yes**
Whole Period				
Swedbank	158.53	0.0000	Yes	**Yes**
Nordea	166.37	0.0000	Yes	**Yes**
SEB	341.89	0.0000	Yes	**Yes**
Handelsbanken	81.01	0.0000	Yes	**Yes**

Table A.30 indicates the presence of heteroskedasticity for all dependent variables in all periods. In the presence of heteroskedasticity OLS is no longer the best linear unbiased estimator. To receive more accurate results it is therefore necessary to adjust for heteroskedasticity. These adjustments will be presented later in this appendix.

7.7 Test for Autocorrelation

In this section a test for autocorrelation is performed. The test that has been used is the alternative Durbin-Watson test for autocorrelation. Test characteristics are described in more detail in the methodology section and results summarized for all examined periods and variables are presented in table A.31.

Test Details

Durbin-Watson Alternative Test for Autocorrelation

Test type: Chi-Square
Significance level: 5%
H0: No Serial Correlation
H1: Serial Correlation
Rejection Rule: Reject H0, for P-values above 0.05.

TABLE A. 31

Dependent Variable	Chi-Square	P-Value	Reject H0 at 5% significance?	Autocorrelation?
Before Crash				
Swedbank	5.284	0.0215	Yes	**Yes**
Nordea	0.136	0.7119	No	**No**
SEB	0.151	0.6971	No	**No**
Handelsbanken	2.207	0.1374	No	**No**
After Crash				
Swedbank	0.008	0.9284	No	**No**
Nordea	0.019	0.8917	No	**No**
SEB	22.612	0.000	Yes	**Yes**
Handelsbanken	3.265	0.0708	No	**No**
Whole Period				
Swedbank	0.944	0.3313	No	**No**
Nordea	0.016	0.8981	No	**No**
SEB	25.886	0.0000	Yes	**Yes**
Handelsbanken	6.465	0.0110	Yes	**Yes**

Table A.31 indicates that autocorrelation is present in some of the examined regressions. Regressions which suffer from autocorrelation need to be adjusted.

7.8 Adjusting for Heteroskedasticity & Autocorrelation

Tests showed that adjustments for heteroskedasticity need to be performed on all dependent variables in all periods. Adjustments for autocorrelation are only necessary for some periods and variables. The estimation method used to correct for both autocorrelation and heteroskedasticity is the Newey-West estimation method available in the STATA software. This method allows the user to always adjust for heteroskedasticity, and when it is necessary also adjust for autocorrelation. The procedure is straightforward. The command used in STATA is Newey followed by the dependent variable and the explanatory variables. When to adjust only for heteroskedasticity and not for autocorrelation the syntax "lag (0)" is used after the last explanatory variable. When to adjust for both autocorrelation of order one, which has been examined here, and heteroskedasticity use the syntax lag (1) after the last explanatory variable.

TABLE A. 32: SWEDBANK BEFORE THE CRASH

Regression with Newey-West standard errors — Number of obs = 876
maximum lag: 1 — F(7, 868) = 123.43
Prob > F = 0.0000

swedbank	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0260434	.0103415	-2.52	0.012	-.0463408	-.005746
OMX_Index_Re	1.11276	.0425195	26.17	0.000	1.029307	1.196213
SEK_EURO_Re	-.0837695	.1415847	-0.59	0.554	-.361658	.1941189
SWE_TBill_Re	.0053168	.0125192	0.42	0.671	-.0192546	.0298882
YieldCurve_Re	.0323062	.0370664	0.87	0.384	-.0404441	.1050564
amihud2002	16.54325	15.42822	1.07	0.284	-13.73773	46.82423
u_Oil	-.0004103	.0003147	-1.30	0.193	-.001028	.0002073
_cons	-.0011253	.0007301	-1.54	0.124	-.0025584	.0003077

Adjusted for autocorrelation: YES

TABLE A. 33: SWEDBANK AFTER THE CRASH

```
Regression with Newey-West standard errors          Number of obs  =        898
maximum lag: 0                                      F(  7,    890)  =      90.37
                                                    Prob > F        =     0.0000
```

swedbank	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0334885	.023711	-1.41	0.158	-.0800246	.0130476
OMX_Index_Re	1.397467	.0791909	17.65	0.000	1.242044	1.552889
SEK_EURO_Re	-.1770145	.1970171	-0.90	0.369	-.5636869	.2096578
SWE_TBill_Re	.0051349	.0035074	1.46	0.144	-.0017488	.0120187
YieldCurve_Re	.0055311	.0053253	1.04	0.299	-.0049206	.0159828
amihud2002	-12.0675	11.75664	-1.03	0.305	-35.14147	11.00646
u_Oil	.0005732	.0005633	1.02	0.309	-.0005325	.0016788
_cons	.0012571	.0013593	0.92	0.355	-.0014107	.0039248

Adjusted for autocorrelation: NO

TABLE A. 34: SWEDBANK THE WHOLE PERIOD

```
Regression with Newey-West standard errors          Number of obs  =       1775
maximum lag: 0                                      F(  7,   1767)  =     149.04
                                                    Prob > F        =     0.0000
```

swedbank	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0276888	.0121052	-2.29	0.022	-.0514308	-.0039469
OMX_Index_Re	1.283137	.0507956	25.26	0.000	1.183512	1.382763
SEK_EURO_Re	-.2191416	.1635203	-1.34	0.180	-.5398551	.1015719
SWE_TBill_Re	.0053211	.0035395	1.50	0.133	-.0016209	.0122631
YieldCurve_Re	.0061762	.0054864	1.13	0.260	-.0045843	.0169366
amihud2002	-2.565655	8.940614	-0.29	0.774	-20.10095	14.96964
uoil	.0006766	.0003594	1.88	0.060	-.0000282	.0013813
_cons	.0000365	.0006855	0.05	0.958	-.0013081	.001381

Adjusted for autocorrelation: NO

TABLE A. 35: NORDEA BEFORE THE CRASH

Regression with Newey-West standard errors
maximum lag: 0

Number of obs = 876
F(7, 868) = 164.40
Prob > F = 0.0000

nordea	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0033941	.0073305	-0.46	0.643	-.0177816	.0109935
OMX_Index_Re	1.035727	.0342029	30.28	0.000	.9685972	1.102857
SEK_EURO_Re	.0303576	.1082547	0.28	0.779	-.1821139	.2428291
SWE_TBill_Re	-.005418	.0113873	-0.48	0.634	-.027768	.0169319
YieldCurve_Re	.0272224	.0292568	0.93	0.352	-.0301999	.0846448
amihud2002	29.28401	9.932252	2.95	0.003	9.789968	48.77804
u_Oil	-.0002911	.0002213	-1.32	0.189	-.0007254	.0001431
_cons	-.0011106	.0004757	-2.33	0.020	-.0020442	-.000177

Adjusted for autocorrelation: NO

TABLE A. 36: NORDEA AFTER THE CRASH

Regression with Newey-West standard errors
maximum lag: 0

Number of obs = 898
F(7, 890) = 183.85
Prob > F = 0.0000

nordea	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0007767	.0148268	-0.05	0.958	-.0298762	.0283228
OMX_Index_Re	1.294198	.0537204	24.09	0.000	1.188764	1.399631
SEK_EURO_Re	-.191395	.1103768	-1.73	0.083	-.4080241	.0252342
SWE_TBill_Re	-.0004715	.001341	-0.35	0.725	-.0031034	.0021605
YieldCurve_Re	-.0034333	.0014813	-2.32	0.021	-.0063405	-.0005261
amihud2002	13.70414	6.754581	2.03	0.043	.4473705	26.9609
u_Oil	-.0000327	.0003466	-0.09	0.925	-.000713	.0006476
_cons	-.0016443	.0007868	-2.09	0.037	-.0031884	-.0001001

Adjusted for autocorrelation: NO

TABLE A. 37: NORDEA THE WHOLE PERIOD

Regression with Newey-West standard errors
maximum lag: 0

Number of obs = 1775
F(7, 1767) = 287.05
Prob > F = 0.0000

nordea	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0010853	.0079366	-0.14	0.891	-.0166514	.0144809
OMX_Index_Re	1.212922	.0351064	34.55	0.000	1.144067	1.281776
SEK_EURO_Re	-.2374981	.0886813	-2.68	0.007	-.4114294	-.0635668
SWE_TBill_Re	-.0004687	.0012706	-0.37	0.712	-.0029607	.0020233
YieldCurve_Re	-.003138	.001553	-2.02	0.043	-.0061839	-.000092
amihud2002	14.80156	5.402278	2.74	0.006	4.206036	25.39709
uoil	-.0001859	.000224	-0.83	0.407	-.0006252	.0002534
_cons	-.0011077	.0004213	-2.63	0.009	-.001934	-.0002813

Adjusted for autocorrelation: NO

TABLE A. 38: SEB BEFORE THE CRASH

Regression with Newey-West standard errors
maximum lag: 0

Number of obs = 876
F(7, 868) = 166.70
Prob > F = 0.0000

seb	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0233479	.0086301	-2.71	0.007	-.0402862	-.0064096
OMX_Index_Re	1.230886	.0409909	30.03	0.000	1.150433	1.311338
SEK_EURO_Re	-.2340571	.1408718	-1.66	0.097	-.5105463	.042432
SWE_TBill_Re	-.00639	.013365	-0.48	0.633	-.0326216	.0198416
YieldCurve_Re	.0396398	.0363367	1.09	0.276	-.0316783	.1109579
amihud2002	34.2088	12.52781	2.73	0.006	9.620459	58.79715
u_Oil	-.0004154	.0002608	-1.59	0.112	-.0009272	.0000964
_cons	-.0016116	.0006147	-2.62	0.009	-.002818	-.0004052

Adjusted for autocorrelation: NO

TABLE A. 39: SEB AFTER THE CRASH

Regression with Newey-West standard errors
maximum lag: 1

Number of obs = 898
F(7, 890) = 101.60
Prob > F = 0.0000

seb	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	.0096198	.0215897	0.45	0.656	-.032753	.0519925
OMX_Index_Re	1.610128	.0791433	20.34	0.000	1.454798	1.765457
SEK_EURO_Re	-.1976208	.2042011	-0.97	0.333	-.5983926	.2031511
SWE_TBill_Re	-.0013739	.0025061	-0.55	0.584	-.0062925	.0035447
YieldCurve_Re	-.0005239	.0022145	-0.24	0.813	-.0048703	.0038224
amihud2002	-1.786003	11.37305	-0.16	0.875	-24.10713	20.53513
u_Oil	.0013951	.000468	2.98	0.003	.0004767	.0023136
_cons	-.0000579	.001228	-0.05	0.962	-.0024679	.0023522

Adjusted for autocorrelation: YES

TABLE A. 40: SEB THE WHOLE PERIOD

Regression with Newey-West standard errors
maximum lag: 1

Number of obs = 1775
F(7, 1767) = 170.03
Prob > F = 0.0000

seb	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0112415	.0106447	-1.06	0.291	-.032119	.009636
OMX_Index_Re	1.469668	.0519847	28.27	0.000	1.36771	1.571626
SEK_EURO_Re	-.283648	.1716468	-1.65	0.099	-.6203002	.0530041
SWE_TBill_Re	-.0012323	.002602	-0.47	0.636	-.0063357	.003871
YieldCurve_Re	-.0003293	.0025281	-0.13	0.896	-.0052877	.004629
amihud2002	5.174106	8.656883	0.60	0.550	-11.8047	22.15292
uoil	-.0000625	.0003242	-0.19	0.847	-.0006984	.0005733
_cons	-.0005361	.0006028	-0.89	0.374	-.0017184	.0006462

Adjusted for autocorrelation: YES

TABLE A. 41: HANDELSBANKEN BEFORE THE CRASH

Regression with Newey-West standard errors
maximum lag: 0

Number of obs = 876
F(7, 868) = 100.08
Prob > F = 0.0000

handelsbanken	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	-.0093101	.00773	-1.20	0.229	-.0244817	.0058616
OMX_Index_Re	.9128199	.0361278	25.27	0.000	.8419117	.983728
SEK_EURO_Re	.022	.1212621	0.18	0.856	-.2160011	.2600012
SWE_TBill_Re	.0057834	.0098912	0.58	0.559	-.01363	.0251968
YieldCurve_Re	.0113139	.0300776	0.38	0.707	-.0477195	.0703473
amihud2002	17.26806	9.187308	1.88	0.061	-.7638723	35.3
u_Oil	.0000392	.0002282	0.17	0.864	-.0004087	.0004871
_cons	-.0008522	.0005388	-1.58	0.114	-.0019097	.0002054

Adjusted for autocorrelation: NO

TABLE A. 42: HANDELSBANKEN AFTER THE CRASH

Regression with Newey-West standard errors
maximum lag: 0

Number of obs = 898
F(7, 890) = 147.15
Prob > F = 0.0000

handelsbanken	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	.0210925	.0136112	1.55	0.122	-.0056213	.0478062
OMX_Index_Re	1.107921	.0440604	25.15	0.000	1.021447	1.194396
SEK_EURO_Re	-.2954181	.1293383	-2.28	0.023	-.5492618	-.0415744
SWE_TBill_Re	.0014578	.0007034	2.07	0.039	.0000772	.0028384
YieldCurve_Re	-.0020185	.0024744	-0.82	0.415	-.0068748	.0028379
amihud2002	7.961156	7.303027	1.09	0.276	-6.372006	22.29432
u_Oil	.0001345	.0002961	0.45	0.650	-.0004466	.0007157
_cons	-.0006864	.0007933	-0.87	0.387	-.0022434	.0008706

Adjusted for autocorrelation: NO

TABLE A. 43: HANDELSBANKEN THE WHOLE PERIOD

```
Regression with Newey-West standard errors          Number of obs  =      1775
maximum lag: 1                                      F(  7,  1767)  =    206.11
                                                    Prob > F       =    0.0000
```

handelsbanken	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
CDS_Re	.0050042	.0075934	0.66	0.510	-.0098889	.0198972
OMX_Index_Re	1.032125	.0320165	32.24	0.000	.9693303	1.094919
SEK_EURO_Re	-.2789827	.1045565	-2.67	0.008	-.48405	-.0739153
SWE_TBill_Re	.0014375	.0007386	1.95	0.052	-.000011	.0028861
YieldCurve_Re	-.0018635	.0026695	-0.70	0.485	-.0070991	.0033721
amihud2002	10.50236	5.594389	1.88	0.061	-.4699617	21.47467
uoil	.0001854	.000206	0.90	0.368	-.0002185	.0005894
_cons	-.000737	.0004389	-1.68	0.093	-.0015978	.0001239

Adjusted for autocorrelation: YES