Liquidity Coverage Ratio:

An Empirical Study of the Deposit Cutoff Rates for a Swedish Bank

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Abstract: This thesis examines the deposit cutoff rates experienced by a large Swedish bank between the years 2006 and 2010 and compares them to the ones proposed by the Swedish Financial Supervisory Authority. These cutoff rates are a fundamental part in the calculation of the Liquidity Coverage Ratio proposed by the Basel Committee in December 2010. Our results suggest that the weights allocated to the different deposit classes should be increased for three out of six classes and decreased for one class in order to match the actual depositors' behavior between the years 2006 and 2010 at the Swedish bank we studied.

Keywords: Liquidity coverage ratio, cutoff rates, liquidity risk, Sweden, Case Study.

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1. Introduction

The financial crisis in 2008 was a shock to the whole global financial system. The crisis was set off by the credit boom in mid-2007 and the crash of securitized products and sub-prime mortgages. When Lehman Brothers and Washington Mutual failed and Fannie Mae and Freddie Mac were taken over by the government, the soundness of financial institutions was doubted and governments needed to step in with various actions in order to promote solvency and liquidity in the system. The price of different commodities and asset classes fell drastically; the financial markets experienced levels of volatility that seldom are seen and the cost of borrowing rose significantly (Krishnamurthy 2010).

When liquidity dried out, important questions were raised about how liquidity risk should be managed. In banking, liquidity risk refers to the risk a borrower faces when the lender is unwilling to renew a loan when the borrower needs it. One of the liquidity risks a bank faces is the risk that depositors unexpectedly withdraw their deposits and the bank cannot replace the deposits without weakening its net worth (Greenbaum and Thakor 2007). Banks also face liquidity risks on the interbank market. When the crisis started, the rates on the unsecured interbank market, for example the London Interbank Offer Rate (LIBOR) and the Euro Interbank Offered Rate (EURIBOR), rose significantly (Eisenschmidt and Tapking 2009). When the financial system experienced a shortage of and insistent need for cash, it was clear that liquidity risk management had been out of focus for too long and that new ways of controlling this sort of risk were desperately needed (Strahan 2012).

The mismanagement of liquidity risk has lead several market participants to take action. The Basel Committee on Banking Supervision is among them. The Committee promotes collaboration amongst its members from all across the world on banking supervisory matters and is currently chaired by Stefan Ingves, the Governor of the Swedish Central Bank, Sveriges Riksbank (Bank for International Settlements 2013). The Committee has concluded that the present set of regulations did not capture the risk of banks to an adequate extent. The Committee therefore started to frame Basel III as a new set of regulations for banks (Sveriges Riksbank 2011). Basel III was published in December 2010 with the objective of strengthening the ability of banks to withstand financial losses. In addition to tougher capital requirements, Basel III also includes new quantitative liquidity

measurements, the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The objective of the two measurements is to support the short-term resilience of the liquidity risk profile of a bank. With the LCR comes the demand that financial institutions can withstand an outflow of cash during a stressed period of 30 days. The Net Stable Funding Ratio demands that the financing of the bank must be more stable than the demand of stable funding (Sveriges Riksbank 2011). This paper will concentrate on the LCR measurement.

The response from core players affected by the new set of regulations was loud when the first regulations were published. Mervyn King, the Governor of the Bank of England, said in June 2012 that the need for banks to keep large buffers of liquidity should be reduced in times when banks have to provide liquidity against a range of collateral and that regulators around the world should take this into consideration (Bank of England 2012). When Stefan Ingves gave a speech at Stockholm School of Economics in March 2012, he compared the liquidity regulations to a situation where you arrive at a train station late at night looking for a cab that can take you to your hotel. However, the only cab present at the train station cannot serve you since the town requires that at least one cab has to be at the train station at all times. Christian Noyer, the Governor of the Banque de France, in June 2012 criticized the liquidity ratios for not taking into account their interactions and consequences beyond the wise objectives themselves, for example how the interbank market actually functions (Schmitz 2012).

As a result of this, the Basel Committee reviewed Basel III, and on 7th January 2013 a package of amendments to the LCR was released. The new package included a change of the definition of high-quality assets and nets cash outflows, a new timetable for when the standards should be set in place, an affirmation of the usability of liquid assets in times of stress and also an agreement made by the Basel Committee to further investigate how LCR and facilities of central banks interact. Once the amendments had been made, the tone from the critics of the liquidity measurements changed and Mervyn King concluded that the new agreement was an achievement and that LCR would no longer delay the financial recovery (Bank for International Settlements 2013). However, far from everyone is convinced that the liquidity requirements are the right way to go. Imad Moosa, Professor for Finance at RMIT University, questions whether the regulation of banks can be set

internationally and he doubts that the same set of rules can be set to different countries (The Conversation 2013). In a conversation on Wednesday the 27th of February 2013 Julia Maschkow, an expert in the field of liquidity and the Basel regulations at Deutsche Bank criticized that the LCR does not incorporate risk and does not take the portfolio structure or the banks diversification into consideration.

Criticism has also been directed towards the cutoff rates that the LCR relies on. These cutoff rates or outflow assumptions are assumptions regarding the value-loss different assets are subject to during periods of stress and the assumptions have been criticized as being too conservative and not being in line with the cutoff rates that were realized during the recent crisis.

According to the Clearing House, the cutoff rates originally proposed by the Basel Committee in 2010 were more conservative than the actual cutoff rates during the stress periods in the 2008 crisis. In their white paper "The Basel III Liquidity Framework: Impacts and Recommendations" from 2011 they compare the proposed cutoff rates for deposits to the ones Wachovia Corporation experienced between the September and October 2008. Wachovia was the largest U.S bank to fail during the financial crisis and was acquired by Wells Fargo in October 2008. In the 30 day period between 15th of September and 15th of October, Wachovia saw cutoff rates on its wholesale deposits of between 12.5% and 25.4%. It is stated in the paper, that Wachovia was a typical commercial bank with an equal mix of commercial and retail activities and came under severe liquidity pressure after the bankruptcy of Lehmann Brothers on the 15th of September 2008. The authors of the paper state that the period between the September and the October 2008 was the worst time period for Wachovia and uses this time period to prove that the actual cutoff rates for non-operational wholesale deposits were much lower than the cutoff rates proposed by the Basel Committee.

Table 1: Wachovia Bank, corporate and financial institution deposit experience

($ billions)	9/15/2008	10/15/2008	% change	Basel Factor
Operational Deposits				
Non-Financial	31.0	27.1	-12.5%	-25.0%
Financial	3.2	2.9	-8.0%	-25.0%
Non-Operational Deposits				
Non-Financial	33.6	25.0	-25.4%	-75.0%
Financial	6.4	3.7	-42.4%	-100.0%
Utilization	**30/9/2008**	**10/31/2008**	**% change**	**Basel Factor**
Retail Draws	34.6%	35.4%	0.8%	5%

(Source: The Clearing House 2011)

It is claimed by the Clearing House that an analysis of broader industry crisis data shows that Wachovia's experience was not unique and that e.g. non-operational deposits for non-financial corporate saw a 41% cutoff in 2008 which is considerably lower than the 75% implied by the LCR (The Clearing House 2011). The Committee answered the criticism by lowering the cut-off rates in the reviewed set of regulations, but even after the changes the rates have still been disapproved as being too old-fashioned.

This thesis will focus on these issues, the liquidity risk measurement LCR and how well it fits one of the oldest and largest banks in Sweden, XXXXX[1]. With all the debates and criticism directed to the measurement, this paper will look into how well the cutoff rates that the LCR is based on fit XXXXX.

We will first start of by presenting the previous research that has been done in the field of liquidity risk and then further elaborate on the concept of the cutoff rates and the characteristics of the Swedish financial market. After describing the data set we have used for our study we will set up the theoretical framework of the analysis and state our research approach, our research question, the limits of our study and the assumptions we will be using throughout it. We will also elaborate on the unique characteristics of two deposit classes, namely the checking and payment module deposit account types and the case study of XXXXX. Then we will analyze each section separately and also look into the special cases of Sections 8 and 9 with the checking accounts. Finally we will discuss the

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[1] Due to the sensitivity of the data used for our study we were asked not to state the name of the bank. We will refer to it as XXXXX throughout our thesis and not state the names of the employees we worked with. We also had to remove all absolute numbers concerning their deposits from our graphs and our analysis.

correlation between the classes, how the three large Swedish banks behaved during our research period and benchmark our findings against the ones from another case study.

2. Previous research

In order to understand the context of this thesis, the concepts of liquidity and liquidity risk need to be discussed. Despite its importance, liquidity risk was never the sole focus of academic research prior to the financial crisis. Due to that, most research on liquidity and liquidity risk is rather recent and comes mainly from the time after the recent crisis. The following is a review of the research done on liquidity risk and the proposed cutoff rates. The case of Sweden is also discussed in more detail.

2.1 Liquidity and liquidity risk

The Financial Stability Review written by Banque de France focuses on liquidity risk. As reported in this paper, it is not clear if difficulties with liquidity are due to structural problems of the financial markets or actually the main source of problems in the financial market themselves (Banque de France 2011).

As James Caruana and Laura Kodres report in their paper "Liquidity in Global Markets", assumptions about the liquidity of different assets can have important implications for how a bank should be funded (Banque de France 2011). The liquidity in the interbank market can be measured in different ways and in the latest crisis illiquidity showed up as a widening in different spreads. One example is the TED-spread, the spread between T-bills and Eurodollars, which suddenly rose to over 300 bps in September 2008 (InvestingAnswers 2013). Another example is the spread between different currencies which also widened during the recent crisis. The authors report that the main cause for illiquidity is asymmetrical information and that markets with the highest uncertainty are also the ones that are the least liquid. Policies to create market liquidity are important, but these policies come with costs. One way to provide liquidity to the market is to support standardization by supplying benchmark characteristics or financial instruments that are standardized. It is also important that regulations do not punish exchange trading environments relative to the OTC market, as this would slow down the overall development of trading. As asymmetrical

information is one of the main causes of illiquid markets, policies should seek to increase the transparency. More information about the underlying risks of an asset would lead to more precise pricing and lower bid-ask spreads. More information about the market in which the asset is sold, for example recent prices and volumes sold would lead to less uncertainty about the environment in which the asset is trading. More information about the financial health of the counterparty would benefit the OTC trading as illiquidity in these markets is worsened by uncertainty over the counterparty's creditworthiness. During the recent crisis this information was not always available. Complex structured products involved risks on prices that were unclear and rating agencies provided insufficient information about them. During the recent crisis institutions did not understand how illiquid some of their assets were in relation to their liabilities and that these illiquid assets should have been removed from their balance sheets. Therefore, one solution could be to match the liquidity between assets and liabilities in a more accurate way or to hold more liquid assets. Also, matching maturities of assets and liabilities could be one possible solution but it is of outmost importance to remember that maturity and liquidity is not the same thing which makes this solution possibly weak. The two authors conclude that new policies regarding liquidity risk management are needed.

In his paper "Liquidity Shortages: theoretical underpinnings", the director of the Toulouse School of Economics, Jean Tirole, discusses the theoretical keystones of liquidity shortage. As the timing of costs and revenues may not always be perfect, financial institutions have two choices of actions. They can "finance as you go" or they can commit to "liquidity hoarding". With the "finance as you go" strategy, institutions turn to the market and borrow from investors and companies when they experience a gap between expenditures and revenues. This would be a perfect solution in a world without agency costs, in other words a world of perfect capital markets. However, as perfect capital markets do not exist, this solution has its clear drawbacks. Asymmetrical information, transaction costs and moral hazard make the capital markets imperfect and companies sometimes may struggle to find financing for projects with a positive net present value (Banque de France 2011). This imperfection in markets makes it necessary for banks to hoard liquidity in order to solve the problem with revenues and costs that are not perfectly synchronized. Jean Tirole states that the purpose of liquidity management is to solve the problem with cash

flows that are not synchronized and different needs across time and states of nature. (Banque de France 2011). In line with what the previous authors have stated, one source of illiquid markets is, in his opinion, asymmetrical information. Jean Tirole also states that this asymmetry increases in times of crisis which is also one reason to why governments choose to inject liquidity in times of stress. By injecting liquidity the owners to illiquid assets get some extra time to convince the market that and buyers of the quality of their assets (Banque de France 2011). Injecting liquidity is however not without a risk. If the government injects too much liquidity into the economy, one potential drawback could be that some actors benefit at the cost of other market participants, which are often the taxpayers. Liquidity injection can also save an actor who actually needs to learn a lesson; thus, in a way, it helps the market participants who have mismanaged their risk. This leads to a moral hazard problem, as market actors are less prone to manage their risk properly when they are sure they will receive a helping hand from the government (Banque de France 2011).

Jean-Charles Rochet, Professor of Economics and Mathematics at Toulouse School of Economics, discusses the regulation of bank liquidity in his paper "Liquidity Regulation and the Lender of Last Resort". The author states that banking authorities worry about the banks taking large positions on complex derivative products which might become illiquid during times of stress. Insufficient liquidity management of derivative products is therefore highly risky for banks. Basel I was the first attempt made by the Basel Committee to synchronize the solvency across countries with one simple ratio. Basel II was a revised version of the same matter, but in the light of the recent crisis one important question is whether solvency ratios are enough or if these need to be complemented with ratios for liquidity (Banque de France 2011). In order for banks to manage their liquidity risk, the bank can hold cash reserves. Another way is to use government securities as collateral when borrowing liquidity.

An important question raised by the author is whether banks' liquidity should be regulated. The author states that banks rely on external sources, deposits, for financing their loans and that the banks need to screen and monitor their borrowers. The screening and monitoring of borrowers leads to an opaqueness of bank assets since the assets may be hard to evaluate by external means. This, in turn, leads to risk of moral hazard as banks may not put enough effort on screening and monitoring their borrowers. As Jean-Charles Rochet

reports, it has been shown that in such situations liquidity needs are not sufficiently covered by financial markets and that institutional arrangements might be needed in order to overcome this failure of the market. One example is pools of liquidity together with interbank credit lines commitments which can be a substitute for the central bank's emergency liquidity assistance (Banque de France 2011).

Liquidity requirements can be a way of mitigating systematic risk. Coordination failures on interbank markets are a good example of this, e.g. when depositors choose to withdraw their deposits simply because they believe other depositors will withdraw and not because they believe the bank will become insolvent. In this way liquidity requirements can make the bank more resistant against large withdraws, which in turn makes the depositors less inclined to make withdrawals; they remain confident about their deposits and do not have to care about the actions of other depositors. Liquidity regulation may also alleviate the risk of banks acting in an opportunistic way as they are less inclined to commit to proper monitoring and screening if they know that they will be bailed out by the government in case they fail (Banque de France 2011).

In his paper Jean-Charles Rochet also discusses why banks do not choose to have the right level of liquidity of their own accord. There are two main reasons for why banks need to be regulated, one micro-prudential and one macro-prudential. The first one, the micro-prudential, is the protection of small depositors who are not able to monitor the bank themselves. This is also one of the reasons why small depositors are insured in most countries today and why banks are monitored by banking supervisors. The second reason, the macro-prudential, is due to financial stability. A country must be able to transfer assets between market participants even in times of stress and recession (Banque de France 2011).

A liquidity ratio might be enough in order to meet the first goal to regulate liquidity on a micro-prudential level. However, the management of liquidity on a macro-prudential level is harder to regulate as it is hard to foresee the liquidity needs for a bank during a crisis. This calls for a second type of requirement which deals with the risks faced on a macro-prudential level. One solution could be the central bank committing to supplying more credit lines under the custody of an independent Banking Supervisor. The characteristics of these credit lines would be stated by the supervisor and the loans would

be senior to other liabilities in order to mitigate the risk of resorting the taxpayers' money. (Banque de France 2011).

2.2 The cutoff rates and periods of stress

In order to manage liquidity and find proper regulation for it, Basel III uses the term Total Net Cash Outflow which is the total expected cash outflows minus total expected cash inflows during a stress scenario for the subsequent 30 calendar days.

$$Total\ Net\ Cash\ Outflow = Total\ Expected\ Cash\ Outflow - Total\ Expected\ Cash\ Inflow$$

By multiplying the outstanding balances of assorted categories, liabilities and off-balance sheet commitments by the rates at which they are expected to run off the total expected cash outflows are calculated. Total expected cash inflow is calculated in the same way: by multiplying the balances of different categories of receivables with the inflow rate which is the rate at which they are expected to flow in under the scenario of an aggregate cap of 75% of total expected cash outflows (Bank of International Settlements 2013). Combined with the value of stock in high quality liquid assets these two components form the LCR:

$$\frac{Stock\ of\ HQLA}{Total\ Net\ Cash\ Outflows\ over\ the\ next\ 30\ calendar\ days} \geq 100\%$$

In their regulations for the LCR the Basel Committee uses the term "periods of stress". The definition is however vague and texts written by Basel Committee do not contain a clear-cut definition of the term. According to Hakio and Keeton from the Federal Reserve Bank of Kansas City it is not easy to come up with a specific definition because two episodes of financial stress are never the same. In their paper "Financial Stress: What Is It, How Can It Be Measured, and Why Does It Matter?" they define financial stress as an interruption to the normal functioning of financial markets (Hakkio Keeton 2009).

According to Christina Claesson from the Swedish Financial Supervisory Authority, the regulatory code FFFS 2012:6 broadly follows the "Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring from December 2010". This states that liquidity stress entails a combined idiosyncratic and market-wide shock that results in:

"(a) The run-off of a proportion of retail deposits;

(b) A partial loss of unsecured wholesale funding capacity;

(c) A partial loss of secured, short-term financing with certain collateral and counterparties;

(d) Additional contractual outflows that would arise from a downgrade in the bank's public credit rating by up to and including three notches, including collateral posting requirements;

(e) Increases in market volatilities that impact the quality of collateral or potential future exposure of derivative positions and thus require larger collateral haircuts or additional collateral, or lead to other liquidity needs;

(f) Unscheduled draws on committed but unused credit and liquidity facilities that the bank has provided to its clients; and

(g) The potential need for the bank to buy back debt or honor non-contractual obligations in the interest of mitigating reputational risk.

Essentially the stress scenario is trying to incorporate many of the shocks that banks experienced during the financial crisis that started in 2007 into one stress scenario for which a bank would need sufficient liquidity on hand to survive for up to 30 calendar days" (Basel 2010:4).

2.3 The Swedish case

In Sweden the Swedish Financial Supervisory Authority (Finansinspektionen) has the primary responsibility for monitoring the companies' active on the finance market. The authority works on the behalf of the Swedish parliament and the Swedish government and aims to support a financial system that is effective and stable. The authority also works for an effective regulation of the financial supervision by EU. This is achieved by working with the European governments that were founded in January 2011. (Finansinspektionen 2012 I)

During the autumn of 2010 the Basel Committee proposed the introduction of the Liquidity Coverage Ratio, which is set to be put into place in the year 2015. The rules stated by the Basel Committee will affect all countries that are members of EU and rules stipulated by the Swedish Financial Supervisory Authority will therefore be substituted by the regulation set by the Basel Committee. The work done by the Basel Committee is carefully followed by the authority and the authority has not been late on proposing their requirements in order to prepare the Swedish banks for the regulation set in place by the

Basel Committee. The Swedish Financial Supervisory Authority's requirement on the Swedish banks has been tougher in both the levels and the timing of when the regulation should be put in place (Sveriges Riksbank 2011).

Sweden emerged as one of the strongest economies after the financial crisis of 2008 and 2009 (Washington Post 2011). Its GDP grew by 5.5% in 2010, compared to a growth of 2.8% in the United States during the same period; its unemployment rate peaked at 9% during the crisis, compared to 10% in the U.S. and since has fallen to 7% in 2011, compared to 9% in the U.S. again (Michigan State University 2013).

One of the explanations to why Sweden did so well during and after the recent crisis is that the country learned the lessons from its banking crisis during the 1990s. During the crisis in the early 90s the commercial real estate market crashed, the banking sector got into trouble and due to a high budget deficit the country had difficulty borrowing money. The bad times during the 90s crisis made Sweden set a goal of an average of 1% budget surplus. When crisis then hit again in the late 2000's the country was in a good position for deficit spending (The Local 2012). Sweden was running on a 3.6% budget surplus in 2007, giving it a cushion in the down turn which helped it not to pill up large amounts of debt during the crisis. The U.S. and Great Britain were running a budget deficit of 3% of their respective economies around the same time (Washington Post 2011). Another explanation is the automated fiscal stimulus of Sweden which started as soon as the job rate fell, providing income, health care and other services. A third explanation is Sweden's aggressive monetary policy. The Riksbank lowered the target short-term interest rate to almost 0%, expanded its balance sheet to more than 25% of the nation's gross domestic product and introduced negative interest rates on bank deposits in order to encourage commercial banks to boost lending (Financial Times 2009). The Swedish Krona is also said to be a fourth reason to Sweden's quick recovery. Because it was floating freely against the Euro it provided a buffer against the economic downturns seen in the past years. The Swedish banking sector is said to be a last reason to Sweden's quick recovery. It is highly concentrated, with the four large banking groups Nordea, Svenska Handelsbanken, Swedbank, and SEB accounting for roughly 80% of the market. Due to their bad experiences during the real estate crisis in the early 90s they were less inclined to get involved in risky real estate lending during the 2000s and therefore had lower losses than for example American banks (Washington Post 2011).

However, Swedish banks were far from immune from the global downturn due to their considerable investments in the Baltic States, which resulted in some of Sweden's heaviest losses during the 2008 financial crisis. The Swedish government responded with a bank support package in 2008 which included guarantees for new debt insurance, increased deposit insurance and a fund that would provide up to SEK 15 billion in equity injections into systemically important institutions (Regeringskansliet 2011). In November 2008 Carnegie Investment Bank was bailed out and in August 2010 the government revoked the license of the embattled HQ Bank, as risky securities deals and an over-valued trading portfolio threatened its survival (Michigan State University 2013).

3. Data

The underlying data to our analysis is provided by XXXXX. We retrieved our data from one of their databases which contains customer information such as account balances and account types from January 2004 up to today's date. In order to reduce the data to a workable size we extracted data from January 2006 to December 2010. The database provided stores all customer data on a monthly basis and always on the last day per month. We first classified all accounts in January 2006 according to the different sections proposed by The Swedish Financial Supervisory Authority and then retrieved the monthly data for these accounts until December 2010. After removing all accounts with multiple entries and empty values, our first set of data from January 2006 contained 1.86248% of the observations[2]. The final dataset from January 2006 to December 2010 contained 100.00000% of the deposit balances of which 99.97449% were classified as retail and 0.02551% where classified as non-retail deposits. We used the SAS Enterprise Guide 4.2 in order to retrieve and classify the accounts. The dataset we used in order to put our findings into perspective and compare how the deposits at the 3 largest Swedish banks developed during our research period has been provided to us by XXXXX's investor relations department.

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[2] We were asked not to state the overall number of bank accounts or bank accounts per classification.

4. Theoretical framework of the analysis

In order to achieve a consistent comprehension of the objectives and goals of this research it is of utmost importance that the hypotheses and the framework for this thesis are carefully defined. Therefore, the theoretical background for this study follows.

4.1 Research approach

The aim of this thesis is to investigate how well the liquidity risk measurement Liquidity Coverage Ratio (LCR) proposed by the Basel Committee fit with one of the biggest banks in Sweden, XXXXX. The LCR can be evaluated by examining either the cash in- or outflow during a crisis period. This thesis will focus on the cutoff rates proposed by the Swedish Financial Supervisory Authority in their regulatory code FFFS 2012:6 which is based on "Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring" from December 2010 and not on the revised version from January 2013. In our discussion with Martin Liljeblad, a Banking Analyst at the Swedish Financial Supervisory Authority in March 2013 he told us that FFFS 2012:6 is based on the original Basel Proposal. FFS 2012:6 was released in November 2012 and therefore does not include the newest changes to the Basel regulation from January 2013. This thesis will not cover assumptions regarding other characteristics for the measurements, for example inflows to the bank.

The way we will approach our analysis is by picking the largest negative percentage changes per month, our proxy of a deposit cutoff rate for a 30 day period, and then comparing them to the weights proposed by the Swedish Financial Supervisory Authority. In case the largest negative percentage change in the deposit balance is higher than the proposed cutoff rate by the Swedish Financial Supervisory Authority we conclude that the weight should be increased so it at least matches this change.

Due to the fact that regulations are set by both the Basel Committee and the Swedish Financial Supervisory Authority, a choice had to be made which of the two authorities the research should be based on. After careful consideration the choice fell on the Swedish Financial Authority. Since the majority of the operations carried through by XXXXX are done in Sweden the regulation by the Swedish Financial Supervisory Authority is the one having the biggest influence on how XXXXX is doing its business. An additional consideration was the fact that the Swedish Financial Authority aims to prepare the Swedish

banks for the regulation stated by the Basel Committee. Up to this day this has resulted in even tougher requirements by the Financial Supervisory Authority than stated by the Basel Committee. The rules suggested by the Basel Committee can therefore be seen as a minimum level of the liquidity requirements which makes it sound to base this thesis on the requirements stated by the Swedish Financial Supervisory Authority (Sveriges Riksbank 2011).

Table 2: Basis for the calculation of the liquidity coverage ratio

Retail	Paragraph	Weight
1. Retail deposits falling due after 30 days.	Section 4	0%
2. Retail deposits covered by a deposit guarantee	Section 5	5%
3. Other retail deposits.	Section 6	10%
Stable deposits which are unsecured or with operational relationships		
1. Deposits, which are covered by a deposit guarantee, from customers other than retail customers.	Section 7	5%
2. Deposits with operational purposes.	Section 8	25%
Unsecured borrowing which does not have a fixed term or falls due within 30 calendar days		
1. Deposits from customers other than retail customers and financial customers.	Section 9	75%
2. Other deposits and unsecured funding.	Section 10	100%

(Source: *Finansinspektionen* 2012)

Due to the scope of this thesis, securities falling due within 30 calendar days, receivables and secured lending are not analyzed in this research. Our research will instead focus on retail and non-retail deposits with or without operational relationships to the bank. This limitation in our research is also due to the data provided by XXXXX which exclusively covers retail and non-retail deposits with or without operational relationships to XXXXX.

As a first step in the research classification according to the Swedish Financial Supervisory Authority has to be applied to the database provided by XXXXX. In order to classify the accounts, variables have to be assigned that answer to the different characteristics determining the classification stated by the Swedish Financial Supervisory Authority. One of the first characteristics for a deposit which has an influence on the classification is the balance of the account. This variable is already present in the database

provided by XXXXX[3] which means that no proxies or assumptions are needed for this variable. The second variable determining which class one bank account belongs to according to the Swedish Financial Supervisory Authority is whether the bank account has a deposit guarantee or not. The majority of the bank accounts at XXXXX have a deposit guarantee; the deposits are covered by the Swedish deposit guarantee scheme. Deposits not covered by the Swedish deposit guarantee are deposits which for example are put into funds. Investments in funds are instead covered by an investment guarantee and hence not a deposit guarantee. Due to the content of the database provided by XXXXX, deposits put in funds and other accounts not covered by the deposit guarantee are not present. This means that all the accounts in the database have a deposit guarantee. However, the question about deposit guarantee is further complicated by the fact that only an amount of up to one hundred thousand Euros is covered by the deposit guarantee and exceeding amounts are therefore left unguaranteed. This has an effect on the classification done as we will see later. All of the deposits in this study are unsecured, which means that they do not have underlying collateral. The words insured and guaranteed are used interchangeably throughout this paper.

The third variable considered when classifying the bank accounts is whether or not the deposits fall due before or after 30 calendar days. Deposits falling due after 30 calendar days are considered more stable and therefore also receive a lower cutoff rate. If the balance can be accessed by the depositor independent of time and date, then the deposit is seen as less stable than a deposit which has a due date after 30 calendar days. A variable for the time when the deposits fall due was however not present in the database which called for proxies and assumptions. In order to solve this shortage of the variable we looked at the different account names for each bank account. As the account names identify the deposit type, we were able to determine whether or not the deposit was due within 30 days based on the account names. The problem was therefore solved by adding an additional classification variable; depending on the type of the bank account and whether it was possible to access the deposits within 30 days.

The last characteristic playing an important role in the determination of classification is whether or not the deposits have an operational purpose. Operational

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[3] BalEndofMo

purpose means that the deposits are connected to the provision of services or cash management where cash management means administration of cash flows of a firm. Just as in the case with deposits falling due before or after 30 calendar days, the database provided by XXXXX did not include a variable or characteristic that could be used in order to determine whether a bank account had an operational purpose or not. This was solved in the same manner as the due dates for the deposits. By looking at the names of the different accounts and researching the characteristics for these different account types and also by talking to experts at XXXXX we were able to add another classification variable which determines if an account is operational or not.

4.2 Payments module and check accounts

The majority of accounts in the database could be classified according to operational purposes or non-operational purposes based on account names as described above. However, two types of accounts could either be operational or non-operational which complicated the classification of these accounts, the payment module accounts and the checking accounts. These accounts therefore had to be treated in a different manner. However, after retrieving our data it became evident that payment module accounts were always classified as retail deposits. The payment module accounts were therefore not affected by the operational classification.

The problem could be solved in various ways but after talking with experts at XXXXX the best way to treat the check accounts was to investigate how sensitive the cutoff rates was according to the classification of these accounts. This approach was also valuable to XXXXX as it provided an insight in how the classification of these accounts affected the cutoff rates of XXXXX.

In order to evaluate how sensitive the cutoff rates were for the classification of the checking accounts two possible scenarios needed to be analyzed. Scenario one was the possibility that all the check accounts were operational and the second scenario was that none of the check accounts are operational. In order to check for the first scenario we added all check accounts to the section which contains non-retail deposits with operational

purposes[4]. The second scenario was evaluated by adding all the checking accounts to the section which contained non-retail deposits but without operational purposes[5].

4.3 Assumptions and getting the bigger picture

When all the accounts present in January 2006 had been classified, this classification was assumed to be constant over time. This means that if a change in the balance, in the guarantee or the operational relationship to XXXXX occurred between January 2006 and December 2010 the classification was not affected i.e. the classification one account received in January 2006 was constant and not a subject to changes.

As an addition to our research we also looked into the total outflow and inflow for the three largest Swedish banks. We believe it is of vital importance to look at the bigger picture and also benchmark how XXXXX performed during the crisis compared to the other big Swedish banks. We consider the period between the Bear Stearns bailout in March 2008 and the acquisition of HQ Bank by Carnegie in September 2010 as our crisis period. Therefore our research from January 2006 to December 2010 consists of both a period we consider as crisis and non-crisis.

4.4 Research question

This empirical research has the objective to analyze the cutoff rates XXXXX experienced for their retail and non-retail deposits during the recent financial crisis. The aim is to compare these rates to the ones the Swedish Financial Supervisory Authority proposed in its Regulatory Code 2012:6 in November 2012. The cutoff rates in FFFS 2012:06 itself are based on the proposal Basel III: International framework for liquidity risk measurement, standards and monitoring from December 2010 by the Basel committee. The question we aim to answer is:

Do the cutoff rates proposed by the Swedish Financial Supervisory Authority in their regulatory code FFFS 2012:6 resemble the ones XXXXX experienced during years of crisis between 2008 and 2010?

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[4] Section 8
[5] Section 9

4.5 A case study of XXXXX

The research conducted in this thesis relies on information and data provided by XXXXX, implying that the results of our case study only apply to XXXXX. However, the general findings in this thesis for XXXXX could also have implications for other big banks operating in Sweden.

Robert Stakes states that a case study is identified when there is an interest in specific cases. A case is specific to time and space and can be empirical, theoretical or both. A case study is the best choice of method when

a) the aim is to answer "why" and "how" questions

b) when the behavior of the object or objects studied cannot be manipulated

c) when the aim is to address contextual conditions because they are important for the phenomenon being studied or

d) the boundaries between the context and the phenomenon are not absolutely clear (Baxter and Jack 2008). With these requirements in mind we make the judgment that a case study of XXXXX is the righteous approach to answer the question of how well the cutoff rates proposed in FFFS 2012:6 apply to the ones experienced by XXXXX during the financial crisis.

The case chosen for a study can be selected in two ways. In the first way the case chosen is studied with a central interest for that particular case. In this approach, the focus lies on understanding the one case chosen and there are no aims to generalize the findings. If the findings are generalized then this is achieved through a "naturalistic generalization". This means that generalizations are drawn from known cases and applied to other situations, cases and problems by formulating the right comparisons between the known case and the studied case.

The second way of conducting a case study is by systematically choosing the case. The choice is based on to what extent it contains large amounts of information, unique information or extreme information. If the case is selected systematically then there is also an aim to generalize the findings (Johansson 2011). Our case study relies on the second approach using unique data of XXXXX's deposits.

The question of generalizations is complicated when it comes to research based on case studies. Generalizations have to be made from a single case which could be problematic. One important thing to consider when generalizations are done from a case study is that the generalizations are not statistical but analytical and based on reasoning. This reasoning is inductive, deductive or abductive or a combination of the three.

Deductive reasoning has similarities to an experiment. At a first step a hypothesis is stated which is then evaluated by deriving consequences by deduction. When comparing the expected findings from theory with real findings from a case the validity of the theory can be assigned. This makes it possible to look into which area that actually fits best for one theory. Induction means that data is collected from a case. This is basically generation of theory and the result is often a theory that consists of different concepts. By induction the study of a case leads to that the rules evaluated are probably operative in other cases. Abduction deals with fact that is unexpected. By using some rule that is already well-known or generated for the specific case, the case is positioned. Generalizations when using abduction can be drawn in two ways. In the first way by abductive reasoning a case is generated based on for example historical data. In the second way generalizations are made from cases that are already well-known by making comparisons to the case studied (Johansson 2003). Our thesis uses the inductive reasoning approach, because data is collected from XXXXX and our results might hold implications for other Swedish banks as well.

4.6 Limits of the study

One limit for the research conducted in this thesis is that credit is not taken into consideration. During periods of stress customers at the bank could for example draw down on their lines of credit in order to avoid potential liquidity shortages. However, if they then realize that too much money has been taken out, the money that is still left over could be deposited into the bank account at XXXXX. In our research this scenario would show up as a deposit inflow but it basically is just a transfer of money from a credit line that we do not consider in this thesis into a bank deposit that actually is covered in the research.

This thesis considers the major events during the financial crisis and assumes that these events lead to cash inflow or cash outflows to XXXXX. However, during the crisis smaller events not taken into consideration in this thesis could have led people to withdraw

money or deposit it into their accounts. This study does not take these other smaller events into consideration.

As mentioned before, this thesis also only deals with deposits from retail and non-retail customers with operational or non-operational relationships to XXXXX. However, another vital part for liquidity and liquidity risk is interbank lending. When interbank lending dries out, banks face real liquidity problems (Rochet et al. 1996). However, interbank lending is not taken into consideration in this thesis.

As described above, the classification of each bank account was conducted for all the accounts available in January 2006. After this classification was done, this classification was assumed to stay constant over the years until December 2010. This means that even though the classification set to one bank account could change over time, for example due to a change in deposit guarantee, accessibility or operational purpose, this is not taken into consideration in this thesis. This is, however, not seen as a major limitation. The aim of this thesis is to evaluate the cut off rates proposed by the Swedish Financial Supervisory Authority. These cutoff rates are unique for each class, which means that in order to fully evaluate the accuracy of the cutoff rates we have to keep the classification constant over time, otherwise we will not catch the outflow rates in a correct way.

Taking a fixed number of classified deposits from January 2006 and then following their development until December 2010 implies that accounts which have been opened during that time are not taken into consideration. This however does not present a limitation to our research and is in line with our aim to see the outflow and not the inflow in these accounts during the stress periods.

Figure 1: Using the bank accounts from January 2006 as a key for our study.

Jan
2006

Dec
2010

20
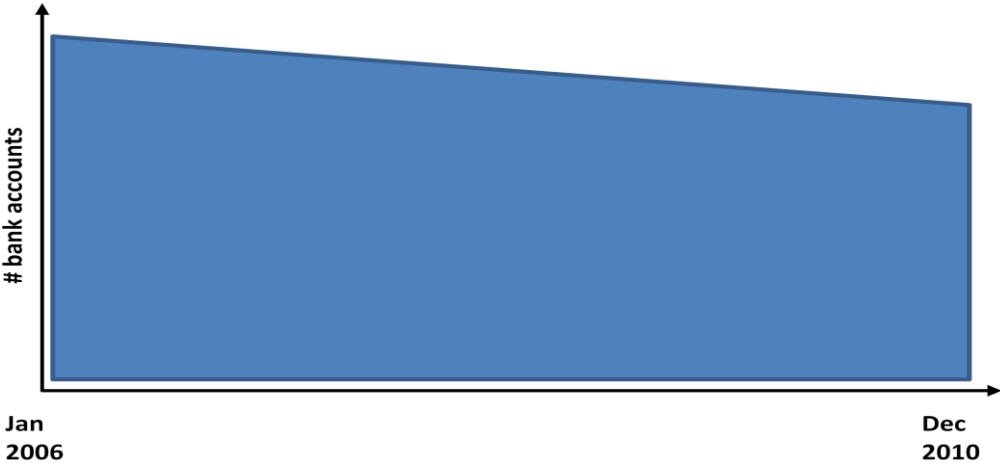
It is the same case for the deposit guarantee scheme which plays an important role in the account classification. For this study we decided to use the European Commission's current deposit guarantee scheme of € 100,000 (European Commission 2010). This number is kept constant over the research period even though it changed from SEK 250,000 in 2006 to SEK 500,000 in 2008 and then to € 100,000 in 2010 (Riksgälden 2013). The SEK per Euro exchange rate used throughout this paper is SEK 9.2530.

Last but not least, the choice of XXXXX as a case could be construed as a weakness as well. The profile of XXXXX makes is attractive for the public and results in depositors having a great confidence in the bank. The outflow could from the beginning be considered as small due to the characteristics of XXXXX. However, this is also exactly what we aim to investigate in this thesis and this is also one of the main criticism that has been directed to the LCR measurement, the question whether or not it is justifiable to force every bank to follow the same regulations independent of profile and stability of the bank.

5. Empirical analysis

First, we will analyze the overall development and the percentage change for Sections 4 to 6 in the retail part and then compare them to the weights proposed by the Swedish Financial Supervisory Authority. Secondly, we will do the same for the non-retail deposits of Sections 7 to 9, with a special focus on Sections 8 and 9 including the checking accounts. None of the data from our dataset was classified as falling into section 10. Finally, we will compare the correlations between each section and analyze how the deposits at the three Swedish major banks developed during our research period.

5.1 Retail deposits

5.1.1 Section 4

Retail deposits falling due after 30 days which include a fee in case of early repayment are cash outflow items which are covered in section 4 and weighted at 0%. This means that under a period of stress of 30 days the Swedish Financial Supervisory Authority states that the cutoff rates i.e. the value loss for these kinds of deposits are 0%. The fee associated with the early repayment has to be large enough to cover the loss of interest for the bank

between the date of withdrawal and the contractual maturity and has to include a penalty fee as well. Overall, 4.36745% of the accounts in our data set qualified for this category in January 2006. All accounts were insured under the Swedish deposit guarantee scheme, not callable within 30 days and had a balance under € 1 million (SEK 9,250,300) where placed into this section. The graph below shows the monthly sum for the accounts in Section 4.

Figure 2: Changes in Deposits Section 4
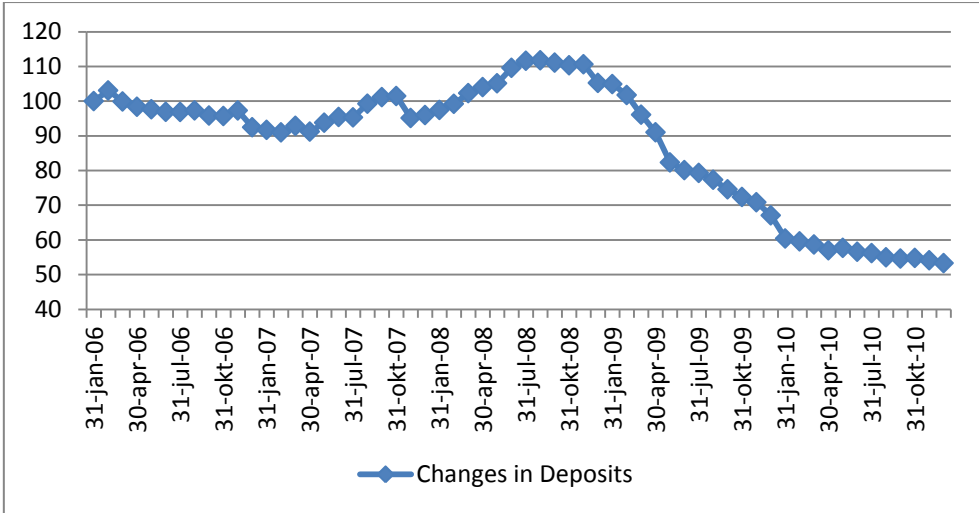
The overall sum of deposit balances decreased from 100 in January 2006 to 53.30 in December 2010. The average cutoff rate per 30 days was at -1.02%. The following graph shows the percentage change per month and also the cutoff rate proposed by the Swedish Financial Supervisory Authority.

The proposed weight of zero is for section 4 surpassed in 38 out of 59 months with cutoff rates as high as 9.55% in May 2009 and 9.94% in January 2010. The weights proposed by the Swedish Financial Supervisory Authority are passed in time we consider as periods of crisis as well as in times we do not considered as crisis periods. The standard deviation of the deposits found in section 4 is 2.91%. In the two cases where the realized cutoff rates reaches levels of 9.55% and 9.94% this implies a level of cutoff rate that are around three times the standard deviation. Even though the average cutoff rate per month is 1.02% this leads us to conclude that the weight for section 4 should be at least be at 9.94%, e.g. 10%.

Figure 3: Percentage changes Section 4
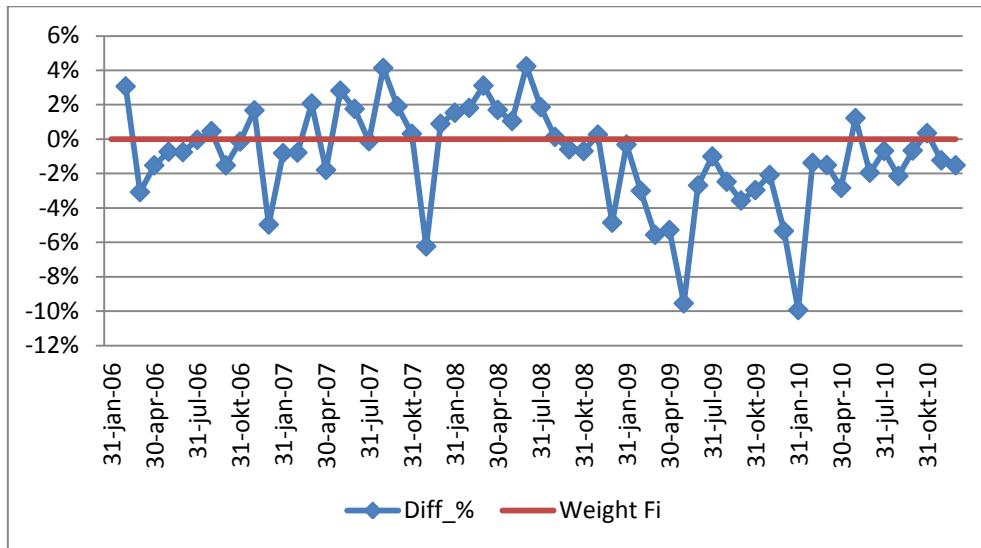
5.1.2 Section 5

Section 5 includes retail deposits and accrued interest which is covered by the Swedish deposit guarantee scheme and accessible within 30 calendar days. In total there were 95.60541% accounts in our data set in January 2006 which also made this data set our largest. The graph below shows the monthly sum for the accounts in Section 5.

Figure 4: Changes in Deposits Section 5
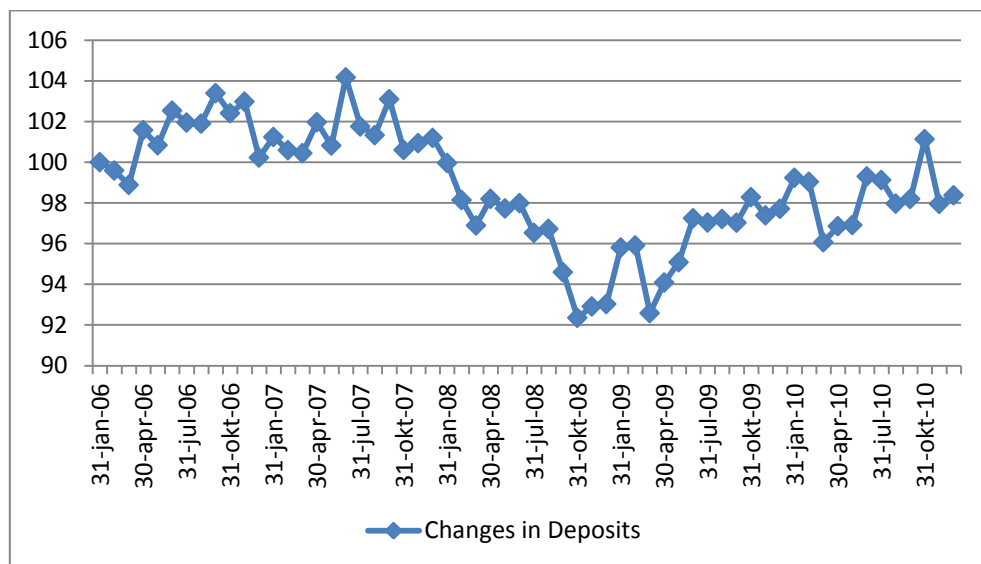
Looking at the graph it becomes evident that section 5 had the largest sum of deposits in June 2007 with a value of 104.17. From that on the deposit class experienced a steady

outflow of money up until October 2008. From October 2008 to March 2009 the deposit class experienced a sharp inflow which was followed by a sharp outflow and since March 2009 to December 2010 the deposit class slowly recovered.

The average cutoff rate for deposits in section 5 is 0.02%. The Swedish Financial Supervisory Authority assigns a cutoff rate of 5% to this class. Looking at the graph below it becomes clear that the realized cutoff rates of XXXX are much lower than the proposed cutoff rate of 5%. The largest cutoff rate for XXXX was recognized in March 2009 when it reached a level of 3.47%. The standard deviation for the cutoff rates from January 2006 to December 2010 is 1.59%. The cutoff rate of 3.47% realized in March 2009 is 2.17 times the standard deviation.

Figure 5: Percentage changes Section 5
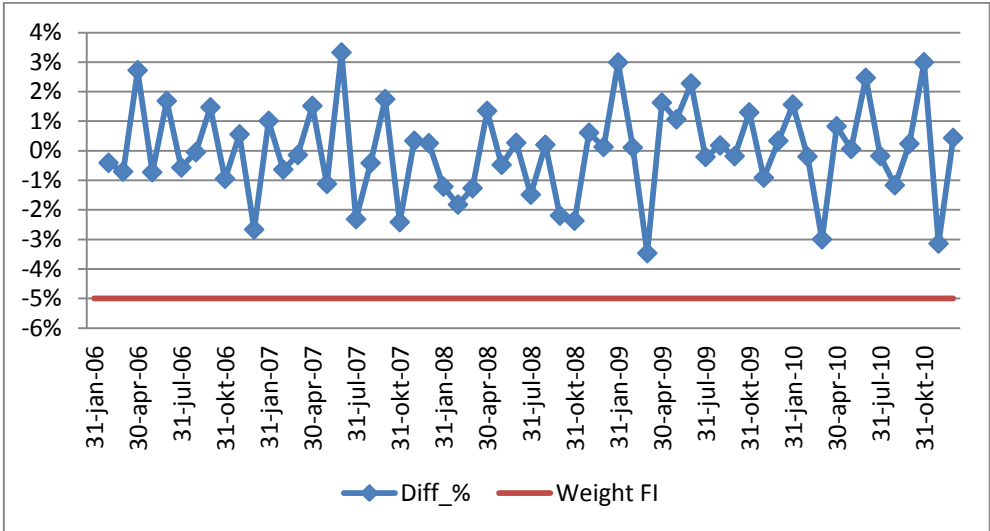
Due to the fact that the realized cutoff rates for the bank we analyzed are much lower than the cutoff rates proposed by the Swedish Financial Supervisory Authority we conclude that the cutoff rate is too conservative and could be set to a lower level. According to our findings the weight should at least be 3.47%, e.g. 4%.

5.1.3 Section 6

Section 6 contains the amount on the deposits that are not covered by the Swedish deposit insurance. In January 2006 the dataset contained 95.60541% of the unique bank accounts and for the whole period between January 2006 and December 2010 we have 95.76995% of our observations. Looking at the graph below it becomes apparent that section 6 has

experienced a cash inflow from 2006 to 2010. This is surprising since this thesis only considers accounts opened before January 2006 and does not consider accounts that are opened between year 2006 and 2010. Due to that, an actual cash outflow is expected but actually not the case for Section 6.

Figure 6: Changes in Deposits Section 6
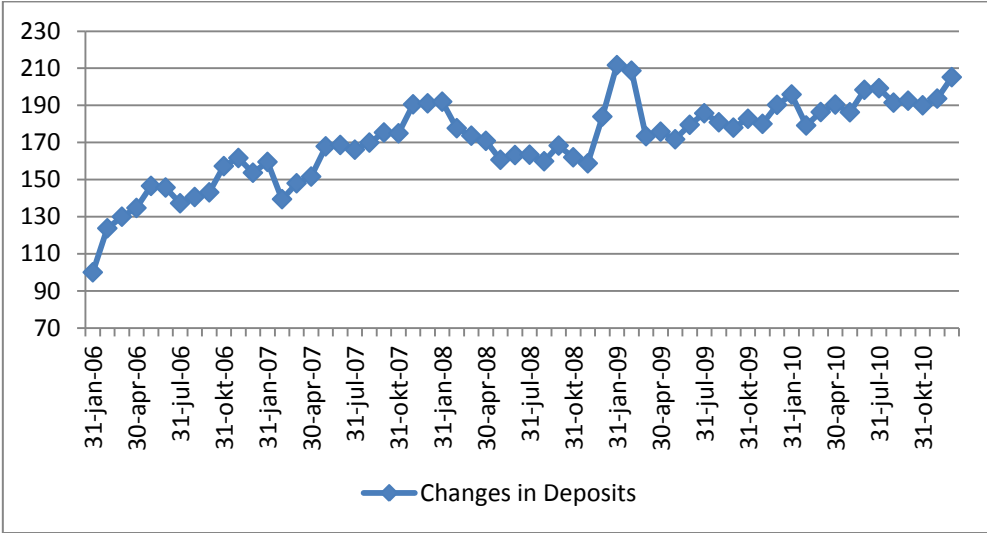
The graph below shows the realized cutoff rates. The average cutoff rate for this section actually shows an inflow of 1.42% with a standard deviation of 6.40% while the Swedish Financial Supervisory authority assigns a cutoff rate of 10% to this section. However, the threshold of 10% is surpassed in two months out of the possible 60 months. In February 2008, before our crisis period, the realized cutoff rate is 12.58% and in March 2009, during our period of crisis the cutoff rate is 16.91% which for February 2008 means 1.74 times the standard deviation and for March 2009 corresponds to 2.42 times the standard deviation.

Figure 7: Percentage changes Section 6
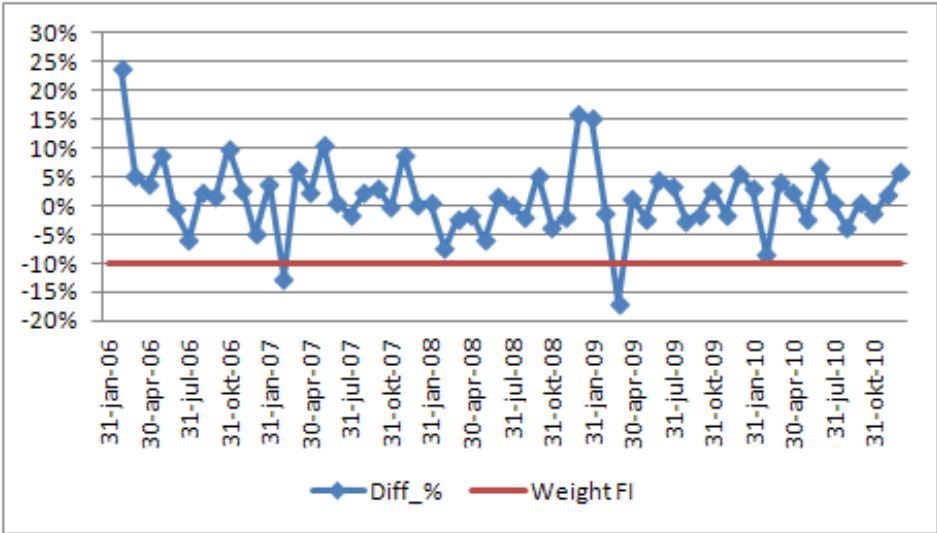
Since the proposed cutoff rate of 10% is surpassed by realized cutoff rates witnessed during the recent crisis we believe that the cutoff rate is set to low and should be increased in order to cover even higher value losses during times of stress.

5.2 Non-retail deposits

The next asset classes contains the non-retail deposits which are guaranteed, not guaranteed and with or without operational purposes. Overall 0.02715% of the unique deposits from our dataset fell into the different sections. As the balances for the non-retail deposits are all over one € 100,000, i.e. 925,030 SEK, this means that each account contains one amount that is guaranteed and one amount that is not guaranteed. The uninsured amount above this threshold goes into Sections 7 and 8 respectively. Again, for the purpose of our analysis we kept the classification constant, even if the deposit balance fell under SEK 925,030 at some point. In such a case the unguaranteed amount in Section 8 would fall to zero for the respective period and the amount guaranteed by the Swedish deposit scheme left would then remain in Section 7.

5.2.1 Section 7

Deposits covered by a deposit guarantee from non-retail customers fall into Section 7 and have a weight of 5% allocated to them. We placed all the guaranteed sums of SEK 925,030 or less into this category irrespective of if they were callable within 30 days or operational. 0.02715% of the deposits were in this section providing us with 0.02551% of the account balances for the time span between January 2006 and December 2010. The graph below shows the monthly sum for the accounts in Section 7.

Figure 8: Changes in Deposits Section 7

26
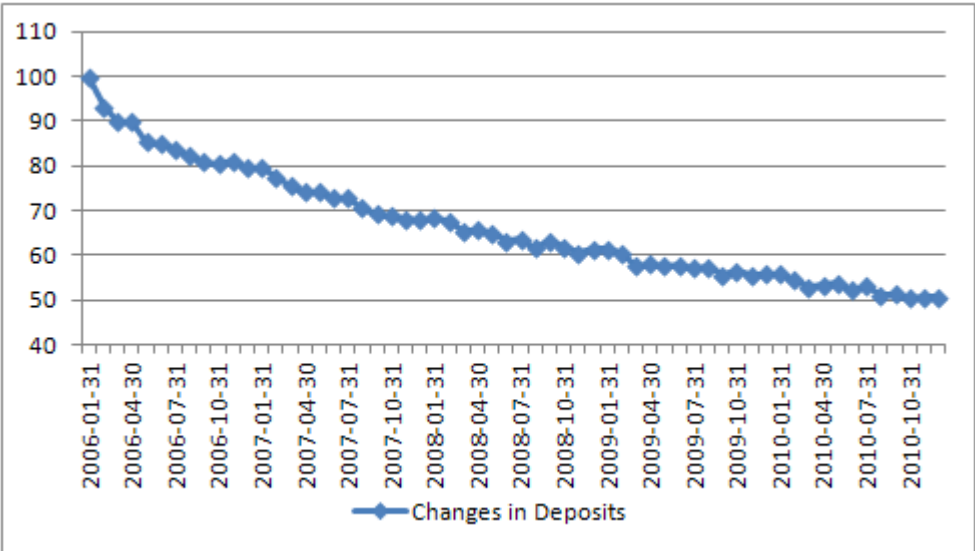
During the time between January 2006 and December 2010 the overall account balance in this category fell from 100 to 50.53.

Figure 9: Percentage changes Section 7
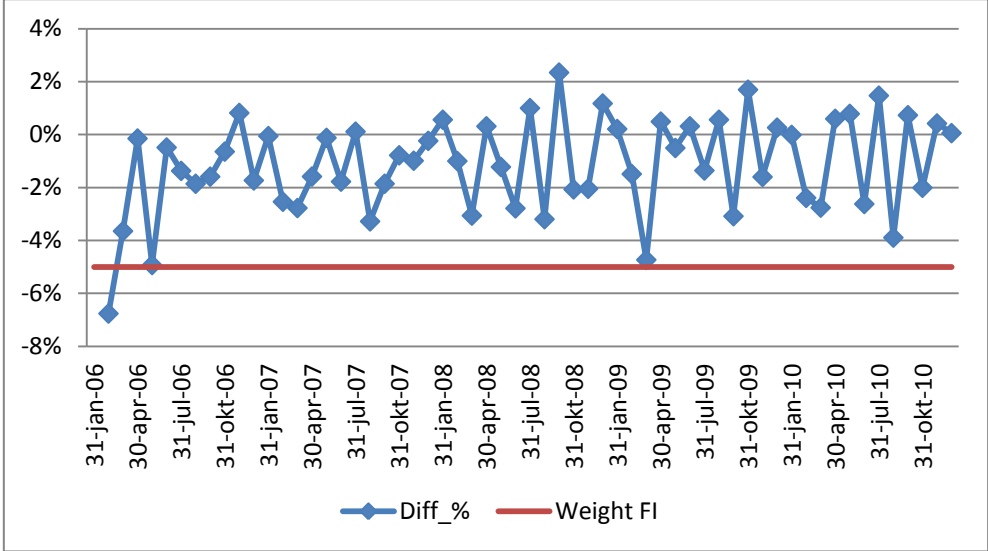
This average monthly change in this section is 1.13% with a standard deviation of 1.80%. Looking at the graph above, it is clear that the proposed cutoff rate of 5% is surpassed by the realized cutoff rates only in February 2006 where the realized cutoff rate reaches a level of 6.76%. We attribute this to internal changes made in the data base at XXXXX[6]. However, besides this all the other realized cutoff rates lie within the proposed cutoff rate, wherefore we can confirm that the weight allocated to this deposit class by The Swedish Financial Supervisory Authority was reasonable for XXXXX during our research period. The highest percentage change after February 2006 is 4.93% in May 2006.

5.2.2 Section 8 (without checking accounts)

Stable Deposits which are not guaranteed by the Swedish deposit guarantee and fulfill an operational purpose are collected in Section 8. As mentioned above, all the excess amounts over SEK 925,030 were placed into this section as it is this amount that is left unguaranteed. Hence, if an account balance falls below SEK 925,030 the amount in Section 8 becomes zero

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[6] According to a system administrator at XXXXX before 2006 there was an old version of the database which aggregated the data from various other systems. In 2005 however a project was launched in order to insure that the data base complies with the new rules of reporting to the Swedish Financial Supervisory Authority connected to the Basel implementation. A follow up project was launched in 2006 which build the database we used for our research study and which has led to a different aggregation of deposits in early 2006.

as the whole balance at the account is guaranteed and therefore not classified as section 8. It can never become negative. Due to the setup of this deposit class, stable deposits which are unsecured and with operational relationships, it includes 0.01180% of the unique deposit accounts and 0.01109% of the observations between January 2006 and December 2010. The Swedish Financial Authority assigns a cutoff rate of 25% to this class. The graph below shows the monthly sum for the accounts in Section 8 without check accounts.

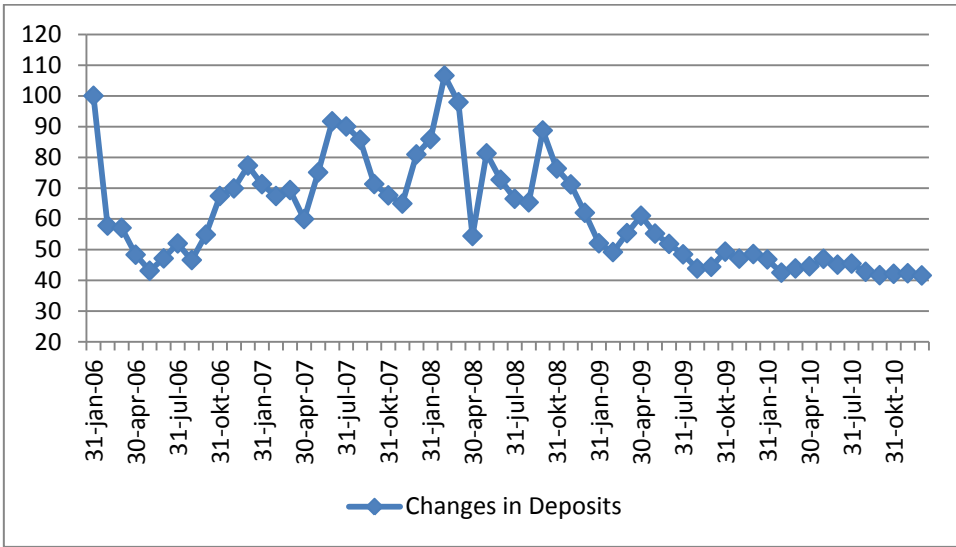**Figure 10: Changes in deposits Section 8 (without checking accounts)**

Figure 10 shows that there have been big changes in the deposit balances in the analyzed period starting at 100 in January 2006 and ending with 41.59 in December 2010. Again it is surprising to see cash inflows of large magnitude simply because the whole analysis is set up in a way to check for cash outflows. The graph below shows the percentage change and also the cutoff rate of 25% proposed by the Swedish Financial Authority.

Figure 11: Percentage changes Section 8 (without checking accounts)

28
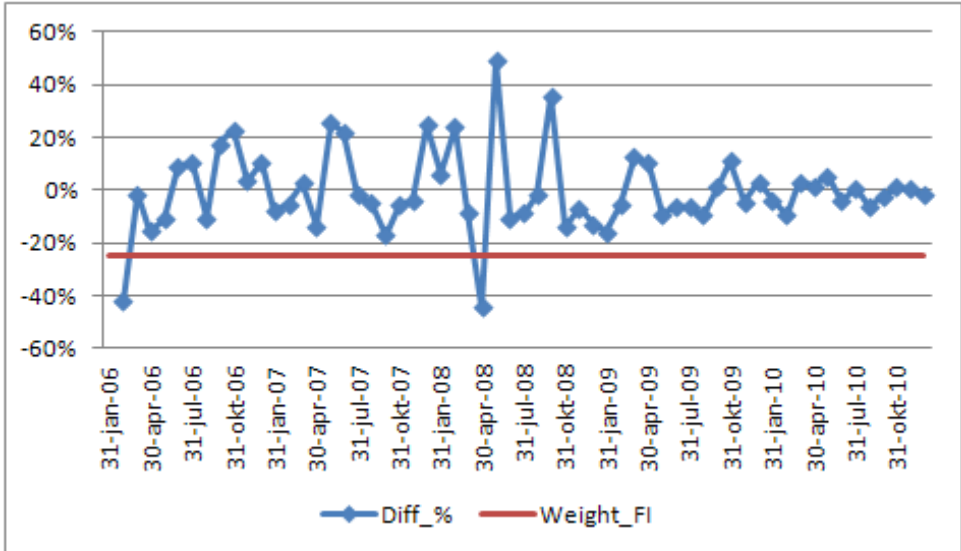
In February 2006 there was a change of 42.19% and in April 2008 there was a change of 44.42%. Just as in Section 7 we attribute the first outlier to internal changes made in the data base at XXXXX. Prior to the change of 44.42% in April 2008 this deposit class went down by 8.11% in March 2008. This coincides with the FED bailout of Bear Stearns and the subsequent sale to J.P. Morgan Chase in the mid of March 2008, the start of our period of crisis (Rose et al. 2011). The mean and standard deviation are -0.26% and 15.48% respectively. A cutoff rate of 42.19% realized in February 2006 and 44.42% realized in April 2008 imply cutoff rates of 2.7 and 2.9 times the standard deviation respectively. We believe that the fall in deposits in April 2008 indicates that the weight of 25% allocated to this category by The Swedish Financial Supervisory Authority is too small and should be at least at 44.42%, e.g. 45%. To put this into perspective, overall deposits at the 3 big Swedish banks increased in April 2008, indicating the unique behavior of holders of operational depositors.

Figure 12: Deposit changes of the three major Swedish banks April 2008
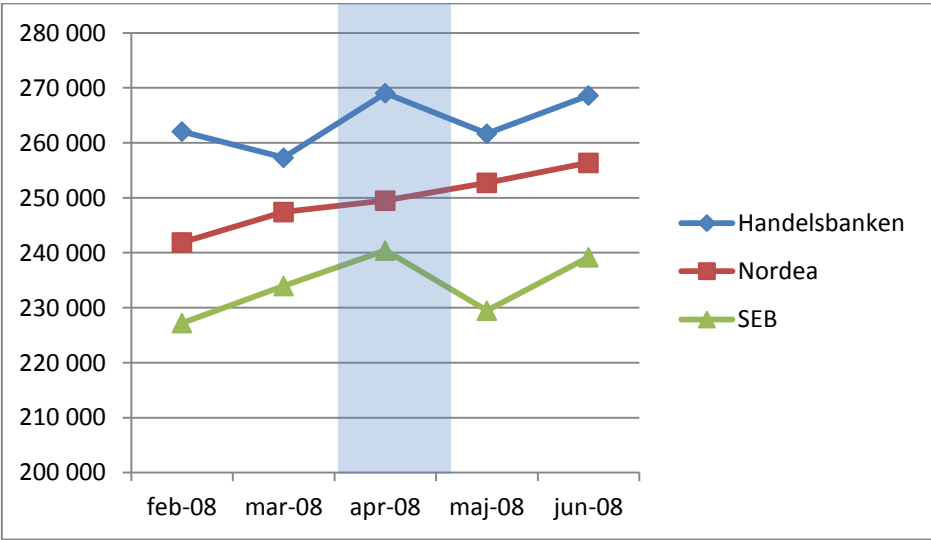
(Source: XXXXX External Relations)

5.2.3 Section 8 (with checking accounts)

Including checking accounts deposits results in Section 8 comprising 0.02271% of the accounts in January 2006 and 0.02136% of the overall deposit balances. The graph below shows the monthly sum for the accounts in Section 8 with checking accounts.

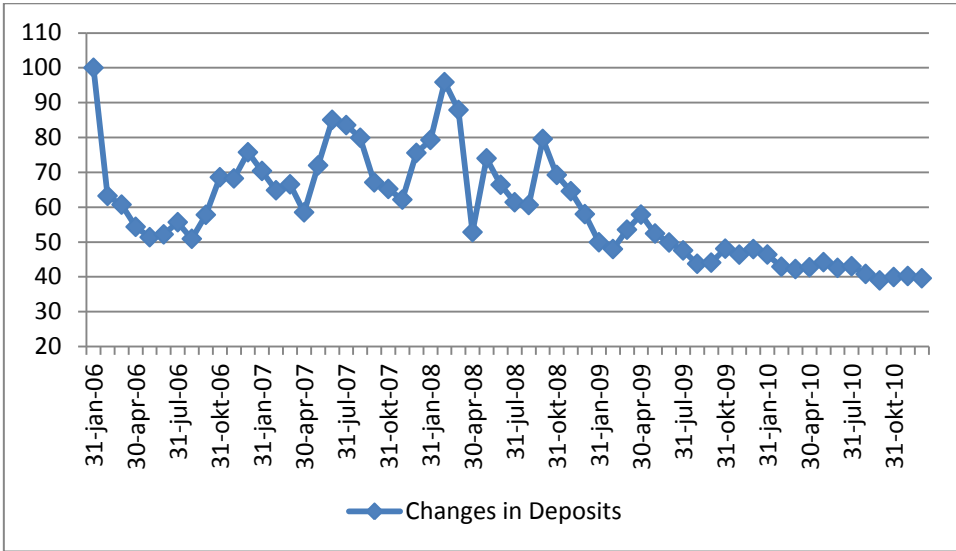**Figure 13: Changes in Deposits Section 8 (with checking accounts)**

Figure 13 illustrates that the sum of deposit balances in section 8 with the checking accounts in excess of SEK 925,030 moves very similar to the one without the checking accounts. It starts at 100 in January 2006, at slightly higher level than at the same time without the checking accounts, and ends at 39.59 in December 2010, at a slightly higher level again[7]. Overall however the deposits in this section behave very similar to the ones in Section 8 without checking accounts as they have a correlation of 99%.

Figure 14: Percentage changes Section 8 (with checking accounts)

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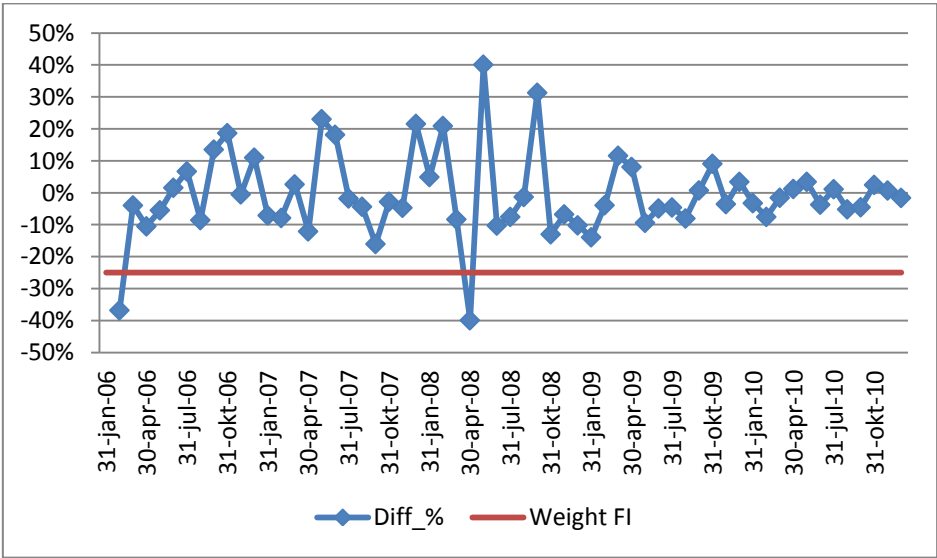
[7] Again, we are not allowed to present the absolute numbers for the section in both cases.

This time we find a change of 36.78% in February 2006 which we attribute the first outlier to internal changes made in the data base at XXXXX and a change of 39.89% in April 2008. The mean change is 0.67% and the standard deviation is 13.27%. Therefore in April 2008 we saw a change of 3 times the standard deviation.

Concluding due to the change of 39.89% in deposits in April 2008 we believe that the weight of 25% allocated to this category by the Swedish Financial Authority is not conservative enough. Taking the results without the check accounts into consideration as well the weight for Section 8 should be at least at 44.42% in order to cover both scenarios, e.g. 45%.

**5.2.4 Section 9 (without checking accounts)**

Section 9 is applicable to deposits and borrowings from non-financial customers which are not guaranteed by the Swedish deposit guarantee and not in the retail category, while section 10 is applicable to all other not guaranteed borrowings not reported under section 4-9, e.g. from other non-retail financial counterparties. The Swedish Financial Authority proposes a weight of 75% for deposits in Section 9 and 100% for deposits in Section 10. We classified all the uninsured excess amounts over SEK 925,030 which were non-operational as Section 9 deposits. There were 0.00443% of the different accounts in section 9 providing us with 0.00415% of the deposit balances for the time span between January 2006 and December 2010. As mentioned before no deposits in our dataset qualified to be classified as section 10. The graph below shows the monthly sum for the accounts in Section 9 without checking accounts.

Figure 15: Changes in Deposits Section 9 (without checking accounts)
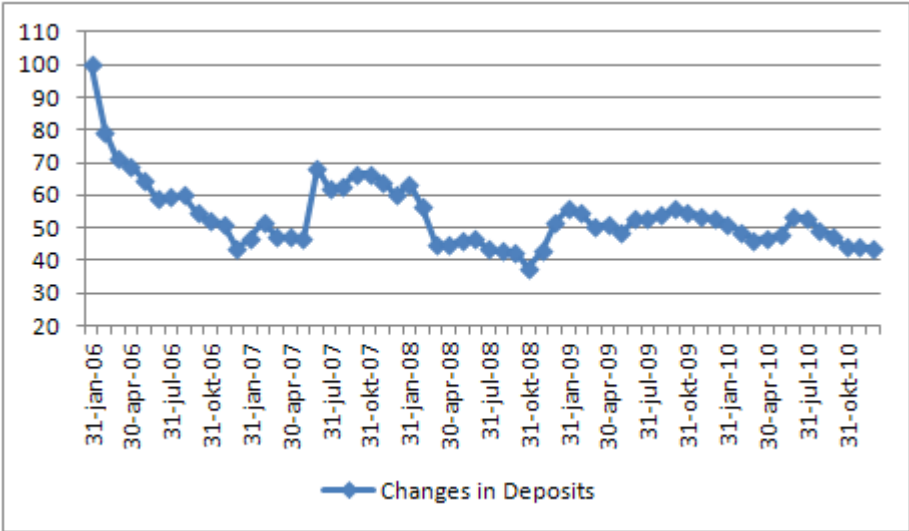
The sum of the non-operational account balances in excess of SEK 925,030 was 100 in January 2006 and went down to 43.91 in December 2010. The mean percentage change is 0.96% and the standard deviation is 9.68%.

**Figure 16: Percentage change Section 9 (without checking accounts)**
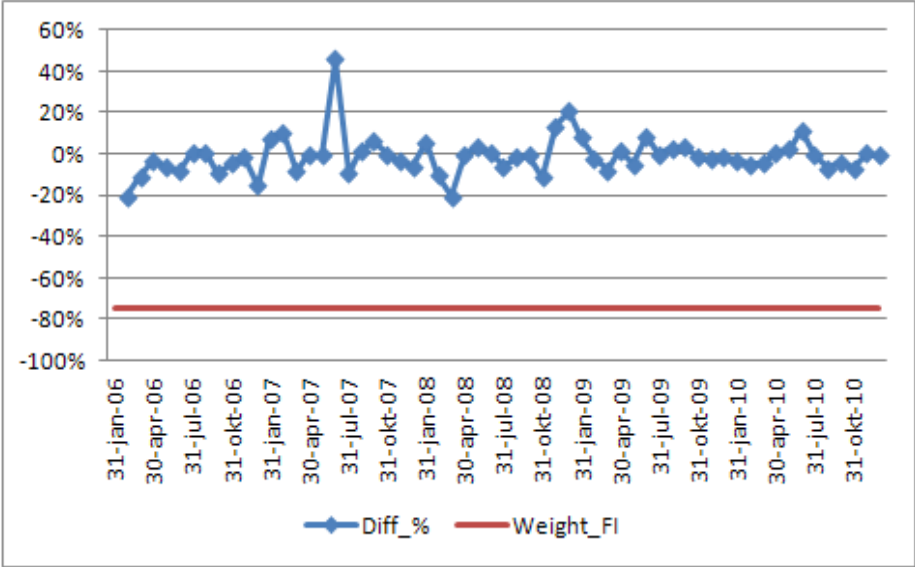
The proposed weight from Swedish Financial Supervisory Authority of 75% is not passed during the research period. We find the highest cutoff rates to be of 20.76% in March 2008 which marks a change of 2.1 times the standard deviation. Because of this we believe that a lower cutoff rate of at least 20.76% for deposits in this class during periods of stress could be applied.

### 5.2.5 Analysis Section 9 (with checking accounts)

0.01535% of the unique accounts are found in this class when the checking accounts are added to section 9, and overall 0.01442% of the observations in our data set. The graph below shows the monthly sum for the accounts in Section 9 with the check accounts.

Figure 17: Changes in Deposits Section 9 (with checking accounts)
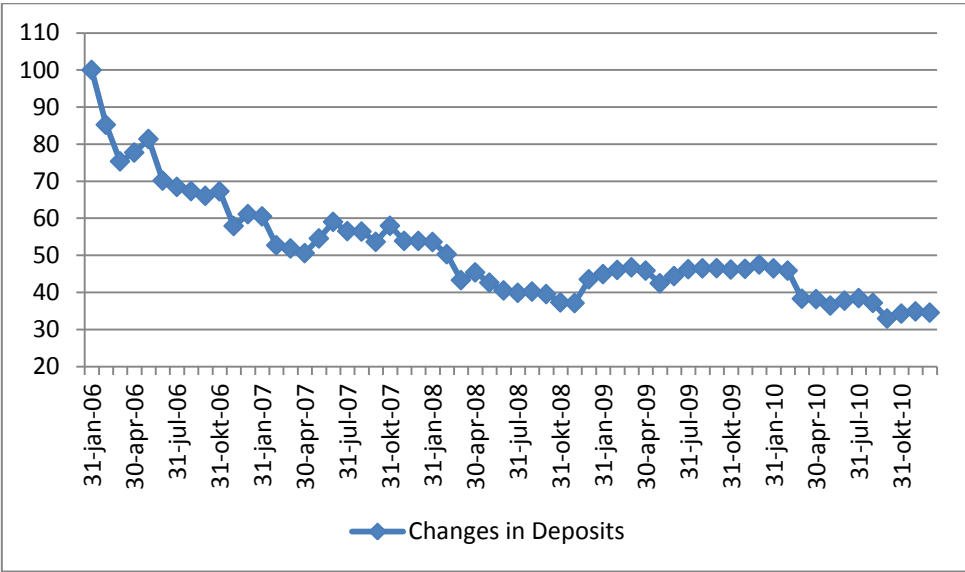
The sum of deposit balances allocated to this section was 100 in January 2006 and 34.54 in December 2010. The mean cutoff per period is 1.58% and the respective standard deviation 6.41%.The correlation between the movements of the deposits in Section 9 including the checking accounts and Section 9 excluding the checking accounts is 45%.

Figure 18: Percentage changes Section 9 (with checking accounts)
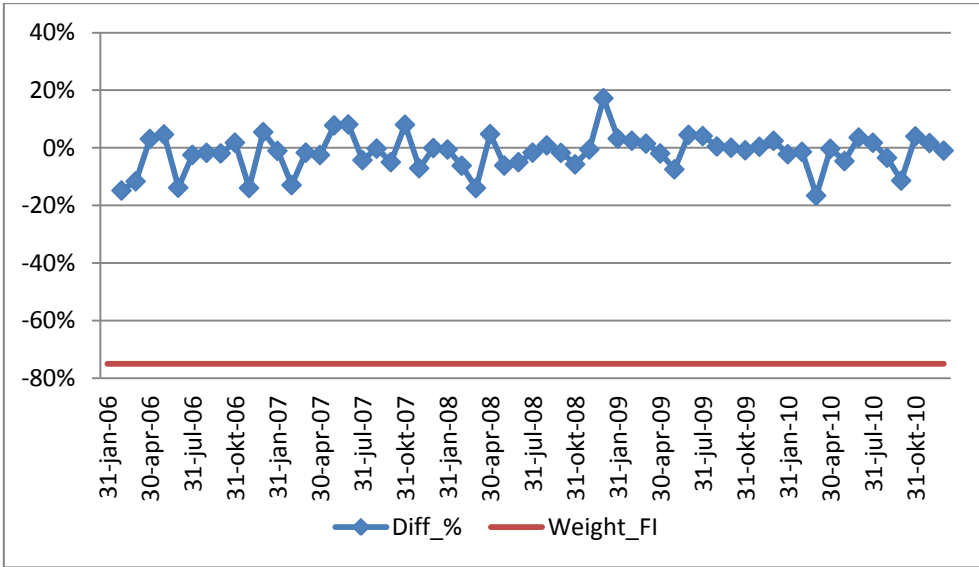
Adding the checking account deposits to Section 9 does not change the fact that the cutoff rate proposed by the Swedish Financial Authority is not surpassed on a single instance during our research period. The largest negative percentage change is of 16.53% in March 2010

which marks a change of 2.6 times the standard deviation. This confirms our earlier conclusion that the weights for this deposit class could be lowered.

5.3 The Watchovia Case

We can use the cutoff rates found by The Clearing House for Wachovia in order to benchmark our findings by comparing the sections with the same underlying classifications from the Basel regulation with each other. Non-financial operational deposits can be compared to Section 8 in our analysis. Whereas The Clearing House finds cutoff rates of 12.5% for these sections for the 30 day period of stress we find the maximum change in deposits of Section 8 without checking accounts to be 44.42%. We can also compare the cutoff rate of 25.4% The Clearing House finds for non-operational non-financial deposits to the highest negative change of 20.76% in our Section 9 without checking accounts. Finally our maximum negative change of 3.47% in Section 5 can be compared to the 0.8% in the whitepaper. This comparison underlines that the findings of our study cannot simply be reapplied for another bank in another financial market.

5.4 Correlation between the different sections

With different outflow rates for different classes of deposits it is important to also analyze the correlation between the different classes. Correlation specifies if two variables are related in a positive or inversely way, and to which degree the two variables move together.

If different classes of accounts and deposits move together this increases the possible risk during times of stress for XXXXX and other banks. However, if the different classes actually move in opposite directions this could reduce the stress for XXXXX or other banks due to diversification effects. The correlation matrix presents the correlation between the different classes of deposits.

Table 3: Correlation Matrix

Section	4	5	6	7	8 with CK	8 without CK	9 with CK	9 without CK
4	1	-0,08	0,08	-0,16	-0,01	0,00	-0,13	0,02
5	-0,08	1	0,27	0,17	-0,20	-0,19	0,16	0,44
6	0,08	0,27	1	0,06	-0,24	-0,26	0,14	0,06
7	-0,16	0,17	0,06	1	0,25	0,25	0,24	0,26
8 with CK	-0,01	-0,20	-0,24	0,25	1	0,99	0,12	0,10
8 without CK	0,00	-0,19	-0,26	0,25	0,99	1	0,03	0,10
9 with CK	-0,13	0,16	0,14	0,24	0,12	0,03	1	0,45
9 without CK	0,02	0,44	0,06	0,26	0,10	0,10	0,45	1

Except for the correlations between the Sections 8 and 9 with and without the check accounts, the highest correlation we find is of 44% between Section 5 and Section 9 excluding the checking accounts. The highest negative correlation of -26% is between Section 6 and Section 8 without checking accounts. These correlations should be taken into consideration when evaluating diversification strategies for different deposit classes and potential stress scenarios for the bank.

5.5 The bigger picture

Looking at the sums of the total household and non-financial deposits of the three largest Swedish banks based on total assets it becomes clear that Swedish banks experienced a cash inflow into their deposits during our research period (Real Banks 2012).

Figure 19: Deposit changes of the three major Swedish banks
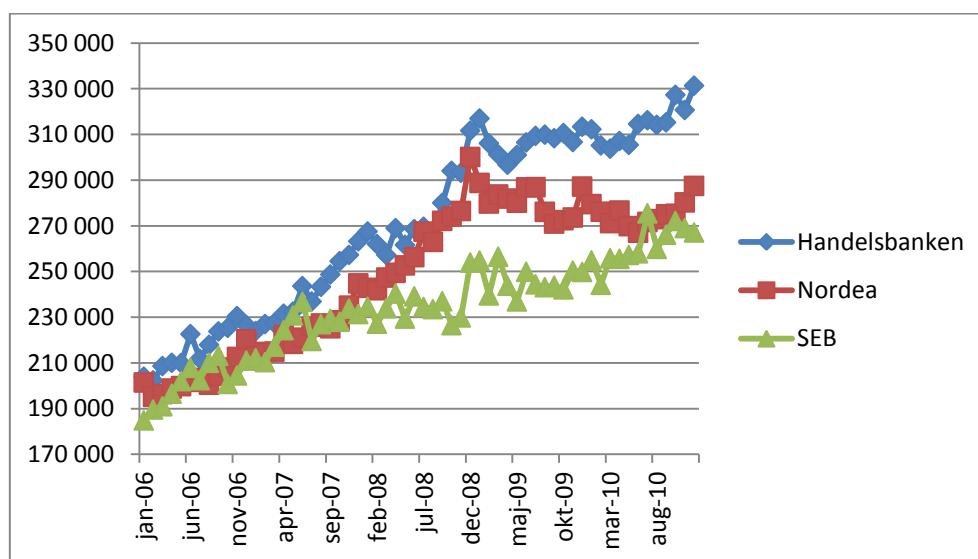
(Source: XXXXX Investor Relations)

Handelsbanken had household and non-financial deposits adding up to SEK 204,022 million in January 2006 and SEK 331,395 million in December 2010. Nordea started with deposits worth SEK 201,491 Million and ended with SEK 287,520 million and SEB with SEK 184,901 million and SEK 267,146 million during our research period. Therefore in terms of the sum of their deposits the three major Swedish banks are in a better position after the crisis than they were before it. This has to be taken into consideration when deductions based on our results for other banks or financial markets are made.

6. Conclusion

Liquidity risk, how it should be measured and how it should be managed have been in the spotlight ever since the recent global financial crisis. The Basel Committee proposed the Liquidity Coverage Ratio (LCR) as one way of making sure that banks have enough liquidity during periods of stress and the Swedish Financial Supervisory Authority has created regulations for Swedish banks on how to manage their liquidity. The research for this thesis has looked into how the LCR fits the profile of a large Swedish bank, XXXXX, by examining the proposed cutoff rates for the different deposit classes.

The deposit class that is considered the most stable by the Swedish Financial Supervisory Authority is Section 4, retail deposits which fall due after 30 calendar days. Section 4 is considered as so stable and secure that the weight proposed by the Swedish Financial Authority for this class is 0% which implies that these kinds of deposits are not subject to value loss during periods of stress. In our research we find that these deposits are very volatile and reach cutoff rates of up to 10% in our sample. According to our research the proposed cutoff of 0% therefore cannot be applied to XXXXX and should be set at least 9.94% in order to cover extreme cases witnessed during our research period.

Deposits found in Section 5 are deposits that are covered by the Swedish deposit guarantee scheme. For this section the cutoff rate of 5% proposed by the Swedish Financial Supervisory Authority matches the realized cutoff rates we find for the period between January 2006 and December 2010. The realized cutoff rates during the crisis are in fact lower than 5%, which leads us to conclude that the cutoff rate for deposits in Section 5 could in fact be set at a lower level for XXXXX.

Section 6 contains the amounts surpassing € 100,000, i.e. deposits that are left unguaranteed. The Swedish Financial Supervisory Authority has proposed a cutoff rate of 10% for this section, which is surpassed in two months during our research period between 2006 and 2010. The proposed cutoff rate of 10% is therefore not ideal and should instead be set at least -16.91% in order to cover all the extreme cases we find in our study.

Section 7 contains deposits which are non-retail and covered by a deposit guarantee. As for Section 5, these deposits have a cutoff rate of 5%. For this section the proposed cutoff rate matched the realized cutoff rates and the proposed cutoff rate was never surpassed during the months between 2006 and 2010. We therefore conclude that the proposed cutoff rate accurately resembles the ones we find during periods of stress for Section 7.

We analyzed Section 8 and 9 twice, due to the fact that the checking accounts could either be classified as operational or none-operational. The cutoff rates for Section 8, which contains deposits that have operational purposes and excluding checking accounts in our first step results in cutoff rates that are noticeably higher than the cutoff rates in the other sections. The monthly cutoff rates between January 2006 and December 2010 are below the proposed weight of 25% in all months except April 2008, where they increase to a level of 44%. Although the proposed cutoff rate matches the realized cutoff rates in all months except for one, we still conclude that the cutoff rate should be increased to at least 44.42% in order to cover all possible events seen between 2006 and 2010 for XXXXX. Including the checking accounts in Section 8 does not change the results significantly. The highest cutoff rate seen during our research period is still in April 2008, which however is lowered when the checking accounts are added to the section to a level of 39.89%. The proposed cutoff rate of 25% should therefore also be increased in this case to a percentage of at least 38.89%.

Section 9 shows cutoff rates that are actually considerably lower than the proposed cutoff rate of 75%. The highest cutoff rate of 20.76% is realized in March 2008. Due to the fact that the difference between the realized cutoff rates and the proposed cutoff rates is so large we conclude that the cutoff rate set for this section should be lowered to around 21% in order to accurately match the outflow in this deposit class for XXXXX.

Including the checking accounts in this section does not change the cutoff rates in a noticeable way. The proposed cutoff rate is still much higher than the realized cutoff rate which makes us hold on to our conclusion that the cutoff rate can be lowered for these kinds of deposits.

As seen in the results presented, the proposed cutoff rates match the real cutoff rates to various extents. The fit is not perfect, and in order to decrease the liquidity risk during periods of stress, the cutoff rates should be increased in 3 cases and decreased in one case. The correct way to solve the problem with cutoff rates not perfectly matching the real cutoff rates could be considered, however. In this thesis we have evaluated the proposed cutoff rate by comparing them to the highest cutoff rate seen for the different sections between the years of 2006 and 2010. The proposed cutoff rates can of course be evaluated in a different way, one example is comparing the proposed cutoff rate with the average cutoff rate. A whole different approach to the problem of ensuring accurate liquidity coverage could be to try to find an entirely new way of regulating liquidity for banks. As the criticism towards the liquidity risk measurements have been loud from the beginning, it might be important to look into other possible solutions how to regulate liquidity risk. Finally, the comparison to the cutoff rates of the deposits at Wachovia Bank during the financial crisis of 2008 underlines that the cutoff rates for XXXXX do not necessarily resemble the cutoff rates another bank might experience in a different setting.

6.1 Suggestions for further research

Although the data provided by XXXXX was large and very informative, it only captures the years from 2004 to date. This means that this thesis only covers the effects of the latest crisis and it thus does not take earlier crises into consideration. The results are derived from the recent crisis and, therefore, one suggestion for further research is to expand the research to include an earlier crisis period. This would make it possible to look at similarities and differences for the cutoff rates between different crises and therefore gain a deeper understanding of how different crises have led to different value losses for XXXXX.

Since this thesis only investigates the case of XXXXX, it would be valuable to conduct further research on the other Swedish banks. This would make it possible to see how different banks are affected by periods of stress and could help to evaluate the criticism

that all banks are treated equally without consideration their individual risk profile or their business model. In the same way, further research could also be conducted on banks abroad in order to gain a deeper insight in how cut-off rates differ between countries.

Also, as mentioned in the limitations of this study, this thesis only looks into a sub-sample of the different sections stated by the Swedish Financial Supervisory Authority. It does not cover all possible deposits, for example swaps. One extension to the study conducted in this paper is to look at the cut-off rates for the deposits that are not covered in this paper. This would lead to a wider understanding of all the deposits available at the bank.

In the same way as stated above, further research could also be conducted on the inflow rates. This thesis only covers the cut-off rates, which are just as important to a bank's liquidity as the inflow rates. The inflow rates are the outstanding balances of contractual receivables times the percentage that these receivables are expected to flow into the bank. The inflow rates are as important to the LCR as the outflow rates which suggest that further research could be conducted on these rates as well.

Last but not least, the Net Stable Funding Ratio is the second liquidity risk measurement that Basel III has proposed in order to manage liquidity risk. The assumptions of this measurement could also be evaluated in the same way as this thesis has investigated the LCR in order to grasp the full picture of the feasibility of the underlying assumptions of the Basel III liquidity risk measurements.

List of References

Australian Prudential Regulation Authority (2011). Available:
http://www.apra.gov.au/adi/Documents/ADI_DP_IBLR_November_2011.pdf. Last accessed
21st March 2013

Bank for International Settlement. *About the Basel Committee* (2013). Available:
http://www.bis.org/bcbs/about.htm. Last accessed 15th April 2013.

Banks for International Settlements (2013). Available:
http://www.bis.org/press/p130106.htm. Last accessed 15th April 2013.

Banks for International Settlements (2013). Available: http://www.bis.org/publ/bcbs238.pdf.
Last accessed 24th April 2013.

Bank of England (2012) *Speech given by Sir Mervyn King, Governor of the Bank of England At
the Lord Mayor's Banquet for Bankers and Merchants of the City of London at the Mansion
House 14 June 2012.* Available:
http://www.bankofengland.co.uk/publications/Documents/speeches/2012/speech587.pdf.
Last accessed: 5th May 2013.

Banque de France (2011). Available: http://www.banque-
france.fr/fileadmin/user_upload/banque_de_france/publications/Revue_de_la_stabilite_fin
anciere/rsf_0208.pdf#page=49. Last accessed 5th April 2013.

Basel (2010), *Basel III: International framework for liquidity risk measurement, standards and
monitoring.December 2010 ISBN print: 92-9131-860-4, p.4*.

Baxter, P. Jack, S. (2008). *Qualitative Case Study Methodology: Study Design and
Implementation for Novice Researchers.* Available: http://www.nova.edu/ssss/QR/QR13-
4/baxter.pdf. Last accessed: 21th February 2013.

Eisenschmidt, J., Tapking, J. (2009). *Liquidity risk premia in unsecured interbank money
markets.* Available: http://www.ecb.int/pub/pdf/scpwps/ecbwp1025.pdf. Last accessed 2nd
May 2013.

European Commission (2010), *Commission proposes package to boost consumer protection
and confidence in financial services.* Reference: IP/10/918, European Union.

Financial Times (2009), *Bank watch as Sweden goes negative.*
http://www.ft.com/intl/cms/s/0/5d3f0692-9334-11de-b146-
00144feabdc0.html#axzz2T9rw4Orz. Last accessed: 13th May 2013.

Finansinspektionen (2012) *FFFS 2012:6.* Available:
http://www.fi.se/upload/90_English/30_Regulations/1_Regulatory%20code/2012/fs1206_e
ng.pdf. Last accessed 19th March 2013.

Finansinspektionen (2012 I) *Vårt uppdrag*. Available: http://www.fi.se/Om-FI/Vart-uppdrag/. Last accessed: 17th April 2013.

Finansinspektionen (2013) *Föreskrifter om krav på likviditetstäckningsgrad och rapportering av likvida tillgångar och kassaflöden.* Available: http://www.fi.se/Regler/FIs-forfattningar/Samtliga-forfattningar/20126/. Last accessed: 19th April 2013.

Greenbaum, S., Thakor, A. (2007) *Contemporary Financial Intermediation.* 2nd edition, Burlington: Academic Press.

Hakkio, C., Keeton, W. (2009). *Financial Stress: What is It, How Can It Be Measured, and Why Does It Matter?* Available: http://www.kansascityfed.com/Publicat/EconRev/PDF/09q2hakkio_keeton.pdf. Last accessed: 3rd April 2013.

Investing Answers (2013), *TED Spread*. http://www.investinganswers.com/financial-dictionary/world-markets/ted-spread-2205. Last accessed: 10th May 2013.

Johansson, R. (2003). *Case Study Methodology.* Available: http://www.infra.kth.se/BBA/IAPS%20PDF/paper%20Rolf%20Johansson%20ver%202.pdf. Last accessed: 15th February 2013.

Krishnamurthy, A. (2010). *How Debt Markets Have Malfunctioned in the Crisis.* Available: http://faculty.chicagobooth.edu/john.cochrane/teaching/35150_advanced_investments/Krishnamurthy_debtmarkets.pdf. Last accessed 3rd May 2013.

Michigan State University (2013), *Sweden: Economy.* https://globaledge.msu.edu/countries/sweden/economy. Last accessed: 13th May 2013.

Real Banks (2012), *Banks in Sweden.* http://www.relbanks.com/europe/sweden. Last accessed: 14th May 2013.

Regeringskansliet (2011), *The 2008 financial crisis - a summary of government* measures. http://www.government.se/sb/d/15390/a/180397. Last accessed: 13th of May 2013.

Riksgälden (2013), *Insättningsgarantin.* https://www.riksgalden.se/sv/Insattningsgarantin/Om_Insattningsgarantin/. Last accessed: 13th of May 2013.

Rochet, J.-C.Tirole, J. (1996) *Interbank Lending and Systematic Risk.* Journal of Money, Credit and banking Vol. 28 No.4, p. 5

Rose, Clayton S., Daniel Baird Bergstresser, and David Lane. *The Tip of the Iceberg: JP Morgan Chase and Bear Stearns (A).* Harvard Business School Case 309-001, November 2011. (Revised from original January 2009 version.)

Schmitz, S. (2012). *The liquidity coverage ratio under siege .* Available: http://www.voxeu.org/article/neglected-part-international-financial-reform-liquidity-regulation. Last accessed 3rd May 2013.

Strahan, P. (2012). *Liquidity Risk and Credit in the Financial Crisis.* Available: http://www.frbsf.org/publications/economics/letter/2012/el2012-15.html. Last accessed 27th April 2013.

Sveriges Riksbank (2011). Available: http://www.riksbank.se/sv/Finansiell-stabilitet/Aktuella-regleringsforandringar/Den-nya-bankregleringen-Basel-III/. Last accessed 10th April 2013.

Sveriges Riksbank (2011) Available: http://www.riksbank.se/en/Press-and-published/Press/Press-Releases/2011/New-capital-requirements-for-Swedish-banks/. Last accessed: 10th April 2013.

Sveriges Riksbank (2011). Available: http://www.riksbank.se/en/Press-and-published/Press/Press-Releases/2011/New-capital-requirements-for-Swedish-banks/. Last accessed: 3rd April 2013.

The Clearing House (2011), *The Basel III Liquidity Framework: Impacts and Recommendations.* http://www.theclearinghouse.org/index.html?f=073043. Last accessed: 14th May 2013.

The Conversation (2013). Available: http://theconversation.com/by-watering-down-liquidity-requirements-basel-iii-remains-a-banks-best-friend-11570. Last accessed 30th April 2013

The Local (2012), *Why Sweden has had a good crisis.*
http://www.thelocal.se/39446/20120302/#.UY9rmaIyYSE. Last accessed: 13th May 2013.

Washington Post (2011), *Five economic lessons from Sweden, the rock star of the recovery.*
http://articles.washingtonpost.com/2011-06-24/business/35236039_1_financial-crisis-budget-surplus-budget-deficit. Last accessed: 13th May 2013.