# GRA 19703

Master Thesis

How did banks´ reliance on short-term funding affect their performance during the 2008 financial crisis?

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# BI Norwegian Business School

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*How did banks´ reliance on short-term funding affect their performance during the 2008 financial crisis?*

## Supervisor

Professor Charlotte Østergaard

## Study Programme

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**Abstract**

This thesis investigates the relationship between short-term funding and bank performance during the 2008 financial crisis. The research is conducted by running cross-sectional regressions on the 50 largest banks in the world for the three time periods of 2006, 2007-2008 and 2007-2009. The regressions expand as the analysis is conducted, first to see if short-term funding is significant for the different time periods and further to measure whether other variables had an effect. The first analysis shows that banks with a high reliance on short-term funding prior to the crisis performed worse during the crisis. When testing for the effect of leverage, i.e. total debt, there is evidence that it was leverage rather than short-term funding seen in isolation that had an effect on bank performance during the financial crisis.

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## 1. Introduction

The financial turmoil that originated from the burst in the housing bubble in 2007 created the worst financial crisis in the US since the Great Depression. The crisis led to a contraction of liquidity in the banking sector and threatened the solvency of large financial institutions across the world. In the run-up to the crisis, banks expanded their balance sheets by using short-term financing to fund longer-term assets. This expansion, as well as their total debt burden, became key determinants to the systemic risk and contagion effect of the financial crisis (Vazquez & Federico, 2015). To shed further light on these issues, this paper investigates the relationship between short-term funding (STF) and stock return during the financial crisis in 2007-2008. The aim is to analyze whether higher reliance on STF had a negative effect on bank performance as measured by stock return.

Previous work finds that exposure to subprime lending was one of the key factors determining the performance of banks following the collapse of the financial markets. At the same time, banks relied heavily on short-term interbank lending and it is therefore interesting to see to what degree this funding affected banks' performance when liquidity suddenly dried up. Previous research on the financial crisis focuses on other contributing factors such as bank regulation, liquidity, the role of the interbank market, risk management failure and the effect of the crisis as a global phenomenon. The amount of empirical work on the effect of STF is in that sense quite limited, and due to this, it is the main variable of interest in this research paper. Banks' operations have a great impact on the financial condition of an economy, and the health of the banking system is in that sense an important indicator of the economy's performance (Arif & Anees, 2012). This analysis could be a potential indicator of which types of funding banks should avoid or pursue in the future in order to prevent financial distress or perhaps even a new crisis in the economy.

Due to the volatility of the financial markets and the risky nature of STF, it is expected that banks who relied on this type of funding before the crisis performed worse during the crisis. This is in accordance with the result of the analysis where STF is seen in isolation, which shows that STF had a significant effect on bank performance during the peak of the crisis. Following this, an alternative measure is applied, including leverage as an explanatory variable in the analysis. This changes

the original results, and STF no longer has explanatory power on bank performance. The analysis does, in fact, show that leverage is significant, meaning it was leverage rather than STF that affected bank performance during the mid-period of the crisis. This is indeed the main result of this thesis, and a further discussion of the results will follow.

This thesis has several sub-divisions. The second section will exhibit the problem formulation stating the research question and the hypothesis, as well as a brief outline of the methodology. The third section will present the necessary background information in order to get an understanding of the topic. Further, the model and data that will be used for the analysis will be portrayed in section four. After running the regressions, the results will be presented and discussed in section five, along with some additional analysis. The limitations of this research will be portrayed in section six. Finally, the topic will be concluded in section seven.

## 2. Problem Formulation and Hypothesis

The topic introduced above implies the following primary research question:

*How did banks' reliance on short-term funding affect their performance during the 2008 financial crisis?*

Based on this research question, the following hypothesis is tested:

$H_0$: *Reliance on short − term funding did not have a negative effect on bank performance*

$H_A$: *Reliance on short − term funding did have a negative effect on bank performance*

In order to test this hypothesis, data on the 50 largest banks in the world based on market capitalization as of January 2006 are examined. The data is analyzed for the three periods of 2006, 2007-2008 and 2007-2009, pre-crisis, mid-crisis, and post-crisis respectively. With a set of control variables, the effect STF had on the banks' buy-and-hold stock return is measured by running cross-sectional regressions on the three periods. The analysis is conducted in order to see whether banks with higher reliance on STF were more likely to perform poorly during the crisis. After

undertaking these regressions, the market-to-book ratio (MTB) is included as an additional explanatory variable, in order to test whether it changes the significance of the STF coefficient and in that respect accounts for the risk incorporated in this funding form. Following this analysis, an alternative measure is applied by running additional regressions on the respective time periods including leverage as an explanatory variable. This is done in order to see if it changes the significance of the STF and whether leverage accounted for the liquidity risk incorporated in the STF.

Due to the complexity and magnitude of financial markets, restrictions must be made. As the paper aims to look at the top 50 financial institutions worldwide, these are more likely to be located in advanced markets rather than emerging markets. Due to this, the sample may lack global representation. Further, considering the number of factors argued to have contributed to the crisis, certain aspects of the theory will be omitted, bearing in mind that the reliance on STF is the main variable of interest. Further limitations of the analysis are discussed at the end of the thesis.

## 3. Background Information

In order to understand the financial conditions leading up to the crisis, there are several aspects that need to be considered. The US was experiencing a low interest rate in the period between 2000 and 2004 (Brunnermeier, 2009). This was both because of a slack interest rate policy from the Federal Reserve, as well as large capital inflows from abroad, especially from China and petroleum exporters such as Saudi Arabia (Reinhart & Rogoff, 2008). US securities were bought by China and other Asian countries in order to peg the exchange rate and to hedge against depreciation of the local currency against the dollar (Brunnermeier, 2009).

After the dotcom crisis at the beginning of the 2000s, the Federal Reserve was afraid of a deflationary period and kept the interest rate at a low level. At the same point in time, there was a significant transformation in the traditional banking sector. Banks repackaged loans and mortgages, pooled, tranched and resold these further via securitization (Brunnermeier, 2009). This was the origin of the structured asset-backed securities, such as mortgage-backed securities, collateralized debt obligations, and credit default swaps. These structured products received AAA-

ratings by the rating agencies, without conducting any background check of the actual underlying assets (Schwartz, 2008). A number of these securitized products were sold through Special Purpose Vehicles (SPVs) that operated as off-balance sheet entities. The banks used the SPVs in an attempt to isolate themselves from the risk associated with the structured products, something which also reduced transparency for the investors (PricewaterhouseCoopers, 2011). Securitization generated large capital inflows to the US from abroad, as well as it grew to a significantly large market within the US. This was a time of increasing housing prices, at the same time as it became easy to borrow money. People could borrow money without any documentation, income, job or collateral (Dodd & Mill, 2008). These loans were known as subprime. Brokers were offering these loans at so-called teaser rates, which meant that the mortgages were considerably more expensive over the long-term than borrowers might initially have anticipated (Docking, 2012). With the expectation of increasing housing prices and the belief that the value of the houses would cover the mortgages, background checks of the borrowers were not a requirement (Schwartz, 2008). The significant increase in the issuance of the securitized products increased the liquidity risk in the financial sector substantially (Schwartz, 2008). However, at that time it was considered a good investment by the investors, and the banks continued issuing them.

From 2004 to 2006, with concerns about inflation growing, the Federal Reserve increased the interest rate substantially (Taylor, 2009). This implied that several borrowers were no longer able to pay interest on their mortgages. By the time people realized the riskiness of the securitized products, subprime lending had increased significantly, and the number of defaulting mortgages were growing at an alarming rate (Schwartz, 2008). Simultaneously, housing prices fell. Subprime lending started decreasing by the end of 2006, and by 2008 it had disappeared, along with the market for structured finance, which had collapsed (Kahle & Stulz, 2013). When the crisis first hit in August 2007, most banks had large exposures to these structured products and carried large amounts of risk (Lang & Jagtiani, 2010). The banks were eventually not able to cover their positions, as the borrowers failed to repay their debt, and houses supposed to cover the mortgages were almost worthless (Schwartz, 2008).

Figure 1 shows the fluctuations of the US short-term interest rate from the beginning of the 1990s through the period of the financial crises in the 2000s. After the increase mentioned earlier, there was a substantial decline in the Federal Funds Rate after the subprime market plunged in 2007. This was due to an expansionary monetary policy implemented by the US government in an attempt to stimulate the economy (Mishkin, 2009).
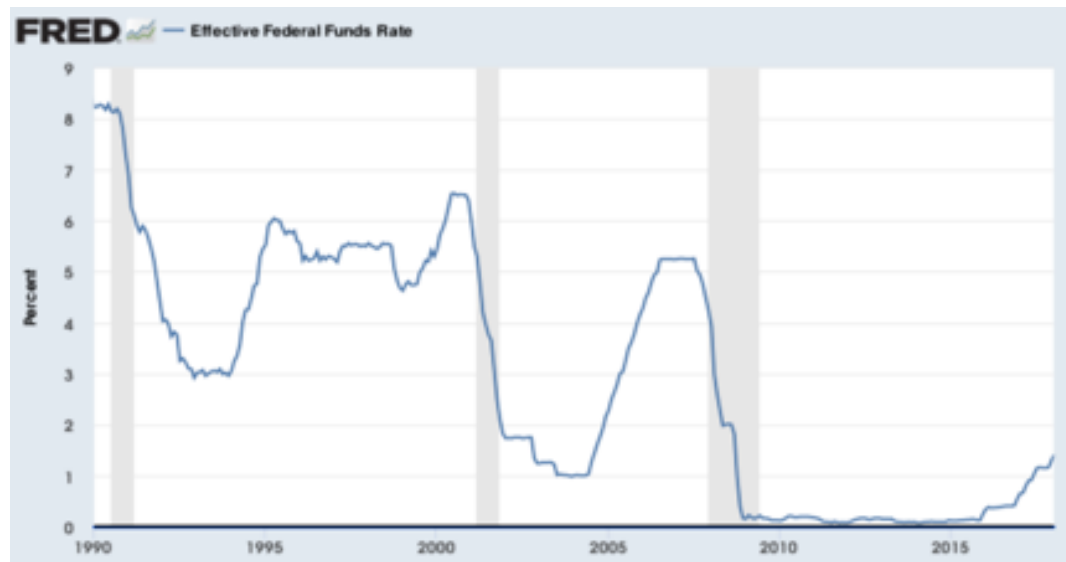


**Figure 1** shows the US short-term interest rate from 1990´s to 2015.
Source: Federal Reserve Bank of St. Louis

By 2008, players in the financial markets were struggling. This caused the default of Bear Stearns in March 2008, which was eventually bailed out by an agreement between the government and JP Morgan (Mishkin, 2011). When the financial turmoil hit Lehman Brothers, it was believed that the investment bank was "too big to fail", and that it would be bailed out by the government in order to prevent the potential repercussions. However, the speculations were contradicted as the government did not intervene, and the bank went bankrupt on September 15, 2008 (Moosa, 2010). Due to their heavy involvement in subprime lending and origination of structured products, there was a significant amount of counterparty risk involved for institutions buying these products (Helleiner, 2011). This almost caused the collapse of the entire financial system, which had a significant impact on markets throughout the world (Deutsche Bank, 2008). The bankruptcy of Lehman Brothers still remains one of the largest in US history (Hynes & Walt, 2010). During the same time period, Washington Mutual was acquired by JP Morgan and Merrill Lynch by Bank of America (Moosa, 2010). Other institutions such as AIG, Fannie

Mae and Freddie Mac were bailed out by the government in order to avoid any further damage to the financial system (Ivashina & Scharfstein, 2010).

The volatility in the market was exceptional, markets were illiquid, and hedging strategies became inefficient (Deutsche Bank, 2008). This was due to the fact that the value of the securitized products plummeted, and banks experienced a significant decrease in market demand (Kahle & Stulz, 2013). Banks were no longer able to sell these products at the same rate as earlier and were experiencing critical liquidity issues, which then again lead to heavy losses (Brunnermeier, 2009; Kahle & Stulz, 2013). Further, banks were using these short-term instruments to fund their long-term asset positions, as these deposits could be drawn at short notice for funding purposes. This maturity mismatch exposed the banks to funding liquidity risk, and as the demand for these asset-backed securities declined, banks were no longer able to roll over their short-term debt (Brunnermeier, 2009; Ivashina & Scharfstein, 2010). This further led to a significant increase in the interbank- and corporate cost of borrowing (Ivashina & Scharfstein, 2010), which then distorted market prices and made it difficult to reduce individual risk exposure (Deutsche Bank, 2008).

The large ripple effects throughout the world are argued to be due to contagion, as several countries moved in a similar trend and were affected in a related manner during the crisis (Fauzi & Wahyudi, 2016). This was the result of some common exposure on the banks' balance sheet. The credit crisis in the US, the UK, and Europe had a considerable spillover effect globally (Nastase, Cretu & Stanef, 2009). The spread can be linked to the fact that both institutional and corporate investors in the eurozone were exposed to the asset-backed securities (Lane, 2012). As there were significant losses in the fragile banking sector, this spilled over to a number of European banks. Many banks became insolvent or experienced a liquidity crisis and had to be bailed out because of the potential repercussions in the economy (Nastase, Cretu & Stanef, 2009).

The first sign of a spillover effect in Europe came at the beginning of August 2007, when the French bank BNP Paribas suspended three of their investment vehicles investing in US subprime assets (Shin, 2009). On August 7, 2007, BNP Paribas stated that "The complete evaporation of liquidity in certain market segments of the

US securitisation market has made it impossible to value certain assets fairly regardless of their quality or credit rating" (BNP Paribas, 2007). By this time, liquidity was tightening in the European market, and many financial institutions struggled to renew their short-term funding (Shin, 2009). This was the case for the UK mortgage bank, Northern Rock, which was funded mainly through short-term debt from the interbank market. When the liquidity dried up at the beginning of August 2007, actors in the interbank market became reluctant to lend to banks that were heavily involved in the subprime market (Shin, 2009). This made it difficult for Northern Rock to roll over their short-term borrowings (Hull, 2015, p. 508). The lack of short-term funding supply led to a liquidity crisis, and the bank requested emergency liquidity support by the Bank of England in order to avoid bank failure. Northern Rock was eventually acquired by the British government at the beginning of 2008 and became the biggest casualty of the financial crisis in the UK (Hull, 2015, p. 508).

The crisis had asymmetric effects across Europe and depended on the initial condition and vulnerabilities of each country, as well as the amount of reliance on external short-term debt funding (Lane, 2012). Beltratti and Stulz (2012) argue that banks with reliance on short-term funding before the time of the crisis were expected to perform poorer during the crisis. The short-term funding transactions completely broke down in both emerging- and leading markets and led to a disruption in the global trade (Nastase, Cretu & Stanef, 2009). In order to prevent the crisis to the extent possible, central banks across Europe cut short-term interest rates, provided excess euro-denominated liquidity, and entered into currency swap agreements to get access to dollar-denominated liquidity (Lane, 2012). Still, the spillover to the eurozone ultimately led to the sovereign debt crisis that disrupted the economy across Europe, where several countries were unable to bail out highly leveraged banks or finance their own government debt (Lane, 2012).

## 4. Model

The data used in this analysis was obtained through Bloomberg and was collected on the 50 largest banks in the world ranked by market capitalization as of January 1, 2006 (Appendix 1). All the data is converted into USD. Only banks with sufficient data in all periods studied are included. This means that banks within the

top 50 that are missing data due to defaults or other factors are excluded and replaced with the next bank on the ranking. Further, considering the availability of data, non-listed banks are excluded as well.

Based on the data extracted, the modelling is comprised of cross-sectional components based on specific time periods of June 2007 to December 2008, June 2007 to December 2009 and from January to December 2006. The first regression for the period of mid 2007-2008 represents the highlights of the crisis. The second regression, from mid 2007 to 2009, captures the spillover effect into 2009. The third regression, for 2006, is included in order to look at the performance of the banks pre-crisis. As the data is split into their respective time periods, cross-sectional regressions are run in order to analyze the effect across the different banks in each specific period (Brooks, 2014, p. 526). In order to carry out the analysis, the statistical software Stata is used.

The dependent variable in the regressions represents the outcome from variations in the explanatory variables across time. As banks more profitable before the crisis were more likely to survive the recession, a profitability measure is applied. This is represented by the buy-and-hold stock return for each individual bank, as applied by Beltratti and Stulz (2012), and includes the dividends and return from the holding periods mentioned above. The different time intervals will be compared in order to capture any potential differences between the periods.

The prime regressor, which will be the variable of interest, is the reliance on STF. This variable is used as it is argued to have affected the funding abilities and fragility of firms (Beltratti & Stulz, 2012), which then again influenced bank performance during the financial crisis. The data on this indicator is accessed through "short-term borrowings and securities sold under repos" from the balance sheets in Bloomberg. This variable measure interest-bearing liabilities due within one year, and includes bank overdrafts, short-term debt, current repurchase agreements, short-term capital leases due to banks and financial institutions due within one year, federal funds purchased and securities sold but not yet purchased. The relative amount of funding held by each bank is measured by dividing the total short-term funding by total assets.

Further, different control variables are incorporated in order to generate a more thorough analysis and avoid having any omitted variables (Berger & Bouwman, 2013). The independent variables consist of liquidity, firm size and a dummy variable on the country of origin. Liquidity is included as it captures the ability to cover current liabilities. The indicator is measured based on the most liquid assets on the balance sheet, which is the amount of cash and marketable securities. This is divided by total assets in order to get the relative size of the variable. Further, the size of the banks is incorporated as it is expected that an increase in bank size is positively correlated with an increase in the probability of survival (Berger & Bouwman, 2013). It is also believed that larger firms' capital structure contains more debt as they have better access to credit markets (Fosberg, 2012). The size variable is measured by taking the natural log value of the total assets of each bank (Mirzaei, 2013). Lastly, a dummy variable on the banks' country of origin is incorporated, where "one" is the dummy for banks located in the US, while "zero" represents banks located elsewhere. This is included as banks across the world did not perform equally poorly (Beltratti & Stulz, 2012), and if one was located in the US this may have had an impact on bank performance. This results in the following regression equation:

$$BH_i = \alpha + \beta_1 STF_i + \beta_2 Liquidity_i + \beta_3 Size_i + \beta_4 D^{US} + \varepsilon_i$$

The control variables are not the variables of interest for the purpose of the research hypothesis but are included as these factors measure something else than the prime regressor. If the control variables are excluded from the regressions it will generate biased results (Berger & Bouwman, 2013). Due to this, the effect of these factors should be incorporated into the equation in order to properly measure the impact of the reliance on short-term funding.

In addition to the previously described regressions, supplemental regressions are run with the MTB as an additional explanatory variable. This is conducted to see if it changes the effect of STF. The MTB demonstrates the difference between the market value and the book value of the banks and reflects the amount of equity investors are willing to invest in the firm relative to its net value, giving an indication of the growth prospects of the banks. If financial markets understand that reliance on STF is a source of risk, the MTB may reflect the STF held by the banks.

Presuming that STF goes from significant to insignificant when incorporating MTB, then the markets' evaluation of the banks already incorporates the risk associated with this funding form. If it turns out that MTB does not account for this risk, the explanatory variable will not be included in the regressions going forward. The MTB variable is measured by dividing market value by book value. This results in the following regression equation:

$$BH_i = \alpha + \beta_1 STF_i + \beta_2 Liquidity_i + \beta_3 Size_i + \beta_4 D^{US} + \beta_5 MTB_i + \varepsilon_i$$

In addition to the regressions illustrated above, the amount of leverage held by each bank is incorporated in the analysis to test whether this affects the significance of the STF coefficient. This is conducted in order to test if leverage accounted for the liquidity risk that is integrated into the STF measure, which will be the case if the significance of STF changes when leverage is included. This will indicate whether STF did affect bank performance or if it was the overall leverage level that carried this effect, and it is therefore used as an alternative measure of funding. To conduct this, alternative regressions including leverage are run on the same time periods as mentioned above. The leverage variable is measured by dividing total debt by total assets. This results in the following regression equation:

$$BH_i = \alpha + \beta_1 STF_i + \beta_2 Liquidity_i + \beta_3 Size_i + \beta_4 D^{US} + \beta_5 Leverage_i + \varepsilon_i$$

## 5. Results and Discussion

The following section presents the results from the previously described regressions. This is further accompanied by a discussion and additional analysis of the results. Due to the small sample size, the significance of the results will be considered at the 10% level, making results with a confidence level at 5% and 1% more robust.

### 5.1 Primary Measure of Funding

This section describes the regression results when STF is seen in isolation and when MTB is included.

*Regression Results*

The first regression run on the buy-and-hold stock return from June 2007 to December 2008, result in STF being statistically significant at a 5% level (Table 1), meaning it does have explanatory power on bank performance. Following this result, the regression on the buy-and-hold stock return from June 2007 to December 2009 proves that the STF is significant at a 10% confidence level (Table 1). The regression run on the buy-and-hold stock return for 2006 shows that STF did not have significant explanatory power on bank performance during this period (Table 1).

**Table 1: Regressions on Buy-and-Hold Stock Return**

The table shows three cross-sectional regressions for the buy-and-hold stock return in 2006, June 2007 to December 2008 and June 2007 to December 2009. 2006 is defined as the pre-crisis period, 2007-2008 represents the climax of the crisis, while 2007-2009 captures the spillover effect into 2009. The sample includes the 50 largest banks in the world based on market capitalization as of 01.01.2006. All the data in the sample are extracted from Bloomberg. The dependent variable is the buy-and-hold stock return. The independent variables consist of short-term funding (STF), liquidity, firm size and a dummy variable on country origin. STF is the variable of interest and is measured by taking interest bearing liabilities due within one year divided by total assets. Liquidity consists of the most liquid assets on the balance sheet, cash and marketable securities, which is divided by total assets. Firm size is found by taking the natural log value of total assets for each bank. For the dummy variable on country origin, "one" represents the banks located in the US, while "zero" represents banks located elsewhere. All independent variables are measured at the beginning of the periods 2006, mid 2007-2008 and mid 2008-2009.

| Variables | 2006 Buy-and-Hold | 2007-2008 Buy-and-Hold | 2007-2009 Buy-and-Hold |
|---|---|---|---|
| STF | -0.179 | -0.465** | -0.479* |
| | (0.208) | (0.199) | (0.278) |
| Liquidity | 0.293 | -0.032 | 0.545 |
| | (0.350) | (0.356) | (0.497) |
| Size | 0.142*** | -0.052* | -0.050 |
| | (0.028) | (0.026) | (0.036) |
| 1.US | 0.002 | -0.039 | -0.105 |
| | (0.070) | (0.071) | (0.099) |
| _cons | -1.547*** | 0.303 | 0.378 |
| | (0.354) | (0.340) | (0.475) |
| Obs. | 50 | 50 | 50 |
| R-squared | 0.401 | 0.271 | 0.193 |

Standard errors are in parenthesis

*** p≤0.01, ** p≤0.05, * p≤0.1

In order to see whether the MTB absorb the underlying risk in the STF, additional regressions are run on the respective time periods incorporating this variable. In the period of 2007-2008, incorporating MTB had minimal effect on the significance of

the STF coefficient (Appendix 2). For 2007-2009, the effect of STF becomes a bit more significant, however, still at a 10% level (Appendix 2). For 2006, the STF coefficient remains insignificant (Appendix 2). Based on these results, the MTB does not affect the significance level of the STF coefficient, and it is therefore not included as an explanatory variable going forward in the analysis. This indicates that markets evaluation of the banks does not incorporate the risk associated with STF. The MTB coefficient does not have a significant effect on bank performance in any of the periods either (Appendix 2). Based on this, the results from the first regressions, excluding MTB, will be further discussed.

### *Discussion of the Results*

Taking the first regression into account, which covers the period from June 2007 to December 2008, this has the most significant results both statistically and economically. The STF coefficient has a significant effect on stock return, which is in accordance with the expectations of the hypothesis, meaning that the null hypothesis is rejected at a 5% level (Table 1). Consequently, showing that STF and bank performance is negatively correlated. Due to its volatile nature, STF is an unpredictable funding form, and one may wonder why banks choose to finance their illiquid loans with this type of capital. This is backed up by the fact that higher reliance on STF had a negative effect on bank performance during the primary crisis period. This is further in accordance with the findings of Beltratti and Stulz (2012), who also show that short-term funding negatively affected bank performance.

The second regression, run on the period from June 2007 to December 2009, also results in STF having explanatory power on bank performance. Thus, the null hypothesis is rejected at a 10% level (Table 1). This is in accordance with what was anticipated as markets were still struggling and STF was an unstable source of funding. However, considering that the regression incorporates the post-crisis period, other more important factors than STF may have played a role during this period than for the mid-crisis period.

In the third regression, for the period of 2006, STF did not have significant explanatory power on bank performance (Table 1). The coefficient being insignificant may stem from the fact that other factors had a greater effect considering the strong economy pre-crisis. With that in mind, one may have

expected the STF being a cheap source of funding due to a growing economy and low interest rates. However, during this period, the interest rate was increasing (see Figure 1), meaning it became more costly to roll over short-term loans, which had a negative effect on bank performance.

The STF coefficient is negative and significant for both the period of 2007-2008 and 2007-2009, which is in accordance with the expectations of the analysis. For the regression run on the period of 2006, the insignificant STF coefficient could in some way make sense, as the disruptions in the market had not yet materialized. The negative coefficient reoccurring for 2007-2008 and 2007-2009, can be linked to the fact that heavier reliance on STF made them more vulnerable to the fluctuations in the money market (Syed, 2011). Reliance on STF did in that respect have an adverse effect on performance. During good times in the economy, banks tend to rely more on STF, as this may be a cheaper funding form than long-term funding, a pattern observed pre-crisis. However, this depends on the price of the STF staying at a relatively low level to be able to refinance. It is found that large banks relied more on this type of funding than smaller banks (Syed, 2011). This can be further linked to the negative coefficient observed in the mid-crisis and post-crisis period, where STF is in fact significant. As when the crisis erupted, money markets became more volatile, and refinancing became restricted and more expensive. This then again affected the funding abilities of the banks, which further worsened their performance.

With respect to the other explanatory variables in the regressions (Table 1), the coefficients are for the most part as expected, except from a negative liquidity coefficient in 2007-2008. This may be a consequence of the abnormal conditions in the market during this period, implying that there were certain aspects that are not possible to explain. For the other two periods, however, liquidity had a positive, but insignificant effect, which is more in accordance with the expectations of the results. As adequate liquidity entails that banks easily access sufficient capital to cover their daily operations, this variable is expected to have a positive effect on bank performance. The size coefficient is both positive and significant for 2006, even at a 1% level. This may be due to the fact that 2006 was the year prior to the crisis, which marked the last year of the aggressive expansion and high profitability of the big banks. For 2007-2008, however, the coefficient is negative at a 10%

significance level. The negative coefficient may stem from the fact that larger banks are usually more complex, being involved in different lines of businesses, hence making it difficult to comprehend the magnitude of their risk exposure (Mongiardino & Plath, 2010). Bearing this in mind, the result is not surprising. For the regressions including the post-crisis period, the coefficient is still negative, but no longer significant. Considering the extended period in this regression, market dynamics had changed, and other factors may have had a greater effect on bank performance. Lastly, the dummy variable on country origin shows that being located in the US did not have a significant effect on any of the periods. Still, it has a positive coefficient in 2006, which reflects the booming economy. For the period of 2007-2008 and 2007-2009, however, the coefficients are negative, reflecting the fact that the US was suffering.

Table 1 shows that the $R^2$ for the different periods are relatively low. This means that the independent variables do not fully explain the variation in the stock return. The reasoning behind the low $R^2$s are discussed in section six.

**5.2 Alternative Measure of Funding**

***Regression Results when including Leverage***

To test for the effect of leverage on bank performance and to measure whether it accounted for the STF, it is included as an explanatory variable in the following regressions. Table 2 shows that for the period of 2007-2008, leverage is significant at a 1% level. The STF coefficient, however, is no longer significant. For 2007-2009, neither leverage nor STF had significant explanatory power on stock return (Table 2). Similar to that of 2006, both leverage and STF has insignificant coefficients (Table 2).

**Table 2: Regressions on Buy-and-Hold Stock Return including Leverage**

The table shows three cross-sectional regressions for the buy-and-hold stock return in 2006, June 2007 to December 2008 and June 2007 to December 2009. 2006 is defined as the pre-crisis period, 2007-2008 represents the climax of the crisis, while 2007-2009 captures the spillover effect into 2009. The sample includes the 50 largest banks in the world based on market capitalization as of 01.01.2006. All the data in the sample are extracted from Bloomberg. The dependent variable is the buy-and-hold stock return. The independent variables consist of short-term funding (STF), liquidity, firm size, leverage and a dummy variable on country origin. STF is the variable of interest and is measured by taking interest bearing liabilities due within one year divided by total assets. Liquidity consists of the most liquid assets on the balance sheet, cash and marketable securities, which is divided by total assets. Firm size is found by taking the natural log value of total assets for each bank. Leverage is measured by taking total debt divided by total assets. For the dummy variable on country origin, "one" represents the banks located in the US, while "zero" represents banks located elsewhere. All independent variables are measured at the beginning of the periods 2006, mid 2007-2008 and mid 2008-2009.

| Variables | 2006 Buy-and-Hold | 2007-2008 Buy-and-Hold | 2007-2009 Buy-and-Hold |
|---|---|---|---|
| STF | -0.620 | 0.436 | -0.167 |
|  | (0.412) | (0.336) | (0.517) |
| Liquidity | 0.409 | -0.348 | 0.436 |
|  | (0.360) | (0.339) | (0.522) |
| Size | 0.143*** | -0.051** | -0.050 |
|  | (0.028) | (0.024) | (0.037) |
| Leverage | 0.433 | -0.888*** | -0.307 |
|  | (0.349) | (0.279) | (0.429) |
| 1.US | -0.008 | -0.001 | -0.092 |
|  | (0.070) | (0.065) | (0.101) |
| _cons | -1.615*** | 0.429 | 0.422 |
|  | (0.356) | (0.312) | (0.481) |
| Obs. | 50 | 50 | 50 |
| R-squared | 0.421 | 0.408 | 0.202 |

Standard errors are in parenthesis

*** p≤0.01, ** p≤0.05, * p≤0.1

Considering the change in the significance level of the STF coefficient when including leverage in the regressions, it appears that overall leverage controls for some of the effect incorporated in the STF. Due to this effect, the regression results displayed in Table 2 are the ones employed throughout the rest of this thesis and is further discussed below.

### *Discussion of the Results when including Leverage*

Due to the significance of the results, in addition to the fact that it covers the primary crisis period, the regression run on 2007-2008 is the one of most interest. Table 2 shows that when including leverage, STF is no longer one of the main explanatory variables for bank performance, meaning that the null hypothesis is no longer rejected. STF has a positive coefficient, which contradicts the expected result, and the reasoning behind it can be debated. The fact that overall leverage had such a negative significant effect on performance, the ability to raise STF may have had a positive impact in the sense that it provided liquidity to the banks' balance sheet. Consequently, contributing to the improvement of the banks' ability to finance their operations during this period. The non-significant STF variable may further stem from the fact that overall leverage is more important than the split between short-term and long-term funding. It has been argued that a crisis originates from the problem of illiquidity, low creditworthiness of investments and debt capacity rather than reliance on short-term debt (Diamond & Rajan, 2000). However, the results of this regression contradict previous empirical work on the effect of STF, especially Beltratti and Stulz (2012), who show that reliance on STF is negatively correlated with bank performance. The excessive confidence in short-term financing has in fact been argued to have provoked the collapse, stemming from the fact that banks did not have sufficient financing over the long-term (Beltratti & Stulz, 2012; Adrian & Shin, 2010; Brunnermeier, 2009; Ivashina & Scharfstein, 2010). On the other hand, Beltratti and Stulz (2012) further emphasize that losses forced banks to reduce their leverage, possibly through fire sales of securities, and that this had a greater effect for banks with a higher leverage ratio. This means that leverage led to larger losses, and hence worse performance, which support the evidence found in this regression analysis.

While leverage is a sufficient source of funding, it also increases the risk and costs of bankruptcy (Jensen, 1986). The benefits of issuing debt can be beneficial to a

certain point, however, when a firm becomes over-leveraged, the cost of raising additional debt becomes progressively more expensive. Considering that the outstanding debt holders have the first claim on the company's assets, it means that the following lenders will have to charge higher interest rates as the firm's balance sheet contain more risk (Pulvino, 1998). This means that the credit rating of the firm will worsen as more debt is issued (Graham & Harvey, 2001). This further enhances the underlying risk in the economy. With this in mind, banks with large amounts of debt in their balances must have experienced immense tensions when the crisis hit, considering the pressure to service the debt requirements. This further led to worse performance and hence lower stock returns.

Higher debt burdens are often followed by economic growth, which can be linked to the fact that higher debt levels improve efficiency (Jensen, 1986). Still, it is important not to become overleveraged, as one has to be able to service the debt requirements. Considering the eruption of previous crises, excess levels of debt is perceived a common pattern amongst these, as banking crises are preceded by quickly growing private debt levels (Reinhart & Rogoff, 2011). Therefore, the amount of leverage held by banks should be carefully considered to make sure they will stay solvent.

Following the above arguments, it is essential to have an insight into the underlying capital structure of the banks both before and during the crisis, as the overall debt level held in the balance sheet had a crucial effect on the banks' actual performance. In order to finance a desirable investment, it is considered safest to increase debt capacity by improving both transparency and governance of the firm (Diamond & Rajan, 2000). This was definitely absent in the lending during the period of the crisis. As mentioned, when banks increase leverage it will increase the overall risk level, and hence make the economy more vulnerable to a crisis (Gertler, Kiyotaki & Queralto, 2012). Then, if there is a downturn in the economy, a lot of firms will struggle due to this high debt burden. The excessive risk taking carried out by financial institutions during this period became the trademark of the crisis. Although the amount of leverage and the capital structure of each bank is reflected by their individual risk preferences, Beltratti and Stulz (2012) find that traditional banks were less exposed to this kind of risk. As interest rates increase, which was the case for the period building up to the crisis (as seen in Figure 1), lending

becomes more expensive, and banks with high leverage levels become more vulnerable (Lane, 2012). This further enhances the difficulty of servicing debt obligations and hence increase the probability of bankruptcy.

The regression run on the period from June 2007 to December 2009 generates non-significant coefficients for both the effect of leverage and STF. As previously mentioned, total leverage is more important than the split between short-term and long-term funding, which explains why the STF is no longer significant. Still, the leverage coefficient is not statistically significant either. As the post-crisis period is included in this regression, there may have been other more important factors affecting bank performance than leverage. Beltratti and Stulz (2012) argue that poor bank performance in the first quarter of 2009 was affected by the uncertainty about resolution mechanisms and the probability of nationalization.

The regression run on the stock return in 2006 further show that neither leverage nor STF is significant for this period. As the crisis had not erupted, it is expected that these variables did not have the same effect on bank performance. Leverage may have had a positive effect, which may stem from better performance being correlated with more risky strategies, entailing higher leverage levels before the crisis. Beltratti and Stulz (2012) further find that large banks with lower levels of leverage, lower returns and higher equity levels pre-crisis where the ones who performed better during the crisis. They also find that the banks favored in 2006 were the ones with worst returns during the crisis.

Considering the other explanatory variables in the regressions, both the sign and significance level primarily stays the same as for the regressions excluding leverage. The negative size coefficient for the period of 2007-2008, however, is significant at a 5% rather than 10% level (Table 2). This may stem from the fact that larger banks held higher levels of leverage, and that this is better reflected when including leverage as an explanatory variable, making the size coefficient more significant. Further, the sign of the dummy variable for 2006 has changed and is no longer positive (Table 2). However, the coefficient for this variable is extremely low and does not have much effect. This can be further linked to the small sample size, and that this may have changed with a larger sample.

Table 2 also shows that the $R^2$s are relatively low. However, when comparing the results in Table 1 and Table 2 for the period of 2007-2008, adding leverage generates a higher $R^2$. This means that leverage explains more of the variation in bank performance than STF does in isolation. Still, the low $R^2$s indicates that the analysis cannot account for all the variation in the banks' performance and the reasoning behind this is further discussed in section 6.

**5.3 Additional Analysis**

Considering the asymmetric exposure to the crisis of different economies, the sample is divided into four regions based on the banks' origin to see whether there was any pattern between location and performance. Banks in the US and Europe are allocated within its own regions, USA and Europe respectively. The Pacific contains areas located in Asia and the Pacific, including Japan, China, Saudi Arabia, and Australia. Canada is in a separate region as it does not match the geographical requirements for the Pacific area, nor represent the regulatory reforms within the US. When looking at geographical differences throughout the analysis, the regions will stay accordingly.

*Stock Return in Different Regions*
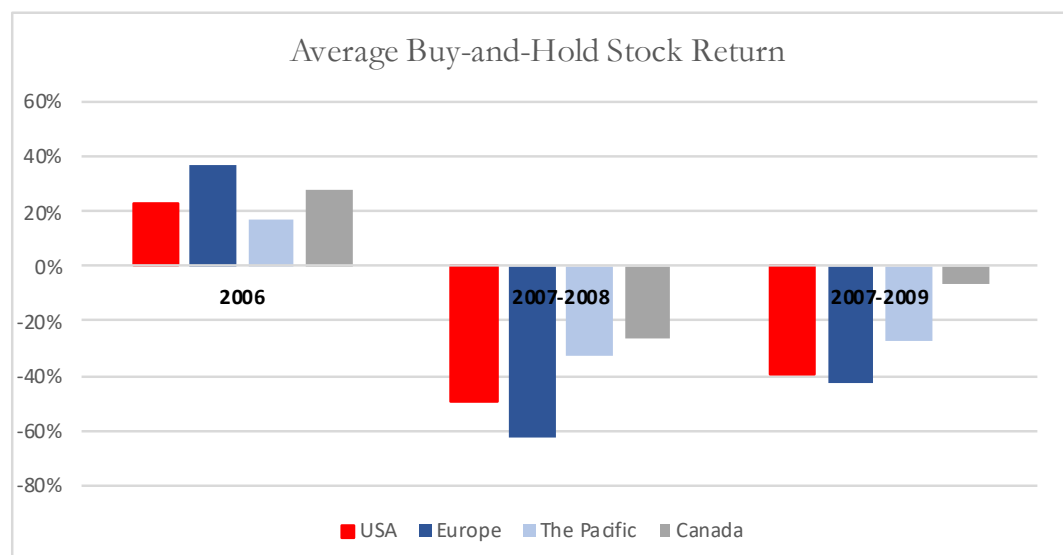


**Figure 2** shows the average buy-and-hold stock return for the periods 2006, mid 2007-2008 and mid 2007-2009 based on the location of each bank.

Based on the data extracted, all regions have an average buy-and-hold stock return above 15% in 2006 (Figure 2). From the mid-crisis period of 2007-2008, there was a common pattern of negative returns for all regions, where Europe's average return was 14 percentage points lower than that of the US (Figure 2). For 2007-2009, the average buy-and-hold stock return was still negative, however, trending in a positive fashion compared to that of the mid-crisis period (Figure 2). These findings are consistent with what is found by Calomiris, Love, and Peria (2010), who show that there is a positive correlation between returns and pre-crisis periods, while there is a negative correlation between returns and an unexpected crisis. The mid-crisis period return captures the extreme volatility in stock prices and the high standard deviation that occurred within this holding period. The fact that the returns from 2007 to 2009 in the US, Europe, Canada, and the Pacific are higher than for 2007-2008 (Figure 2), albeit negative, shows that longer holding periods reflect higher risk and thereby higher return. Further, the improvement in returns in this period can be argued to be due to the changes in banking sectors, such as stricter regulatory reforms, nationalization of banks and capital injections by governments. Seeing the common negative returns across the different regions over both the period of 2007-2008 and 2007-2009 (Figure 2), shows that the crisis had a global effect and that the repercussions were difficult to avoid to a certain extent.

### *Sources of Finance*

Based on the significant effect of leverage in the midst of the crisis, some of the underlying financing sources in the banks' balance sheet is subsequently investigated. The figure below presents the average change in the level of leverage, STF, and equity relative to the total assets held by the respective banks from Appendix 1 within the sample period of 2006-2009.
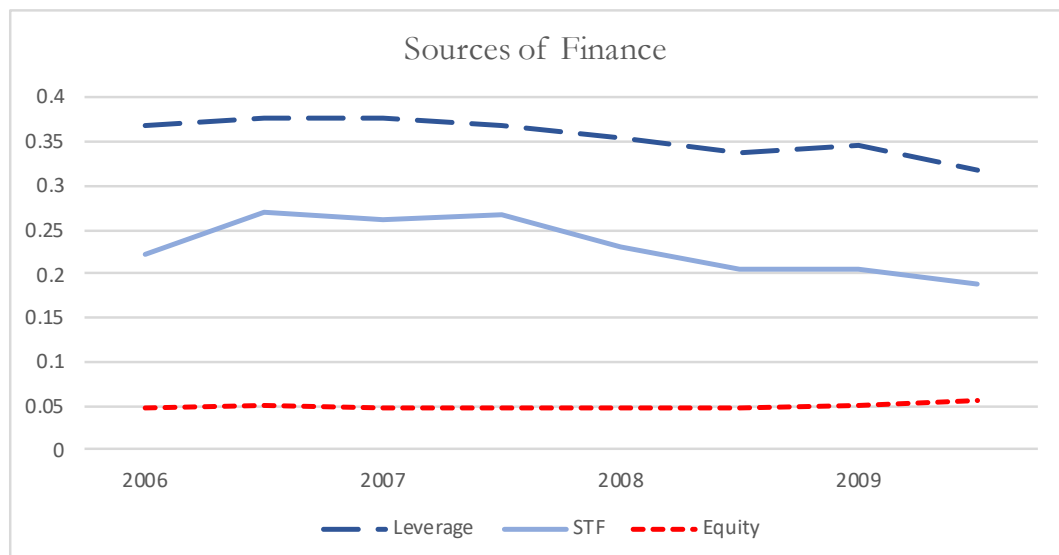
**Figure 3** shows STF, total debt and equity relative to the total asset value held by the banks in the sample from Appendix 1 in the period of 2006-2009.

Figure 3 shows that there was an increase in STF from 2006 to the beginning of 2008, equivalent to almost 20%. This supports the fact that at the beginning of 2007 banks were unable to sell their assets due to illiquid market conditions and hence relied on STF in order to improve their liquidity. Bearing in mind that this funding form is used in order to raise rapid financing needed for daily operations. The large spread between STF and equity further backs up this claim. At the beginning of 2008, the level of STF reversed quickly, and by the end of 2009, it had decreased by 30% (Figure 3). While STF increased in 2006, the leverage ratio remained constant at approximately 0.37 from 2006 to 2008 (Figure 3). This indicates that in 2006 banks were changing their funding structure from long-term to short-term. Similar to STF, leverage started to decrease at the beginning of 2008, however, in a more moderate fashion (Figure 3). This trend can be explained by the fact that STF constitutes a significant amount of the overall leverage level, underpinning the argument that debt captures the greater effect of this type of funding as previously discussed.

Beltratti and Stulz (2012) and Fahlenbrach, Prilmeier, and Stulz (2012) further argue that banks with higher levels of debt rely more on STF, which support the parallel trend observed between the two sources of funding. The pattern partly stems from the freeze in interbank lending, and the fact that banks were unable to roll over their short-term debt, as banks following the crisis were unwilling to lend in the interbank market due to lack of confidence. This resulted in further market

failure (Fang, Lu & Su, 2013). Figure 3 also shows a low, but constant equity ratio of 0.05 throughout the period. This again backs up the fact that banks relied heavily on leverage as a funding source rather than equity. Ivashina and Scharfstein (2010) further found that the issuance of loans decreased substantially during the financial crisis, and by mid 2008, the number of loans was down by 32% and the volume of lending was down 49% from the peak of the credit boom. This trend is in accordance with what is found in this analysis and further backs up the fact that financial markets were constrained, making financial institutions unable to raise funding.

### *Short-Term Funding and Debt Across Regions*

Considering the sources of finance previously discussed, equity is considered less risky than debt and STF, and with a higher amount of equity, it will be easier for firms to withstand the implications of the crisis. It is argued that firms experiencing financial distress suffer the most from the consequences of a crisis, and sufficient secure financing is an important aspect (Mac an Bhaird, 2013). Seeing the higher levels of STF and total debt, and bearing in mind the uncertainties of these sources of funding, both are further examined relative to equity for the different regions.
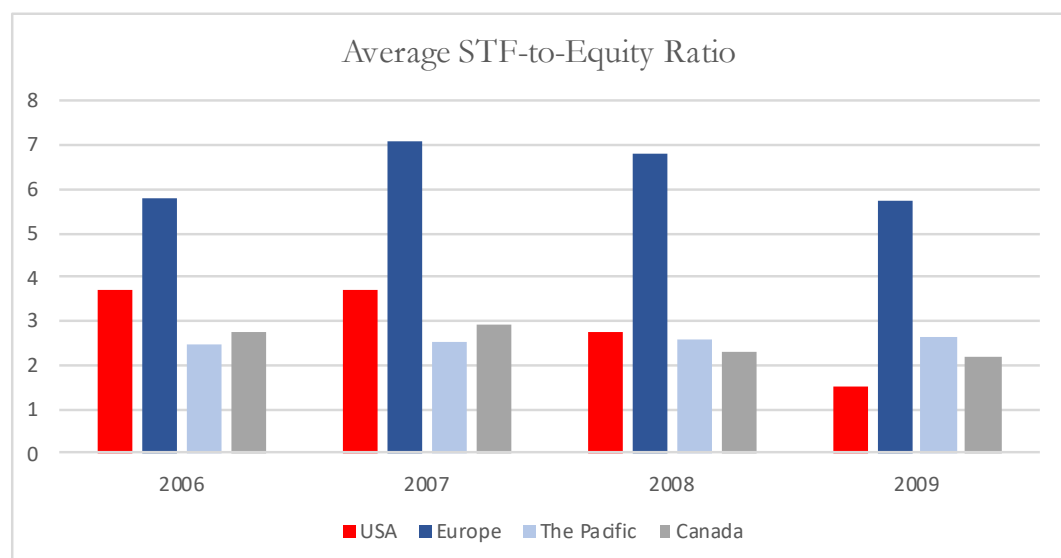


**Figure 4** shows the average STF-to-equity ratio within each region at the specified time periods.
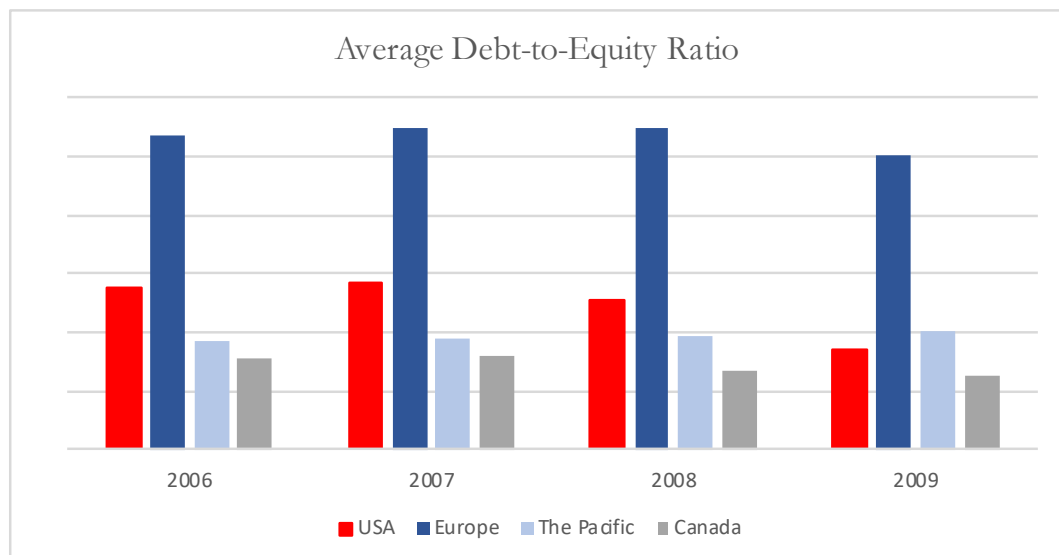
**Figure 5** shows the average debt-to-equity ratio within each region at the specified time periods.

From the early 2000s throughout the crisis, the US and Europe shared similar debt dynamics (Lane, 2012). Banks were operating with heavy levels of debt, which can be further linked to the severity of the crisis in the two areas. Looking at the STF-to-equity ratios (Figure 4) and debt-to-equity ratios (Figure 5) from the period of the crisis, European banks had significantly higher levels of both STF and leverage than banks in the other regions. The high leverage ratios held by the European banks increased their risk of bankruptcy and hence made them more vulnerable. Even though US banks held lower levels of leverage, they were hit the hardest. This can be explained by the fact that they were in the epicenter of the crisis and that this had a greater effect. However, in this respect, one would expect that the dummy variable on country origin would have a significant coefficient, which in this case it does not. Nevertheless, the result may be biased due to its small sample size. Still, the coefficient is negative for both the mid-crisis and post-crisis period, meaning that being located in the US may have had a negative effect on bank performance. The level of leverage held by each bank will further have strengthened the severity of the crisis on their individual performance. Several European banks were also exposed to the US financial market through securitized products in the interbank market, and as the market price of these products fell, banks were affected accordingly (Rose & Spiegel, 2012). However, the excess level of distressed debt was the main contributing factor to the problems that arose. The uncertainty regarding the amount of exposure further intensified the liquidity shock when the crisis hit (Tintchev, 2013), and the severity of the situation was much worse than

anticipated. This further contributed to the severity of the European sovereign debt crisis.

Due to the magnitude of Asian output and exports to both the US and Europe, and a business cycle driven by these common factors rather than idiosyncratic shocks, their exporting decreased significantly as a consequence of the crisis (Keat, 2009). However, apart from stressed markets due to an increase in risk aversion, fall in asset value and a dry-up in credit and cross-border trade, the financial and monetary systems were largely resilient. Following the economic crisis that erupted in Japan in the early 1990s, banks were operating in a more risk-averse manner. Households and corporations held strong balance sheets, meaning they relied less on leverage and rather more on equity. Taking into account the average STF-to-equity ratio (Figure 4) and debt-to-equity ratio (Figure 5) for the Pacific, it shows that they had considerably lower levels of this funding compared to Europe. A similar pattern is observed when comparing them to the USA, whereas in 2009 both the STF level and debt levels exceed the US. This may stem from the fact that US banks started raising more stable funding during this period (Bank of International Settlements, 2018). Due to few inherent sources of vulnerabilities, Asia was able to withstand the financial shocks and the consequences not being as severe (Keat, 2009). Further, for India, Indonesia, and China, substantial domestic demand made it possible to avoid a recession. Contrasting from South-East Asia, which suffered due to newly established industrialized economies (Keat, 2009). Common for both Asia and Australia was the reliance on exports, which was hit by the global economic recession. Several Australian banks were also involved in the market for structured finance, however, due to stronger country regulations and a higher risk aversion, the country managed to get through the crisis with limited destructions (Brown & Davis, 2010).

The moderate economic downturn in Canada has been argued to be due to prudent risk management and better regulatory response from the government in the run-up to the crisis (Boivin, 2011). Canadian banks also held relatively low levels of debt, seeing their average debt-to-equity ratio is in the lower layer compared to banks located elsewhere (Figure 5). This was a result of Canada having stricter debt requirements than others, such as the USA and Europe. Even though Canada was better equipped pre-crisis, the country was exposed to cross-border contagion. Their

resembling reliance on STF compared to USA (seen in Figure 4) also made them vulnerable to the liquidity pressure in the interbank market and their funding costs were tightened accordingly (Arjani & Paulin, 2013).

Looking at the debt levels for the banks within the different areas discussed above, there is a clear pattern between the average amount of leverage held by the banks and the performance within the areas they are located. This further backs up the fact that leverage to a large degree affected the performance of the large banks and hence their local economy. The lower exposure to debt funding and hence higher levels of equity show stronger resilience against the implications of the crisis. The levels of STF is relatively similar to the total debt, however, were held at a lower level compared to equity. This can be linked back to the arguments made in relation to the common pattern observed between leverage and STF.

### *Banks that Defaulted During the Crisis*

As mentioned, there were several financial institutions that defaulted or were bailed out during the financial crisis that is not incorporated in this sample. It is argued that these large banks defaulted due to investments in pooled subprime mortgages (Fang, Lu & Su, 2013). Still, in order to get a closer insight into the effect of leverage on the banks' performance, the amount of debt held by some of the banks that collapsed during the crisis is examined. The banks included are Lehman Brothers, Northern Rock, Washington Mutual, Bear Stearns, and HBOS, which were all large individual banks prior to the crisis. To prevent further contagion and systemic failure following these insolvencies, all these banks, except Lehman Brothers, were either bailed out or acquired by another bank (French, Leyshon & Thrift, 2009).
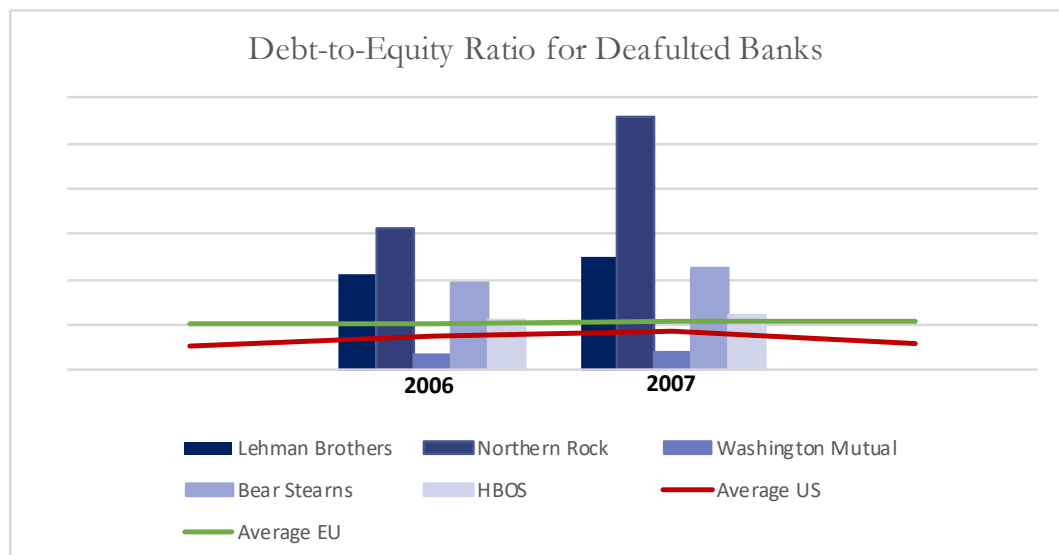
**Figure 6** shows the debt-to-equity ratio of five large banks that defaulted during the financial crisis, and the average debt-to-equity ratio for banks located in USA and Europe from the sample in Appendix 1, represented by Average US and Average EU respectively.

Figure 6 shows that the average debt-to-equity ratio held by these banks were significantly higher than the average debt-to-equity ratio for banks located in both Europe and the US. Even though there is not run any regression on the significance of these results, due to the outcome of the previous regressions, it is possible to draw a link between the amount of leverage with the occurrence of financial distress. Seeing the debt-to-equity ratio of banks such as Lehman Brothers, Bear Stearns, and Northern Rock, the amount of debt was at a level significantly above the average of the US and Europe (Figure 6). For HBOS, the ratio was more similar to the average of the European banks, which was the region with the highest level of debt. Banks with such high debt ratios during the crisis felt immense pressure and consequently struggled meeting their financial obligations. However, Washington Mutual provide contradicting results, considering its relatively low level of debt (Figure 6). The bank did, in fact, hold large amounts of toxic assets and was affected by this to a greater extent (Hynes & Walt, 2010). Nevertheless, the bank's reporting during this period may be insufficient due to essential data being omitted because of involvement in the subprime market. Meaning that Washington Mutual may have been more exposed to debt than this graph indicates.

### 5.4 Summary of the Results

Contemplating the results observed throughout this section, it is clear that the overall level of leverage held by the individual banks had the most impact on their performance, and that this effect was most significant in the period from 2007 to

2008. Considering the impact of leverage, the results further show that STF did not have the effect that was initially expected, even having the opposite effect during the peak of the crisis. Incorporating the post-crisis period into the sample, leverage no longer has the same effect on bank performance. While in the pre-crisis period, higher reliance on leverage may have been linked to better performance, bearing in mind the risk-return trade-off aspect of the theory. Even though the buy-and-hold stock return clearly show that all regions were affected by the crisis, there is a clear pattern to where banks were more heavily financed by debt. Banks located in the US and especially Europe carried significantly higher levels of leverage, which were the areas the crisis had its most severe effects. Asian and Canadian banks held lower levels of debt and, in that respect, had stronger performance than banks in Europe and the US.

## 6. Limitations

Conducting empirical research entail that topics may be excluded from the analysis due to limitations, as well as some aspects are omitted due to lack of sufficient data. The result from this thesis may be short in some respects, however, it will be as sufficient as possible.

This thesis uses a relatively small sample, which may have resulted in less significant results than what would have been generated with a larger sample. This explains why the standard errors of the regressions as presented in Table 1 and 2 are somewhat large. Also, more banks within each region could have strengthened the pattern observed within the different areas.

The movement of the share price within the holding periods is not reflected in the profitability measure, and it does not reflect the sharp, temporary fall in share prices that culminated in the winter and spring of 2009. Thus, it is no surprise that the regressions exhibit rather small $R^2$ values, which indicates that the analysis cannot account for all the variations in banks´ performance. The relatively low $R^2$s may also stem from the fact that the banks that defaulted fall outside the sample, and that the high levels of debt held by these banks (as seen in Figure 6) could have strengthened the results. Considering that share price is a subjective measure of performance from the investors' point of view, it may not reflect the actual

performance of the banks. This problem, however, is less important when the focus of the analysis is on the relative performance between banks relating to how they were financed.

In regard to the topic investigated, it would have been interesting to measure the banks' exposure to the subprime market. However, due to lax accounting standards and little concern regarding risk exposure prior to the crisis, data on direct exposure to subprime loans are not available. Considering these lax accounting standards, the data used in this analysis may be subject to deficiency. Especially, the levels of debt, that may have been much larger than the banks initially expressed. Further, the financial condition of several banks was unknown to the public, meaning that a number of these carried much more risky assets than what was initially anticipated.

## 7. Conclusion

A sample of the 50 largest banks in the world has been examined in order to see whether the amount of STF had a negative effect on performance during the crisis. The first regression on STF in isolation shows that it had significant explanatory power during the peak of the crisis, meaning that reliance on STF had a negative effect on bank performance. This means that by looking at the first regression exclusively, the null hypothesis is rejected.

When including leverage in the analysis, however, it shows contradicting results as STF does no longer have a significant effect. This implies that bank performance was not affected by the reliance on STF during the crisis. Consequently, concluding that the null hypothesis is not rejected. Leverage, on the other hand, has significant explanatory power and was a more important indicator of bank performance than the split between short-term and long-term funding. The unexpected results of STF when including leverage as a separate variable contradict previous research, as one would have expected STF to be negatively correlated with performance. However, the significance of the leverage variable is more in accordance with what is previously researched.

Considering the globalization of the economy, it is impossible that a crisis with such repercussions in the US would not have an effect on the rest of the world.

Contemplating the degree of commerce between countries, businesses and banks are interlinked in such a way that their performance will be affected by global events. Countries are of course linked to each other to different degrees, which in some ways helps to explain the way in which the financial crisis played out. Asian banks, for instance, were less intertwined with the US and hence did not suffer as badly following the crisis. European banks, on the other hand, operated with large exposures to the US, and their performance was affected accordingly. Still, there were several other factors that affected the banks' and economies' performance during this period.

By looking at the similarity between the debt pattern observed before the crisis and that of previous crises, the crisis should not have been a complete shock from the perspective of industry professionals. Still, the global scale of the crisis was much larger than what has been experienced in previous decades. Lastly, the excess levels of debt observed during the crisis period can be spotted in today's economy. Additionally, the market for structured finance has been quite active for the last couple of years. This development has increased the underlying uncertainty in financial markets, and in that sense, banks and individuals should be aware of the potential repercussions from a downturn in the economy, as it creates the foundation for a new crisis.

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## 9. Appendices

## 9.1 Appendix 1: Top 50 Banks Ranked by Market Capitalization

**Appendix 1:** The top 50 banks in the world ranked by market capitalization as of 01.01.2006. The market capitalization is extracted from Bloomberg and is presendted in millions of dollars. Region is based on the location of the country.

| Nr | Bank | Country of origin | Region | Market Capitalization |
|---|---|---|---|---|
| 1. | Citigroup Inc | The United States of America | USA | 241,690.30 |
| 2. | Bank of America Corporation | The United States of America | USA | 184,585.60 |
| 3. | HSBC Holdings Plc | United Kingdom | Europe | 181,739.70 |
| 4. | JP Morgan Chase & Co | The United States of America | USA | 138,386.70 |
| 5. | UBS Group AG | Switzerland | Europe | 123,145.00 |
| 6. | Mitsubishi UFJ Financial Group | Japan | The Pacific | 121,751.50 |
| 7. | Wells Fargo & Co | The United States of America | USA | 105,402.50 |
| 8. | Royal Bank of Scotland Group | United KIngdom | Europe | 96,417.90 |
| 9. | Mizuho Financial Group Inc | Japan | The Pacific | 92,101.70 |
| 10. | Banco Santander SA | Spain | Europe | 82,454.60 |
| 11. | China Construction Bank | China | The Pacific | 81,375.40 |
| 12. | Ing Groep NV | Netherlands | Europe | 76,446.60 |
| 13. | Sumitomo Mitsui Financial Group | Japan | The Pacific | 73,084.80 |
| 14. | Unicredit SPA | Italy | Europe | 71,526.30 |
| 15. | Barclays Plc | United Kingdom | Europe | 68,153.20 |
| 16. | BNP Paribas | France | Europe | 67,063.50 |
| 17. | American Express | The United States of America | USA | 63,861.90 |
| 18. | Goldman Sachs | The United States of America | USA | 61,748.80 |
| 19. | Banco Bilbao Vizcaya Argenta | Spain | Europe | 60,371.10 |
| 20. | Morgan Stanley | The United States of America | USA | 59,261.70 |
| 21. | Credit Suisse | Switzerland | Europe | 57,329.00 |
| 22. | Bank of Nova Scotia | Canada | Canada | 56,568.10 |
| 23. | US Bancorp | The United States of America | USA | 54,249.00 |
| 24. | Societe Generale SA | France | Europe | 50,084.90 |
| 25. | Deutsche Bank AG-Registered | Germany | Europe | 48,989.20 |
| 26. | Lloyds Banking Group Plc | United Kingdom | Europe | 47,038.70 |
| 27. | Credit Agricole SA | France | Europe | 46,318.60 |
| 28. | Resona Holdings Inc | Japan | The Pacific | 45,794.90 |
| 29. | Royal Bank of Canada | Canada | Canada | 45,327.60 |
| 30. | Commonwealth Bank of Australia | Australia | The Pacific | 40,073.40 |
| 31. | Nomura Holdings | Japan | The Pacific | 36,485.40 |
| 32. | Intesa Sanpaolo | Italy | Europe | 36,289.20 |
| 33. | Toronto-Dominion Bank | Canada | Canada | 33,528.30 |
| 34. | KBC Group NV | Belgium | Europe | 33,259.70 |
| 35. | Samba Financial Group | Saudi-Arabia | The Pacific | 31,117.50 |
| 36. | Standard Chartered Plc | United Kingdom | Europe | 29,290.40 |
| 37. | Nordea Bank AB | Sweden | Europe | 26,921.00 |
| 38. | Suntrust Bank Inc | The United States of America | USA | 26,338.00 |
| 39. | Hang Seng Bank Ltd | China | The Pacific | 24,953.10 |
| 40. | Bank NY Mellon | The United States of America | USA | 24,560.50 |
| 41. | Bank of Montreal | Canada | Canada | 24,454.70 |
| 42. | Franklin Resources Inc | The United States of America | USA | 24,268.10 |
| 43. | BB&T Corporation | The United States of America | USA | 22,761.40 |
| 44. | ORIX Corporation | Japan | The Pacific | 22,671.00 |
| 45. | Riyad Bank | Saudi-Arabia | The Pacific | 22,511.50 |
| 46. | Danske Bank A/S | Denmark | Europe | 22,063.90 |
| 47. | Saudi British Bank | Saudi-Arabia | The Pacific | 21,198.30 |
| 48. | Fifth Third Bancorp | The United States of America | USA | 20,958.10 |
| 49. | Can Imperial Bank of Commerce | Canada | Canada | 20,393.50 |
| 50. | Commerzbank AG | Germany | Europe | 20,188.70 |

## 9.2 Appendix 2: Regression on Buy-and-Hold Stock Return including Market-to-Book Ratio

**Appendix 2:** The table shows three cross-sectional regressions for the buy-and-hold return in 2006, June 2007 to December 2008 and June 2007 to December 2009. 2006 is defined as the pre-crisis period, 2007-2008 represents the climax of the crisis, while 2007-2009 captures the spillover effect into 2009. The sample includes the 50 largest banks in the world based on market capitalization as of 01.01.2006. All the data in the sample are extracted from Bloomberg. The dependent variable is the buy-and-hold stock return. The independent variables consist of short-term funding (STF), liquidity, firm size, market-to-book ratio (MTB) and a dummy variable on country origin. STF is the variable of interest and is measured by taking interest bearing liabilities due within one year divided by total assets. Liquidity consists of the most liquid assets on the balance sheet, cash and marketable securities, which divided by total assets. Firm size is found by taking the natural log value of total assets for each bank. MTB is measured by taking the market value divided by the book value. For the dummy variable on country origin, "one" represents the banks located in the US while "zero" represents banks located elsewhere. All independent variables are measured at the beginning of the periods 2006, mid 2007-2008 and mid 2007-2009.

| Variables | 2006 Buy-and-Hold | 2007-2008 Buy-and-Hold | 2007-2009 Buy-and-Hold |
|---|---|---|---|
| STF | -0.182 | -0.479** | -0.536* |
|  | (0.211) | (0.202) | (0.276) |
| Liquidity | 0.295 | -0.036 | 0.527 |
|  | (0.354) | (0.359) | (0.490) |
| Size | 0.145*** | -0.049* | (0.039) |
|  | (0.034) | (0.027) | -0.037 |
| MTB | 0.003 | 0.006 | 0.024 |
|  | (0.017) | (0.012) | (0.016) |
| 1.US | 0.107 | -0.042 | -0.118 |
|  | (0.068) | (0.072) | (0.098) |
| _cons | 0.004 | 0.257 | 0.191 |
|  | (0.072) | (0.354) | (0.484) |
| Obs. | 50 | 50 | 50 |
| R-squared | 0.401 | 0.276 | 0.233 |

Standard errors are in parenthesis

*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$