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THE FINANCIAL CHARACTERISTICS OF BANKS THAT USE DERIVATIVES: U.S. EVIDENCE

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ABSTRACT

This research studies financial characteristics of commercial banks in U.S, which have or have not reported use of derivatives, between the years 2006-2010. This study follows the guidelines of a research by Sinkey and Carter (2000). Previous researches conducted on this topic are used as a foundation when formulating the hypotheses. The data used in the analysis is from 2006 to 2010, consciously including the financial crisis years. The data is gathered from Uniform Bank Performance Reports, which are public documents, published by the Federal Financial Institutions Examination Council. The annual data for the commercial banks is gathered from multiple reports, in order to have the necessary dataset for this research. The gathered data is analysed by utilizing descriptive statistics and the Tobit model. The commercial banks included in this research are also divided into two sub-groups of banks that use and banks that do not use derivatives. The results of this study show the use of derivatives to be more common among larger banks. Similar results are also reported in the earlier researches in this field, reviewed in this study. The banks reporting use of derivatives also show having a more risk prone capital structure, which is studied in the second hypothesis of this research. This also is in line with results of similar studies. The analysis does find a continuously positive relationship between the dependent variable and the variables total assets, notes and debentures, book value of equity and liquidity in the Tobit analysis' results. There are similarities in the Tobit analysis results until the year 2008, after which the results are more unsystematic. Possible causes for the results obtained are deemed to arise from the financial crisis, globalization, change in the markets and strengthened legislation. The research could be taken further by including more years after the financial crisis to the dataset and taking into account the continuing chances taking place in the financial market.

KEYWORDS: Derivatives, derivative contracts, commercial banks, U.S. banking industry, financial crisis, financial characteristics

1. INTRODUCTION

Derivatives are financial instruments that are used for risk management worldwide. The value of derivatives derives from other financial assets such bonds, stocks, exchange rates or interest rates, as the name suggests. Derivatives can be used in various ways; to attain protection against decrease in value even while maintaining upside potential (options), to hedge a current market exposure (forward and futures), to gain protection against default (credit derivatives) or to alter the nature of an exposure (swaps). With the help of derivatives, corporations and financial institutions have the ability to manage input costs, credit exposure, exchange-rate risk and financing costs, which partly explains the rapid growth of derivatives markets as the phenomenon of globalization has steadily gained importance for the World's financial markets. (Sundaram, 2013)

Approximately 30 years ago the market for derivatives was domestic and fairly limited in size. Since then it has been estimated to have grown at a rate of 24 percent per year resulting into a vast and global market. There are no other financial instruments that have experienced such a broad development, equities as a comparison have had a growth rate of 11 percent whereas for bonds it has been nine percent. (Deutsche Börse Group 2008) Becketti (1993) justifies the popularity of derivatives with the argument that they do combine features that are not found in other types of assets. The gross market value of OTC derivatives was $20.7 trillion at the end of June 2016. For the previous year it was reported to be $14.5 trillion. The noticeable increase can be explained with the market value of foreign exchange derivatives entailing yen and pound sterling doubling due to the volatility in the currencies during the first half of 2016. (Bank for International Settlement, n.d.) The below table shows the notional amounts outstanding and gross market values for the different derivative contracts during 2007, 2009 and 2011. Interest rate contracts show an increasing notional amount outstanding during the reported years. Commodity contracts have a noticeable decrease in notional amount outstanding from the year 2007 to 2009 as well as credit default swaps. FX contracts and interest rate contracts have the largest total value in notional amounts outstanding and in the gross market values in year 2011. (Sundaram, 2013)

	Notional amounts outstanding			Gross market values		
	Dec.2007	Dec.2009	Dec.2011	Dec.2007	Dec.2009	Dec.2011
Total contracts	**585,932**	**603,900**	**647,762**	**15,802**	**21,542**	**27,285**
FX contracts	**56,238**	**49,181**	**63,349**	**1,807**	**2,070**	**2,555**
Forwards and forex swaps	29,144	23,129	30,526	675	683	919
Currency swaps	14,347	16,509	22,791	817	1,043	1,318
Options	12,748	9,543	10,032	315	344	318
Interest rate contracts	**393,138**	**449,875**	**504,098**	**7,177**	**14,020**	**20,001**
Forward rate agreements	26,599	51,779	50,576	41	80	67
Interest rate swaps	309,588	349,288	402,611	6,183	12,576	18,046
Options	56,951	48,808	50,911	953	1,364	1,888
Equity-linked contracts	**8,469**	**5,937**	**5,982**	**1,142**	**708**	**679**
Forwards and swaps	2,233	1,652	1,738	239	176	156
Options	6,236	4,285	4,244	903	532	523
Commodity contracts	**8,455**	**2,944**	**3,091**	**1,898**	**545**	**487**
Gold	595	423	521	70	48	82
Other commodities	7,861	2,521	2,570	1,829	497	405
Credit default swaps	**58,244**	**32,693**	**28,633**	**2,020**	**1,801**	**1,586**
Single-name instruments	32,486	21,917	16,881	1,158	1,243	962
Multi-name instruments	25,757	10,776	11,752	862	558	624
Unallocated	61,387	63,270	42,606	1,759	2,398	1,977

Figure 1. Derivative contracts overview 2007, 2009 and 2011. (Sundaram, 2013)

As a result of the emergence of derivatives the cost of investing has decreased and the investment universe has expanded. The use of derivatives can be beneficial and therefore they have developed to be more and more essential to the global economy and the financial system. Transactions costs for derivatives are relatively low when compared to direct investments into the underlying asset types. New derivative contracts can be introduced rapidly, investors are able to trade on the expectations of future prices, protection against risk can be attained with small upfront payment and foremost they can be tailored to meet the needs of investors, thus displaying a high factor of adaptability. These are some of the aspects that make derivatives interesting to investors. (Deutche Böre Group, 2008)

Banks have two different functions in the derivative markets: Some banks operate as intermediaries in the Over the Counter (OTC) market while other banks are end-users, using derivatives the same way as investors do. Frequently, thus the same institutions play both the role of intermediary and end-user at the same time, the growth of the usage of OTC derivatives having increased the demand of intermediation operations offered by banks. (Becketti,1993). As the market for derivatives has grown, it has continuously presented new challenges due to the complex nature of the products

themselves, which also means that the corresponding legislation has been evolving and strengthened to both protect customers and the markets themselves. Whereas derivatives may not have been as easy to access for retail customers of the banks as for institutional customers, this situation has changed. Especially due to the financial crisis of 2007 and onwards and the continuing effects of it, the legislation regarding financial markets and products, especially derivatives and other structured products, has further increased. This means that the use of derivatives is more restricted and monitored today compared to the previous market situation, especially pre-crisis. The use of derivatives however continues to have effects on the financial characteristics of banks, based on the banks' usage or non-usage of such derivative contracts.

1.1. Purpose of the study

This research focuses on the use of derivatives in the U.S. banking industry between 2006-2010 and on the financial characteristics of commercial banks. Sinkey and Carter (2000) have conducted a study that examines the financial characteristics of commercial banks, including banks that do and that do not use derivatives. This study follows the structure of Sinkey et al. (2000)'s research with more recent data. The original research has been done with data from 1996. For this research I have chosen to use the data from multiple years including the years immediately prior to and following the financial crisis in 2007. The main reasoning behind the chosen time span is the financial crisis that had it roots in the credit boom of 2007, which towards the fourth quarter of 2008 escalated into a banking panic, that had repercussions through the entire World's economy (Ivashina, 2008). In comparison to Sinkey et al. (2000)'s research, the time span for the dataset included in this study, is chosen to yield both more recent results as well as analysing multiple years in order to be able to compare the results. One of the main objectives was also to include the financial crisis and analyse the possible effects of this event on the data.

The financial crisis that occurred in 2007-2008 has affected economies globally and has resulted in multiple researches in order to explain the origins and causes of the crisis and subsequent recession. The financial crisis is also a current topic in other fields of study and since the crisis continues to affect the global economy, topics related to it are still current. In the public discourse, derivatives are said to be one of the underlying reasons for the crisis because of their complex nature and as they turned out to be hazardous thereby exposing both intermediaries and investors to great risk. In order to

prevent history from repeating itself, studying derivatives and making them more comprehensive is necessary and one of the main motivations for this study. By analysing the financial characteristics of commercial banks and derivatives' use among commercial banks, the study aims to find significant relationships between these two and whether the possible relationships have positive or negative effects. As the dataset used also includes the crisis years, the study aims to establish whether a noticeable change in the use of derivatives among the commercial banks can be seen due to the crisis and if there are other effects on other financial characteristics of these commercial banks.

1.2 Structure of the study

The first part of this study consists of an introduction and a literature review. The reader is here also given an overview of the various types of derivate products and their markets. Earlier, relevant studies on the subject including findings are reviewed and summarized in the literature section. The second part of this study focuses briefly on an explanation of the background and the basic structure of the banking sector of the USA, together with an assessment of how the financial crisis affected it. Further in the second part, this study also includes a chapter introducing different types of derivative contracts used in the banking industry as well as describing their inherent characteristics. In the third part of the study the data and chosen methodology is discussed. In this section it is explained how the relevant dataset has been gathered, what exact factors it consists of and how the analysis is conducted. Following this data section will be the empirical results, where the outcome of the analyses are shown with multiple tables in order to provide thorough evaluation of the data and how correlate to the hypotheses. Conclusions and summary will sum up the research, the analyses and will provide insight into what has been done, what where the results and what could be done in the future.

1.3 Research problem and approach

The research focuses on the financial characteristics of commercial banks in the USA and their use as well as non-use of derivatives. The use of derivatives has increased in general but the concentration of their use is mainly distributed among the largest banks. Seven banks hold approximately 94 percent of all derivative contracts held in total by

U.S commercial banks in data from 1996. (Sinkey et al., 2000) In this research the report condition and income for commercial banks' year-end data, also known as Call Report, is used to provide the variables required for the analyses. This has also been used in the research of Sinkey et al. (2000) and Vuillemeys (2014), when they studied the financial characteristics of U.S. banks. In order to analyse the data I will use descriptive statistics and the Tobit model, following the example of Sinkey et al. (2000). I present the hypotheses for this research as the following:

H1: Use of derivatives is more common among larger banks.
Measured by the number of total assets, larger banks utilize derivates more than smaller banks.

H2: Banks reporting usage of derivatives have more risk-prone capital lending practices. User banks have larger share of assets as loans whereas non-user banks have more conservative capital structure.

H3: The use of derivatives has an effect on risk appetite.
A correlation exists between the use of derivatives and the reported amount of short-term debt, where the latter amount can be related to a possibility of bank default.

2. LITERATURE REVIEW

The literature review is presented in two sections: The first one summarises earlier researches and studies, which focus on banks and their usage of derivatives. In the second sub-chapter the usage is also related to the level of risk. The literature review chapter is summarized with a table describing the main researches and their execution of analyses as well as their main findings related to this study.

2.1 The usage of derivatives

Sinkey et al. (2000) examine the differences in the financial characteristics of banks that use derivatives and those who do not. Their results do not support the hypothesis under which banks are required to have steady capital positions in order to engage in the derivatives market. In their research Sinkey et al. (2000) use derivatives' data at the bank level from the year 1996. The types of derivatives included in the scope of the research are swaps, forwards, options and interest-rate futures, the biggest category consisting of foreign-exchange contracts. In the study, member banks of International Swaps and Derivatives Association (ISDA) were compared against non-member banks. The empirical analysis is conducted using the Tobit model where the notional value of bank's derivatives scaled by total assets is the dependent variable. The research presents a hypothesis, that use of derivatives is indeed correlated with several financial characteristics, such as dividends, net interest margin and loan charge-offs.

The results indicate that bank size is positively correlated with the usage of derivatives. This did hold even when the ISDA member banks were excluded from the data. When comparing user to non-user banks, it can be stated that banks that are not involved in derivatives take more conservative actions. These banks are less exposed to the interest-rate risk and their portfolios consist of better quality loans, which are characterized by inferior net loan charge-offs. (Sinkey et al., 2000)

Cyree & Huang (2012) use a sample of 335 commercial banks in order to study the effect of derivatives' use on the banks' valuation. They use the time period of 2003 to 2005 as a high growth period and 2007 to 2009 as a slow growth period. 2006 is omitted as a transition year. They aim to investigate whether derivatives resulted in differential performance and valuation of banks before and after the crisis. The

asymmetric effects of derivatives usage on shareholders value are also discussed. When derivatives are used for speculating and trading purposes, they are expected to trade at premium during good times, whereas they are expected to be traded at discount during bad times. This means that derivatives are suitable as a hedge against downside risk and making the use of derivatives more valuable during bad economic times. In order to test these predictions, gross notional principal of derivatives holdings is used in order to summarize the bank's derivative position. The long-run performance of the bank is measure by using buy-and-hold returns, buy-and-hold abnormal returns based on the size as well as book-to-market matched portfolio and Sharpe ratios. (Cyree et al., 2012)

In the research Cyree et al. are not able to find a systematic effect on the markets' valuation of the banks and these findings do apply to all kind of derivatives, including credit default swaps. There was no difference in the usage of derivatives during good and bad times. The exceptions here are the aforementioned credit default swaps, the use of which increased during bad times however in small magnitudes. (Cyree et al., 2012) The study suggests banks to have a balanced approach and to limit their use of derivatives to risk management, as opposed to use them for speculation, and offering them to customers. Cyree et al. (2012) were not able to find supportive evidence to the allegation that the usage of derivatives in itself would increase the speculative behaviour of a bank or that derivative usage significantly contributed to the loss of value during the subprime mortgage crisis. Their results show that larger banks, with lower growth, lower NIM, lower percentage of insider holdings and larger off-balance-sheet liabilities are more prone to use derivatives. The results from the study also support the absence of a systematic relationship between market performance and usage of derivatives. (Cyree et al., 2012)

As the origins of the financial crisis are widely studied, credit derivatives and their usage have emerged as one of the possible causes. In their study, Bedendo & Bruno (2012) investigate the role of credit risk transfer (i.e. securitization), loans sales and credit derivatives in the crisis, since banks have extensively been using these products during the preceding decades as tools to manage credit risk. These tools have been criticized to increase the risk taking behaviour of banks as well as prompting the growth in credit that was a result of decreased monitoring. One of the aspects that the research focuses on is whether banks using credit risk transfers were more stressed than banks that did not. Their analysis includes Call Report data of medium and large size U.S. commercial banks from 2001-2009. The sample banks all had total assets greater than USD 1 billion. The results show a higher risk to banks, which were intensively using

securitization and loans sales. This higher risk manifested itself through higher default rates during the crisis among those banks. Bedendo et al. (2012) found it noteworthy that neither credit derivatives nor credit risk transfers had the same amount of benefits and drawbacks as were shown by securitizations and loan sales. (Bedendo et al., 2012)

Mayordomo, Rodriguez-Moreno & Pena (2014) researched the effect on the individual systematic risk based on the banks' holdings of financial derivatives. The financial crisis uncovered the threats posed by the oversized banking sector balance sheets, where the major concern is the amount of derivative holdings. The research aims to explain to what extent these threats have had an effect on the systematic risk. In their study the authors use a dataset of 95 U.S. bank holding companies between 2002 and 2011. They find a significant relationship between the amount of a certain derivative holding during a given quarter and the contribution of the bank to the systematic risk a quarter later. This effect is not the same for all types of derivatives researched; foreign exchange and credit derivatives for example have a more increasing effect on systematic risk than other types. Nevertheless derivatives are not the only balance sheet items that have a significant effect on the systematic risk. Leverage ratio, total loans and proportion of non-performing loans are also variables, increases in the holdings of such instruments also led to an increase in the systematic risk. (Mayordomo et al., 2014)

The study considers five types of derivatives: Credit, equity, interest rate, foreign exchange and commodity. The summary of the main descriptive statistics shows that derivative holdings are a small proportion of the banks' total assets, interest rate derivatives being the most common type of derivatives on the balance sheets. In the whole sample only four out of 95 banks did not hold any kind of interest rate derivatives. The research also shows that during 2004-2006 the banks increased their notional positions in derivatives due to the economic boom. In the terms of economic impact on systematic risk, Mayordomo et al. (2014) are able to show that traditional banking activities do have a stronger effect. While derivatives are seen as one of the main sources for the destabilization that occurred during the financial crisis, this study and the data show that not all derivatives have a harmful effect on the financial system. Interest derivatives are shown to diminish the contribution to systematic risk, whereas credit and foreign exchange derivatives increase it. Many countries are implementing new regulations concerning derivatives, which according to the study should be done carefully in order to avoid results that are actually hindering the diminishing of systematic risk. Based on the results of the study, regulators worried about systematic

risk should focus more on the effect of non-performing loans and leverage. (Mayordomo et. al, 2014)

2.2 Derivatives and bank risk

In his study "Are derivatives too risky for banks?", 1993, Becketti discusses the problems related to derivatives and their complex nature. Warren Buffet (1992, quoted in Becketti 1993) was concerned that derivatives could generate negative reactions across the financial markets. The study discusses whether the use of derivatives was too risky during the stage of market development at time of the study. Becketti (1993) forecasts in his research that the utilization of derivatives will more likely to be concentrated to major banks, which have the risk taking ability and experience. (Becketti, 1993)

Hundman (1999) describes the reason for banks to participate in the market for derivatives since the traditional banking activities, i.e. borrowing and lending, expose them to the risk of the financial market. The hypotheses of the research suggests, that banks employ derivatives in order to decrease their exposure to market risk instead of speculating and thereby increasing the risk taking. She states there should be a negative relationship among banks' risk weighted capital to asset ratio and the use of derivatives. In the empirical model she uses return on asset, non-current loans to loans, capital to total assets unwaged for risk, net interest margin, total assets, loan loss allowance to loans and trend variable based on quarterly real GDP as independent variables. The ratio of derivatives to total assets is used as the dependent variable. The results of the study do support the hypothesis presented, the use of derivatives reduces banks' exposure to the interest rate risk and they can be used successfully to reduce the market risk exposure for banks. (Hundman, 1999)

Duffee & Zhou (2000) study the impact on banks when these are being introduced to the market of credit derivatives, especially to credit-default swaps. These swaps can reduce the effects of an occurrence of loan defaults prompting bank's financial distress. The findings of the study indicate, that the introduction to the credit-derivatives market is not essentially required, since the introduction might results other loan-risk sharing markets to break down. Another factor according to Duffee et al. (2000)'s study is the asymmetric information problem related to lending, as banks themselves more aware of the value of the loans than outsiders are. With the credit-derivative contracts the risk can

be transferred, the use of these contracts can therefore be viewed as a risk management action, as they could benefit the bank when loan default. Despite this assumption the study also shows how the introduction to the derivatives market can also damage banks if they use it to transfer risk to others. Duffee et al. (2000) do not find the risk transferring possibility achieved with credit derivatives to be significant enough to guarantee the instruments to be profitable. They conclude that capital allocation can be improved when the effects of poor-quality products are reduced with credit-derivatives. (Duffee et al., 2000)

Instefjord (2004) studies whether the financial innovation of credit derivatives and the consequential derivatives dealing make the banks associated with them more prone to risk taking. The results show that the risk of bank default may increase through financial innovation in the credit market. The increase of risk can be seen especially for banks operating in vastly elastic credit market segments. The trading of credit derivatives is therefore a possible threat to the banks' stability. (Instefjord, 2004)

Lastly Beltratti & Stulz (2012) study the factors, which contributed to the poor performance of banks during the credit crisis in 2007 and 2008. A significant variation in the cross-sections of stock returns for larger banks globally can be observed. The research studies how the banks that performed better during the crisis are differentiated themselves from their rivals in the years before the crisis. According to Beltratti et al. (2012) multiple institutions used excessive reliance on short-term capital, exhibited poor governance, had insufficient capital and were laxly regulated. These were all contributing factors to the crisis according Beltratti et al. (2012). Large banks are defined in the study as banks having assets in excess of $50 billion in 2006. The data sample includes 164 institutions from 32 countries, which all were loan-making and deposit-taking banks. The study concludes that the performance of large banks throughout the crisis is negatively related to their performance during 2006. Banks with large stock returns during 2006 were the ones to suffer the biggest losses during the financial crisis. (Beltratti et al., 2012)

Calluzo et al. (2014) study whether the financial system has become any safer after the financial crisis, while stating that this questions still is not fully answered. New legislation has been introduced, such as the Basel III rules, but it has also been suggested that the new regulations do not result in any concrete restructuring of the system. In the study both shadow banking and traditional banking systems are included, as they are inseparable, both providing monitoring services, information as well

liquidity insurance. As the origins of the financial crisis are a topic of debate, it can be recognized that in both systems the institutions are exposed to systematic risk as well as individual risk. This presents the questions whether the financial institutions are less risk prone or if the financial system is less vulnerable to contagion risk than before the crisis. In their research Galluzo & Dong (2014) present the opinion that the financial market is more vulnerable to contagion risk than it was before the crisis. These results are conducted with two econometric measurements of risk, VaR at 0.1% probability level and CoVaR at 1% probability level. First measurements represent the possibility of catastrophic risk whereasthe other one stands for contagion risk. The results show that financial institutions are more robust to individual low-probability occurrences, whereas the financial market has become more exposed to the contagion risk after the financial crisis occurred. Their findings indicate that since the financial market nowadays is more integrated it might also experience more synchronized contractions in future crises. This research, according Calluzo et al. (2014), is the first of its kind to study the chancing nature of banking risk for both, traditional and shadow banking. (Galluzo et al. 2014)

Vuillemey (2015) researches the effect of derivatives' hedging on the risk management and lending practices by financial intermediaries. He estimates the interest rate derivatives market to be the largest market globally and that the majority of the derivatives are held by commercial banks. His model studies the effect of derivatives on bank defaults, which according his theory may or may not increase the event of bank defaults. He finds that the outcome depends on the relative weight of the financial frictions such as bankruptcy costs and cost to equity issuance. Vuillemey (2015) also states the business cycle's influence on the role that use of derivatives might have on bank failures. (Vuillemey, 2015)

Table 1. Summary of the literature review.

Study	**Cyree et al. (2012)**
Research	The effect of derivatives usage on the banks' values. They aim to investigate whether derivatives resulted in differential performance and valuation of banks before and after the crisis.

Conclusions	They results show that larger banks, with lower growth, lower NIM, lower percentage of insider holdings and larger off-balance-sheet liabilities are more prone to use derivatives. There was no difference in the usage of derivatives during good and bad times, except among credit default swaps, which faced increase during bad times. The results do not show, that the derivative usage would have significantly contributed to the loss of value during the subprime mortgage crisis. The results also support the absence of relationship among the market performance and the usage of derivatives.

Study	**Sinkey et al. (2000)**
Research	Examining the differences in the financial characteristics of banks that use derivatives and which do not.
Conclusions	The bank size is shown to be positively correlated with the usage of derivatives. Non-usage banks are shown to be more conservative in their actions as well to have a better quality of loans in their portfolios.

Study	**Instefjord (2004)**
Research	Whether the financial innovation of credit derivatives and the consequential derivatives dealing make the banks associated riskier.
Conclusions	The trading of credit derivatives is therefore a possible threat to the banks stability as the bank risk is shown to increase when operating in credit market segments.

Study	**Beltratti et al. (2012)**
Research	Study researches the factors, which contributed to the poor performance of banks during the credit crisis in 2007 and 2008. The research studies, how the banks, which performed better during the crisis different from the rivals before the crisis.
Conclusions	The excessive reliance on short-term capital, poor governance, insufficient capital and lax regulation are all factors contributing to the crisis. The study concludes, that the performance of large banks

	throughout the crisis is negatively related in their performance during 2006. Banks with large stock returns during 2006, where the ones to suffer the biggest losses during the financial crisis.

Study	**Mayordomo et al. (2014)**
Research	The effect of banks holdings of the financial derivatives on the individual systematic risk. Aims to explain in what extent the situation has affected the systematic risk.
Conclusions	The research shows that interest rate derivatives have diminish the contribution to systematic risk, whereasforeign and credit exchange derivatives increase it.

Study	**Vuillermey (2015)**
Research	Effect of derivatives hedging on the risk management and lending by financial intermediaries. His research focuses on the effect of derivatives on bank default.
Conclusions	Vuillemey (2015) estimates interest rate derivatives market to be globally largest one and that the major of derivatives is been held by commercial banks. Whether the possibility of default is increased or decreased depends on relative weight of financial frictions. Also business cycle does influence the effect of derivatives on bank failures.

3. U.S. BANKING INDUSTRY

The U.S. banking system is one of the largest, oldest and most significant ones for the world economy. It dates back as far as 1784, when the Bank of New York was established, which is still operating as Bank of New York Mellon and is one of the oldest banks in the industry. This means that a bank existed in the U.S. a mere eight years after the Declaration of Independence. Banks in the U.S. today play two main parts in society: They provide the payment system, which is effectively necessary for the economy to function. Secondly, they function as financial intermediation, i.e. the business side of the banks, which incorporates their financing, lending and investing of money to governments, companies or individuals. (Sylla, n.d.)

3.1 Historic overview

The banking industry in the U.S started its' growth during the 1780's. The Bank of North America, the Bank of Massachusetts and the Bank of New York were all established by 1789. Alexander Hamilton, the first Secretary of the Treasury, was a key figure in developing the system. He defined the value of the U.S. dollar with gold and silver coins, implemented a federal revenue system as well founding the Bank of the United States, its' National Bank, which had the monopoly rights to distribute its' bank offices to U.S. cities. The industry grew rapidly and in the early 1790's the securities market emerged. The injection of $10 million worth of Bank of the United States stock as well as $63 million worth of new U.S. national debt securities stimulated it. Stock exchanges were established in Philadelphia and New York. The banking industry growth from the 1790's can be seen as one of the key components of the rapid growth of US economy. Due to political actions, the United States did not have a central bank from 1836 until 1914. Without the central bank providing oversight over finance and banking activities, the expanding banking system faced significant problems. Insufficient reserves being one of the most common problems, which resulted in an ever-increasing number of insolvencies and failed banks. The lack of a central bank coupled with a unhealthy finance sector, had an overall effect on the economy, increasing unemployment and with it a business recession. Insolvencies and the lack of reserves were not the only problems affecting the banking industry in the 19th century, when the Dollar were only provided as coins. New national currency was introduced,

which would solve the earlier problems, this currency was also backed by the US bonds, making the Federal Government liable for the new currency. (Sylla, n.d.)

By 1907 the US economy as well as its banking system were the largest in the world. In 1914 the Federal Reserve System (FED) was created, a decentralized central bank, which also resulted in twelve regional Reserve Banks, thereby once more giving the U.S. financial sector its much-needed central bank. Payment systems were improved, as well as the Federal Reserve Notes were introduced by the FED. Who also had the power to contract or expand the U.S. currency and to provide credit, which was used to reduce variations in interest rates as well as to stabilize the economy. After the disastrous Wall Street crash and substituent crisis of 1929, the Banking Act of June 1933 also known as the Glass-Steagall Act, introduced federal regulation of interest rates for deposits, federal deposit insurance and mandated a separation of commercial banking from investment banking. The Act strengthened the central bank's powers as well as reformed the FED into what it is known as today. The stability in the banking industry stayed firm all the way from 1930 to the 1980's, with the cost of making the banking industry in the U.S. less competitive and more regulated than before. For the market of Wall Street the weakening of the commercial banking industry was profitable, one example of this effect is the emergence of money market mutual funds. With these depositors were able to earn higher rates form Wall Street as from regulated banks. Considerable pressure by the commercial banking industry ultimately therefore caused the deregulation of the Act and Congress removed restrictions on interstate banking in 1994, thereby setting the stage for the development of today's banking industry. (Sylla, n.d.)

3.2 Current industry overview

According to the Federal Deposit Insurance Corporation, an independent agency created by the U.S. Congress to provide deposit insurance, the assets of the entire U.S. banking industry amounted to $15,976,92 billion in 2015. Whereas the amount of assets has increased, the actual number of banks has been declining. On average institutions with more than $10 billion in assets make up 80% of the industry assets. During the financial crisis, the number of banks continued to fall, as more of them failed. In 2005-2006 there were no bank failures whereas during the time period of 2008-2013 the FDIC reported 489 bank failures. Since 2011, the asset growth rate has been positive, but this should not be seen as a return to the previous lending patterns. Larger banks have the ability of

generating sufficient income from a range of other financial activities while smaller banks are more dependent on lending activities. Profitability trends can therefore vary among the banks according to their size. (Getter, 2016)

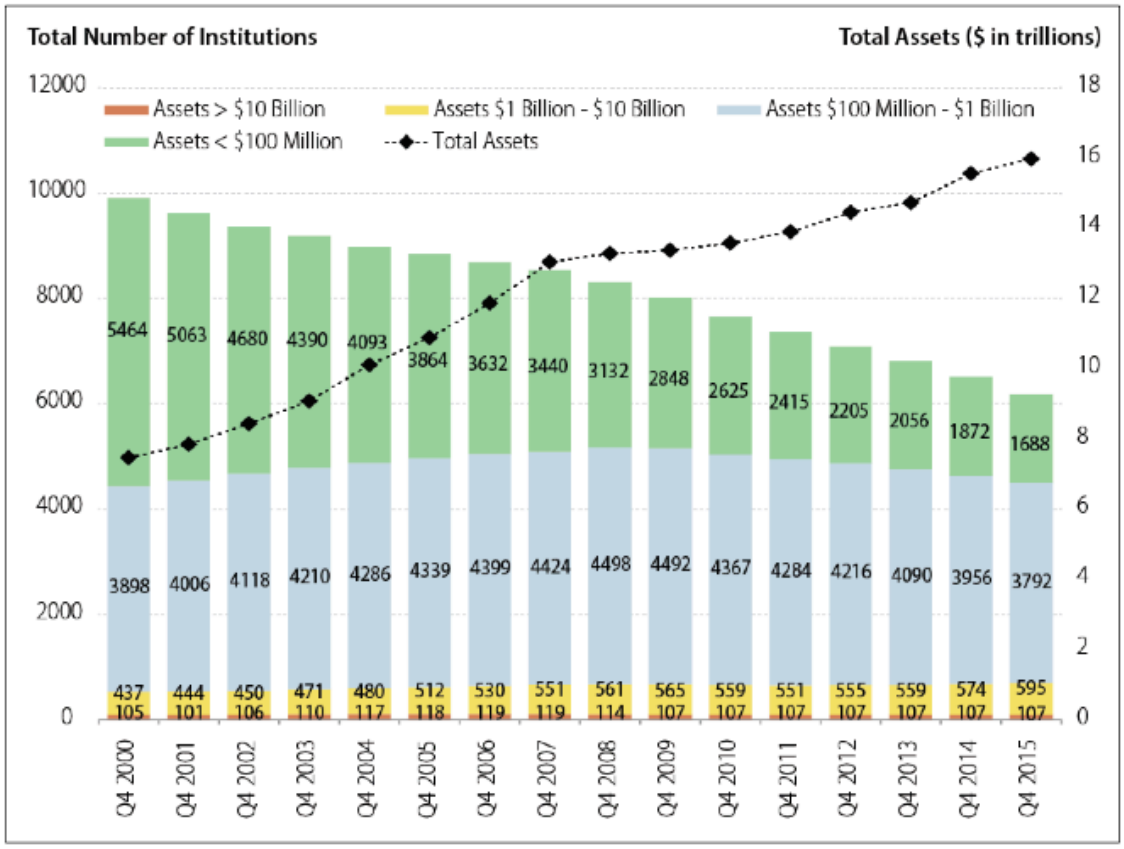


Figure 2. Amount of FDIC-insured institutions during 2000-2015 (Getter, 2015).

The figure above summarizes the changes in the number of institutions as well as showing the increase in assets. The number of institutions having assets below $100 million has increased, whereas the number of institutions having between $100 million - $1 billion in assets has remained on a steady level throughout the period of 2000-2015. The amount of total assets has increased yearly after the financial crisis in 2007.

3.3 The Financial Crisis

In the early 2000s, as cheap credit made commercial real estate and housing business boom, it turned the situation in the financial market into a bubble. There were strong

assumptions that prices would not decrease and credit was given more easily by bankers and other lenders. Wall Street bankers provided so-called mortgage-backed securities, into which the lending bankers increasingly invested. In the middle of the decade, as the housing prices did not increase anymore and instead started to decrease, many of the borrowers defaulted which caused the value of the mortgage-backed securities to fall. The banks that had invested in mortgage-backed securities or were holding these loans were now facing financial trouble in increasing numbers. The decline of the assets value threatened to make them insolvent. For the customers of the banks, this did not create a scare, since they are protected by federal deposit insurance, provided by FDIC. For money market lenders there is no such guarantee, which forced them to refuse lending to banks, which in 2007 and 2008 led to the drying up of market funding for banks. Only with the help of the U.S. Treasury Department and the Federal Reserve System a crisis such as the Great Depression was able to be avoided. (Sylla, n.d.) The Federal Reserve Bank of Louisiana provides a detailed timeline for the different phases of the crisis. The timeline includes detailed information about the changes in the market during the years 2007-2011 on a daily and a monthly basis. Other researches also have used this timeline as a tool in order to determine the progression and duration of the financial crisis. The information provided by the Federal Reserve Bank of Louisiana is also used in this research to give a better understanding of the development of the crisis as well as to providing the rationale for the choice of years in the dataset used.

The start of the crisis is dated to be 27th of February 2007 as the Federal Home Loan Mortgage Corporation (Freddie Mac) published a press release saying that they will seize to purchase the most risk prone subprime mortgages or mortgage-related securities. The next event occurred in April as leading subprime mortgage lender New Century Financial Corporation filed for bankruptcy protection. During the summer of 2007 a long row of events took place, each playing a role in developing crisis; Standard & Poors' downgrading of bonds that were backed by subprime mortgages and placing over 600 securities on credit watch. A "difficult conditions" warning was given by Countrywide Financial Corporation, Bear Stearns liquidated two hedge funds that where invested in mortgage-backed securities, American Home Mortgage Investment Corporation filed for a bankruptcy protection in August when also the Federal Reserve Board voted on reducing the primary credit rate by 50 basis points. During the autumn and winter of 2007, the primary credit rate as well as the federal fund rate continued to decrease, both of them decreased three times during a period of five months. In October Bank of America, JPMorgan Chase and Citigroup announced their plans of creating $80 billion Master Liquidity Enhancement Conduit in order to buy the highly rated assets

from the existing special use products. In the interbank funding of the markets, liquidity decreased as the pressure on the financial markets intensified. (Federal Reserve Bank of St. Louis, n.d.)

The beginning of 2008, the primary credit rate as well as the federal fund rate continued to decrease. In March 2008 the Federal Reserve Board announced it would continue to screen the market and its development, promoting the function of the financial system as well as securing liquidity. Many financial companies were also given a downgrade of their credit ratings. In July 2008, The Federal National Mortgage Association (Fannie Mae) and Freddie Mac received the authorisation from the Federal Reserve' board to lend from the Federal Reserve Bank of New York City, if proven necessary. The Securities Exchange Commission (SEC) temporarily prohibited the naked short selling of Freddie Mae and Fannie Mae securities. In September 2009 some of the main events of financial crisis took place: The Federal Housing Finance Agency placed Freddie Mae and Fannie Mae under government conservatorship, a form of bankruptcy protection. Bank of America announced it intentions to purchase Merrill Lynch & co. whereas Lehman Brothers Holdings Inc. filed for the Chapter 11 bankruptcy protection. On the 17th of September the SEC banned the short selling of financial market companies stock. At the end of September 2008, the U.S. Treasury Department launched its Temporary Guarantee Program for Money Market Funds. This way shareholders in the funds were provided coverage for the amounts they held in the participating money market funds as of 19th of September. The U.S treasury Department submitted a legislation draft to the Congress on 20th of September, requesting the authority to purchase troubled assets. The U.S. House of Representatives rejected this draft nine days later. At the end of October 2008 the U.S Treasury Department purchased preferred stock from nine U.S banks worth $125 billion under the Capital Purchase Program. Under this program these transactions occurred repeatedly. At the end of 2008 the Federal Reserve's board announced that in early January they expected to begin the purchase of Fannie Mae, Ginnie Mae and Freddie Mac mortgage-backed securities. (Federal Reserve Bank of St. Louis, n.d.)

In early January of 2009 the Federal Reserve Bank of New York made the first of these purchases of fixed-rate mortgage-backed securities. On the 16th of January the Bank of America was given a package of guarantees, capital and liquidity access by Federal Reserve, FDIC and the U.S. Treasury Department. A loss-sharing arrangement is made on a $118 billion portfolio consisting of securities, loans and other assets, which are exchanged to preferred stock. On the 17th of February the U.S. Treasury Department

publishes the first monthly survey of bank lending conducted among 20 recipients of government investments, which were distributed through the Capital Purchase Program. The results show that the banks continued to renew and to refinance loans from the beginning of the financial crisis until and including December 2008. The Homeowner Affordability and Stability Plan was introduced by the U.S. Government, which permitted the refinancing of home mortgages that were being guaranteed or owned by Freddie Mac and Fannie Mae and exceeding over 80 percent the value of the underlying real estate. The U.S. Treasury Department also limited Freddie Mac and Fannie Mae's portfolios to $900 billion as well as increased the preferred stock purchase agreements to $200 billion. For the year 2008 Fannie Mae reported total losses of $58.7 billion and Freddie Mac $50.1 billion. (Federal Reserve Bank of St. Louis, n.d.)

In May 2009 The Federal Reserve published the results of stress test for the 19 largest U.S. bank holding companies, as a part of the Supervisory Capital Assessment Program. These results show that the firms could possibly lose $600 billion during 2009 and 2010, if the economy would result in the most undesirable scenario used in the stress test. In June the U.S. Treasury Department announced a proposal to reform the financial regulatory system, which included the establishment of the Financial Service Oversight Council, which would supervise firms that can be seen as a threat to the financial stability. At the end of August FDIC reported the number of troubled banks to have increased from 305 to 419, with total assets value increasing from $220 billion to $299.8 billion in the period of the first quarter to the second quarter of 2009. This increase among the troubled banks can also be seen in the figure below. In November CITI Group filed for bankruptcy under the Chapter 11, despite the fact that a year earlier the U.S. Government purchased the preferred stock worth $2.3 billion under the Trouble Asset Relief Program. (Federal Reserve Bank of St. Louis, n.d.)

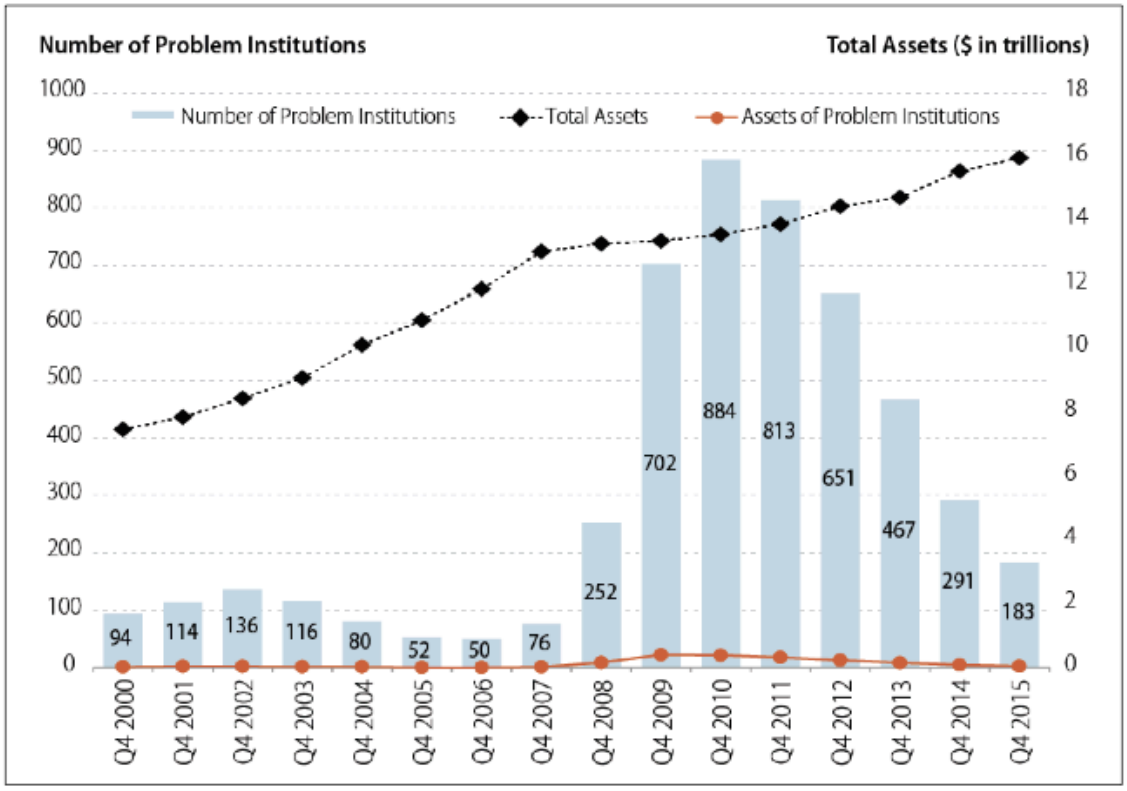


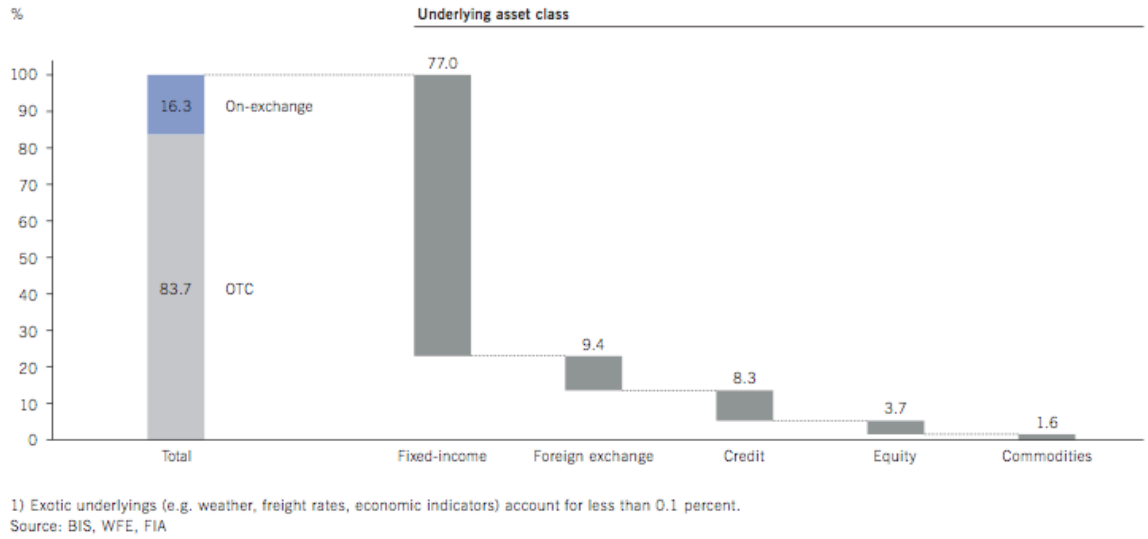
Figure 3. Assets of distressed institutions and FDIC problem list (Getter, 2016).

In January 2010 new restrictions on market shares of commercial banks were presented as well as limitations on the trading activities. Wider market share restrictions were also implemented on commercial banks and their trading activities in hedge funds and private equities. By February 2010 the amount of troubled banks had increased to 702 with total assets worth $402.8 billion. Fannie Mae reported the losses for year 2009 to be $72 billion and Freddie Mac announced losses of $21.6 billion. (Federal Reserve Bank of St. Louis, n.d.)

In July 2010 the Dodd-Frank Wall Street Reform and Consumer Protection Act is signed. This law aims to promote the financial stability in the United States with the help of a number of different mechanisms. In December 2010 the Federal Reserve Board published information over 20 000 individual transactions made in order to stabilize the markets during the financial crisis. The transactions were executed in order to support economic recovery, stabilize the flow of credit to companies and individuals as well as restore the employment after the crisis. In January 2011 the Financial Crisis Inquiry Commission published the final report of the causes of the economic and financial crisis in the United States. (Federal Reserve Bank of St. Louis, n.d.)

4. DERIVATIVE INSTRUMENTS

While derivatives are similar to securities, they should not be classified as such, since they offer multiple advantages such as possible protection against as well as fulfilling investment and arbitrage purposes. Various types of derivatives exist and their classification is in general done based on a) underlining asset type they are derived from, b) product type and c) how they are traded. This chapter introduces five main categories of derivatives, which are being used by financial institutions. These categories are credit derivatives, interest rate derivatives, equity derivatives, foreign exchange derivatives and commodity derivatives. (Deutsche Börse Group, 2008)



1) Exotic underlyings (e.g. weather, freight rates, economic indicators) account for less than 0.1 percent.
Source: BIS, WFE, FIA

Figure 4. Breakdown of the global derivatives market – OTC versus on-exchange and by underlying asset class, notional amount outstanding as of June 2007. (Deutsche Börse Group, 2008).

The above figure displays the allocation of derivatives among the asset classes. Fixed income, foreign exchange and credit derivatives are the most common ones. Commodities as well as exotics underlyings account for the minority asset classes of the derivatives. In the sub-chapters below, the different derivatives mentioned above will be presented one by one.

4.1 Credit Derivatives

Credit derivatives have experienced enormous increases, seen over the last decade their notional principle value increased from $800 billion to $42 trillion. These instruments make it possible for companies to trade credit risk in the same way, as they are able to trade market risk. Credit derivatives are contracts where profit derives from the credit worthiness of the underlying country or company. Insurance companies are the biggest sellers of credit derivatives, whereas banks are the main customers for this kind of protection. Credit derivatives can be labelled under two different classes, multiname and single name. Credit Default Swaps are the most common single name instruments, where the payoff is based on a number of events that could occur to a company or a country. The most common multiname instruments are Collateralized Debt Obligations. Until June 2007, multiname credit derivatives were preferred over the single name ones, as their share of the market increased between 2004 and 2007 by 23 percentages. (Hull, 2009)

Credit Default Swaps (CDS) are the most popular type of credit derivative instrument, since they provide an insurance against a possible default of a particular company. A position in corporate bonds can for example be hedged by credit default swaps. The buyer of the CDS has the right to sell the bonds issued by the particular company for the face value in case of a credit event occurring whereas the insurance seller has the right to buy the bonds for the face value if a credit event occurs. The buyer of a CDS has to make periodic payments until the end of the duration or until a credit event takes place. The seller is the one receiving these payments. Collateralized Debt Obligations (CDO), are another of popular asset type of securities and are created on portfolio of bonds, which is allocated into multiple tranches. These are created by choosing a portfolio of underlying assets and constructing a complex structure, which channels the cash flows from the portfolio into different investor categories. (Hull, 2009)

Portfolios of loans, mortgages, credits, bonds and other financial assets can also be taken and formed into an asset-backed security (ABS), another variant of a credit derivative. This way financial institutions have the possibility of transferring assets from the balance sheet and selling them to a special purpose vehicle, which then provides this kind of derivative instrument to investors who are then holder of the credit risk of these assets. The risk of ABS can be allocated into different tranches, from AAA senior tranches to BBB mezzanine and to equity tranches, which normally is not credit rated. As the mezzanine tranches is not as attractive to buy, institutions dealing in asset-

backed securities started to merge multiple mezzanine tranches together in order to create a new security, which can be then be rated to have AAA classification by the rating agency. In case of many credit events occurring simultaneously, the mezzanine tranches would also experience simultaneous loss, making even the best-rated tranches risky and prone to result in losses. In 2007 these kinds of events occurred, as downgraded subprime mortgages were turned into mezzanine tranches, which defaulted. This led to enormous losses and was a contributing factor to the crisis in the financial sector. (Hull, 2009)

4.2 Interest Rate Derivatives

During the 1980's and 1990's the exchange of interest rate derivatives increased rapidly in over-the-counter as well as in exchange-traded markets. For theses instruments the payoff is dependent on the level of interest rates. Compared to foreign exchange and equity derivatives, interest rate derivative instruments are more challenging to valuate and there are multiple reasons for this: The behaviour of an individual interest rate is more complicated than the behaviour of an interest rate for an exchange rate or for a stock price. In order to evaluate multiple instruments it is necessary to develop a model, which can describe the behaviour of an entire zero-coupon yield curve. On the yield curve the volatilities also vary. The interest rates are used to define the payoff as well as for the discounting of the derivatives. (Hull, 2009)

The most popular over-the-counter interest rate options are swap options, bond options and interest rate caps/floors. A bond option is the option of buying or selling a specific bond at specific date for a specific price. These options can also be embedded into bonds as they are issued in order to make the latter appear more attractive to the potential purchaser or to the issuer of the bond. There are different bond option instruments, one of them being the embedded bond option. These are callable bonds, giving the issuer the possibility to buy the bond back if necessary but normally with a few years lock-out period. There is also type of an embedded bond with the possibility of redemption, which is called a puttable bond. Bonds with the put option do provide a lower yield, since the option increases the value to the holder of the bond. (Hull, 2009)

An interest rate cap on the other hand is an over-the-counter instrument, which is been offered by financial institutions. These instruments can be described as a floating-rate note, where the rate is set to equal LIBOR periodically. These instruments are designed

to work as insurance in case the interest rate on the floating-rate note rises above a set cap rate. In case the interest rate falls below a certain rate, the opposite of a cap, a so called floor will provide the payoff. (Hull, 2009)

Another popular type of interest rate options are swap options. Their holder has the possibility to enter into specific interest rate swap at a certain point of time in the future. Many of the large financial institutions exercise these options for themselves or for their corporate customers. These options can guarantee the companies that the level of interest they are paying at some future point of time, will not be exceeding a given level. (Hull, 2009)

4.3 Equity Derivatives

Equity derivatives have three categories: Exchange-traded derivatives, OTC derivatives and structured products. Each of these financial instruments, the value of which derives from the underlying equity asset or another variable has their own history, characteristics and market shares. These equity derivatives are all subject to complex tax treatment as well as regulatory demands. All three of the categories have in common that they are referencing to a specific financial instrument, the underlying asset being an equity asset or other variable, from which the value is derived and which is entered into by the both counter parties for a specific purpose. (Parker, 2009)

OTC derivatives have been available for hundreds of years and the market has grown spectacularly from $2.3 trillion in 2002 to $6.3 trillion by the middle of 2006. These derivatives are bilateral contracts, based on the specific requirements of the parties. Principal categories consist of options, swaps and forwards. In comparison, the exchange–traded derivatives differ by having to comply with specific regulations and requirements, set by the exchange on which they are traded. The principle market categories for the exchange-traded products include standardised contracts traded at the exchange as well as the structured products, options and futures. The structured product market consists of negotiable instruments such as certificates, bonds and fund units, which have an embedded equity derivative element, the latter being their distinguishing feature. There are multiple factors which effect the decision of the parties to enter into an equity derivatives transaction, such as corporate finance strategy, reduction of transactions costs, gaining market access or the investment of portfolio returns for example. (Parker, 2009)

4.4. Foreign exchange derivatives

Foreign currency exchange rates can fluctuate significantly even over a short period of time and thereby affecting values and asset pricing. Foreign currency derivatives, such as forwards, are important for investors who invest in securities that are dominated in foreign currencies. Exchange rates are generally affected by multiple factors such as international or domestic political and economical changes, volatility in interest rates as well as other complex factors. Most common derivatives contracts among foreign exchange are forward contracts, currency swaps and options on forward contracts options on currencies. (Peery, 2012)

4.5 Commodity derivatives

Commodity-based over the counter derivatives are mostly governed by Commodity Futures Trading Commission (CFTC) since they commonly are highly customized regarding the conditions and terms. These derivatives are mostly available only for a range of participants, cash-settled forwards commonly for the petroleum-based fuels or natural gasses. Other commodity derivatives are also plausible, but they are handled as swaps. Another specific category among the commodity derivatives are energy swaps. These swaps are also regulated by the CFTC and can be traded in exchange-traded markets or in OTC market, most commonly used derivatives in the market are oil swaps. (Peery, 2012)

5. DATA & METHODOLOGY

In this chapter of the research the data, hypotheses and research methodology are explained. The choices made in this research are based on earlier literature, which has been reviewed in the beginning of this research, in order to make this study well founded on the current state of research and to gain reliable results. In order to have a broader take than earlier researches, this study focuses on multiple years in order to compare possible changes in the dataset on the researched relationships among the variables.

5.1 Description

In this research the Uniform Bank Performance Report (UBPR) is used from the Federal Financial Institutions Examination Council (FFIEC). This report is an analysis of the commercial and savings banks, which file the Consolidated Reports of Condition and Income, also known as the Call report. The UBPR reports are classified under variable subjects, such as capital or asset quality, and each of these reports contains data for four separate quarters, which tie into the Call report filed by the banks. The UBPR also compares the performance of a bank against itself as well as against a performance peer group formed of peer banks. The data is targeted to federal and state banking supervisors as well as for the banks under supervision. The UBPR is a public document as the FFIEC agencies have determined it to be beneficial for the general public as well as for the banking industry to receive this kind of information, as they then will have access to the same data as the state and federal bank regulators. (Federal Financial Institutions Examination Council, 2015)

The UBPR based data below includes five different types of financial data. The dollar data is shown for most of the banks and it is taken from the Call reports and summary of Deposits. The data is shown in thousands, as it is also given in the Call reports. The expense and income data is generally shown as a year-to-date value and the Balance Sheet data given is mostly spot or end-of-period value. The report also uses ratio data, which is shown in percentage form of two decimals of precision. The report of peer group average data includes multiple ratios, which are computed. An average of the given ratio is used as a benchmark in order to measure the individual bank performance. For most of the ratios, percentile ranking is also computed. This value varies between 0 to 99, reflecting the percentage position of the given bank, in comparison against the

peer group. The reports also include structural data. (Federal Financial Institutions Examination Council, 2015)

In this research data from commercial banks is used, which is one of the peer groups defined in the report after their line of business. These groups are defined by combination of asset size, location in a metropolitan statistical area and by the number of branches. Most banks in the data fall into the group of commercial banks. Since UBPR data includes multiple reports, the analysis combines them, in order to research the use of derivatives as well as the financial characteristics of the banks. (Federal Financial Institutions Examination Council, 2015)

5.2 Hypotheses

This research focuses on the following hypotheses, which have been formed based on the earlier researches and analyses conducted in this field of finance.

H1: Use of derivatives is more common among larger banks.
Measured by the number of total assets, larger banks utilize derivates more than smaller banks.

H2: Banks reporting usage of derivatives have more risk-prone capital lending practices. User banks have larger share of assets as loans whereas non-user banks have more conservative capital structure.

H3: The use of derivatives has an effect on risk appetite.
A correlation exists between the use of derivatives and the reported amount of short-term debt, where the latter amount can be related to a possibility of bank default.

5.3 Research data

This study follows the structure of Sinkey et al. (2000)'s work, which focuses on the financial characteristics of commercial banks, which have reported usage or non-usage of derivatives. In order to summarize the usage of these products, UBPR reports on derivative instruments are used for the years 2006 to 2010. As this report includes all banks, which have filed the report, the dataset is first sorted to include only the

commercial banks. The variable ID_RSSD is used as well the list of IDs provided by Federal Deposit Insurance Corporation. In the data the institutions are given "bank charter classes", which are used to select only commercial banks classified with "N". The classification code, given by the FDIC, includes the following characteristics: institution's charter type, charter agent, Federal Reserve membership status and the primary federal regulator. The data used in this research consist of commercial banks included in the "N" classification, which stands for commercial banks, which are nationally chartered, Fed members and are supervised by the Office of the Comptroller of the Currency (OCC).

The summary below shows the amount of commercial banks for the chosen periods as well as from this quantity the number of institutions, which have reported using derivatives and number of institutions, which have not reported any derivative contracts. The number of banks shown below, has the most noticeable change during the period of 2006-2008, whereas after this period the number stays approximately in the same range. Whereas the number of commercial banks included in the data decreases, so does also the percentage of the derivatives using banks, except the increase in 2009. The number of user banks stays throughout the dataset on the same level until year 2009, whereas the change in the amount of banks not utilizing derivatives decreases by 164 institutes during the period of 2006-2010. In essence, the below table shows that the majority of the banks that disappeared were banks that did not use derivatives.

Table 2. Summary of the user and non-user banks from 2006 to 2010.

	2006	2007	2008	2009	2010
Amount of banks	1507	1445	1372	1317	1250
Amount of non-user banks	1243	1192	1133	1118	1079
Amount of user banks	264	253	239	247	171
Percentage of user banks from total	17,52%	17,51%	17,42%	18,75%	13,68%

The table below shows a summary of the different classes of derivatives contracts in the U.S. commercial banks during the years 2006-2010. These figures are taken as a year-end data and shown in millions as well as percentage share of the total amount of derivatives contracts during the given year for the chosen institutions. This data is

provided by the UBPR derivatives instruments report, which is taken from the Call report. The first summary contains derivative contracts, which is the total notional amount of all derivative contracts. Also all other derivative classes included are given as the notional amount of the indicated derivatives contracts from the call report for the specified year. The number of samples is also shown in this table in order to give a better overview of the data. The last row in the table shows the percentage share of the different derivatives contracts in the given year from the total number of derivatives contracts.

Table 3. The Derivatives activities of U.S. commercial banks from 2006 to 2010.

	2006	2007	2008	2009	2010
Interest rate contracts	106 093,49 m	128 072,51 m	135 538,24 m	138 532,66 m	151 058,57 m
Foreing Exchange contracts	11 164,79 m	15 534,16 m	14 035,37 m	14 057,59 m	18 052,55 m
Equity commodity & other	3 121,29 m	3 554,88 m	3 227,24 m	2 573,33 m	2 464,64 m
Derivative Contracts total	120 379,57 m	147 161,54 m	152 800,84 m	155 163,58 m	171 575,76 m
Amount of observations	1 507	1 445	1372	1317	1250
Percent of Total					
Interest rate contracts	88,13%	87,03%	88,70%	89,28%	88,04%
Foreing Exchange contracts	9,27%	10,56%	9,19%	9,06%	10,52%
Equity commodity & other	2,59%	2,42%	2,11%	1,66%	1,44%
Derivative Contracts	100,00%	100,00%	100,00%	100,00%	100,00%

The data from the commercial banks regarding the variables used in this research is gathered form seven different UBPR reports. The gathered data shows that most common derivative contracts are interest rate contracts. They report an increasing value in the annual data thorough the research. The other contracts included in the table shown above have more fluctuation in their amounts. Equity commodity contracts decrease from 2006 to 2010. Foreign exchange contracts show higher amounts during 2007 and 2010. This summary of the data also follows the example of the figures reviewed in the earlier chapters, where interest rate contracts are shown to be the most common derivatives contracts. This summary table of the derivatives data gathered also shows that the value of derivatives contracts is increasing.

5.4 Research methodology

The research of Sinkey et al. (2000) utilized the differences in mean values as well the regression (Tobit) analysis in their study of the commercial banks use of derivatives. They hypothesized the use of derivatives to be related to other financial characteristics. In order to study the hypothesis in this research the following formula is utilized:

(Formula 1. The use of derivatives to be related to other financial characteristics)

$$DER_i = \beta_0 + \beta_1 LNTASS_i + \beta_2 EQRAT_i + \beta_3 NIM_i + \beta_4 NOTES_i + \beta_5 DIV_i + \beta_6 LIQUID_i + \beta_7 GAP12_i + \beta_8 NETCO_i + \epsilon_i$$

The variables included are:

DER	= the notional value of a bank's derivatives scaled by total assets
LNTASS	= the natural logarithm of a bank's total assets
EQRAT	= the ratio of the book value of equity scaled by total assets
NIM	= net interest income scaled by total assets
NOTES	= notes and debentures scaled by total assets
DIV	= the dividend payout scaled by total assets
LIQUID	= Liquid assets scaled by total assets
GAPI2	= the twelve-month maturity gap scaled by total assets;
NETCO	= net charge-offs scaled by total assets
ϵ	= random-disturbance term

This equation is estimated with the Tobit model in this research. The model was originally developed to investigate consumer expenditures on household goods. This method is suitable in the context of this research, as the value of the dependent variable first used in Tobit's examination for many of his observations was zero. Also the dependent variable DER, cannot have a value less than zero in this research. (Sinkey et al., 2000) Tobit is a suitable method when estimating models, where the dependent variable is limited at some extent, such as in this research. The results for the Tobit analysis are shown in the following empirical results chapter.

The data is collected for the various years from seven different UBPRs, such as the report Ratios Capital Income. The user guide for the data is utilized in order to sort out the correct variables for this analysis. In the guide, possible formulas behind the data as well as more detailed information are provided. According the study of Sinkey et al. (2000), the variables are divided by the amount of total assets, in order to be analysed as ratios. Total assets are presented as natural logarithm in this analysis, according the example of Sinkey et al. (2000). The research shows first the descriptive statistics of the data for the different years and compares the mean differences in the results among the variables. The descriptive statistics for user and non-user banks are shown and compared. T-test results are also provided to view the statistical significance of the variable DER and the other variables in the dataset. In order to compare the statistics by the commercial bank size, the data is divided by calculating the mean value of the logarithm value of total assets. This way the comparison of the banks above this mean value to banks below this mean value of the variable LNTASS is conducted. This section is followed by Tobit-test results and their findings.

6. EMPIRICAL RESULTS

The first five tables below present the descriptive statistics for the data from 2006 to 2010. Following the descriptive statistics, t-statistics for the annual data are presented. The next sub-chapter 6.2 includes tables where the data is divided based on the total asset size of the banks. These tables are used to illustrate the mean values of the variables in order to compare possible changes in the results between larger and smaller institutions. The third subchapter includes ten tables displaying the mean values of the variables for the user and non-user commercial banks for the time period of 2006-2010. These tables provide the base for analysing of the two first hypotheses and at the end of this chapter, the results for the Tobit analysis are provided, hence providing an empirical basis also for the third hypothesis.

6.1 Descriptive statistics & t-statistics

The below tables include the descriptive statistics for the dataset. The tables are divided to include the statistics for the years 2006 to 2008 and 2009 to 2010. The results are used to compare differences in the mean values of the financial characteristics variables on an annual level. The descriptive statistics of 2006, the beginning year for the dataset used in the analysis, works as a comparison base for the results of the following years. 2007 marks the year when the financial crisis had its beginnings, as described in the earlier chapters. The most remarkable changes in the 2007 descriptive statistics compared to the data of 2006, are among the variables EQRAT and DER. The mean value of the variable DER varies from 2006 to 2010. Whereas the value in 2006 is 0,1089, it changes by increasing to 0,1109 for 2007. The results for 2008 and 2009 are similar to 2007, whereas the mean value for 2010 increases to the level of 0,1330, being the highest annual mean value for the variable DER. As stated also in the previous parts of this research, the number of commercial banks in the data is decreasing during the years. The variables LNTASS and EQRAT do not show drastic changes in the mean values, EQRAT variable decreases throughout the data whereas the variable LNTASS steadily increases. The most noticeable change in the mean value between the variables is found in the statistics of the LIQUID variable. The mean value of the variable decreases in the data until year 2009, but there is a noticeable increase to the level of 2,1610 in 2010. Similar results are also shown for the variable NETCO in the dataset.

The variable GAP12 shows a slight increase during the first two years of data whereas there is an obvious decrease in the value during the last few years of the data. Overall the other variables in the dataset also show small changes in the mean values through the data, but not as noticeable ones as the above mentioned.

Table 4. Descriptive Statistics for the sample from 2006 to 2008.

		DER	LNTASS	EQRAT	NIM	NOTES	DIV	LIQUID	GAP12	NETCO
Year 2006	Mean	0.108907	5.275456	1.122317	0.037675	0.000914	0.005249	3.123576	0.556510	0.000176
	Median	0.00000	5.189200	0.098700	0.037332	0.000000	0.002600	9.954828	0.000264	0.00000
	Maximum	51.46140	9.077800	1.903600	0.112882	0.040200	0.625800	212.2837	128.5281	0.076905
	Minimum	0.00000	3.340400	-0.009100	0.000000	0.000000	0.00000	-59.23123	-0.000136	-7.775835
	Std.Dev	1.680757	0.678571	0.113018	0.010058	0.003488	0.021118	12.10977	5.374039	0.002950
	Skewness	23.59856	1.505013	6.954814	0.555749	5.552580	21.25102	8.472660	15.51593	20.27715
	Kurtosis	639.0911	7.57308	68.89074	9.517207	35.94364	552.6255	115.8558	296.0518	451.4324
year 2007	Mean	0.110986	5.308965	0.127567	0.037094	0.000964	0.008650	2.574983	0.652387	0.000144
	Median	0.00000	5.222900	0.103000	0.036400	0.00000	0.004700	0.000100	0.000300	0.00000
	Maximum	58.29920	9.120200	0.993900	0.360900	0.042800	0.661800	173.0037	106.1363	0.061500
	Minimum	0.00000	3.510900	0.018500	0.000200	0.00000	0.00000	-3.944600	-0.000100	-0.000100
	Std.Dev	1.833140	0.695768	0.102697	0.013713	0.004634	0.0031331	10.83670	5.808454	0.002518
	Skewness	25.60537	1.529839	5.213175	10.22947	5.666188	15.00543	7.756844	12.35975	20.84291
	Kurtosis	745.5302	7.502309	34.21603	226.3466	37.53208	257.9994	83.96310	177.2901	468.6701
year 2008	Mean	0.101016	5.333338	0.118625	0.035566	0.000861	0.006657	2.370463	0.492981	0.000207
	Median	0.000000	5.240000	0.099900	0.035900	0.000000	0.003700	0.000100	0.000300	0.000000
	Maximum	45.23340	9.240000	0.994400	0.132600	0.036700	0.495800	113.0357	241.4453	0.085300
	Minimum	0.00000	3.510000	-0.045700	0.00000	0.000000	0.000000	-5.124100	-0.000200	0.000000
	Std.Dev	1.593164	0.685648	0.086808	0.009794	0.004186	0.020726	9.192904	7.561259	0.0003452
	Skewness	22.28861	1.624363	6.239563	1.788672	5.754705	15.70195	5.871702	26.00846	19.80648
	Kurtosis	552.3756	8.060181	49.84945	21.06440	38.26211	304.2988	46.90583	779.5689	426.3905

Table 5. Descriptive Statistics for the sample from 2009 to 2010.

		DER	LNTASS	EQRAT	NIM	NOTES	DIV	LIQUID	GAP12	NETCO
year 2009	Mean	0.111697	5.351786	0.114927	0.035185	0.000833	0.005013	0.052204	0.309622	0.000375
	Median	0.00000	5.527000	0.099500	0.035200	0.00000	0.002350	0.000000	0.000300	0.00000
	Maximum	44.57120	9.210000	0.987900	0.190200	0.053500	0.337600	2.350000	112.9018	0.116000
	Minimum	0.00000	3.530000	-0.234200	-0.002100	0.000000	0.00000	-0.030000	-0.000100	0.00000
	Std.Dev	1.714271	0.679555	0.085110	0.01142	0.004321	0.015765	0.187302	4.280026	0.005628
	Skewness	20.89824	1.642279	6.778608	3.566007	6.446163	15.65490	6.059174	2112512	16.92192
	Kurtosis	470.3788	8.12885	59.17950	43.35833	51.01693	291.2479	50.59652	498.3087	300.5875
year 2010	Mean	0.133009	5.361242	0.115375	0.035633	0.000590	0.004845	2.161038	0.172005	2.620192
	Median	0.00000	5.270000	0.101500	0.035600	0.000000	0.001900	0.000000	0.000300	0.000000
	Maximum	44.38760	9.210000	0.953200	0.198400	0.039300	0.453600	111.9873	33.46880	0.021300
	Minimum	0.00000	3.140000	0.013200	-0.005100	0.000000	0.000000	-0.011600	0.000000	0.000000
	Std.Dev	1.971308	0.684302	0.079755	0.011238	0.003402	0.017600	7.754389	1.791375	0.000626
	Skewness	19.46751	1.653112	7.482374	4.644979	7.125595	18.00599	7.384360	14.41852	31.92918
	Kurtosis	398.8415	8.281579	68.98575	60.22985	59.77141	398.5015	78.66614	235.5315	1075.012

The below tables display the t-statistic results for the data. The first one includes the years 2006 to 2008 and the second table shows years 2009 and 2010. As shown, the results for the first three years are consistent. Negative values are shown for the variables NIM, DIV and NETCO. Other variables have positive t-values in the results for 2006-2008. The variable DIV has a positive value in the statistics on the year 2009 whereas after this, the value is back to negative in the results of 2010. Also GAP12 has a negative value in the data of 2010, whereas until this point in time, its' value on the t-statistics has been positive. NETCO on the other hand has a positive t-statistics value in 2010, which is a change when compared to the values shown for 2006-2009. Throughout the dataset the variables LNTASS, NOTES and LIQUID show the highest positive t-statistics values. There is some variation in the values of the variables, the most noticeable change for the t-statistic values can be seen between 2008 and 2009. The tables below also include the p-values on the significance level of 0.05. The results show significant values for the variables LNTASS and NOTES throughout the dataset. The variable NETCO has a significant value in the results for the years 2007-2010. The variable LIQUID has a significant p-value only in the dataset of 2009 whereas the variable NIM has a significant value in the results of 2010. The null hypothesis is rejected for these variables and the variable DER. All the other variables do not show significant p-values in the results for the dataset from 2006 to 2010. These results fail to reject the null hypothesis for these variables and the variable DER.

Table 6. U.S. Commercial banks 2006-2008 t-statistics.

		Coefficient	Std. Error	t-Statistics	Prob.
2006	**LNTASS**	0.645311	0.072768	8.868009	0.0000
	EQRAT	0.636800	0.403665	1.577544	0.1149
	NIM	-7.941692	4.270900	-1.859489	0.0632
	NOTES	53.26152	10.56167	5.042905	0.0000
	DIV	-1.505849	2.034049	-0.740321	0.4592
	LIQUID	0.006305	0.003458	1.823403	0.0684
	GAP12	0.003969	0.007689	0.516146	0.6058
	NETCO	-19.26410	14.10580	-1.365686	0.1722
	C	-3.133377	0.451893	-6.933888	0.0000
	R-squared		0.118415		
	Adjusted R-squared		0.113707		
	Mean dependent var		0.108907		

		Coefficient	Std. Error	t-Statistics	Prob.
2007	**LNTASS**	0.647947	0.080333	8.065794	0.0000
	EQRAT	0.748176	0.500289	1.495486	0.1350
	NIM	-2.061524	3.554158	-0.580032	0.5620
	NOTES	56.65606	11.40831	4.966211	0.0000
	DIV	-0.372537	1.629951	-0.228558	0.8192
	LIQUID	0.006601	0.004325	1.526419	0.1271
	GAP12	0.004288	0.008065	0.531686	0.5950
	NETCO	-43.39938	18.90129	-2.296106	0.0218
	C	-3.412882	0.483537	-7.058158	0.0000
	R-squared		0.104162		
	Adjusted R-squared		0.099171		
	Mean dependent var		0.110986		

		Coefficient	Std. Error	t-Statistics	Prob.
2008	**LNTASS**	0.600431	0.071035	8.452595	0.0000
	EQRAT	0.530647	0.533755	0.994177	0.3203
	NIM	-4.618466	4.353622	-1.060833	0.2890
	NOTES	60.30418	11.13493	5.4115768	0.0000
	DIV	-0.244492	2.144380	-0.113502	0.9096
	LIQUID	0.007532	0.004500	1.673941	0.0944
	GAP12	0.004033	0.005377	0.750066	0.4533
	NETCO	-25.68896	12.37379	-2.076078	0.0381
	C	-3.064770	0.44922	-6.872882	0.0000
	R-squared		0.122148		
	Adjusted R-squared		0.116996		
	Mean dependent var		0.101016		

Table 7. U.S. Commercial banks 2009-2010 t-statistics.

		Coefficient	Std. Error	t-Statistics	Prob.
2009	**LNTASS**	0.765414	0.077476	9.879414	0.0000
	EQRAT	0.527406	0.586299	0.899551	0.3685
	NIM	-2.558227	4.068090	-0.628852	0.5296
	NOTES	38.02887	11.92009	3.190317	0.0015
	DIV	0.722864	3.054566	0.236650	0.8130
	LIQUID	0.536952	0.246258	2.180440	0.0294
	GAP12	0.004273	0.010757	0.397235	0.6913
	NETCO	-17.01598	8.627223	-1.972359	0.0488
	C	-4.013514	0.462560	-8.676749	0.0000
	R-squared		0.113907		
	Adjusted R-squared		0.108484		
	Mean dependent var		0.111697		

		Coefficient	Std. Error	t-Statistics	Prob.
2010	**LNTASS**	0.744676	0.087155	8.544317	0.0000
	EQRAT	0.537836	0.766995	0.701226	0.4833
	NIM	-10.99805	4.68124	-2.349367	0.0190
	NOTES	65.35593	18.23233	3.584617	0.0004
	DIV	-0.626011	3.370298	-0.185743	0.8527
	LIQUID	0.006950	0.006772	1.026275	0.3050
	GAP12	-0.004499	0.029814	-0.150896	0.8801
	NETCO	384.8701	89.10703	4.319189	0.0000
	C	-3.589398	0.518701	-6.919975	0.0000
	R-squared		0.142374		
	Adjusted R-squared		0.136837		
	Mean dependent var		0.133009		

6.2 Differences in mean values - size based

For the following tables the variables for every year of the data are divided into two groups according to the mean value of the LNTASS variable; larger and smaller commercial banks. The mean values are taken from the descriptive statistic tables previously reviewed. This is done in order to review the descriptive statistics based on the size of the commercial banks. Banks above the mean values are viewed to represent the larger institutions whereas the banks below the mean values represent smaller commercial banks in the data. As it can be seen from the tables below, the amount of

larger institutions is continuously smaller than the amount of institutions below the mean value of LNTASS variable in the dataset.

Table 8. 2006 Commercial banks above and below the mean value of total assets.

		Above the mean value			Below the mean value		
		Mean	Std.Dev	Std.Err. of Mean	Mean	Std.Dev	Std.Err. Of Mean
Year 2006	DER	0.253285	2.563091	0.100922	0.000875	0.012875	0.000439
	LNTASS	5.834106	0.635172	0.025010	4.857440	0.309063	0.010493
	EQRAT	0.103506	0.086770	0.003417	0.136392	0.127463	0.004341
	NIM	0.036769	0.009994	0.000394	0.038351	0.010060	0.000343
	NOTES	0.002063	0.006457	0.000254	0.0000543	0.000879	0.0000299
	DIV	0.006118	0.027294	0.001075	0.004599	0.014896	0.000507
	LIQUID	0.776019	2.310492	0.090976	4.880160	15.66184	0.533444
	GAP12	0.109261	0.841450	0.033132	0.891169	7.051511	0.240175
	NETCO	0.000291	0.003339	0.000131	0.0000892	0.002619	0.0000892
	Count	645			862		

Table 9. 2007 Commercial banks above and below the mean value of total assets.

		Above the mean value			Below the mean value		
		Mean	Std.Dev	Std.Err. of Mean	Mean	Std.Dev	Std.Err. Of Mean
year 2007	DER	0.257103	2.804251	0.113078	0.002719	0.37619	0.001306
	LNTASS	5.884680	0.655191	0.026420	4.882366	0.311745	0.010821
	EQRAT	0.107955	0.060211	0.002428	0.142100	0.123242	0.004278
	NIM	0.035449	0.010194	0.000411	0.03814	0.015718	0.000546
	NOTES	0.002189	0.006844	0.000276	0.0000569	0.000882	0.0000306
	DIV	0.007721	0.027471	0.001108	0.009338	0.033909	0.001177
	LIQUID	0.504335	1.710789	0.068986	4.109258	14.03025	0.486997
	GAP12	0.098760	0.878815	0.035437	1.062605	7.602576	0.263889
	NETCO	0.000337	0.003853	0.000155	0.00000	0.00000	0.00000
	Count	615			830		

Table 10. 2008 Commercial banks above and below the mean value of total assets.

		Above the mean value			Below the mean value		
		Mean	Std.Dev	Std.Err. of Mean	Mean	Std.Dev	Std.Err. Of Mean
Year 2008	DER	0.234947	2..438659	0.100999	0.002052	0.024150	0.000860
	LNTASS	5.899039	0.653826	0.027079	4.915336	0.300797	0.010709
	EQRAT	0.102392	0.051232	0.002122	0.130619	0.104084	0.003705
	NIM	0.034690	0.010974	0.000454	0.036213	0.008772	0.000312
	NOTES	0.001922	0.006042	0.000250	0.0000767	0.001440	0.000513
	DIV	0.005115	0.007072	0.000293	0.007797	0.026597	0.000947
	LIQUID	0.320653	1.389707	0.057556	3.885088	11.84068	0.421539
	GAP12	0.058388	0.492166	0.020383	0.814106	9.952376	0.354314
	NETCO	0.000488	0.005286	0.000219	0.00000	0.00000	0.00000
	Count	583			789		

The mean value for the variable of LNTASS in the data of 2006 is 5,2754. According to this the data consist of 645 commercial banks classified as larger institutions and 862 commercial banks classified as smaller institutions. The variables DER, NOTES, LIQUID and variable GAP12, have the most noticeable changes in this annual data. In the table of 2007, the mean value of the variable of LNTASS is 5,3090. According to this, the data is comprised of 616 commercial banks classified as larger institutions and 830 commercial banks classified as smaller institutions. Whereas the amount of banks decreases, the mean value of the variable DER increases in the data of 2007. The decrease of commercial banks is more noticeable among the smaller institutions. The mean value for the variable of LNTASS in the data of 2008 is 5,3333. According to this, the annual data of 2009 consists of 563 commercial banks classified as larger institutions and 753 commercial banks classified as smaller institutions. Also in this annual data, variables DER, EQRAT, NOTES and NETCO have the higher mean values in the dataset for the larger banks.

Table 11. 2009 Commercial banks above and below the mean value of total assets.

Year 2009	Above the mean value			Below the mean value		
	Mean	Std.Dev	Std.Err. Of mean	Mean	Std.Dev	Std.Err. Of mean
DER	0.25720	2.614952	0.110207	0.002445	0.025024	0.000912
LNTASS	5.909094	0.646890	0.027263	4.935100	0.297321	0.010835
EQRAT	0.103869	0.063307	0.002668	0.0123195	0.097528	0.003554
NIM	0.034497	0.011678	0.000492	0.035700	0.011279	0.000411
NOTES	0.001869	0.006365	0.000268	0.0000568	0.000981	0.0000358
DIV	0.004040	0.006184	0.000261	0.005741	0.020119	0.000733
LIQUID	0.009698	0.029757	0.001254	0.083984	0.241498	0.008801
GAP12	0.088754	0.686264	0.028923	0.474761	5.622938	0.204911
NETCO	0.0008777	0.008584	0.000362	0.00000	0.00000	0.00000
Count	563			753		

In 2009 the mean value of the variable LNTASS is 5,3598. According to this the data consist of 563 commercial banks classified as larger institutions and 753 commercial banks classified as smaller institutions. The mean values of the variables DER, EQRAT, NOTES and NETCO are higher for the larger commercial banks than for the smaller commercial banks in the data of 2009. The mean values of the variables NIM, DIV, LIQUID and GAP12 are larger for the smaller commercial banks in the data for that year. The data of 2010 below shows the mean value for the variable of LNTASS to be 5,3612. According to this the data consist of 530 commercial banks classified as larger

institutions and 718 commercial banks classified as smaller institutions. From the year 2006 to 2010 the amount of large commercial banks in this data has decreased by 115 institutions and the amount of small commercial banks by 144 institutions.

Table 12. 2010 Commercial banks above and below the mean value of total assets.

		Above the mean value			Below the mean value		
		Mean	Std.Dev	Std.Err. Of mean	Mean	Std.Dev	Std.Err. Of mean
Year 2010	DER	0.308769	3.017470	0.131701	0.00325	0.04089	0.001272
	LNTASS	5.922000	0.657947	0.028579	4.947312	0.301674	0.011258
	EQRAT	0.106497	0.046997	0.002041	0.121929	0.096602	0.0003605
	NIM	0.035545	0.010918	0.000474	0.035698	0.011476	0.000428
	NOTES	0.001348	0.005086	0.000221	0.0000304	0.000552	0.0000206
	DIV	0.003938	0.006223	0.000270	0.005514	0.022563	0.000842
	LIQUID	0.886551	2.064688	0.089684	3.101816	9.967625	0.371975
	GAP12	0.066069	0.493943	0.021456	0.250204	2.320923	0.086618
	NETCO	0.0000617	0.000959	0.0000417	0.00000	0.00000	0.00000
	Count	530			718		

6.3 Differences in mean values – use of derivatives based

For this part of the research the data is divided into two groups of commercial banks, those that use and those that do not use derivatives. This is done in order to review the mean values and differences in them based on the usage or non-usage of derivative products. The separation in the data is done with the DER variable. Whereas in the previous chapter the number of commercial banks was decreasing in both of the groups, in this grouping the number of banks not using derivatives decreases while the number of banks using derivatives fluctuates in the annual data. The data is listed in the tables annually and a short summary of the most noticeable changes is provided after the tables at the end of this chapter.

Table 13. 2006 Commercial banks - no use & use of derivatives.

		No use of derivatives			Use of derivatives	
	Mean	Std.Dev	Std.Err. Of mean	Mean	Std.Dev	Std.Err. Of mean
Year 2006						
DER	0.00000	0.00000	0.00000	0.621667	3.981997	0.245075
LNTASS	5.1000548	0.482819	0.013695	6.098982	0.842890	0.051876
EQRAT	0.127189	0.122846	0.003484	0.099373	0.035132	0.002162
NIM	0.038108	0.010206	0.000289	0.035633	0.009075	0.000559
NOTES	0.000294	0.002343	0.000006	0.003832	0.008601	0.000529
DIV	0.005359	0.023146	0.000657	0.004732	0.004851	0.000299
LIQUID	3.706946	13.23641	0.375435	0.376884	1.779947	0.109548
GAP12	0.659890	5.897690	0.167281	0.069768	0.909848	0.055997
NETCO	0.00007	0.002260	0.000064	0.000632	0.005045	0.000311
Count	1243			264		

Table 14. 2007 Commercial banks - no use & use of derivatives.

		No use of derivatives			Use of derivatives	
	Mean	Std.Dev	Std.Err. Of mean	Mean	Std.Dev	Std.Err. Of mean
Year 2007						
DER	0.00000	0.00000	0.00000	0.63894	4.350040	0.273485
LNTASS	5.131427	0.49816	0.014433	6.145378	0.85373	0.054406
EQRAT	0.132748	0.111118	0.003218	0.103160	0.036792	0.002313
NIM	0.037588	0.014389	0.000417	0.034769	0.009611	0.000604
NOTES	0.000384	0.002834	0.000081	0.003698	0.008718	0.000548
DIV	0.008868	0.03496	0.000993	0.007621	0.008056	0.000506
LIQUID	3.027564	11.83177	0.342698	0.442666	2.399704	0.150868
GAP12	0.775227	6.375965	0.184675	0.073634	0.885310	0.055659
NETCO	0.000015	0.000539	0.0000156	0.000746	0.005874	0.000369
Count	1192			253		

Table 15. 2008 Commercial banks - no use & use of derivatives.

		No use of derivatives			Use of derivatives	
	Mean	Std.Dev	Std.Err. Of mean	Mean	Std.Dev	Std.Err. Of mean
Year 2008						
DER	0.000000	0.00000	0.00000	0.579888	3.787121	0.244968
LNTASS	5.156628	0.480231	0.014267	6.171046	0.870532	0.056310
EQRAT	0.122998	0.093705	0.002784	0.097985	0.033516	0.002168
NIM	0.035970	0.009742	0.000289	0.033648	0.009829	0.000636
NOTES	0.000277	0.002215	0.0000658	0.003629	0.008261	0.000534
DIV	0.007045	0.022679	0.000674	0.004818	0.004917	0.000318
LIQUID	2.817204	10.04318	0.298371	0.253647	1.271260	0.082231
GAP12	0.592462	8.37268	0.247096	0.021384	0.215099	0.013914
NETCO	0.000033	0.001117	0.0000332	0.001033	0.007867	0.000509
Count	1133			239		

Table 16. 2009 Commercial banks - no use & use of derivatives.

Year 2009	No use of derivatives			Use of derivatives		
	Mean	Std.Dev	Std.Err. Of mean	Mean	Std.Dev	Std.Err. Of mean
DER	0.000000	0.00000	0.00000	0.620226	4.007235	0.260298
LNTASS	5.177711	0.482041	0.014675	6.144304	0.861660	0.055971
EQRAT	0.117980	0.092384	0.002812	0.101030	0.033778	0.002194
NIM	0.035314	0.011663	0.000355	0.034602	0.010502	0.000682
NOTES	0.000213	0.001812	0.0000552	0.003657	0.008903	0.000578
DIV	0.005335	0.017273	0.000526	0.003546	0.004398	0.000286
LIQUID	0.061390	0.204502	0.006226	0.010380	0.048023	0.003119
GAP12	0.362399	4.717224	0.143607	0.069346	0.598105	0.038851
NETCO	0.0000758	0.002490	0.0000758	0.001738	0.012079	0.000785
Count	1079			237		

Table 17. 2010 Commercial banks - no use & use of derivatives.

Year 2010	No use of derivatives			Use of derivatives		
	Mean	Std.Dev	Std.Err. Of mean	Mean	Std.Dev	Std.Err. Of mean
DER	0.000000	0.00000	0.00000	0.700402	4.487140	0.291471
LNTASS	5.184758	0.483121	0.015194	6.114093	0.879076	0.057102
EQRAT	0.118059	0.087520	0.002753	0.103927	0.025820	0.001677
NIM	0.035635	0.011121	0.000350	0.035632	0.011750	0.000763
NOTES	0.0000722	0.000899	0.0000283	0.002799	0.007186	0.000467
DIV	0.005153	0.019401	0.000610	0.003530	0.004862	0.000316
LIQUID	2.437303	8.503014	0.267422	0.982542	2.564607	0.166589
GAP12	0.206784	1.985217	0.062436	0.023647	0.249730	0.016222
NETCO	0.00000	0.00000	0.00000	0.000138	0.001433	0.0000931
Count	1011			237		

In the data used in this research, a majority of the banks is classified as commercial banks with no usage of derivatives. Banks reporting use of derivatives have a higher mean value of variable LNTASS, which is also supported by the results shown in the previous chapter. The number of commercial banks using derivatives decreases throughout the annual data but not as noticeably as the number of commercial banks who have no reported use of derivatives. The variable DER has mostly an increasing mean value in the data and there is visible increase from 2009 to 2010 for the user banks. The mean value for the size, LNTASS variable, nevertheless decreases in the dataset of 2009 for the derivatives users after the aggregated values from 2006 to 2008. The mean value for the variable LIQUID is higher for the commercial banks that do not use derivatives as shown in the results. The variable NOTES has higher mean value

among commercial banks that use derivatives. The data for the year 2010 consists of 1011 commercial banks with no derivative usage and 237 commercial banks classified as institutions using derivatives contracts. From the year 2006 to 2010 the amount of commercial banks not using derivatives has declined by 232 institutions and the amount of derivative using commercial banks by 27 institutions. The below table summarizes the differences in the mean values for the variables of commercial banks with use of derivatives and commercial banks with no usage of derivative contracts. DER, LNTASS, NOTES and NETCO variables have higher mean values among the banks that use derivative contracts whereas the variables EQRAT, NIM, DIV, LIQUID and GAP12 have higher mean values among the banks who do not report use of derivatives products.

Table 18. Mean differences between banks that do not and do use derivatives.

	2006	2007	2008	2009	2010
DER	0,621667	0,63894	0,579888	0,620226	0,700402
LNTASS	0,9989272	1,013951	1,014418	0,966593	0,929335
EQRAT	-0,027816	-0,029588	-0,025013	-0,01695	-0,014132
NIM	-0,002475	-0,002819	-0,002322	-0,000712	-0,000003
NOTES	0,003638	0,003314	0,003352	0,003444	0,0027268
DIV	-0,000627	-0,001247	-0,002227	-0,001789	-0,001623
LIQUID	-3,330062	-2,584898	-2,563557	-0,05101	-1,454761
GAP12	-0,590122	-0,701593	-0,571078	-0,293053	-0,183137
NETCO	0,000562	0,000731	0,001000	0,0016622	0,000138

6.4 Tobit analysis

This chapter presents the Tobit analysis results for the annual data of commercial banks from 2006 to 2010. The tables include the results for the coefficients, asymptotic standard error, z-statistics and significant levels. These Tobit analyses with the annual data are done with a significant level of five percent. The coefficient outcomes on variables display one unit increase or decrease in the predicted value of the dependent variable DER. The variable C in the Tobit analysis shows the results for the constant of the model. In all of the Tobit analysis the data is left-censored, by 0. The method used in all the Tobit analysis conducted is ML-Censored normal (TOBIT) and the coefficient covariance is computed using observed Hessian. The sample sizes are the same as

reported earlier for the annual datasets. The two tables showing the Tobit analysis are listed below from 2006 to 2008 and 2009 to 2010 and the results are examined below the tables in order to highlight the most important outcomes attained in the analysis. The summary and conclusions of the results is presented more in depth in the following chapter.

Table 19. Tobit analysis - use of derivatives by U.S. commercial banks from 2006 to 2008.

		Coefficient	Std.Error	z-Statistic	Prob.
Tobit - year 2006	**LNTASS**	0.645311	0.072551	8.894609	0.0000
	EQRAT	0.636800	0.402458	1.582276	0.1136
	NIM	-7.941692	4.258127	-1.865067	0.0622
	NOTES	53.26152	10.53009	5.058031	0.0000
	DIV	-1.505849	2.027966	-0.742542	0.4578
	LIQUID	0.006305	0.003447	1.828872	0.0674
	GAP12	0.003969	0.007666	0.517695	0.6047
	NETCO	-19.26410	14.06362	-1.369783	0.1708
	C	-3.133377	0.450542	-6.954686	0.0000
	Count	1507			
Tobit - year 2007	**LNTASS**	0.647947	0.080082	8.091030	0.0000
	EQRAT	0.748176	0.498729	1.500165	0.1336
	NIM	-2.061524	3.543073	-0.581846	0.5607
	NOTES	56.65606	11.37272	4.981749	0.0000
	DIV	-0.372537	1.624867	´-0.229273	0.8187
	LIQUID	0.006601	0.004311	1.531195	0.1257
	GAP12	0.004288	0.008039	0.533350	0.5938
	NETCO	-43.39938	18.84234	-2.303291	0.0213
	C	-3.412882	0.482029	-7.080242	0.0000
	Count	1445			
Tobit - year 2008	**LNTASS**	0.600431	0.070802	8.480456	0.0000
	EQRAT	0.530647	0.532001	0.997454	0.3185
	NIM	-4.618468	4.339320	-1.064330	0.2872
	NOTES	60.30418	11.09834	5.433619	0.0000
	DIV	-0.243392	2.137336	-0.113876	0.9093
	LIQUID	0.007532	0.004485	1.679459	0.0931
	GAP12	0.004033	0.005360	0.752538	0.4517
	NETCO	-25.68896	12.33314	-2.082921	0.0373
	C	-3.064770	0.444457	-6.895536	0.0000
	Count	1372			

The Tobit analysis results computed with the data of year 2006 shows a positive relationship between the variables DER and LNTASS, EQRAT, NOTES, LIQUID and GAP12. The results in the Z-statistics column show the same variables to have a positive relationship with the dependent variable DER. The p-value, given in the fourth column, shows significant results on the level of 0.05 only between the dependent variables DER and the variable NOTES. For the variable LNTASS the p-value is zero. All the other variables show non-significant results in the p-value column in the data of 2006. The positive relationship among the LNTASS, EQRAT, NOTES and LIQUID coefficients to variable DER is visible also in the data of 2007. Nevertheless there are changes in the coefficient values, as they increase from the results of 2006. The Z-statistics also display light changes in their values, nevertheless the variables LNTASS, EQRAT, NOTES, LIQUID and GAP12 have positive relationship to the dependent variable DER in the data of 2007. On the significance level of 0.05, variables NOTES and NETCO are significant. Like in the data for 2006, LNTASS variable has p-value of zero. The coefficient values for the variables LNTASS, EQRAT, NOTES, LIQUID and GAP12 are also positive in the data for 2008, indicating a positive relationship with the dependent variable DER. The results on Z-statistics imply a positive relationship for LNTASS, EQRAT, NOTES, LIQUID and GAP12 with the dependent variable. The p-value of variables EQRAT, NIM, DIV, LIQUID and GAP12 is over 0.05 making them not significant. The only variable in the data of 2008 having significant p-value is the variable NETCO. LNTASS and NOTES variables are reported to have a p-value of 0.0000. The results of the Tobit analysis for the first three years do not show significant changes in the variables having positive relationship to the dependent variable DER. The variable showing significant p-values in the data for the years 2006 to 2008 are LNTASS, NOTES and NETCO. The Tobit analysis above gives a basis for comparison for the second Tobit analysis shown below which includes the years 2009 and 2010.

Table 20. Tobit analysis - use of derivatives by U.S. commercial banks from 2009 to 2010.

		Coefficient	Std.Error	z-Statistic	Prob.
Tobit - year 2009	**LNTASS**	0.765414	0.077210	9.913371	0.0000
	EQRAT	0.527406	0.584291	0.902642	0.3667
	NIM	-2.558227	4.054155	-0.631014	0.5280
	NOTES	38.02887	11.87926	3.201282	0.0014
	DIV	0.722864	3.044103	0.237464	0.8123
	LIQUID	0.536952	0.245415	2.187935	0.0287
	GAP12	0.004273	0.010720	0.398600	0.6902
	NETCO	-17.01598	8.597672	-1.979138	0.0478
	C	-4.013514	0.460975	-8.706572	0.0000
	Count	1316			
Tobit - year 2010	**LNTASS**	0.744676	0.086840	8.575293	0.0000
	EQRAT	0.537836	0.764224	0.703768	0.4816
	NIM	-10.99805	4.664374	-2.357885	0.0184
	NOTES	65.35593	18.16647	3.597613	0.0003
	DIV	-0.626011	3.358124	-0.186417	0.8521
	LIQUID	0.006950	0.006747	1.029995	0.3030
	GAP12	-0.004499	0.029706	-0.151443	0.8796
	NETCO	384.8701	88.78515	4.334847	0.0000
	C	-3.589398	0.516827	-6.945062	0.0000
	Count	1248			

The data of 2009 shows a positive coefficients between the dependent variable DER and the variables LNTASS, EQRAT, NOTES, DIV, LIQUID and GAP12. Z-statistics show a positive relationship between DER and the variables LNTASS, EQRAT, NOTES, LIQUID and NETCO. The results of p-value show significant results for the variables LIQUID, and NETCO. The LNTASS variable is reported to have a p-value of 0.0000. In the last set of data, 2010, the coefficient is positive between the dependent variable DER and the variables LNTASS, EQRAT, NOTES, LIQUID and NETCO. The Z-statistics report positive relationship between DER and the variables that are also shown

to have positive coefficient value in the data of 2010. The p-value shows no significant values on the level of 0.05 for all the other variables expect the variables NIM and NOTES. The variables LNTASS and NETCO have a p-value of zero.

Throughout the Tobit analysis from 2006 to 2010 the data does not show great variation between the variables reporting positive relationship with the dependent variable DER. In the data for 2009 the variable DIV shows a positive relationship, but this is the only time in the analysis for the time period of 2006 to 2010 when the variable has a positive value reported. Until the year 2010, the variable GAP12 also has a positive relationship with the dependent variable whereas in the analysis for the 2010, this variable has a negative coefficient value indicating a negative relationship. Instead the variable NETCO shows a positive relationship to the variable DER in the analysis results for 2010. As described above, after the Tobit analysis for the first three years, the results for the annual data are rather similar without noticeably exceptions. In the data for 2009 the variable LIQUID is shown to have a significant p-value. The variable does not continue to have significant p-value in the analysis for 2010, whereas in NIM and NOTES show significant p-values in that annual data. When comparing the analysis results for the whole time period, a change in the results after the year 2008 can be seen. The analysis' results before 2008 are more in line, whereas the data for the last two years gives more noticeably varying results.

7. SUMMARY & CONCLUSIONS

This research has followed the study of Sinkey et al. (2000), where the authors analysed the financial characteristics of commercial banks, which use and do not use derivatives. Their analysis was carried out on annual data of 1996. In this research the data covers a five-year period from 2006 to 2010, which also includes the main years of the financial crisis. The hypotheses in this research are conducted according to the results of Sinkey et al. (2000) as well as other research, which have been reviewed in the beginning of this research.

The first hypotheses set in this research states derivatives usage to be more common among the larger banks. The comparison is done based on the total assets variable, LNTASS. The data has been divided according the mean value of the size of the commercial banks in the annual data. The results obtained do show a higher value for the DER variable among the commercial banks with higher mean value of LNTASS. The value of the variable DER fluctuates during the years, nevertheless staying higher for the larger commercial banks. The variable DER increases and decreases in the data for both, bigger and smaller commercial banks. The last year of the analysis shows the highest mean value of the variable DER for both larger and smaller commercial banks. Similar results, where derivatives use is more common among larger banks, have also been shown in the research of Sinkey et al. (2000).

It appears reasonable that the use of derivatives is more common among the larger commercial banks, as derivatives do require deeper knowledge of financial products and to some extent more capital. This research does not divide ISDA licensed banks from the commercial banks dataset, nevertheless the approval by the association does set requirements for the banks, for example the minimum amount of capital. Also from a practical point of view the smaller commercial banks might benefit from only focusing to their core business rather than widening their range of product offerings and diving into the derivative market. The simple reason for this is that as derivatives are technically and financially complex, it would require more internal departments with higher operating costs affecting their profitability. It can of course be discussed whether it is positive that the use of derivatives is concentrated among the larger banks. When the use is concentrated to large institutions, they could possibly affect the legislation and evolvement of the market to be more profitable for them and harder to access for

smaller institutions. This could also result in monopoly situation among the larger banks, which would have the required knowhow, systems and accessibility to the derivatives market.

The second hypothesis in this research focuses on the capital structure of commercial banks. Based on the review of previous studies and their empirical results, banks that use derivatives have larger share of assets as loans. For the non-user banks, the earlier studies report more conservative capital structure with more equity capital. The comparison outcome among banks that use and banks that do not use derivatives show repeating results among the variables. Banks reporting derivatives' usage show higher values for variables total asset (LNTASS) as well as for variable notes & debentures (NOTES). For banks with no derivative usage, book value of equity (EQRAT) and liquid assets (LIQUID) variables have the highest values in the data through the whole analysed period. Through the dataset the net interest income (NIM) variable values are higher among the non-user banks in the data. In the research of Cyree et al. (2012), it is concluded that banks with a low NIM value are more prone to use derivatives. Throughout the data non-user banks report higher values for their ratio of book value of equity (EQRAT) whereas the user banks have the highest values on the notes and debentures (NOTES). The comparison of the values among the variables does follow the expectations of the first and the second hypothesis of this research. An interesting exception in the results is nevertheless the reported values for variable NIM. Whereas the analysis results for the variable NIM do follow the outcome of earlier researches for the years 2006 to 2009, i.e. the variable NIM values are higher for user banks, the results for the last analysed year 2010, mark an exception. The difference between the results for the variable NIM values is 0.000003, meaning that the NIM values are remarkably similar between the two groups. As this is the last year in the used dataset it cannot be concluded whether higher values for the variable NIM could be shown for the derivatives user group in the following years. As the researches reviewed for this study also focuses on the years before or during the financial crisis, it would be interesting to see a possible trend or so called "new normal" on the relationship among the studied variables after the years of financial crisis. Such a study could show results with consistent and significant relationships between variables that have not earlier shown such. These possible results could further be used to evaluate the use of derivatives and their effect on the financial characteristics of commercial banks.

The Tobit analysis results displayed in the empirical results chapter does not show great variation throughout the data period. The coefficient values for total assets, book value

of equity, notes & debentures, liquid assets and twelve month maturity gap were positive and represented positive relationship to the dependent variable of derivatives in the date from 2006 to 2008. Net interest earnings, dividend payout and net charge offs display negative relationship on the coefficient results for this period of three years. On the significant level of 0.05 the results for the variable vary. On the data of 2006, significant p-values are only given for variables notes and debentures as well as total assets. 2007's Tobit results have significant p-values on total assets, notes and debentures as well as for net charge offs variables. On the 2008 annual data the same variables report significant p-values. The Tobit analysis results for the last two years included in the research vary from the outcome of 2006 to 2008. The results for the year 2009 include liquidity variable with a significant p-value whereas the variable notes and debentures does not anymore show a significant value. Nevertheless the coefficient values do indicate a positive relationship between the dependent variable derivatives and total asset, book value of equity, notes and debentures, dividend payout, liquid assets and twelve-month maturity gap variables. The last year of the data analysed shows positive relationship for total assets, book value of equity, notes and debentures, liquidity and net charge offs variables towards the derivative variable. The variables having a significant p-value are total assets, net interest income, notes and debentures as well as net charge offs.

The Tobit analysis results do not show any harmonized outcome in the results. Whereas the data has similarities during the first two to three years, the last two years in the analysis show greater variety. The third hypothesis given in this research compares the use of derivative to short-term debt and their relationships affect to bank riskiness. This hypothesis is also constructed based on the previous literature reviewed in this study. The use of derivatives among the banks does fluctuate in the data analysed, decreasing during the year of 2008 whereas again increasing during years 2009-2010. Throughout the five-year dataset, except the year 2007, the variable notes and debentures show decrease in the mean value. The variable presenting 12 months maturity gap increases by 2007 but decreases the following years in the analysis. Net charge offs variable increases noticeably from 2007 to 2010 in the analysis. In the Tobit analysis from 2006 to 2009 the variables for notes and debentures and 12 months maturity gap are shown to have positive relationship to the dependent variable as well as not significant p-values. Net charge offs analysis results show a negative relationship in the data from 2006 to 2009, with a significant p-value, whereas in 2010 the analysis shows a positive relationship between net charge offs and derivatives with a significant p-value. Based on the results achieved in the Tobit analysis for the whole dataset, the constant positive

relationship is shown between the variables total assets, book value of equity, notes and debentures as well as liquidity and the dependent variable. These results achieved do support the third hypothesis presented in this research.

As the annual data used the analysis does include the financial crisis, the events related to it can be estimated to affect the results. In this research the data is compared and analysed in various ways in order to examine possible similarities and fluctuations among the variables and their values. It is also noted that the amount of commercial banks in the data does decrease during the research, whereas the number of commercial banks using derivatives increases. Having more recent data as well as including multiple years in the research results in more noise in the outcome as when compared to the researches reviewed in this study. As this research included only the years 2009 and 2010 as years after the main years of the financial crisis, it can not be interpreted from the results whether the outcome would be similar also in the following years after 2010, meaning a new normal could have been established. Having conducted this kind of research for multiple years after and before the financial crisis would give more solid conclusions of derivatives' usage and the financial characteristics of commercial banks as well as on the risk appetite of institutions. It could also then possibly be seen from the data how long the financial crisis' effects can be seen in the analysis outcome and whether the financial crisis has been severe enough to completely change the expectations and relationships between the variables. After the year of 2008 the markets have faced changes in legislation as well as in the overall set up. More consumers and institutes are entering the market and derivatives as products have become easier available for these segments. At the same time the legislation has tightened from what is has been ten years ago and such scenarios as the markets before the financial crisis should not occur. As the financial crisis has been highly researched and studied subject, it has also increased the overall information level of the financial markets and the various investment products.

The different results for the first years in the analysis in this research do show some similarities when compared towards each other. As the change in the results is more noticeable after the year 2008, this could be set as a changing point. Possibly, the years before the financial crisis have had a different point of normality than the years after the crisis. In order to see possible changes to this mentioned normal after the financial crisis, it would be beneficial to analyse multiple years before the financial crisis, which could be seen to have had a less volatile market. Nevertheless such an approach would also set some limits time-wise, due to the IT bubble in beginning of 21st century

affecting market characteristics. As stated numerous times in this research, the financial crisis has affected the global market for many years to come. In case a similar research would be conducted, where more recent years would be include in the data, it should be taken into notice that the markets have become more global. Depending on the results and analysis, the globalization of the market will probably also account for some of the results.

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