Bachelor Thesis:

Lessons from the subprime lending crisis

Does the increase of the securitization, caused by Government Sponsored Enterprises, lead to a higher foreclosure rate?

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Subject:	Lessons from the subprime lending crisis
Date:	11-06-2010

Abstract

This thesis links the increase of securitizations, caused by Government Sponsored Enterprises (GSE), with the increase of the foreclosure rate. The database Bankscope is used to analyze the two GSEs; Fannie Mae and Freddie Mac. The variables of interest are: residential mortgages loans, total securities, total problem loans, foreclosure real estate, loan impairment charge, impaired loans, restructured loans and mortgages loans held for sale. A t-test is conducted to compare the prior (2002-2007) respectively the post (2007-2009) period means of the variables to analyze if the means are significantly different. The main conclusion is that the foreclosure rate did increase and other loans are in trouble as feasible in an increase of problem loans, loan impairment and restructured loans.

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Chapter 1: Introduction

1.1 The reason why this research is important

Does the increase of the securitization market, caused by Government Sponsored Enterprises, lead to a higher foreclosure rate? In the last few decades the U.S. subprime mortgage market was rising rapidly and developed into a big part of the U.S. mortgages market. This development was possible due to a decline in credit standards and a increase in lenders' risk taking. Also the loose monetary conditions and the competition that was increasing are reasons for the crisis. Financial innovations like securitizations and changes in the market lead to a decrease in lending standards. This is observable in the decline of denial rates. The increase of housing prices also influenced the lending standards (Dell'Ariccia, et all, 2008).

The increase of the supply of subprime mortgages has lead to a growing number of homeownership in the United States and this is also something the government did encourage. On the contrary subprime lenders are generally more risky and have a worse credit history. Subprime mortgages are mostly held by young people or people from ethnic minorities (Calomiris, 2008). Subprime mortgages can be defined as: "a class of mortgage used by borrowers with low credit ratings. Borrowers who use subprime loans generally do not qualify for loans with lower rates because they have damaged credit or no credit history, and are thus considered risky by lending agencies. Because the default risk for poor credit borrowers is greater than of other borrowers, lenders charge a higher interest rate on subprime loans"[1].

In the nineties Freddie Mac and Fannie Mae (Government Sponsored Enterprises) bought a lot of mortgages and played thus a big role in the secondary market because they hold only a small amount of the loans and securitised the rest of the loans. GSE are not allowed to originate mortgages themselves nevertheless they can intensify the mortgages market by securitization or buying and holding mortgages. In this way, GSE meet the legislative goal of homeownership for low and moderate-income households (Loutskina & Strahan, 2007).

Securitization is pooling a number of assets together and then sells it to a special purpose vehicle (SPV). In 2007 the mortgages outstanding that are securitized is more than sixty percent. Credit supply has become less sensitive to changes in the financial conditions, because loans are more liquid. Via securitization banks can provide liquidity with funds from capital markets instead of finance a liquidity with deposits like the banks used to do. The grow of securitization of financial

[1] Source: http://www.investorwords.com/6688/subprime_mortgage.html

asset had grown with a lot of products like collateral debt obligations, collateral loan obligations and credit-card securitizations. Although the growth had been the biggest in the supply of mortgages. Government-sponsored enterprises like Fannie Mae and Freddie Mac have played a big role in that change. Securitizations had changed the role of banks. Traditionally banks needed liquid deposits to originate illiquid loans. Because of securitisation banks do not originate and hold the loans anymore but banks originate and distribute the loans. (Loutskina & Strahan, 2007).

The median house prises did grow forty percent between 2000 and 2006. A quarter of the mortgages outstanding were subprime mortgages. However, this was not a problem because the interest rates did not grow and the house market was still booming. Eventually these conditions disappear and the subprime mortgages were the first loans to default (Mah-Hui Lim, 2008). The mortgages defaulted because the interest rate did grow and the borrowers were not able to pay the rent anymore. As a result of that a lot of houses were available for sale and that is why the house prices did fall.

In 2007 default rates on mortgages and foreclosure have been rising substantially. As a result of that the mortgages lending decreased and is also accompanied by sales of foreclosure homes. This has lead to a decline of the median home prices. This is the first time in 40 years that the median home prices have declined on an annual basis. The overflow of supply of existing homes has driven the sales down to the lowest level in 27 years and as a result of that there is also a decline of sales of new constructed homes. This created a weak house market and has a huge impact on other sectors like construction, household removal, do-it-yourself firms, legal offices and so on. The weak house market has influenced the employment rate negatively (Kregel, 2008).

The increase of the supply of subprime mortgages was not possible if lenders were not able to spread risk to securitizing mortgaged into mortgage-backed securities (MBS) (Keys et all, 2007). Eventually securitization has increased the most in the supply of subprime mortgages due government sponsored enterprises (Loutskina & Strahan, 2007).

1.2 Structure of this thesis

There is an extensive literature on the Government Sponsored Enterprises and the development of the securitization market. In this paper the result of many financial papers will be examined for the theoretical part. For the empirical part the database Bankscope will be used.

The following structure will be used in this thesis. Chapter 2 will give background information about the present financial crisis, the role of the U.S. government, subprime mortgages and securitisation. Chapter 3 will deepen in on the subject and give literature review. Chapter 4 will give an empirical approach on the research question. The variables of interest are: residential mortgages loans, total securities, total problem loans, foreclosure real estate, loan impairment charge, impaired loans, restructured loans and mortgages loans held for sale. The data will be obtained from the database Bankscope. At last the conclusion will be presented in Chapter 5. In this chapter there will be also some recommending for future research.

1.3 Main results

Government Sponsored Enterprises are introduced to support the secondary market for residential mortgages for U.S. household with a low or middle income and provide mortgages in unserved areas (Jaffee & Quigley). In the nineties Freddie Mac and Fannie Mae bought a lot of mortgages and played a big role in the secondary market because they hold only a small amount of the loans and securitised the rest of the loans (Loutskina & Strahan, 2007). Securitization leads to a decline in lending standard and an increasing supply of mortgages. Lenders were gambling on that the housing boom will continue and if the borrowers couldn't afford the house anymore they could always liquidate the house and repay the loan (Dell'Arciccia et all, 2008). Nevertheless the house prices began to fall in 2007 and the subprime mortgages were the first to default (Mah-Hui Lim, 2008). Securitizations had indeed leaded to an increase of homeownership in the beginning but it resulted in problem. The foreclosure of real estate did increase and other loans are in trouble as feasible in an increase of problem loans, loan impairment and restructured loans.

Chapter 2: Background

2.1 The present financial crisis

The collapse of the housing bubble has been the trigger of the present financial crisis because the subprime mortgages began to default. In 2001 the Federal Reserve Bank want to get the U.S. economy out of the recession with loose monetary policies. A lot of houses are built and the Americans bought houses like there was no tomorrow. As a result of that the house prices were growing rapidly (Mah-Hui Lim, 2008). Unfortunately this situation was not sustainable and the subprime mortgages market crashed in 2007. The subprime market experiences the same scenario as a lending boom scenario like losing standard, a fast growing market, declining risk premiums and worse loan performance (Demyanyk and Van Hemert, 2007).

The 'overconsumption' of the Americans was possible because of the loose monetary policies of the Federal Reserve Bank and the huge amount of foreign funds of the United States. The household consumption growth fast and was funded by equity loans on their houses. These consumption habits of the households in the United States and the U.S. government are mostly funded by the surpluses of foreign countries, which ironically happen to be even the poorer countries. The U.S. was able to get these funds because the U.S. dollar is popular. There is a so called global account imbalances (Mah-Hui Lim, 2008).

2.2 The U.S. Government

After the great depression federal support of the housing market started with the settlement of the Federal Home Loan Bank (FHLB) in 1932. FHLB has to provide short-term debt to mortgages institutions to support and help the local credit markets in charter of the Congres. The interest rates on these loans were as low as the government could borrow it on the credit market.

In 1934 Federal Housing Administration (FHA) was developed to support the mortgages market for the lower-income households. The FHA supplies low-down-payment mortgages and mortgages for less creditworthy households. This program insurance mortgages against defaults. It resulted in a growing market share but also in an increase of mortgages with a loan-to-value ratio of 95 percent or more. In 1944 the Veterans' Administration (VA) loan program was introduced for Veterans after returning from the war. VA guaranteed up to sixty percent of the mortgages loan. Eventually the market shares of these two government-insured programs (FHA and VA) did decline; one of the sources is the increase expansion of the Government Sponsored Enterprices supply of mortgages because they target the same 'down-market' (Jaffee & Quigley,

2009). Freddie Mac provide the same services as Fannie Mae and these institutions are known under the name Government Sponsored Enterprises (Kregel, 2008).

The Federal National Mortgages Association (Fannie Mae) was created by Roosevelt Administration in 1938, to support the housing market (Kregel, 2008). In the beginning they purchased mortgages insured by the FHA. In 1968 the Government National Mortgages Association (Ginnie Mae) took this role over and Fannie Mae become a public corporation (Loutskina & Strahan, 2007). Ginnie Mae guaranteed the timely payments of mortgages that were originated under special government supporting programs. Other advantages Ginnie Mae had were tax exemptions and special credit lines (Kregel, 2008).

Fannie Mae became a federal private corporation for supporting low and middle-income housing with the same advantages as Ginnie Mae except Fannie Mae did not have their liabilities guaranteed by the government (Kregel, 2008). After the privatisation Fannie Mae continued buying and selling mortgages to be able to issue debt and they also began to focus on conventional mortgages (Jaffee & Quigley, 2007). Conventional mortgages are not guaranteed or insured by the government (Jaffee & Quigley, 2009).

In 1970 Federal Home Loan Mortgages Corporation (Freddie Mac) was created to provide stability and liquidity for residential mortgages. Eventually Freddie Mac became private in 1986 (Loutskina & Strahan, 2007). In the beginning Freddie Mac did not hold mortgages in their portfolio. Instead Freddie Mac pooled these mortgages into mortgages backed securities and these MBS were sold to investors. Although the default risk was guaranteed by Freddie Mac (Jaffee & Quigley, 2009).

Government Sponsored Enterprises are introduced to support the secondary market for residential mortgages for U.S. household with a low or middle income and provide mortgages in unserved areas as stated in the Federal Housing Enterprise Safety and Soundness Act of 1992. Freddie Mac and Fannie Mae have the benefit that the government give guarantee on their debt and mortgage backed securities obligations (Jaffee & Quigley, 2007).

Government Sponsored Enterprises can fund their operations by borrowing in the private market. After the reform GSE did not have explicit guarantee on their liabilities anymore,

although implicit this guarantee by the government remained. Kregel (2008) explains this as follows:

> The shift away from direct borrowing by the government required alternative sources of funding through sales to private investors. This involved the creation of bonds backed by specific mortgages, credit enhanced through overcollateralization. Since these bonds involve no sale or conveyance of ownership of the mortgage collateral, they remain the general obligation of the issuer. Since the overcollateralization was relatively high they did not provide a definitive answer to the funding needs of either the thrifts or the GSEs. To meet these difficulties, a mortgage-backed security was created that sold (passed through) the income stream from a pool of mortgages to private market investors, such as institutions and insurance companies. These structures provided the basis for the development of the new financial instruments that have played a major role in the recent market crises. (p. 4, 5)

The department of Housing and Urban Development (HUD) has introduced the goal of increasing homeownership in 2005. It was a federal objective to achieve an ownership society by indirect activities like tax expenditures and federal credit, guarantee programs and insurance undertaken by the FHA. As mention before; FHA was developed to support the mortgages market for the lower-income households. The FHA supplies low-down-payment mortgages and mortgages for households with not perfect credit ratings (Jaffee & Quigley, 2009).

In the nineties Freddie Mac and Fannie Mae bought a lot of mortgages and played a big role in the secondary market because they hold only a small amount of the loans and securitised the rest of the loans. GSEs are not allowed to originate mortgages themselves. GSEs can intensify mortgages by securitization of the mortgages or buying and holding them. If GSEs buys the mortgages they take on the credit and the interest rate risks. If GSEs securitize the mortgages, they buy the mortgages and issue MBS (mortgages backed securities) or the GSEs sell credit protection to the originator. Either way GSEs provide liquidity. GSEs have limitations on the amount they can purchase or securitize, the so called non-jumbo mortgages. In 2006 the mortgages must be under the amount of 417,000 dollar per single family home. This way GSEs meet the legislative goal of homeownership for low and moderate-income households. (Loutskina & Strahan, 2007)

2.3 Subprime mortgages market & securitization

The increase in the supply of subprime mortgages is initiated by the U.S. government. The government encourages homeownership by encourage high mortgages leverages, deductibility of mortgages interest, funding subsidies and initiatives to increase the supply of mortgages to minorities and low-income individuals. Under normal conditions these people were not able to get a mortgages but eventually they did get a so called subprime mortgages. These initiatives also encourage creditworthy borrowers to increase their leverages (Calomiris, 2008).

In the last few decades the U.S. subprime mortgages market was rising rapidly and developed into a big part of the U.S. mortgages market. This development leads to a decline in credit standards and a increase in lenders' risk taking. Also the loose monetary conditions and the competition that was increasing are reasons for the crisis. Financial innovations like securitizations and changes in the market lead to a decrease in lending standards. This is observable in the decline of denial rates. This decline was bigger in areas with more competition and in area where lenders ware able to sell more original loans. The increase of housing prices also influenced the lending standards (Dell'Ariccia et all, 2008).

Securitization is concerting illiquid loans that are hold by banks into liquid securities that can be hold by group of shareholders. Securitization has transformed the role of the financial intermediaries. Securitization can lower the cost of capital because the risk is shared. (Keys et all, 2007)

The last years banks provide liquidity in a different way because they can securitizes the liquidity. Because the loans are becoming more liquid the banks financial conditions are less influences by loan supply. Banks can finance liquid loans by deposits or they are able to securitize them with funds from capital markets. Because the loans are liquid the originator doesn't have to hold the loan by himself, so liquid loans are a substitute source for financing a loan. An increase of deposits cost doesn't influence the supply of the liquid loans. On the contrary illiquid loans must be held by the originating lender (Loutskina & Strahan, 2007).

The increase of the supply of subprime mortgages was not possible if lenders were not able to spread risk to securitizing mortgaged into mortgage-backed securities (MBS). This also led to an increase of homeownership. Nevertheless there is a rising number of subprime delinquencies and foreclosures. Because these loans are not on the balanced sheet of the bank anymore, the banks does not bear the consequences of the delinquent loan. The securitization process is also a

complex process, which influences the transparency of loans' quality. Lenders do not screen borrowers credit worthiness good enough. And this lead to an information asymmetry between the lenders and the investors. Because the banks and investors have a long term relationship there will also be some moral hazard from the lenders (Moral hazard: "The risk that a party to a transaction has not entered into the contract in good faith, has provided misleading information about its assets, liabilities or credit capacity, or has an incentive to take unusual risks in a desperate attempt to earn a profit before the contract settles"[2]). Nevertheless loans that are easier to securitize (because the loans are above a credit score cut-off) they default twenty percent more frequently than similar loans under this cut-off (Keys et all, 2007).

Kregel (2008) stated:

> Thus, the subprime market was stable as long as an increasing number of new mortgages could be originated and prices of housing continued to rise in conditions of falling interest rates. However, the Federal Reserve started to reverse the accommodative monetary policy introduced after the stock market collapse and the terrorist attacks at just about the time that lenders started to loosen their lending standards. (p 18)

Between 2000 and 2006 the house prices were growing and the number of subprime mortgages did increase to twenty-five percent of total mortgages outstanding. This was not a problem because the interest rates did not grow and the house market was still booming. Nevertheless the house prices began to fall in 2007 and as a result of that the subprime mortgages were the first to default. (Mah-Hui Lim, 2008)

In 2005 delinquencies rates started to rise. Eventually default rates on mortgages and foreclosure have been rising substantial in 2007. As a result of that the mortgages lending decreased and is also accompanied by sales of foreclosure homes. This has lead to a decline of the median home prices. This is the first time in 40 years that the median home prices have declined on an annual basis (Kregel, 2008). Jaffee and Quigley (2009) also mentioned that a lot of U.S. household did get in trouble in 2008. 7,9% of the outstanding mortgages were not paid on time (delinquencies) and 3,3% of all the residential mortgages were foreclosed (Jaffee & Quigley, 2009).

[2] Source: http://www.investopedia.com/terms/m/moralhazard.asp

Chapter 3: Literature overview

3.1 Supply of mortgages loans

Loutskina and Strahan (2007) focus on how the supply of mortgages loans is effected by securitization and mortgages delinquencies. The securitisation has experienced the fastest grow in the mortgages market and a large part is caused by the secondary market activities of GSEs. It is regulated that GSEs only supply mortgages below a certain threshold. Securitization is pooling the cash flows of similar assets together and then sell this pool to a special purpose vehicle (a separate legal entity). This pooling process lead to a diversified portfolio and these cash flows are used to support payments on debt securities that the special purpose vehicle issue. Traditionally banks needed liquid deposits to originate illiquid loans. Securitizations had changed the role of banks. Instead of originate and hold the loans banks originate and distribute the loans. Securitization advances financial integration and investor diversification. Integration is the possibility to let capital flow between markets. A disadvantage of integration is that the drop in the real estate market in the U.S. and the U.K. to spread throughout the financial system. Diversification increases the risk taking behaviour because investors did not do a proper credit evaluation. (Loutskina and Strahan, 2007)

3.2 Decline in lending standards

Dell'Arciccia et all (2008) link the recent sub-prime mortgages crisis with a decline in lending standards associated with the growing expansion of this market. They used the application denial rate and the loan-to-income ratio as the two indicators for lending standard. The lending standard decline more in area whit a large credit expansion, increasing house prices and higher securitizations rates. These conclusions are in line with the theory based on information asymmetry and the relation between financial instability and credit booms.

Dell'Arciccia et all (2008) also investigate the link between lending standards and delinquency rates in the market of the subprime mortgages. In area where the volume and number of originated loans are increasing the delinquency rates raised more. This relationship has a link with the decrease in lending standard. Also a lot of competition in a certain area leads to a decline in denial rates. They measured this with a significant increase in loan-to-value ratios and the decline in loan denial rates. The decline in lending standards can also be link with the characteristics of a credit booms such as financial innovation (e.g. securitization), fast rising house prices, changes in the structure of the market and the supply of aggregate liquidity. In areas where credit booms are larger the decline of lending standards was more. Although the credit booms dynamics are

different in the prime and subprime mortgages market. The subprime market behaves consistent with the theory of intermediation where information asymmetry played an important role among lenders. This asymmetry can be notices by the decline in standards in association with the increasing number of applications. In the prime markets the credit history of borrowers is public available and thus the information asymmetry is less. The increasing house price is also mentioned to be one of the cause of the decline of lending standard. Lenders were gambling that the housing boom will continue on and on. And if the borrowers couldn't afford the house anymore they could always liquidate the house and repay the loan. Disintermediation is also associated with the decline in lending standards. In areas where the lenders sold larger portions of their portfolios to third parties the lending standard declined more. (Dell'Arciccia et all, 2008)

3.3 Loan-to-Value ratios

Demyanyk and Van Hemert (2007) find that the foreclosure rates and the delinquencies of subprime borrowers can be determined by high loan-to-value ratios. Demyanyk and Van Hemert (2007) define a loan delinquent if the payments on the loan are sixty days or more late, if the laon is foreclosed, real-estate-owned or defaulted. A delinquent loan is thus in trouble. They focus on the performance of young (first seventeen months after originations) subprime mortgages. High loan-to-value borrowers seem to be a lot riskier than low loan-to-value borrowers. Over time mortgages rates because more sensitive to the loan-to-value ratios of the borrower. In principle there should be a subprime mark-up to cover the default risk of the subprime borrower. The increase of the subprime mortgages market should thus be accompanied with a increase in subprime mark-up. Eventually this seems not to be the case, subprime mark up seems to decline over time. This situation was not sustainable and the subprime mortgages market crashed in 2007. The subprime market experiences the same scenario as a lending boom scenario like losing standard, a fast growing market, declining risk premiums and worse loan performance.

3.4 Securitization

Keys et all (2007) conclude that loans that are more easily securitize, default more. Securitization is concerting illiquid loans into liquid securities. Financial intermediation suggests that lenders do not screen the borrowers as much as the borrowers used to due securitization. Keys et all (2007) investigated this by using a dataset on securitized subprime mortgage loan. If the possibility is higher that a portfolio will be securitized this portfolio defaults around twenty percent more than a portfolio that is less likely securitized. Remarkable is that the portfolios are the same in case of risk characteristics and loan terms. Securitization has thus an adverse and negative effect on the bank's screening of the creditworthiness of the borrowers. Although securitization improves the

credit markets the benefits are limited. Securitization increase the distance between initiator and borrower and this had a negative impact on the transparency. The improvement of the efficiency of the market is only true if diversification of the risk outweighs the danger if the distance. Mian and Sufi (2007) concluded that the expansion of the supply of subprime mortgages between 2002 and 2005 is caused by the increase of securitization and had lead to an increasing mortgages default from 2005 to 2007. They also mention the fact that the house prices were growing between 2002 and 2005.

3.5 Government Sponsored Enterprises (GSEs)

GSEs have two missions. First GSEs want to create and also guarantee MBS. Second GSEs hold and purchase MBS and mortgages. Those both business lines are needed to increase the homeownership for low- and moderate income households and a good spread of mortgages funding in all urban areas.

GSEs receive large subsidies of the government and the government guarantee their debt. The federal government thought that GSEs were too big to fail. Because of the government give guarantee to GSEs they have an advantage on their MBS instead of other entities. The debt obligations are issued at a interest rate between U.S. treasury and AAA corporate debt. It is remarkable the GSEs itself have a lower credit rating. The MBS are guaranteed by the GSE against default risk until the fall in 2008 (Jaffee & Quigley, 2009). Nowadays the MBS are guaranteed by the U.S. government because the government take over Freddie Mac and Fannie Mae in September 2008. (Jaffee & Quigley, 2009b)

Chapter 4: Empirical approach

4.1 The database: Bankscope

To analyse the GSEs the database Bankscope is used. In Bankscope it is possible to obtain financial information about nearly all banks over the world like the balance sheet, ratings, ratios, stock data etcetera. In this thesis only data on Fannie Mae and Freddie Mac will be analized because those two Government Sponsored Enterprises play a big role in the secondary market (Loutskina & Strahan, 2007). The data is used from 2002, because this is a few year before the subprime lending crisis started. For all the variables of interest except one (foreclosure real estate of Fannie Mae) the data is available. The last data available in Bankscope is for most of the variables of year 2009 except for restructured loans of Freddie Mac and mortgages held for sale from both the GSEs. For Fannie Mae the number of 2002 of foreclosure real estate is not available.

4.2 Used variables & Empirical approach

The variables of interest are presented in table 1. In the figures 1 up to 8 (see appendix) these variables are presented in a bar chart to give an basic impression of the development of these variables over time.

Table 1: Used variables

Variable	Definition
Residential mortgage loans	Mortgage of a residential property[3] That are bought each year.
Securities	An investment instrument, other than an insurance policy or fixed annuity, issued by a corporation, government, or other organization which offers evidence of debt or equity.[4]
Problem loan	In the banking industry, a problem loan is one of two things; it can be a commercial loan that is at least 90 days past due, or a consumer loan that it at least 180 days past due. This type of loan is also referred to as a nonperforming asset.[5]
Foreclosure	The legal process by which an owner's right to a property is terminated, usually due to default. Typically involves a forced sale of the property at public auction, with the proceeds being applied to the mortgage debt.[6]
Impairment charge	Companies sometimes pay more for assets than they turn out to be worth. When reality dawns, a firm may take an impairment charge in its accounts, which can lead to a nasty hit to its profits. The charge reflects the difference between the value of the asset in the accounts and its actual worth, as determined by accountants.[7]
Impairment	The amount by which stated capital is reduced by distributions and losses.[8]
Restructured loans	New loan that replaces the outstanding balance on an older loan, and is paid over a longer period, usually with a lower installment amount. Loans are commonly rescheduled to accommodate a borrower in financial difficulty and, thus, to avoid a default.[9]
Mortgages loans held for sale	Mortgages loans held for sale.

[3] Source: http://www.investorwords.com/4209/residential_mortgage.html
[4] Source: http://www.investorwords.com/4446/security.html
[5] Source: http://www.investopedia.com/terms/p/problem-loan.asp
[6] Source; http://www.investorwords.com/2039/foreclosure.html
[7] Source: http://www.thisismoney.co.uk/jargon/I/impairment-charge
[8] Source: http://www.investorwords.com/2379/impairment.html
[9] Source: http://www.businessdictionary.com/definition/rescheduled-loan.html

To identify if these variables are statistically significant the t-test is used. "*A t-test is a statistical test that establishes a significant mean difference in a variable between two groups.*" (Sekaren, p 424) The two groups that are used are the prior (2002-2006) and the post (2007-2009) crisis period. These two groups are chosen this way because the house prices were growing between 2000 and 2006 and began to fall in 2007 (Mah-Hui Lim, 2008). The sample size is thus unequal with a equal variance. The following five step procedures will be used.

i. $H_o: \mu_1-\mu_2 = 0$ vs $H_1: |\mu_1-\mu_2| > 0$

ii. Test statistic: $T = \left| \frac{X_1 - X_2}{S_{X_1,X_2}\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \right|$

iii. Reject $H_0 \leftrightarrow T > t_{\alpha/2;m}$

iv. Calculate the val

v. Draw conclusion

Where $S_{X_1,X_2} = \sqrt{\frac{(n_1-1)S_{X_1}^2 + (n_2-1)S_{X_2}^2}{n_1+n_2-2}}$

And the degrees of freedom is $t=(n_1 + n_2)-2$ (Nieuwenhuis, Chapter 18)

In these tests the probability will be used, which means that by which probability the prior and post mean are significantly different. The probability is calculated in excel with the function T.VERD function (t-test, degree of freedom, 2 sides). If the probability is 10 % or higher, the H_0 will not be rejected. The results of all these variables are presented in table 2 (Fannie Mae) and table 3 (Freddie Mac).

4.3 Analysing the data

If we look at table 2 and table 3 it is observed that almost all the H_0-hypthese are rejected. This means that all the means of the prior period are significantly different from the means of the post period. For Fannie Mae the only variables that are not rejected are residential mortgages loans and mortgages held for sale. For Freddie Mac the variables that are not rejected are total securities and also mortgages held for sale.

GSEs have the federal goal to achieve an increasing number of homeownership by supporting the low and middle-income household. Figure 1A and 1B demonstrates that Freddie Mac and Fannie Mae are both big players in the mortgages market in the U.S. since 2002. For Freddie Mac the prior period is significantly bigger than the post period. For Fannie Mae this difference is not significant although the average residential mortgages loans from 2002 up until 2009 is $377,533.- mil which indicate that Fannie Mae is a big player in this market (Table 2 and 3).

Because GSEs are not allowed to originate loan by themselves they can only intensify the market by securitized the mortgages or buying and holding the mortgages (Loutskina & Strahan, 2007). Securitization is concerting illiquid loans that are hold by banks into liquid securities that can be hold by group of shareholders (Keys et all, 2007). Figure 2A and 2B show the development of the total securities. It is statistical proven that the total securities of Fannie Mae is smaller in the post period (table 2). For Freddie Mac this difference is not significant although the average 'total securities' from 2002 up until 2009 is $658,207.- mil which indicate that Freddie Mac is a big player in the security market. Mian and Sufi (2007) concluded that the expansion of the supply of subprime mortgages between 2002 and 2005 is caused by the increase of securitization and had lead to an increasing mortgages default from 2005 to 2007.

Unfortunately no data available in Bankscope about default rates. Instead of default rates, problem loans will be used because a problem loan can result in a default loan. In figure 3A and 3B observable that the problem loans are increasing substantially since 2007 this is also confirmed by the t-test (table 2 and table 3). The year 2008 of Freddie Mac is obvious because this year is a lot smaller than the year before en after. A possible conclusion could be that in 2008 several loans are default and are omitted from the sample. But this should be investigated to know for sure.

Keys et all (2007) mention that there is a rising number of subprime delinquencies and foreclosures because the loans are not on the balance sheet of the bank anymore. In figure 4A and 4B it is clear that the foreclosure rate of real estate increase to a large extent since 2007. This is also statistical significant (table 2 and table 3). A possible explanation is that the house prices began to fall in 2007. As a result of that the subprime mortgages are the first to default. (Mah-Hui Lim, 2008)

In figure 5A and 5B the loan impairment charge is offered. Since 2007 the impairment charge did increase enormously. Freddie Mac and Fannie Mae 'admitted' that their asset book value were too high and did take an impairment charge in their books. Before 2007 these impairment charge was of a minimum level. The prior means from Fannie Mae and Freddie Mac are respectively 406.2 and 162.6 and the post means are 35,047 and 15,605.3 (table 2 and table 3). This is a enormous difference which is thus statistically significant. In figure 6 it is feasible that the impaired loans also increase since 2007 and this is statistically significant. It is clear that the impairment charge is positively related to the impaired loan because these impaired loans also started to increase since 2007. Unfortunately the graph of Freddie Mac is not available on Bankscope. It obvious the figure of total problem loans of Fannie Mae (Figure 3A) had the exact same number as the figure of the impaired loans. A possible explanation is that Fannie Mae's problem loans immediately reduce by the losses. This should be investigated to know for sure.

In figure 7A and 7B the restructured loans are presented. It is obvious that the restructured loans increased over time, the means of both GSEs are significantly higher in the post period (table 2 and table 3). A loan becomes restructured to prevent that the loan defaults. Kregel (2008) mention that delinquencies rates started to raise in 2005. Eventually the default rates on mortgages and foreclosure lave been rising since 2007. This can be a possible explanation for the increase of the restructured loans because the GSEs tried to prevent loans to default.

Because GSEs are not allowed to originate loan by themselves they can only intensify the market by securitized the mortgages or buying and holding the mortgages (Loutskina & Strahan, 2007). The difference between prior and post means are not statistically significant (table 2 and table 3). A possible explanation is that the numbers of 2009 are not available. The numbers of mortgages loans held for sale did increase enormously between 2007 and 2008, if this trend kept on going it could be that difference would be significant. This should be investigated further if the number of 2009 is available.

Chapter 5: Conclusion & recommending for future investigation

5.1 Conclusion

Government Sponsored Enterprises are introduced to support the secondary market for residential mortgages for U.S. household with a low or middle income and provide mortgages in unserved areas as stated in the Federal Housing Enterprise Safety and Soundness Act of 1992. (Jaffee & Quigley, 2007) Freddie Mac was created to provide stability and liquidity for residential mortgages. (Loutskina & Strahan, 2007). Fannie Mae was created to support the housing market. (Kregel, 2008). GSE has increased the supply of mortgages to minorities and low-income individuals. Under normal conditions these people were not able to get a mortgages but eventually they did get a so called subprime mortgages. These initiatives also encourage creditworthy borrowers to increase their leverages (Calomiris, 2008).

Government Sponsored Enterprises can fund their operations by borrowing in the private market (Kregel, 2008). GSEs are not allowed to originate mortgages themselves. GSEs can intensify mortgages by securitization of the mortgages or buying and holding them. If GSEs buys the mortgages they take on the credit and the interest rate risks. If GSEs securitize the mortgages, they buy the mortgages and issue MBS (mortgages backed securities) or the GSEs sell credit protection to the originator. Either way GSEs provide liquidity. (Loutskina & Strahan, 2007). The average total securities between 2002 and 2009 of the Fannie Mae and Freddie Mac are huge (Figure 2A and 2B). For Fannie the total securities are significantly lower after 2006. This is explained by Mah-Hui Lim (2008) because the house prices were growing between 2000 and 2006. Nevertheless the house prices became to fall in 2007 and as a result of that the subprime mortgages were the first to default. This can be verified by figure 3A and 3B because problem loans did grow substantially in after 2006. The foreclosure of real estate did also increase since 2006. Freddie Mac and Fannie Mae noticed that their asset were not worth as much as it was presented in the books. The GSEs increased their impairment charge in 2007 to a large extent (Figure 5A and 5B). In figure 7A and 7B is presented that the restructured loans are increasing over time. Loans are restructured to prevent them for default. Kregel (2008) mention that delinquencies rates started to raise in 2005. Eventually the default rates on mortgages and foreclosure lave been rising since 2007. This can be a possible explanation for the increase of the restructured loans because the GSEs tried to prevent loans to default.

This all taken together. The supply of mortgages increased and can be for a large part explained by the secondary market activities of the GSEs (Loutskina and Strahan, 2007). Securitization leads to a decline in lending standard and an increasing supply of mortgages. Lenders were gambling on that the housing boom will continue and if the borrowers couldn't afford the house anymore they could always liquidate the house and repay the loan. (Dell'Arciccia et all, 2008) Nevertheless the house prices began to fall in 2007 and the subprime mortgages were the first to default (Mah-Hui Lim, 2008). Securitizations had indeed lead to an increase of homeownership in the beginning but it resulted in problem. The foreclosure did increase and other loans are in trouble as feasible in an increase of problem loans, loan impairment and restructured loans.

5.2 Recommending for future investigation

A lot of loans are in trouble (increase of problem loans, loan impairment and restructured loans.) In the future it may be a good option to investigate the development of these trouble loans. Do these loans develop in foreclosure or will these loans be 'repaired' because the borrowers can pay their bills or because the houses are sold and the loan is repaid. In other words what is the recovery rate?

References

Bankscope. Available from bankscope: http://dbiref.uvt.nl/iPort?db=bank&language=eng

Calomiris, C. W., (2008). "The Subprime Turmoil: What's Old, What's New, and What's Next," *The Journal of Structured Finance, 15,* 6-52.

Dell'Ariccia, G., Igan, D. & Laeven, L., (2008). "Credit Booms and Lending Standard: Evidence from the Subprime Mortgage Market," *IMF WP/08/106*

Demyanyk, Y. & Van Hemert, O., (2009). "Understanding the Subprime Mortgage Crisis" *RFS Advance Access published online.* doi:10.1093/rfs/hhp033

Jaffee, D. M., & Quigley, J.M., (2007). "Housing Subsidies and Homeowners: What Role for Government-Sponsored Enterprises?", *Brookings-Wharton Papers on Urban Affairs*

Jaffee, D.M., & Quigley, J.M., (2009). "Housing Policy, Mortgage Policy, and the Federal Housing Administration" *University of California*

Jaffee, D.M., & Quigley, (2009b) "The Government Sponsored Enterprises: Recovering From a Failed Experiment" *Working paper NO. W09-001 University of California*

Keys, B.J., Mukherjee, T., Seru, A., & Vig, V.,. (2007). "Securitization and Screening: Evidence From Subprime Mortgage Backed Securities", *mimeo, London Business School*

Kregel J., (2008). "Changes in the U.S. Financial System and the Subprime Crisis", *Working Paper No. 530*

Loutskina, E. & Strahan, P.E., (2007). "Securitization and the Declining Impact of Bank Finance on Loan Supply: Evidence from Mortgage Originations," *Journal of Finance*, forthcoming.

Mian, A., & Sufi, A. (2007). "The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis," unpublished manuscript, University of Chicago Graduate School of Business.

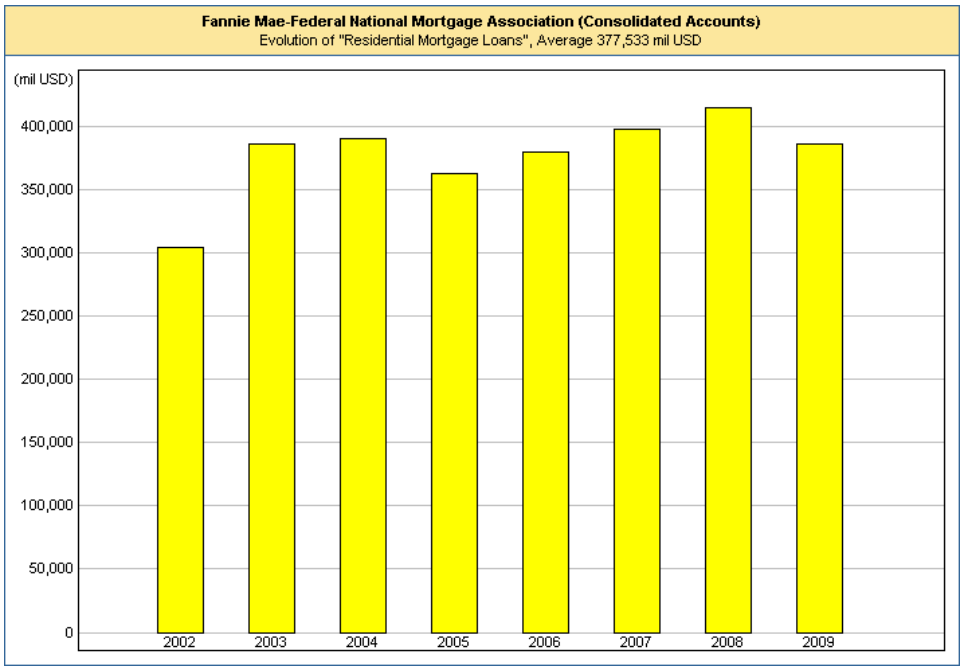
Mah-Hui Lim, M,. (2008). "Old Wine in a New Bottle: Subprime Mortgage Crisis—Causes and Consequences," *working paper no. 532*

Nieuwenhuis, G,. (2009), "*Statistical methods for business and economics"* McGraw-Hill Education

Sekaran, U. (2003). "*Research methods for business: A skill-building approach*." (fourth edition) United States of America, Hermitage Publishing Services

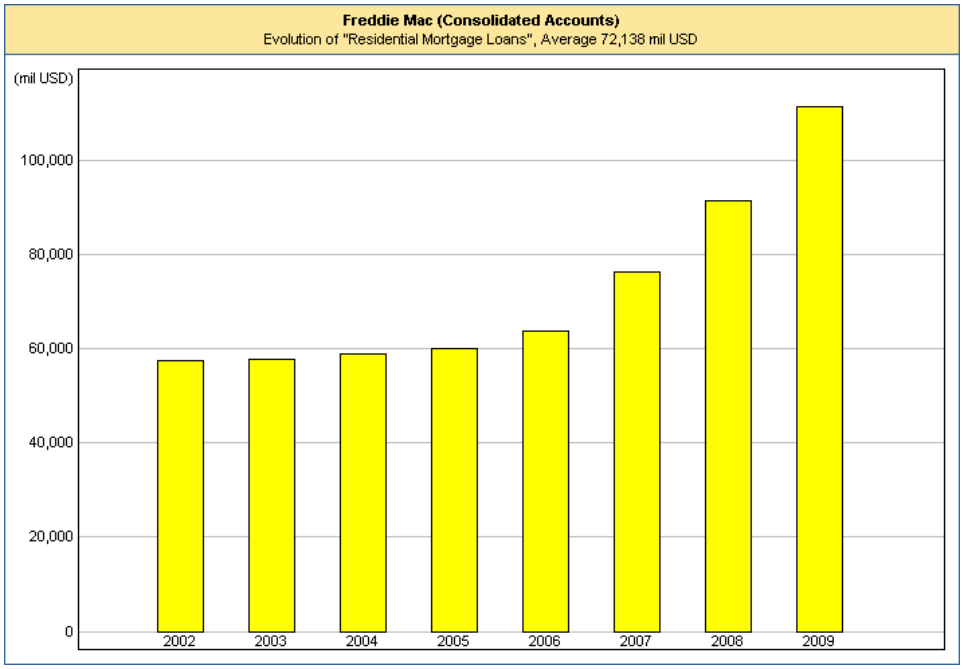
Appendix

Figure 1A: Residential mortgages loans Fannie Mae (source bankscope)



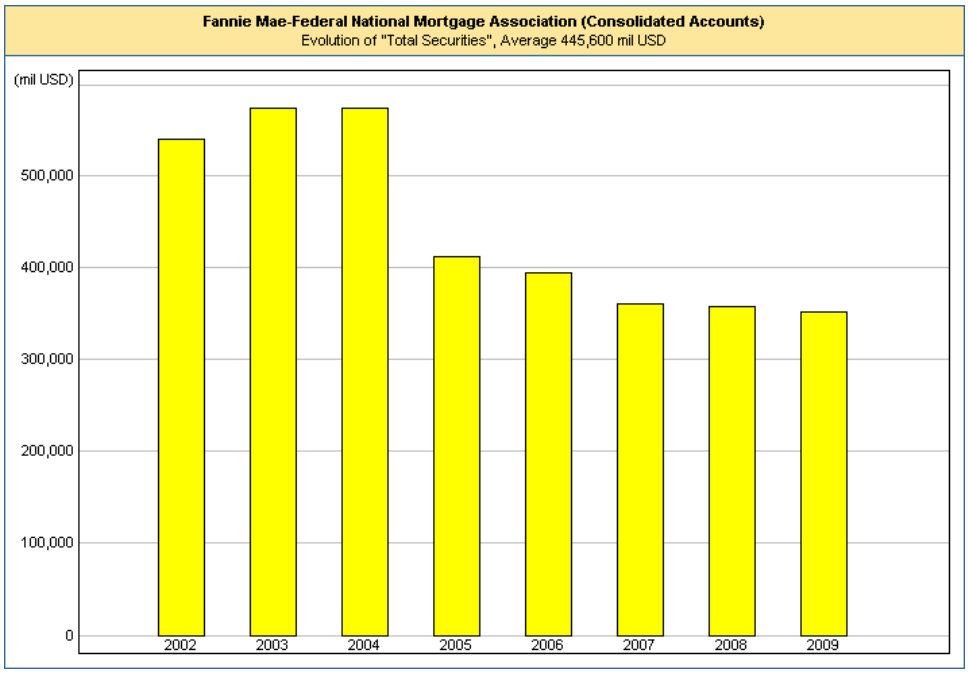
year	2002	2003	2004	2005	2006	2007	2008	2009
number	304394	385755	390000	662781	379027	397214	415065	386028

Figure 1B: Residential mortgages loans Freddie Mac (source bankscope)



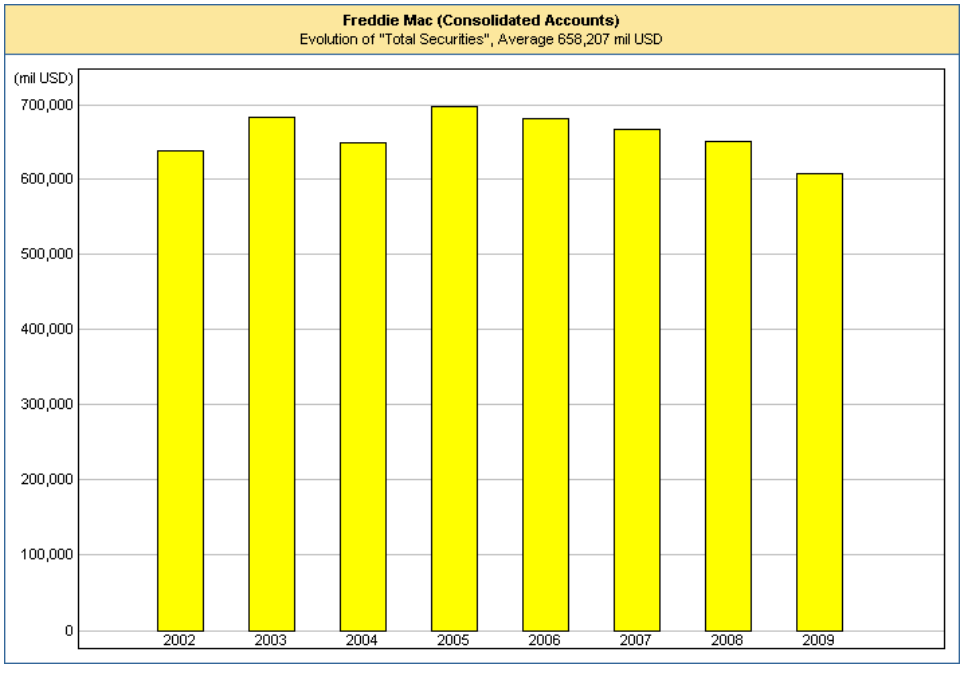
Year	2002	2003	2004	2005	2006	2007	2008	2009
Number	57483	57804	58852	60009	63697	76347	91344	111569

Figure 2A: Total securities Fannie Mae (source bankscope)



Year	2002	2003	2004	2005	2006	2007	2008	2009
Number	540008	574288	573971	411877	395043	360310	358163	351141

Figure 2B: Total securities Freddie Mac (source bankscope)



Year	2002	2003	2004	2005	2006	2007	2008	2009
Number	636956	681065	647390	696621	680579	665682	650214	607149

Figure 3A: Total problem loans Fannie Mae (source bankscope)

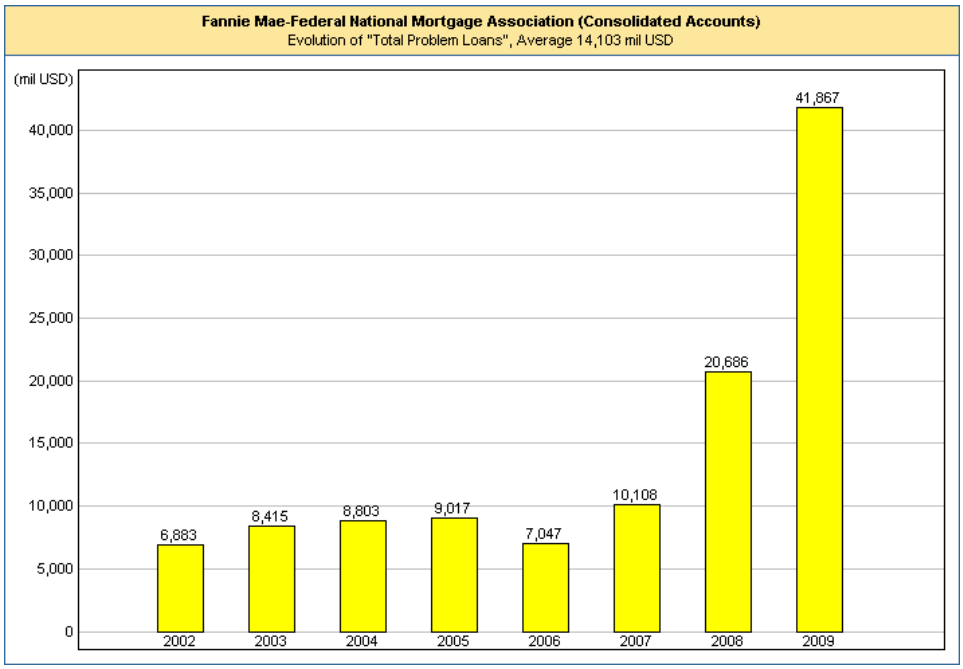


Figure 3B: Total problem loans Freddie Mac (source bankscope)

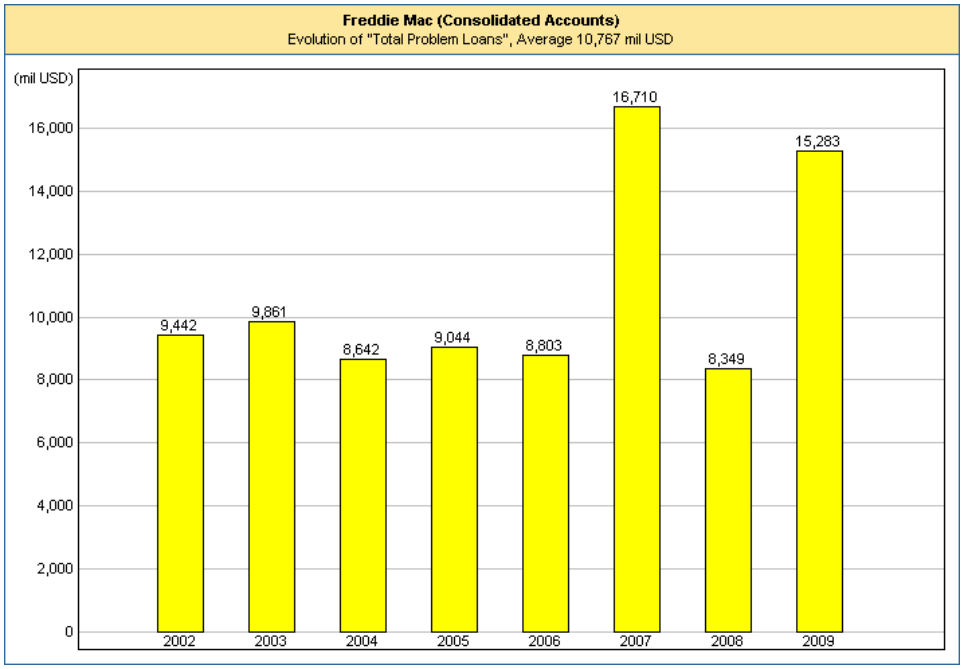


Figure 4A: Foreclosure real estate Fannie Mae (source bankscope)

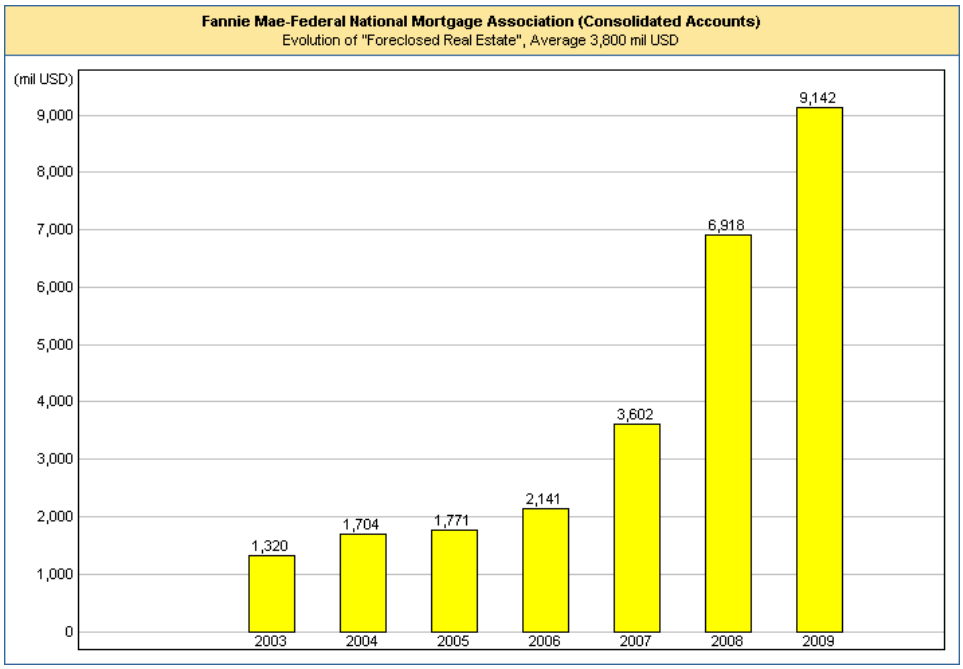


Figure 4B: Foreclosure real estate Freddie Mac (source bankscope)

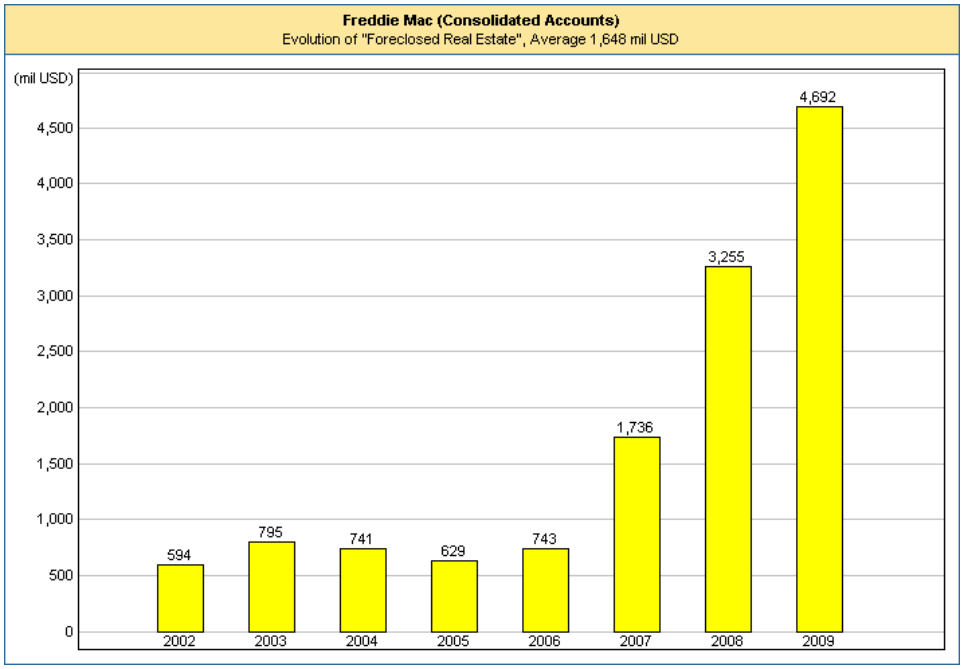


Figure 5A: Loan impairment charge Fannie Mae (source bankscope)

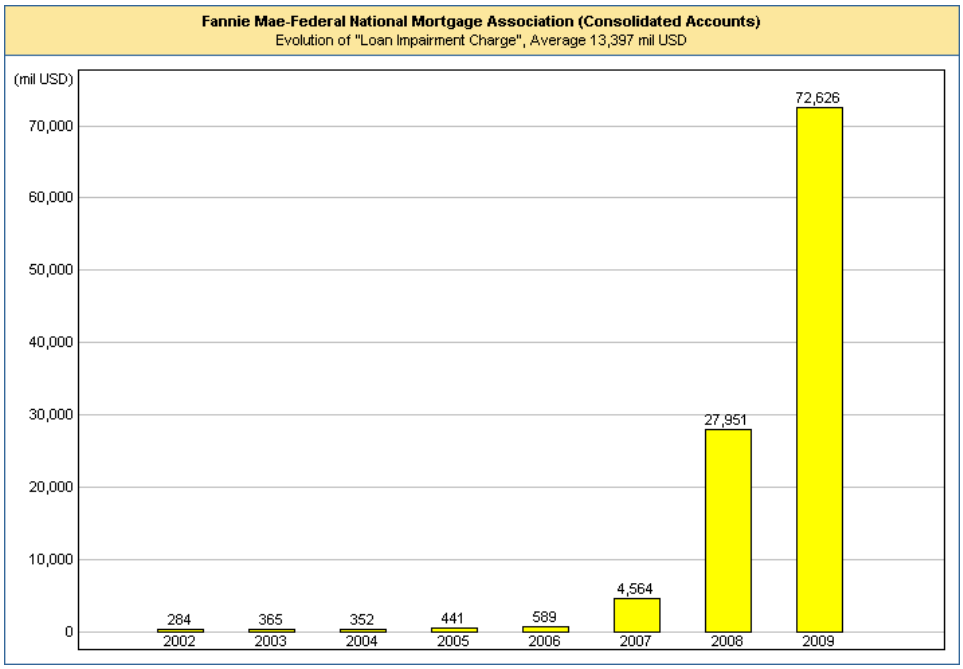


Figure 5B: Loan impairment charge Freddie Mac (source bankscope)

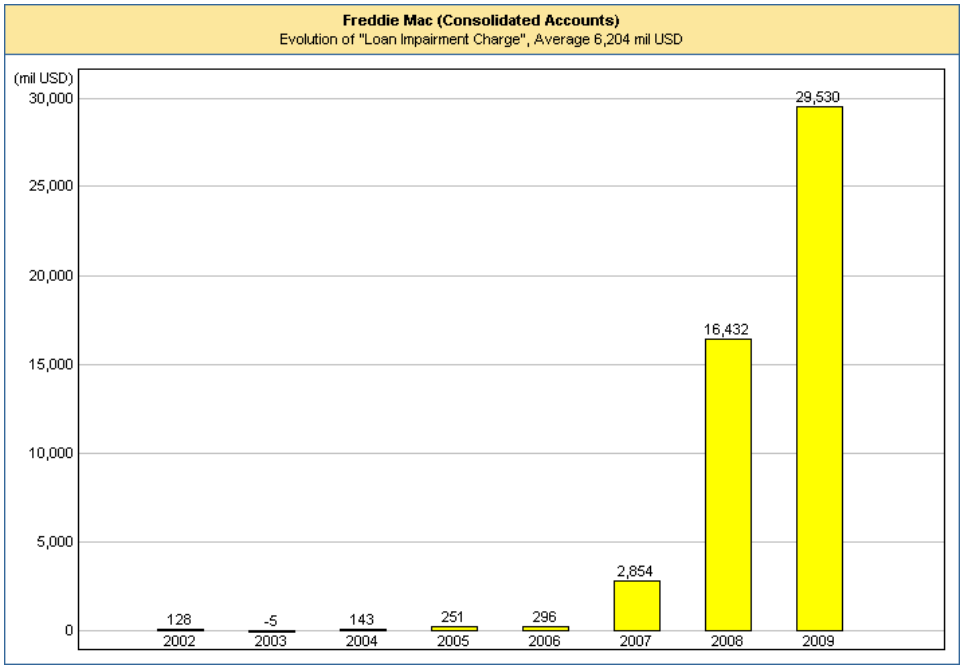


Figure 6: Impaired loans Fannie Mae (source bankscope)

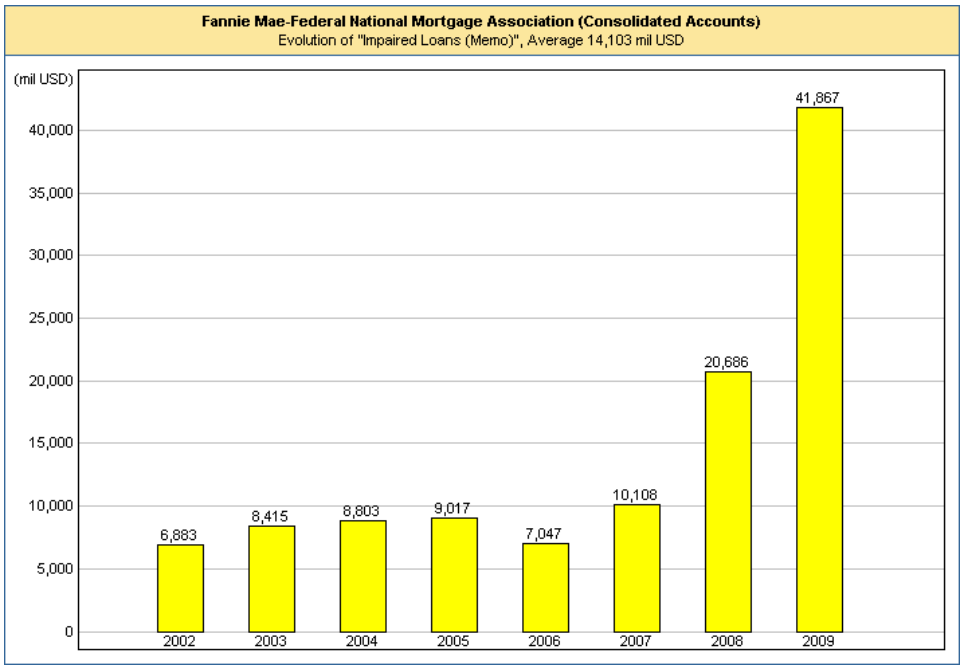


Figure 7A: Restructured loans Fannie Mae (source bankscope)

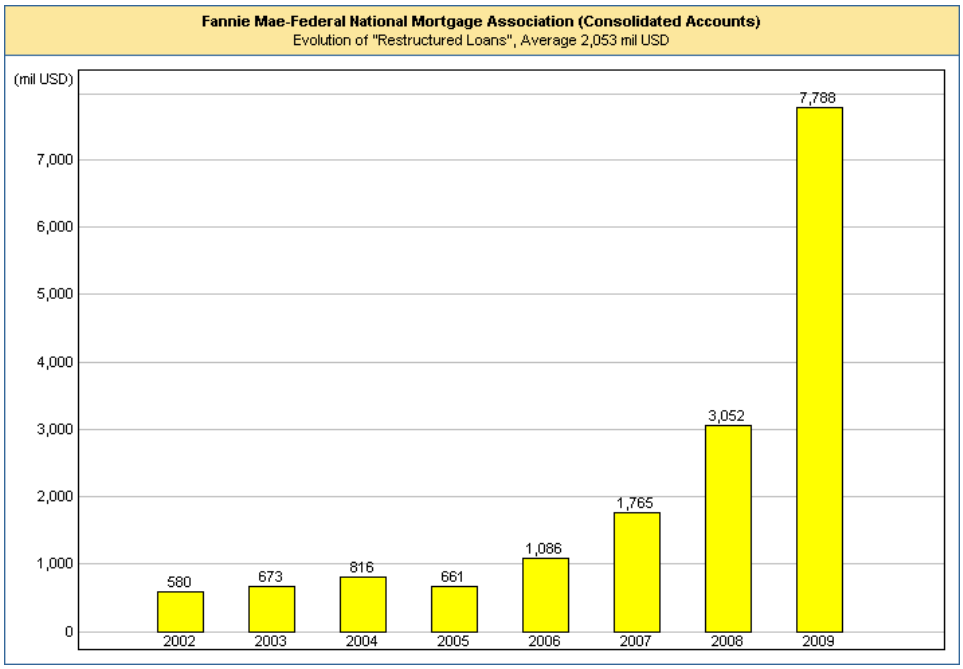


Figure 7B: Restructured loans Freddie Mac (source bankscope)

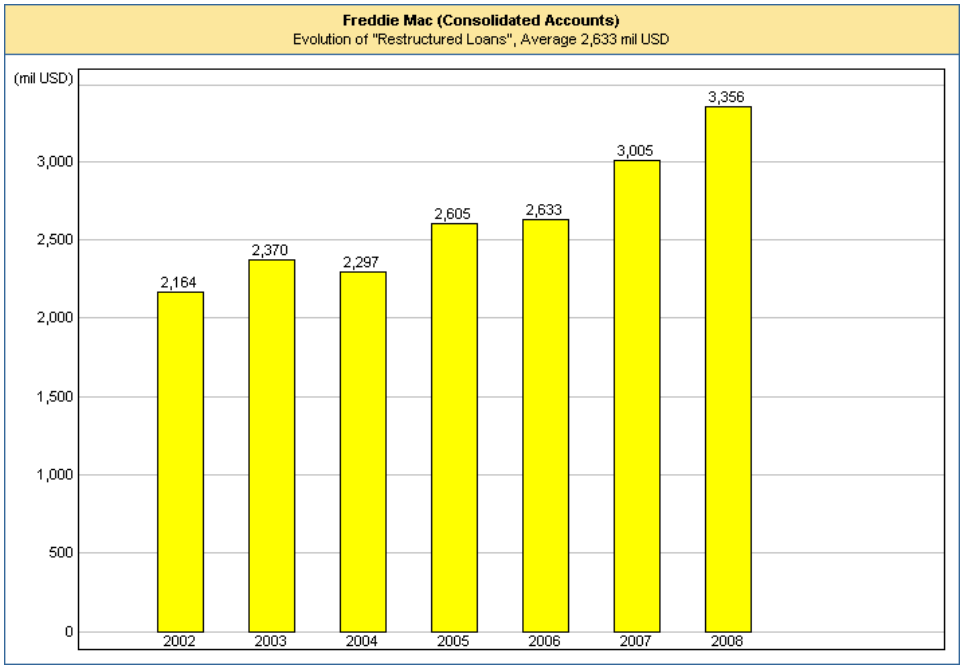


Figure 8A: Mortgage loans held for sale Fannie Mae (source bankscope)

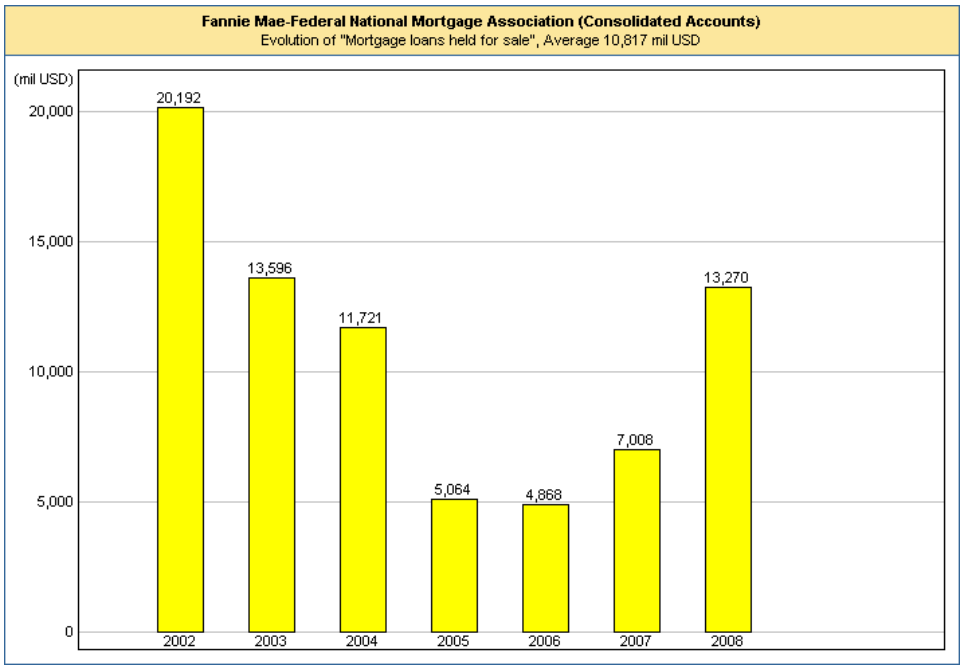


Figure 8B: Mortgage loans held for sale Freddie Mac (source bankscope)

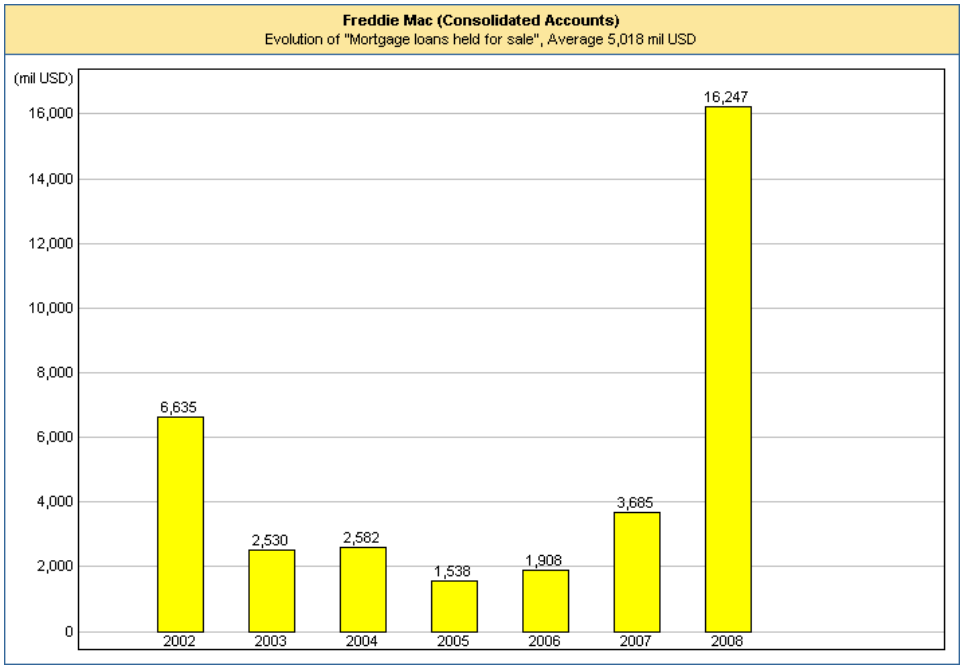


Table 2: Fannie Mae (prior period 2002-2006, post period 2007-2009)

Variable	Prior mean μ_1	Post mean μ_2	Prior variance	Post variance	Standard deviation	Test statistic	Degree of freedom	Probability	Reject H_0 if: $T > t_{\alpha/2;m}$
H_0: $\mu_1-\mu_2=0$ vs H_1: $\lvert\mu_1-\mu_2\rvert>0$ $\alpha = 0.01$									
Residential mortgages loans	364391.4	399435.7	1232171495	214488694.3	29882.16684	1.605852	6	0.159429	**Don't reject H_0**
Total securities	499037.4	356538	7842014458	22998109	72357.96898	2.696667	6	0.035734	**Reject H_0**
Total problem loans	8033	24220.33	1000444	261527154.3	9372.442626	2.364956	6	0.055904	**Reject H_0**
Foreclosure real estate	1734	6554	113104.6667	7772272	1782.35002	3.540753	5	0.016549	**Reject H_0**
Loan impairment charge	406.2	35047	13548.7	1195873873	19965.8122	2.375755	6	0.055086	**Reject H_0**
Impaired loans	8033	24220.33	1000444	261527154.3	9372.442626	2.364956	6	0.055904	**Reject H_0**
Restructured loans	763.2	4201.667	39782.7	10060432.33	1838.477426	2.560986	6	0.042852	**Reject H_0**
Mortgages held for sale	11088.2	10139	41137636.2	19606322	6068.885677	0.186939	5	0.857869	**Don't reject H_0**

Table 3: Freddie Mac (prior period 2002-2006, post period 2007-2009)

Variable	Prior mean μ_1	Post mean μ_2	Prior variance	Post variance	Standard deviation	Test statistic	Degree of freedom	Probability	Reject if: $T > t_{\alpha/2;m}$
H_o: $\mu_1-\mu_2=0$ vs H_1: $\lvert\mu_1-\mu_2\rvert>0$ $\alpha = 0.01$									
Residential mortgages loans	59569	93086.6667	6303673.5	312424986	10408.8477	4.40932142	6	0.00452267	**Reject H_0**
Total securities	668522.2	641015	633806420	919994223	27003.747	1.39483549	6	0.21251599	**Don't reject H_0**
Total problem loans	9158.4	13447.3333	245035.3	20003834.3	2613.67589	2.24697479	6	0.06571389	**Reject H_0**
Foreclosure real estate	700.4	3227.66667	7207.8	2185044.33	856.243722	4.04160909	6	0.00679033	**Reject H_0**
Loan impairment charge	162.6	15605.3333	13820.3	206090777	8288.91665	2.55109737	6	0.04342635	**Reject H_0**
Impaired loans	Not available	Not available	Not available	Not available	Not available	Not available			**Not available**
Restructured loans	2413.8	3180.5	40641.7	61600.5	211.739132	4.32788104	5	0.0075144	**Reject H_0**
Mortgages held for sale	3038.6	9966	4232826.8	78901922	4377.9728	1.89124671	5	0.11717235	**Don't reject H_0**