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**An Analysis of Residential Mortgages and How Lending Standards  
and Regulations Have Changed Pursuant to the Financial Crisis of 2008**

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Submitted to the Tufts Economics Department  
in part fulfilment of a Bachelor's Degree with Honors.

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April 26, 2015

# **An Analysis of Residential Mortgages and How Lending Standards and Regulations Have Changed Subsequent to the Financial Crisis of 2008**

## **Abstract**

The residential mortgage has been an essential asset of small banks for decades, however since the financial crisis the lending practices associated with residential mortgages have undergone a great deal of scrutiny. Residential Mortgage Backed Securities (RMBS) have brought to light in recent years the widespread and greatly unrecognized risk engrained within residential mortgages issued during the early 2000's when unqualified borrowers flooded the mortgage market and housing prices grew to unseen heights. Since the crisis, both the banks and government organizations have imposed tighter restrictions on lending practices and have increased the qualifications required for an individual to receive a mortgage. Have these changes actually effected lending policies though? My thesis looks to understand how lending standards have actually changed by looking at both new legislature and lending records as well as a data set of 21,000 residential mortgages from before and after the financial crisis. Specific identifying factors of the mortgages will be analyzed through regressions to see if in fact changes have been made to decrease risky lending practices or not.

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## 1. The Consensus Today

The residential mortgage crisis and the resulting financial crisis of 2008 and 2009 was a difficult time not only for the U.S. economy but for economies around the world. In the years preceding the crisis, the housing market was in a significant boom period with house prices increasing by almost 92% in the ten years leading up to 2008. During this time, the volume of mortgages being issued also rose considerably. This was the result of increased trade-ups to bigger or better houses, a growing number of people and firms attempting to invest in the housing market, and more first time home buyers entering the market. As this occurred, the banks wanted to maximize their effective lending capabilities, and given the strong performance of the real estate market, banks began to relax their lending standards and utilize the mortgage securitization process even more to expand their lending capacity.

The banks themselves are not entirely to blame though as Peter Wallison of the *Wall Street Journal* put it, "... government housing policies -- implemented primarily by Fannie Mae and Freddie Mac -- forced a reduction in mortgage underwriting standards, which was the real cause of the crisis. The goal was to foster affordable housing for low-income and minority borrowers, but these loosened standards inevitably spread to the wider market, building an enormous housing bubble between 1997 and 2007."<sup>1</sup> For perspective, Fannie and Freddie guarantee 59% of all mortgages being issued in the U.S. today.<sup>2</sup> While the approach of lending to more individuals with lower qualifications was extremely profitable for banks at the time, when house prices began to falter and decline, many of the borrowers who had minimal qualifications for a mortgage started to become delinquent in their payback schedule. The question of whether

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<sup>1</sup> Wallison, Peter J. "Four Years of Dodd-Frank Damage." *Wall Street Journal*, Eastern edition ed. Jul 21, 2014. Web.

<sup>2</sup> Reckard, Scott E., Tim Logan. "Fannie Mae, Freddie Mac Reach Deal to Ease Mortgage Lending." *Los Angeles Times*, Business section. Oct 17, 2014. Web.

lending standards are better today than they were prior to the financial crisis is an important, and a contested, one.

The years post financial crisis saw the private sector punished for its ‘reckless’ actions and the federal government imposed substantial new regulations and reforms to improve oversight and accountability. In 2009, the majority consensus of economists was that poor government oversight, inexpensive credit, the securitization and derivative market, a lack of regard or due diligence by banks, larger exotic loans, and the housing boom all worked together to create the financial crisis. Alan Greenspan, Chairman of the Federal Reserve during the years just preceding the crisis, believes that “mistakes were made,” but “[He] did not forecast a significant decline because we had never had a significant decline in [housing] prices.”<sup>3</sup> He believes that a substantial portion of the blame for the crisis lays on Wall Street, which pushed the banks to make more loans to people with lesser qualifications in an effort to create more securities. Needless to say, different groups put the blame on different parties depending on where their allegiances lie. Throughout the myriad of interpretations though, it’s clear that through a joint effort by both the government and the private sector all the necessary ingredients for a severe mortgage crisis were made available.

Since the crisis there has been a great deal of work done by the government on increasing the regulation and oversight of the finance industry. The banks themselves have also worked to make their lending practices more robust and reduce unnecessary risk. The most significant piece of legislature created after the financial crisis is the Dodd–Frank Wall Street Reform and Consumer Protection Act which was signed into law in 2010 by President Obama.<sup>4</sup> While the bill

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<sup>3</sup> Scannell, Kara., Sudeep Reddy. “Greenspan Admits Errors to Hostile House Panel.” *The Wall Street Journal*, Politics and Policy. Oct 24, 2008. Web.

<sup>4</sup> United States. Congress. *H.R. 4173 - Dodd-Frank Wall Street Reform and Consumer Protection Act*. 111<sup>th</sup> Congress (2009-2010), Final Public Law Summary (07/21/2010). Washington: GPO, 2010. Web.

is wide reaching in an effort to increase the regulation of a large majority of the financial industry, the section Title XIV – Mortgage Reform and Anti-Predatory Lending Act, specifically looks at the mortgage industry and the regulations within. Some of the key conditions laid out focus on lenders fully understanding the likelihood of a borrower to repay the loan, including increased borrower document disclosure requirements, not lending more than 80% of the value of the home unless extra insurance is provided, enforcing a 43% income-to-debt ratio minimum for the borrower, and requiring a bank to hold at least 5% of a mortgage on its balance sheet through to its maturity.<sup>5</sup> These regulations have been significant in increasing the oversight of lending by banks, however these new regulations are slowly beginning to be removed.

When Dodd-Frank was first implemented many thought that it was going to be completely useless given the bill’s complexity and the fact it lacked any provisions to make the mortgage lending industry any safer at the time. Stanford economics professor John Taylor said in 2010 that the “...Dodd-Frank financial reform bill is certainly a threat to future economic growth. It does not prevent future financial crises. Rather, it makes them more likely and in the meantime impedes economic growth.”<sup>6</sup> *The Economist* wrote in 2010 that this bill “may promote rather than curb reckless lending.”<sup>7</sup> There were, however, many supporters of the bill after its inception, citing “progress in three critical areas: regulatory oversight, derivatives, and dealing with troubled banks that are too big to fail.”<sup>8</sup> Many feel that the bill provides adequate new regulations for the most important areas requiring increased oversight and understand that implementing such a bill requires a good deal of time. In regards to lending practices, the biggest

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<sup>5</sup> United States. Bureau of Consumer Financial Protection. *Final Rule: Ability-to-Repay and Qualified Mortgage Standards under the Truth in Lending Act*. 12 CFR Part 1026. Final Rule; official interpretations. Washington: CFPB, 2012. pdf. Pg. 453.

<sup>6</sup> Taylor, John B. “The Dodd-Frank Financial Fiasco.” *The Wall Street Journal*, Opinion. Jul 1, 2010. Web

<sup>7</sup> “Not all on the same page.” *The Economist*, Financial Regulation. Jul 1, 2010. Web.

<sup>8</sup> “A Decent Start.” *The Economist*, Financial reform in America. Jul 1, 2010. Web.

step being made was that the bill “consolidates oversight of consumer financial products, from mortgages to credit cards, in a single agency.”<sup>9</sup> This agency is the Consumer Financial Protection Bureau (CFPB) and is lauded for its goal of protecting consumers and not banks. This is an important step on the road to regulating lending practices and avoiding future problems.

It has been five years since its creation though and there is still little agreement on the effectiveness of Dodd-Frank. Matt Egan of *CNN Money* concedes that while the effectiveness of the laws in place may be there, the fact that only 52% of the rulemaking requirements have been met is inadequate for the amount of time that has passed and the money that has been spent.<sup>10</sup> Bloomberg says that while the plan was designed well, implementation of any of the three fail safes designed to prevent a future crisis engrained in the bill have yet to be accomplished. Chris Flanagan and Adam Katz of Bank of America Merrill Lynch said, “We think persistently low mortgage application volumes and this week’s extremely weak new home sales report for June and May are natural outcomes of the legislation.”<sup>11</sup> While so many politicians, economists, and bankers may attack the bill, an important point is being made about how the effectiveness of the bill is actually quantified. In many ways, the goal of the bill was to implement better regulations in the finance industry in an effort to avoid the root causes of the financial crisis. The only way one can really know if the bill has been effective is to wait and see if there is another financial crisis, which there hasn’t been so far. The bill works to implement new laws, restrict reckless lending, and better monitor and react to issues. While it may have taken a great deal of time to implement some of these new regulations, the broad effect of the bill is to create a stronger economy, and the majority of analysts concede that fact during their arguments.

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<sup>9</sup> Ibid.

<sup>10</sup> Egan, Matt. “Wall Street Reform Law Only Half Done.” *CNN Money*, Markets. Jul 20, 2014. Web.

<sup>11</sup> Gaffney, Jacob. “Bank of America Merrill Lynch concludes Dodd-Frank killed housing.” *HousingWire*, Jul 25, 2014. Web.

After the crisis, lending standards became very tight as banks sought to reduce their risk profile, even without the government imposing any laws stipulating such. The question of whether or not lending standards today are any better than they were prior to the financial crisis is important given the impact the crisis has on the housing and credit markets. For the most part the consensus is that mortgage lending standards are significantly more robust today than they were prior to the financial crisis. *CNN Money* points out that “The new rules are designed to take a "back to basics" approach to mortgage lending and lower the risk of defaults and foreclosures among borrowers... "No debt traps. No surprises. No runarounds. These are bedrock concepts backed by our new common-sense rules, which take effect today," said CFPB director Richard Cordray...”<sup>12</sup> Banks are even implementing tougher standards on their own accord. The tighter standards do not sit well with everyone though, and a major push in the last six months has resulted in the easing of lending standards.

In the last few months of 2014 Congress finalized their overhaul of Dodd-Frank, done mainly at the behest of Wall Street. The Wall Street financial institutions justification for this is that the economy has performed very well since the crisis and such harsh regulations as originally stipulated and imposed by Dodd-Frank are no longer necessary to keep the economy stable and the banks in check. Some of the new rules work to make lending easier for banks and to increase credit availability. A significant change is the removal of “any requirement for borrowers to make a down payment.”<sup>13</sup> This is seen as both positive and negative, for while it opens up more credit it also induces lending to people who may be less qualified and for banks to take on greater risk. Another significant change is to the rule stipulating a bank retain 5% of

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<sup>12</sup> Christie, Les. “What the new mortgage rules mean for you.” *CNN Money*, Personal Finance. Jan 10, 2014. Web.

<sup>13</sup> Eavis, Peter. “U.S. Regulators Approve Eased Mortgage Lending Rules.” *New York Times*. Investment Banking. Oct 21, 2014. Web.

every loan on its books to keep “skin in the game” and encourage more conscientious lending.<sup>14</sup> New loopholes have been established whereby a bank does not have to do this if the mortgage is low risk, a term with a flexible definition.<sup>15</sup> The new changes are seen by both government organizations and financial institutions as a positive move as it will “encourage lenders to continue offering carefully underwritten QM loans and avoid placing further hurdles before qualified borrowers.” while it also “strikes the proper balance between protecting the economy from risky practices and encouraging lending.”<sup>16</sup>

Since the financial crisis, there have been a number of substantial changes made in an effort to stop the economy from declining any more than it did and to avoid the trap of lowering lending standards to increase profits from ever happening again. Legislation like Dodd-Frank and other smaller bills worked to curb reckless or predatory lending practices and bolster financial supervision. There were proponents and adversaries of the new regulations along the way however Dodd-Frank and other new regulatory measures have been passed and today the consensus is that they have had a positive effect on the economy. Today lending practices are seen to be significantly stronger by both the public and private sectors. The economy is so strong though that with recent updates to financial legislation, lending standards are starting to be relaxed as the government puts more faith in the private sector to monitor its own actions. The opinions about lending standards come with their own methodology for interpretation, however I would like to know for sure. I will therefore work to analyze hand collected data to see how residential mortgage lending standards have changed and whether they are better today than they were before the financial crisis.

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<sup>14</sup> Goad, Benjamin., Vicki Needham. “Relaxed mortgage regs could free up credit.” *The Hill*. Oct 21, 2014. Web.

<sup>15</sup> Eavis, Peter. “U.S. Regulators Approve Eased Mortgage Lending Rules.” *New York Times*. Oct 21, 2014.

<sup>16</sup> Goad, Benjamin., Vicki Needham. “Relaxed mortgage regs could free up credit.” *The Hill*. Oct 21, 2014. Web.

## 2. Academic Analysis

When I began doing research for my thesis, the focus was on the much broader subject of the financial crisis, instead of if and how lending standards have changed since the financial crisis. As I began my initial research I was overwhelmed by the amount of material available on the greater subject and pertaining to every area from the U.S. Federal Reserve's involvement in the crisis to its effects on Asia. As with many theses, there can be changes in the focus of the paper along the research route as new information comes to light and new areas of greater interest to the writer crop up. Looking back, I am quite happy that I began with the subject of the financial crisis as my topic, however it is such a broad subject that there had to be refinement.

While academics, consultants, government groups, and banks may blame the financial crisis on differing causes, the recurring theme of the Collateralized Debt Obligation (CDO) was prevalent throughout most of them. Even though this is more focused than just the entire subject of the crisis, it is still an extremely broad and well discussed area. Luckily that meant that while I was well equipped to learn about the subject, I sometimes struggled to get a clear and concise understanding of the problem. A significant step towards understanding the problem came when I read a paper by Anna Katherine Barnett-Hart entitled *The Story of the CDO Market Meltdown: An Empirical Analysis*.<sup>17</sup> Her paper, written as an honors thesis during her completion of a bachelor's degree in economics from Harvard, was extremely helpful as it laid out the financial crisis in terms of the effect of improper CDO use.

Barnett (2009) is an excellent combination of logical theoretical development and quantitative regressions which work well to present and fully analyze the question of what external negative effects were present in the CDO market prior to the financial crisis which made

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<sup>17</sup> Barnett-Hart, Anna Katherine, *The Story of the CDO Market Meltdown: An Empirical Analysis*. Thesis Harvard University, 2009. Cambridge, MA: Harvard, 2009. Print.

CDOs have such a large negative effect on the economy. Her overview of the subject was useful in understanding the development of the CDO over the seven to ten years prior to the crisis and how the product changed during that time. The section which most assisted my efforts was the hypothesis section. Here the paper posed a number of possible reasons why the CDO market collapsed and how it had become so unstable. The hypotheses look at all areas of the CDO market, however three specific hypotheses are particularly important. They are: *1A: The Housing Effect*, *2C: The Originator Effect*, and *3B: Peer Pressure Effect*.<sup>18</sup> The reason these are of particular importance is that they are all related to the underlying residential mortgages and ultimately the engrained risk therein. This paper allowed me to learn about the financial crisis from the standpoint of the CDO collapse, an area of great importance. After reading Barnett's paper and learning about the importance of the residential mortgage backed securities industry and the many faults that existed in it, my own research and topic became significantly more focused towards the residential mortgage industry pre- and post-financial crisis.

As I began looking into the residential mortgage market in the years prior to the financial crisis, it became quite clear that there were a limited number of federal regulations in effect that controlled who could receive a mortgage and even fewer regulatory bodies to monitor the finance sector. This meant that people with few qualifications could receive a mortgage, one backed by a government sponsored enterprise like Fannie Mae or Freddie Mac, and purchase homes well beyond their means. Within most of the books and articles I read, the term 'subprime mortgages' continued to crop up. This intrigued me, and as I dug deeper into the area of mortgages the significance of the practice of lending to those within the subprime, or very risky, category of borrowers started to foster within me a desire to know more about this area. As a

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<sup>18</sup> Ibid. Pg. 39.

result, I began looking for academic sources that discussed this area to try and understand just how residential mortgages were being made to people with apparently no qualifications. I wanted to find out why banks were allowing this, how the government was involved, and what was being done to limit this issue.

As I continued my research along this refined track, I came across two very important papers that chose to ask important questions which others had avoided. While I had already begun writing and collecting data on this subject at the time of finding both of these papers, they were nonetheless of tremendous value. This was because the questions asked and hypotheses asserted related strongly to my question of changing lending standards. They also offered results from data that I was unable to attain. The papers: *Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market*<sup>19</sup> by Giovanni Dell’Ariccia, Deniz Igan, and Luc Laeven, and *The 2007 Subprime Mortgage Crisis: Evidence of Relaxed Lending Standards*<sup>20</sup> by Seda Durguner both look at the notion that residential mortgage lending standards pre-financial crisis were significantly worse in the years just prior to the financial crisis than they had been in the late 1990s and early 2000s. While I am looking at if and how the lending standards have changed since 2003 and 2007, the notion of changing standards is common amongst all three.

In Dell’Ariccia (2008), which was written as a working paper for the International Monetary Fund, there were a few areas which were of significance to my paper given the data I had and the necessity for finding a suitable method to analyze that data. Firstly, the paper proposes a linear regression model that includes the variables Average Income and a dummy for whether a property is Owner Occupied. This correlated well with the data I had collected on

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<sup>19</sup> Dell’Ariccia, Giovanni, Deniz Igan, and Luc Laeven, *Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market*. Working Paper IMF, 2008. New York: IMF Research Department, 2008, Web.

<sup>20</sup> Durguner, Seda. *The 2007 Subprime Mortgage Crisis: Evidence of Relaxed Lending Standards*. Thesis, University of Cincinnati, 2010. Cincinnati: University of Cincinnati, 2010. Web.

Bloomberg. The results that they pulled from this data, while following a different thrust from my regression, still showed a high significance level when relating a lower AvgIncome to a higher likelihood of that mortgage being subprime.

The paper also discussed whether there was a stronger correlation between lower lending standards and higher mortgage securitization rates, something which I had not thought about. Given the significance of mortgage securitization in allowing banks to originate more subprime mortgages without fear of losing their money given the ability to pass the mortgage along, the strong relationship between the two was not unexpected. The paper shed light on what kind of empirical analysis would work given the data, something very difficult to attain and quite complex.

In Durguner (2010) there is a substantial amount of information regarding the paper's approach to understanding key variables, both dummy and continuous, that came from the residential mortgage industry. It was very important to correctly understand the meaning of certain lending practices and how variable data was used within banks. While the specific data analysis was interesting, it had minimal bearing on my paper as it looked more towards an individual attaining the mortgage than at the subprime market overall. Factors like the loan-to-value ratio, purchase price, and credit score were however very important to my paper when looking at their impacts on the overall mortgage markets.

Some useful conclusions that were reached were that the lower the average income of the state is, the higher the number of subprime mortgages. This is only true though from 2005 to 2007. The paper's data asserts that indeed the lending standards got worse the closer to 2007 one got, something which I expected to be true. This means that my question of how lending standards have changed since 2003 and 2007, and if they have gotten any better should be

significant. If the lending standards were terrible in 2007, it is quite likely that the standards have gotten better, since then, however that can only be concluded effectively by analyzing the data. What I can say now though is that these three papers were extremely helpful in both assisting me narrow down my thesis topic and also better understanding my data and analysis methods.

A paper by McKinley L. Blackburn and Todd Vermilyea entitled, *The Prevalence and Impact of Misstated Incomes on Mortgage Loan Applications*<sup>21</sup> was also of interest towards my topic, however only in a very specific way. In understanding whether lending standards have changed, it is necessary to know whether people were originally being honest when they received a mortgage from the bank. If people were misstating their incomes prior to the financial crisis one cannot hold the bank necessarily responsible if they were restricted in the methods for properly ascertaining an individual's income. If the bank was not checking, then that is another matter, and can be solved by penalizing banks that do not check. In this case, Blackburn (2010) provides evidence that banks' lending standards were rapidly decreasing in the years prior to the crisis. New 'low doc/no doc' or 'stated income/stated assets' (SISA) options made it possible for banks to either forgo the hassle of verifying a person's income and accept on faith what he told the bank, or they would exempt certain individuals from having to disclose that information if the person was "self-employed or had highly variable income."<sup>22</sup>

This was beneficial for the banks as it allowed them to issue more loans. There is evidence of not only the applicants but also the loan officers or brokers 'massaging' the income statements to meet the bank and/or government standards depending on the loan. This was very common in the subprime and Alt-A categories where the individual was typically close to the

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<sup>21</sup> Blackburn, McKinley L., and Todd Vermilyea. *The Prevalence and Impact of Misstated Incomes on Mortgage Loan Applications*. Research Paper, The Federal Reserve Bank of Philadelphia, 2010. Philadelphia, The Federal Reserve Bank of Philadelphia Publications Office, 2010. Web.

<sup>22</sup> Ibid. Pg. 1

minimum borrowing cut-off standards. The Alt-A classification is slightly better than a subprime one meaning that while the borrower or mortgage are risky in a number of areas like credit history and score, loan-to-value ratio, and documentation, they do not qualify as risky in all areas. The paper identifies the main source of these standards as not necessarily the bank but the larger government sponsored enterprises (GSE) who bought residential mortgages on behalf of the government. They would then sell them on to the investment banks to be securitized or securitize them themselves depending on the market. Also noted is that before 2000 almost all mortgages were full-doc, indicating that the housing bubble played, along with the securitization drive, a major part in the relaxing of mortgage lending standards. This example bolsters the necessity for the question of whether lending standards have increased or not to be answered given the implications if they have not increased.

John M. Griffin and Gonazalo Maturana analyze other areas of misrepresentation and poor lending practices in their paper entitled, *Who Facilitated Misreporting in Securitized Loans*.<sup>23</sup> This paper is useful in looking at how much misrepresentation (lying) existed in the original residential mortgages that were subsequently securitized by investment banks. This is key to not only seeing how scrupulous banks were when they originated mortgages but also how meticulous the securitization process was when Wall Street banks took them onto their books. As the paper points out, both groups were quite careless when dealing with the mortgages in question. The paper states that 30% of loans contained misrepresented information and that if the mortgage contained misrepresented information, it was 51% more likely to become delinquent.<sup>24</sup>

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<sup>23</sup> Griffin, John M., and Gonzalo Maturana. *Who Facilitated Misreporting in Securitized Loans?* University of Texas at Austin, 2013. Austin: University of Texas, 2013. Web.

<sup>24</sup> *Ibid.* Pg. 1

The paper notes a number of key statistics relating to their data and the how certain misrepresentation affects different types of mortgages like no-doc, low doc, and jumbo loans.

It also covers aspects like whether a property was really owner-occupied or not and how that mistake affects expected vs. actual delinquency rates. Almost 8% of loans listed as owner-occupied were in fact not owner-occupied, indicating a serious lack of due diligence on the banks part.<sup>25</sup> Facts like mortgages with an unreported second lien are 97% more likely to be delinquent are extremely useful as I look to better understand which areas of mortgage lending practices were most problematic. This allows greater focus when looking at statistics today for lending and where the standards have gotten better, worse, or stayed the same.

The final paper I will discuss is a report by Eric Weiss at the Congressional Research Service entitled *Changes to the Residential Mortgage Market: Legislation, Demographics, and Other Drivers*.<sup>26</sup> This looks at a broad range of mortgage characteristic trends both before and after 2008. It notes Congress's concern for the residential mortgage market as the reason why this research effort was made. The paper describes bills like the Dodd-Frank Wall Street Reform Act and others which were implemented to curb bad practices by the financial industry. The paper is focused on the significance of the legislative changes and how those have impacted the residential mortgage industry, which offers a great deal of information of specific new regulations and requirements, like qualified mortgages (QMs). It also describes regulatory agencies and their new roles. The paper is an excellent overview of the recent changes made by the government up to 2012 and how those changes have affected the economy and mortgage

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<sup>25</sup> Ibid. Pg. 3

<sup>26</sup> Weiss, N. Eric. United States Cong. Congressional Research Service. *Changes to the Residential Mortgage Market: Legislation, Demographics, and Other Drivers*. R42571. Washington: CRS, Apr 16, 2013. Web.

industry during and since then. While the data is not as current as one would like, it offers a great deal of very helpful information for my paper.

The six papers I have discussed here have all been useful in my work to more effectively understand the mortgage industry, and how economics can be utilized in this specific area of data analysis. The papers were written by authors from a wide range of backgrounds, including students, economists, academics, and government groups. Thus, I am able to learn about the mortgage industry from a number of different sources, eliminating much of the bias one is subject to when dealing with a topic as recent as the financial crisis.

### **3. The Housing Bubble**

In the years prior to the financial collapse of 2007 and 2008, the financial industry was booming as an apparently healthy and growing economy promoted higher rates of investment by companies and individuals. One of the strongest areas of the economy was the housing sector which would see a dramatic increase in real housing prices from 1990 until 2006, later to be known as the Housing Bubble. As can be seen below, the housing bubble was the result of a rise in house prices far greater than ever seen before in the real estate market and which caused a spike in prices that could not continue for long. The measure used to identify the actual increase in housing prices is the real price of houses index, depicted in Diagram 1. The scale used here sets the average price of a house sold in 1890 equal to 100 on the index scale. Following the chart, as the years rise, the index changes according the average price that year. If the index rises to 199, as it does in 2006, then to find the average house price you would take the average price in 1890 and multiply it by 1.99. This is just an excellent representation of how house prices changed in the past century. In the case of the real house prices in the United States during the

period from 1890 to 2006, the price index rose and fell during the various recessions and booms. However during that time the greatest increase or decrease in any 10 year period was 40 points. From 1996 to 2006, the index rose from 110 to a peak of 199. This significant upward change in the price index indicates an event, the housing bubble, the likes of which we had not been seen in the previous 116 years.<sup>27</sup>

This substantial rise in real house prices can be said to have affected the volume of housing transactions and the number of mortgages being originated as this rise in house prices enticed new speculative buyers into the market as well as encouraging renters to own their own property. How had this been possible though? Beginning in the 1990's, a series of deregulation and new government initiatives promoted an increased lending of credit to home buyer's within the United States. These would be achieved through government sponsored enterprises (GSE), the most well-known of which are Fannie Mae and Freddie Mac.<sup>28</sup> Created by Congress in 1938 and 1970 respectively, these two institutions sat at the crossroads between commercial and governmental constructs.<sup>29</sup> The idea was that Fannie Mae would use its access to cheap credit from the United States government to purchase residential mortgages made by banks to individuals, thereby guaranteeing the private sector continued access to credit. While this began as an exercise in promoting regrowth after the Great Depression, it morphed into something much larger as the years passed.

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<sup>27</sup> Shiller, Robert J. "The New York Times Week in Review Image Graphic: A History of Home Values." *The New York Times - Breaking News, World News & Multimedia* Bill Marsh, 26 Aug. 2006. Web. 28 Feb. 2015.

<sup>28</sup> The Financial Crisis Inquiry Commission, The Financial Crisis Inquiry Report: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States (Washington: U.S. Printing Office, 2011) Pg. 38.

<sup>29</sup> *Ibid.* Pg. 38.

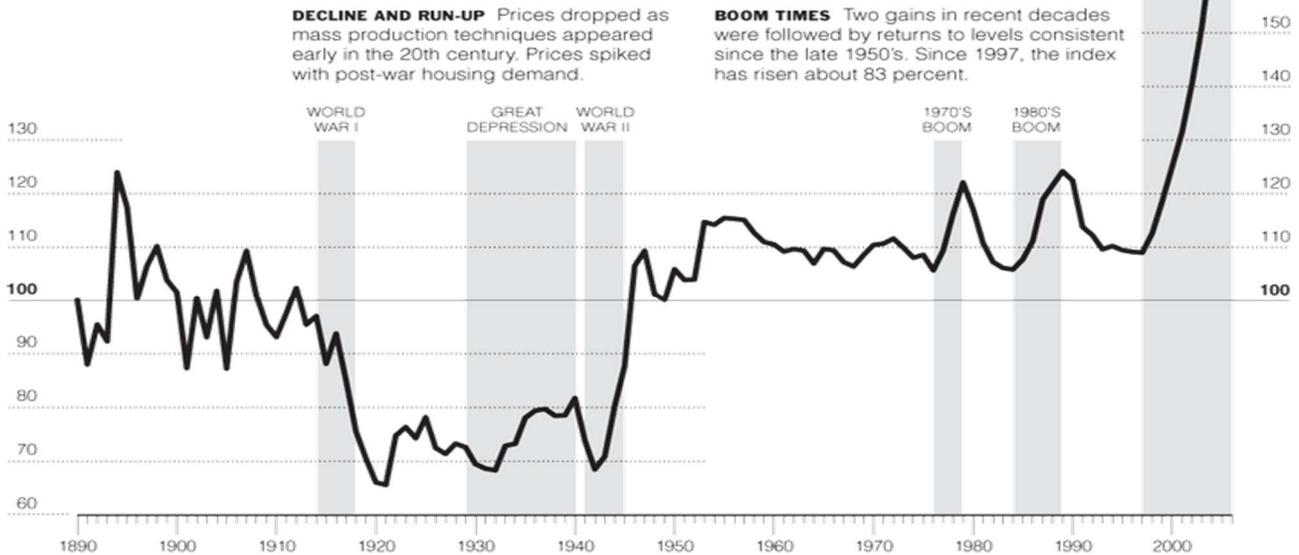
## Diagram 1: A History of Home Values

Source: Peakprosperity.com

### A History of Home Values

The Yale economist Robert J. Shiller created an index of American housing prices going back to 1890. It is based on sale prices of standard existing houses, not new construction, to track the value of housing as an investment over time. It presents housing values in consistent terms over 116 years, factoring out the effects of inflation.

The 1890 benchmark is 100 on the chart. If a standard house sold in 1890 for \$100,000 (inflation-adjusted to today's dollars), an equivalent standard house would have sold for \$66,000 in 1920 (66 on the index scale) and \$199,000 in 2006 (199 on the index scale, or 99 percent higher than 1890).



Source: "Irrational Exuberance," 2nd Edition, 2006, by Robert J. Shiller

Bill Marsh/The New York Times

Freddie Mac was designed along similar lines as Fannie Mae with its goal being to help banks and thrifts sell off mortgages they had issued, allowing them to free up more room on their books to originate new mortgages. The two GSEs worked in tandem, both promoting the creation and lending of mortgages to the general public. During the years since Fannie Mae's conception, Congress had reduced its restrictions on the types of mortgages it could purchase. The regulations from Congress specified the maximum loan size limits, debt-to-income ratios, and loan-to-value ratios that the two firms could purchase from banks, however as these limits were increased the portfolios of the two corporations grew and so by 1970, Fannie Mae alone had \$7.2 billion worth of mortgages on its books. With the introduction of Freddie Mac, their combined

access to \$4.5 billion of credit from the Treasury meant they could afford to purchase, at that time, an immense amount of mortgages from banks and thrifts.<sup>30</sup>

This presented a problem though because while Fannie and Freddie could purchase loans, they could not sell them on. As a result, the value on their books continued to grow and weighed heavily on both the stock holders and the government. Another issue was that almost non-existent capital requirements for the two meant that if there was a reduction in the value of the mortgages on their books, which will be a recurring theme present in the recent crisis, the firms could have trouble paying back its borrowed credit. As a result, Congress passed a series of laws between 1968 and 1970 which would become the basis for the general housing finance problems we have seen recently. It is also the impetus for the key financial instrument which added immense reward but also risk to the recent financial crisis. That instrument would be a security, created through the securitization process, known as a securitized bond. Securitization allowed the firms to sell off bundles of mortgages to third parties, effectively clearing their books of the mortgages and making room for new ones, just like the small banks had done but this time in much large quantities.

While the housing bubble did not begin to form until about 1994, the creation and development of these two firms would be paramount to its growth and the possibility for its very existence. A major step from Congress came in the 1989 Financial Institutions Reform, Recovery, and Enforcement Act (FIRREA). This set strict capital requirements on banks and thrifts to much higher figures than before.<sup>31</sup> As a result, it was considerably more advantageous for these banks to sell off their mortgages to Fannie and Freddie, thereby clearing their balance sheet and lowering their capital requirement. At the same time, Congress relaxed even further the

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<sup>30</sup> Ibid. Pg. 38.

<sup>31</sup> Ibid. Pg. 40.

standards for GSEs to buy mortgages and lawmakers pushed for a “more vibrant market for home mortgages which served the best interests of the country.”<sup>32</sup> At the beginning of the housing boom the two firms had \$759 billion in outstanding mortgage-backed securities and debt obligations.<sup>33</sup> Just five years later that figure would have almost doubled to \$1.4 trillion. The effort of the government to provide, through the intermediaries of Fannie Mae and Freddie Mac, inexpensive credit to almost any borrower in an effort to grow home ownership rates had led to the greatest rise in lending the country had ever seen.

President Clinton announced in 1995 that he wanted to raise homeownership by families from 65.1% to 67.5% and pushed GSE’s to increase buying rates to make this possible.<sup>34</sup> The agenda was to “...make people believe that they have some permanence and stability in their lives even as they deal with all the changing forces that are out there in this global economy.”<sup>35</sup> The global and national economy was surely changing, and the push to increase homeownership worked to boost the economy, especially in the construction and finance sectors. President George W. Bush continued this push for more families to buy their first homes with a “Zero Down Payment Initiative” which allowed certain first-time buyers to pay nothing down on a FHA-insured mortgage.<sup>36</sup> With such a prevailing housing market, cheap loans, and effectively limitless credit, the housing market boomed. The system almost became self-sustaining. As more buyers entered the market, prices went up and homeowners sold to those entering the market. They then got a new loan and bought a new home, continuing the upward price drive. Also, the speculative market for houses increased rapidly, working to continue the seemingly limitless rise

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<sup>32</sup> Ibid. Pg. 40

<sup>33</sup> Ibid. Pg. 40

<sup>34</sup> Ibid. Pg. 41

<sup>35</sup> Ibid. Pg. 41

<sup>36</sup> Ibid. Pg. 41

of house prices. Today, though, the story is very different as the level of homeownership has fallen to just 63.9%, a level not seen since 1994 and a lower level than before either of the presidents made their pushed for increased homeownership rates.<sup>37</sup>

Fannie Mae and Freddie Mac were vital when it came to enabling the housing bubble to have such a great effect on the mortgage market. Without them, banks would not have been able to issue so many mortgages. By 2000, both entities combined held or guaranteed over \$2 trillion worth of mortgages, while only holding \$35.7 billion in equity. The end did come abruptly for both the housing market and these firms when a sharp decline in real house prices in 2006 created a domino effect in the economy, starting at heart with Fannie and Freddie. The creation of these two firms many years before had created the possibility for the housing boom. Without them, the government could not have sponsored so much cheap lending or made it as accessible to banks, and without it, it stands to reason that significantly fewer houses would have been sold. Within all of that came the creation of securitization, a cornerstone of the financial industry today and a main instigator for the financial collapse of 2007. Without the connection between the rise in housing prices, the housing boom, and the mortgage backed securities sold around the world, the financial crisis would have been much more isolated. This is because the securities were the window to the public. With those securities, Fannie and Freddie were free to supply more credit to banks throughout America in return for buying more mortgages, a large percentage of which would ultimately never be paid back. The process of securitization is therefore the key to the systemic failure of the financial system and its far reaching and very serious consequences.

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<sup>37</sup> Timiraos, Nick. "Homeowner Rate Falls to a Level Seen in '94." *The Wall Street Journal*, Jan 29, 2015. Print.

#### **4. Mortgage Practices**

While my thesis looks at Asset Backed Securities, and particularly Residential Mortgage Backed Securities, there would be no story to tell and no data to look at without the residential mortgage boom and the resulting interest in securitization. In the previous section I discussed the significant increase in loans being made for the purchase of houses, however as the volume of home loans went up, the lending practices that had been used by banks for so many years to find qualified borrowers deteriorated greatly, driven partly by the new ‘mortgage wars.’

To begin though we must understand why there was such an incredible rise in the number of mortgages being issued during the latter half of the 90’s and through the 2000’s. There are two main causes for this increase: the housing bubble causing speculative buying and the easing of lending standards and reduced bank risk through securitization.

As we’ve already discussed, the housing bubble was widespread and led to an average increase in home values of 78%, from \$176,200 to \$313,600, during the period from 1997 to 2006.<sup>38</sup> This was felt across America. Land parcels that were previously worthless were now being developed in earnest. For many, the housing bubble seemed like an excellent opportunity to take advantage of the market and investors set about purchasing properties, with mortgages, with the goal of reselling them in a few months’ time for a profit. The U.S. housing turnover rate peaked in 2004 while the peak for investment property sales occurred in 2005. This was made possible by the abundance of credit available to investors. Properties were now, more than ever before, an investment rather than just a home. Larger financial groups and financial funds were substantial buyers of residential and commercial real estate as well.

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<sup>38</sup> “Median and Average Sales Prices of New Homes Sold in United States.” United States Census Bureau, 2011.

Of those who purchased properties on speculation, only around 10% purchased those homes with cash. That meant that up to 90% of the houses purchased in the United States up to the end of 2007 were done with some sort of financing. This in many ways was a cycle because as more people purchased houses on speculation, more people needed loans so banks lent more and the cycle continued. The speculative market also worked to continue the upward pricing trend for houses as it continually put houses back on the market at inflated prices. This continuous cycle of a 10-20% price inflation over a 6 month period caused the market to continue upwards.<sup>39</sup> Rapid turnover also put more pressure on banks as a new mortgage was required in many cases for the house to be purchased. Each resale could result in a new mortgage meaning more money for the banks and more mortgages on their books.

This trend of buying on spec continued as long as the housing bubble continued and, when it ended, added to the intensity of the sharp fall in prices. What should be taken away from this avenue of lending is that speculative buying had only ever been a small market for mortgage lenders. Banks for the most part had focused on lending to individuals or families while larger commercial banks dealt with investment properties. As more individuals and smaller firms looked to invest, they utilized low rates and reduced collateral restrictions that could now be found at smaller banks. A house occupied by a family had always brought more peace of mind to a bank as it indicated a stronger tie to the area and the asset. With speculative buying, who was to say if the investor would pay back the money if the housing market crumbled? In the short term though this was not much of a concern to the banks during the bubble and so banks were happy to lend to almost anyone, as was the case with the new subprime and NINJA (No Income, No Job, [and] No Assets) loans.

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<sup>39</sup> Shiller, Robert, Irrational Exuberance (New York: Broadway Books, 2005) Pg. 188.

The second, but equally important, reason for increased volume of mortgages being issued is the reduction in lending standards by banks. Listed as one of the most important reasons for the financial crisis by the National Commission on the Causes of the Financial and Economic Crisis in the United States in *The Financial Crisis Inquiry Report*, it is only fair to say that lowered standards are vital to understanding the changes that occurred in the banking industry over the past 15 years as well as to my thesis.<sup>40</sup> The notion of relaxed standards is directly related to my data analysis and is the focus of my question asking whether the standards for lending have changed over the years since the financial crisis and how that is identified in the data available.

To understand the fact that lending standards have changed one has to understand how banks used to operate. Originally when a bank contemplated lending to a person, that person had firstly to come to the bank himself to solicit a loan. The bank then looked at a number of factors about the request and numerous personal attributes in an effort to understand as best as possible whether that person was likely to pay back the loan to the bank. If the individual was eligible for the loan he would then pay back the bank over a series of years, depending on the contract, at which point the bank would have fully recuperated the loan plus interest. Those standards completely changed during the mortgage boom for a number of reasons.

The idea of securitization will be discussed in detail in section 5 however suffice to say the part of its process that we are concerned with is the sale of the loan to a third party bank. What happens in effect is that the small bank that has made a loan to an individual sells that loan, and the promised set of re-payments and interest, to a large investment bank. Thus the small

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<sup>40</sup> The Financial Crisis Inquiry Commission, The Financial Crisis Inquiry Report: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States (Washington: U.S. Printing Office, 2011), Pg. xxiii.

bank is no longer responsible for the loan and does not have to worry whether it is repaid or not as they have been paid the loan value including discounted interest already by the investment bank and therefore carry no more risk with that loan. What this lack of participation by the originator caused was a rapid deterioration in the lending practices of small banks. Where they used to care about the collateral composition of the house, credit scores and past performance of the individual, and keeping the loan-to-value (LTV) low, now all that resulted from considering those did was reduce the likelihood that they could issue that mortgage.

As securitization became more popular during the early to mid-2000's, the demand for more and more mortgages by investment banks grew. To meet the demand, banks set about lending to people with credit scores below 650, a mark which even then carried a 'poor' label and, for the most part, indicated a person not eligible for a loan in the first place.<sup>41</sup> Instead they were getting loans with almost 100% LTV's, low interest adjustable rate mortgages (ARM), or interest only loans. Banks actively looked for borrowers, sometimes engaging in this predatory lending by offering 0% teaser rates and high LTV loans. The objective was no longer to create the loans and earn a small return, but create the loans and sell them off as quickly as possible for a quick turnaround profit. The basis for that was that the bank would be paid the value of the mortgage and discounted interest up front, no matter if it became delinquent at a later date.

The banks at this time were also taking borrowers on their word, doing little due diligence on a loan in an effort to speed up the lending process. During 2005, "68% of "option ARM" loans originated by Countrywide and Washington Mutual had low- or no-documentation requirements."<sup>42</sup> This is supported by data today which shows that indeed the ARM type loan

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<sup>41</sup> Harbour, Sarita. What Do Credit Score Ranges Mean? Investopedia. Aug 15, 2014. Web. 28 Feb, 2015.

<sup>42</sup> The Financial Crisis Inquiry Commission, The Financial Crisis Inquiry Report: Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States (Washington: U.S. Printing Office, 2011), xxiii.

was the riskiest of all mortgages given its low teaser rates designed to draw in those who could only afford that low rate, not the increased rate that would follow in a few years' time.

For the most part these practices happened when issuing all loans, however the worst loans were termed "subprime." To reach this 'illustrious' status, according to the Financial Crisis Inquiry Report a person had to have a weak credit history with payment delinquencies or bankruptcies, low credit scores, high debt to income ratios, or be potential borrowers who offer little documentation about their past financial history. Twenty years ago a person with this record would have been completely ineligible for a loan or would have had to pay very high interest rates. What banks realized during the securitization boom was that this untapped market could make up the shortfall of demand by investment banks. The government did also put pressure on the banks to loan more as I mentioned earlier with presidents Clinton and Bush both pushing the GSEs to provide as much credit as possible to banks to get as many families into their own homes. Many of those people should have been ineligible for loans, but because of the pressure from the government and the private sector demand, small banks were happy to oblige and make more loans.

As you can see in Diagram 2, subprime mortgage originations went up significantly from just 2.4% in 2002 to 23.5% at its peak in 2006. Due to the intensity of these lending practices, almost 1 in 4 Americans were receiving a special mortgage deemed of higher risk given their personal attributes. This is a very significant figure as its significance is that  $\frac{1}{4}$  of the residential mortgage pool was high risk and yet no warning was given by banks and little indication of the risk was raised by the GSE's or the rating agencies. The fact that so many mortgage recipients were high risk is also significant because it means that even with only small drop in house values, the ability for the mortgage holder to pay might be completely eradicated. As

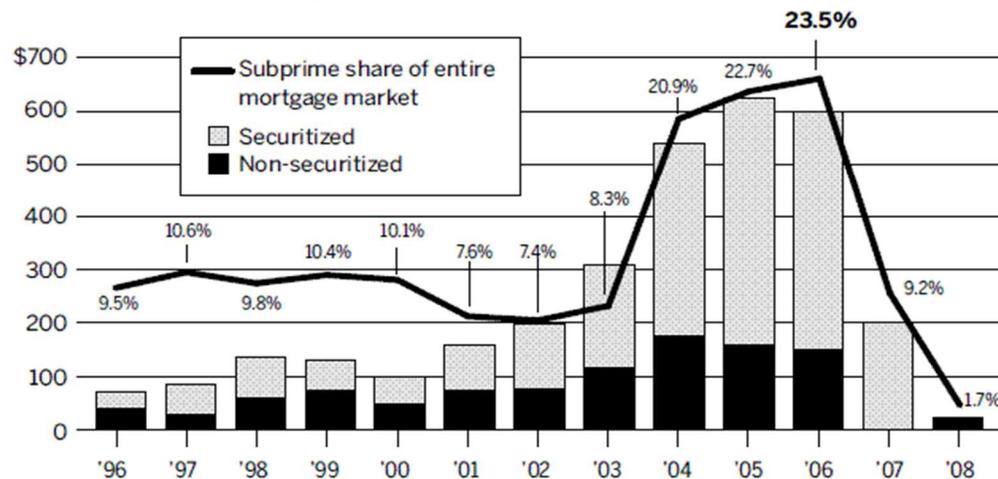
delinquencies began to occur in earnest during 2008 and 2009, it's easy to see which were the most common mortgages to become delinquent. With so many sub-standard mortgages being made it's no wonder the effects of their delinquencies was so widespread.

**Diagram 2: Subprime Mortgage Originations**  
*Source: Financial Crisis Inquiry Report, pg. 70*

### Subprime Mortgage Originations

*In 2006, \$600 billion of subprime loans were originated, most of which were securitized. That year, subprime lending accounted for 23.5% of all mortgage originations.*

IN BILLIONS OF DOLLARS



NOTE: Percent securitized is defined as subprime securities issued divided by originations in a given year. In 2007, securities issued exceeded originations.

As banks set the bar lower and lower for making loans, they reached a point where prudent lending practices should have indicated that the bank should go no further. That was the point at which a person had the NINJA qualities, meaning close to or at zero qualifications for a loan. This was the bottom of the barrel for many. While NINJA loans did not really come about until the end of 2005 and early 2006, they still had a mighty effect on the overall mortgage industry and the financial crisis and are a perfect example of the reckless lending practices that the banks became accustomed to during the 2000's. Below Diagram 3 and 4 both show the delinquency rate, or percent of the total mortgages that were no longer being paid back, trends in

the years before and after the financial crisis. Diagram 3 shows delinquency rates across multiple types of loans while Diagram 4 shows the more recent trends for single family residential mortgages. This is an indication of how loans are less likely to become delinquent since the financial crisis given new regulations that have been implemented and stricter banking practices.

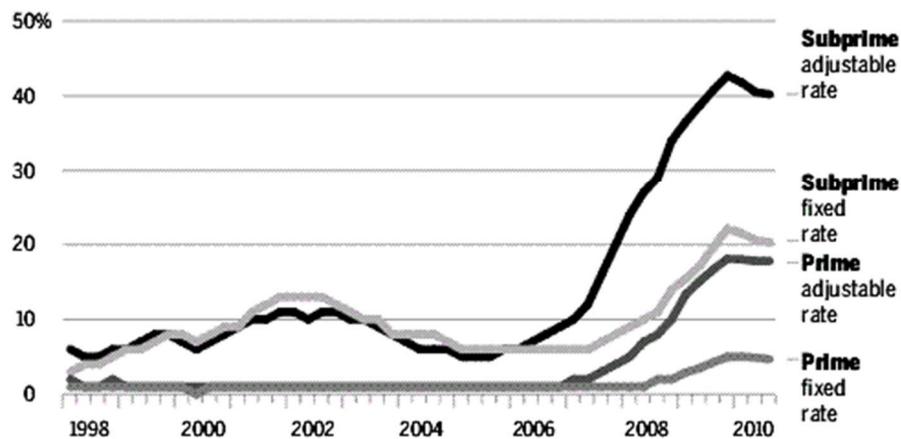
**Diagram 3: Delinquency Rate on Single Family Residential Mortgages, 2003-2014**

*Source: Federal Reserve Economic Data, FRED®*

**Mortgage Delinquencies by Loan Type**

*Serious delinquencies started earlier and were substantially higher among subprime adjustable-rate loans, compared with other loan types.*

IN PERCENT, BY TYPE



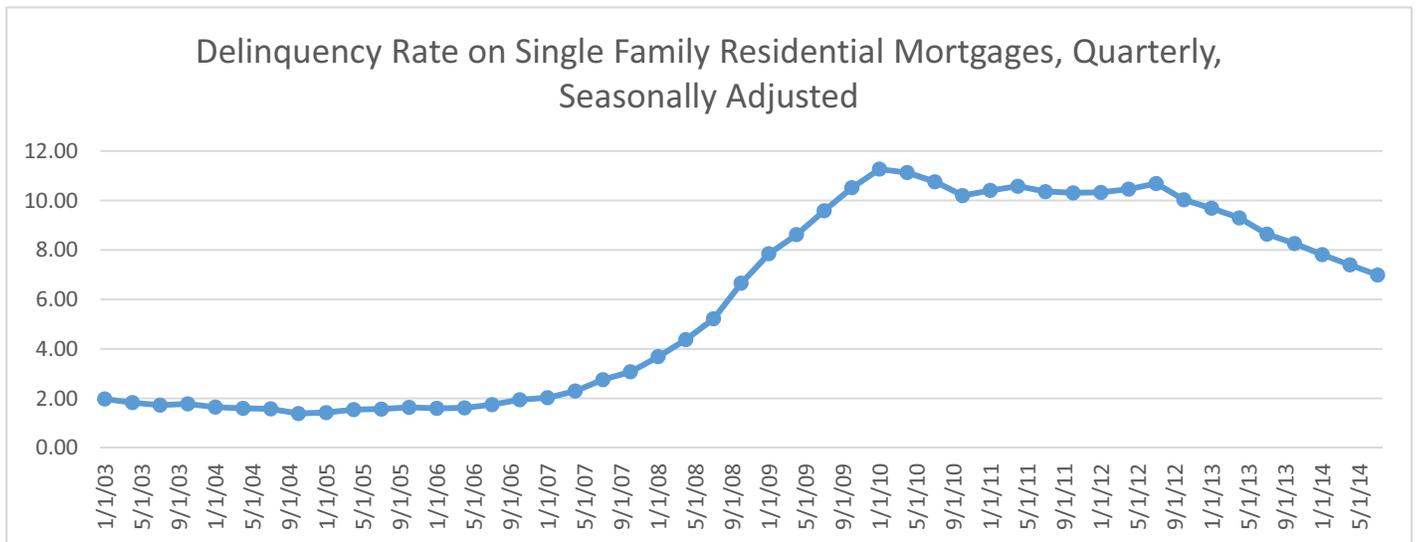
NOTE: Serious delinquencies include mortgages 90 days or more past due and those in foreclosure.

SOURCE: Mortgage Bankers Association National Delinquency Survey

The housing bubble and the introduction of securitization both had very large effects on the mortgage industry and lending practices of banks. While these were the main factors that led to more reckless loans, smaller factors engrained within the bigger ideas like government influence and lack of oversight allowed this issue to become much larger than it otherwise might have been. How lending practices have changed is significant, and within that how the rules and standards that are in use define how reckless or safe a bank can be are important as well. My data attempts to quantify those risks over multiple time periods in an effort to show whether there has been a significant increase or decrease in those standards. As I mentioned earlier, the idea of

securitization and the asset backed securities that it creates are very important to the build-up and initiation of the financial crisis and is what caused, for the most part, the deterioration in lending standards by banks.

**Diagram 4: Mortgage Delinquencies by Loan Type**  
*Source: Financial Crisis Inquiry Report, pg. 217*



### 5. Securitization and the Asset Backed Security

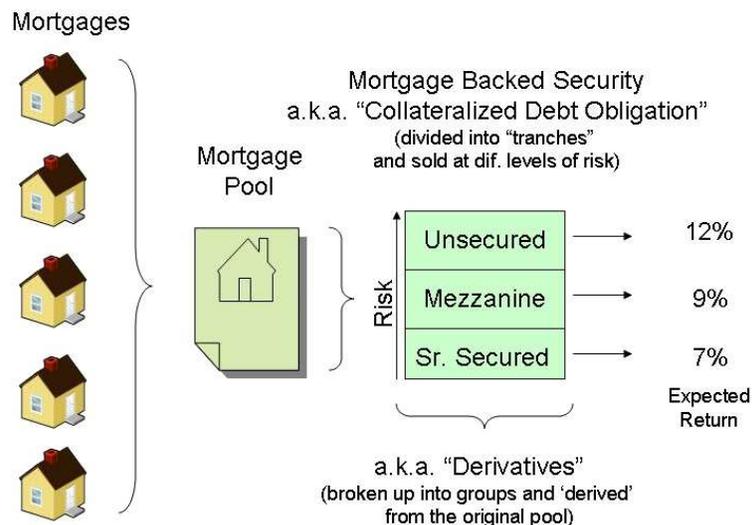
Earlier it was mentioned quite quickly what the process of securitization is and how it helped grow the residential mortgage industry as a result of the housing boom. The entire process of securitization though is very important and something which needs to be looked at a bit more in depth to really understand its true potential both as a negative and positive process. Something to be remembered is that a security is basically a bond where an individual is getting fixed interest payments from an asset that is unchanging for its duration.

Securitization begins with a financial institution, usually investment banks, who are looking for loans of any type that they can purchase. These could also be auto, residential, commercial, or credit card loans from any number of institutions and from almost any individual

in the world.<sup>43</sup> These items are the backbone of the security, however by themselves these loans are of no use. The goal of a security is to ease the process by which a bank can sell an asset to parties looking to invest in a particular area of the market. If the institution had to sell off each loan to a client individually that process would be quite tedious and not in the best interest of the bank. To avoid this issue, the bank utilized the securitization process by combining all of the loans into one complete package. The ‘security’ is now one entity which can be sold off to anyone looking to take a stake in that sector. In our case it is a Mortgage Backed Security MBS.

**Diagram 5: Mechanics of an MBS**

*Source: Wikimedia Commons*



After pooling and organizing the loans selected, the MBS now exists. It still remains on the institutions books though, so the next step is to move the product, and its risk, off the bank’s books and so creating value for the bank and, in theory, value for the security’s buyer. How can they do this though when some MBSs are more than \$300 million in total value? They do this by dividing the security up into slices known as tranches. Each tranche contains a variety of the

<sup>43</sup> Arestis, Philip. The Financial Crisis: Origins and Implications (New York: Palgrave MacMillan, 2011) Pg. 44.

mortgages within the MBS and which vary in risk depending on the rating given to the tranche by the rating agency (which will be discussed later). The process of dividing a security “lets buyers customize their payments. Risk-averse investors would buy tranches that paid off first in the event of default, but had lower yields. Return-oriented investors bought riskier tranches with higher yields.”<sup>44</sup> These tranches are still in many cases too large for any one individual to completely buy so in most cases there are hundreds of investors to every tranche. That is not to say that some entire tranches were not bought by large firms.

The utilization of securitization in modern finance has Congress and Fannie Mae and Freddie Mac to thank for it. Fannie and Freddie were the first two firms to accumulate great swaths of mortgages, however like the banks they needed to move them off their books to create room to buy more mortgages. They solved this problem by creating the securitization process. While they were the first to use securitization in a quasi-government situation, many attribute the use of securitization in the private sector to Lou Ranieri.<sup>45</sup> While working at Salomon Brothers in the 1970s he bundled a group of mortgages together and sold debt securities against it, paying out the debt holders when the mortgages paid in money. However there was an issue during the initial stages of securitization which was that securities were not eligible to be rated by a rating agency.<sup>46</sup> As a result, major buyers were wary or unable to purchase securities given the unknown risks associated with them. As it would turn out, even with a rating a buyer did not necessarily know the real risk of the product.

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<sup>44</sup> The Financial Crisis Inquiry Commission, Pg. 43.

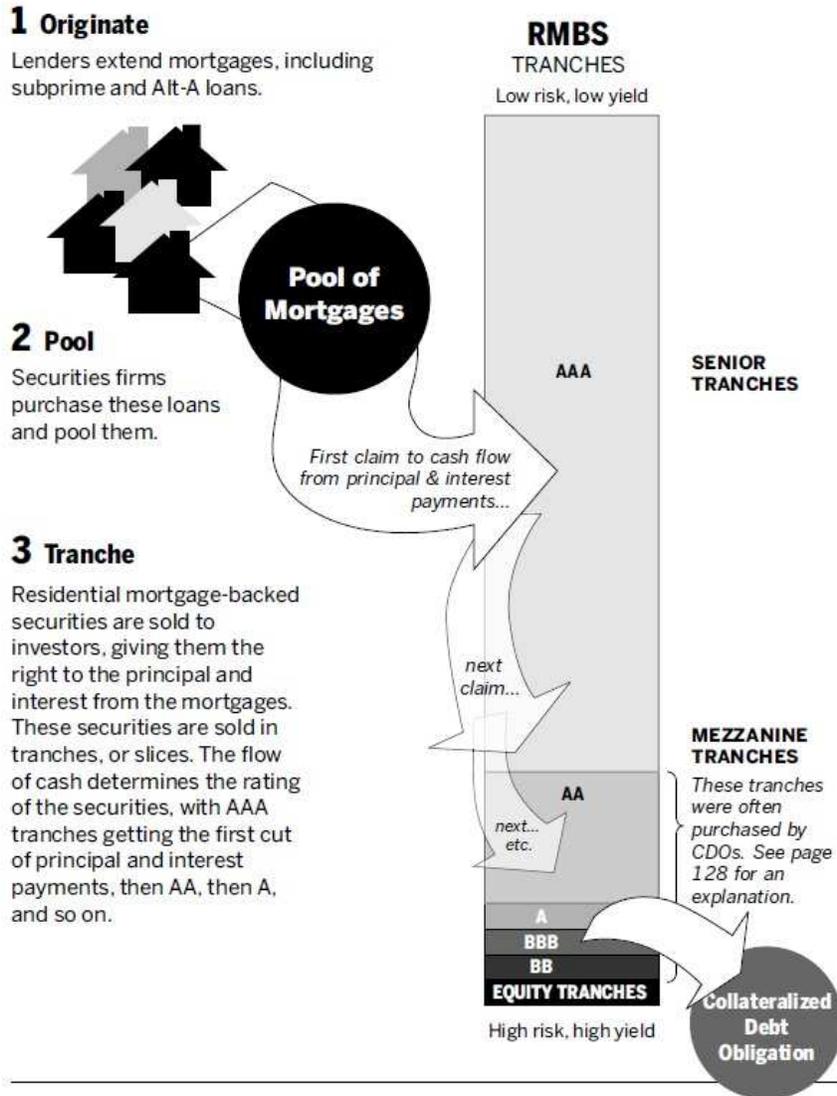
<sup>45</sup> McNamee, Mike. “Lewis S. Ranieri: Your Mortgage Was His Bond” *Bloomberg* (2004). Web.

<sup>46</sup> Faber, David. And Then the Roof Caved In: How Wall Street’s Greed and Stupidity Brought Capitalism to its Knees (Hoboken: John Wiley & Sons, Inc., 2009). Pg. 84.

**Diagram 6: Residential Mortgage-Backed Securities**  
*Source: Financial Crisis Inquiry Report, pg. 73*

**Residential Mortgage-Backed Securities**

*Financial institutions packaged subprime, Alt-A and other mortgages into securities. As long as the housing market continued to boom, these securities would perform. But when the economy faltered and the mortgages defaulted, lower-rated tranches were left worthless.*



As the housing boom continued and banks continued to lower the bar on who could receive a loan, the securitization industry continued to consume mortgages no matter how risky

they appeared. As was noted, “The securitization machine began to guzzle these once-rare mortgage products with their strange-sounding names: Alt-A, subprime, I-O (interest-only), low-doc, no-doc, or ninja loans; 2–28s and 3–27s;<sup>47</sup> liar loans; piggyback second mortgages; payment-option or pick-a-pay adjustable rate mortgages.”<sup>48</sup> The question remains though, how did the rating agency cope with the new, lower quality loans and how did it affect the securities industry.

## **6. Rating Agencies and the Rating Process**

The great expansion of mortgage issuance brought about a greater number of low quality subprime and NINJA mortgages to be issued and laterally securitized. As the quality of mortgages being pooled became worse, the riskiness of that security should in effect go up as there is now a greater average risk over all the mortgages. While the riskiness did go up, it was overlooked for the most part by the banks, rating agencies, and consumers during the boom.

The main rating agencies during the 2000s were Moody’s, Standard and Poor’s, and Fitch. They were tasked by the banks and the government to rate, for safety purposes, every security produced in an effort to give, as the *Financial Inquiry Report* mentions, peace of mind and a complete awareness of the risks to the consumer. Unfortunately as the *Report* notes, the rating agencies failed to do this. They failed for a number of reasons including, but not limited to “flawed computer models, the pressure from financial firms that paid for the ratings, the relentless drive for market share, the lack of resources to do the job despite record profits, and

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<sup>47</sup> The 2-28 and 3-27 loan types above indicate two popular adjustable rate mortgage types. They offered a 2 or 3 year fixed interest rate period to begin with and then devolved into a floating rate based on the pricing index and a buffer. “Often, a 2/28 ARM is designed as a short-term financing vehicle that provides borrowers with time to repair their credit before they refinance into a mortgage with more favorable terms.”(Investopedia).

<sup>48</sup> The Financial Crisis Inquiry Commission, Pg. 43.

the absence of meaningful public oversight.”<sup>49</sup> By the end of 2007, almost 80% of all securities were being rated AAA, the same rating given to a U.S. government bond. Most of the securities however contained at least some and in many cases a high percentage of subprime and low quality mortgages.<sup>50</sup> Only six of the biggest companies in the United State maintained this AAA rating, so how did these risky securities come to also hold it?<sup>51</sup>

Some of the reasons have already been listed such as conflicts of interest or the process of ‘rating shopping’ which meant that rating agencies had to fight for business by offering greater leniency to clients. In Diagram 6, the more tranches the rating agencies rated, the more money they received year after year. That meant there was more at stake when it came to getting the business. A better rating also usually meant a faster sale and a happier bank. Why were they happier? Because, when a tranche is created it is given an interest rate that the purchaser of that tranche will receive. The safer and less risky the tranche, your AAA to A rated tranches, the lower the interest rate you will receive from the bank for holding that tranche. The riskier the tranche, from B down to junk and unrated, the higher the interest rate. What the bank would like is for as many tranches of a security to have the lowest interest rate possible so that the interest they are receiving from mortgage holders is greater than the interest they have to pay out. Therefore they are making more money. That is why they are much happier when a greater percentage of an RMBS is given a AAA rating, lowering the overall interest rate being paid out.

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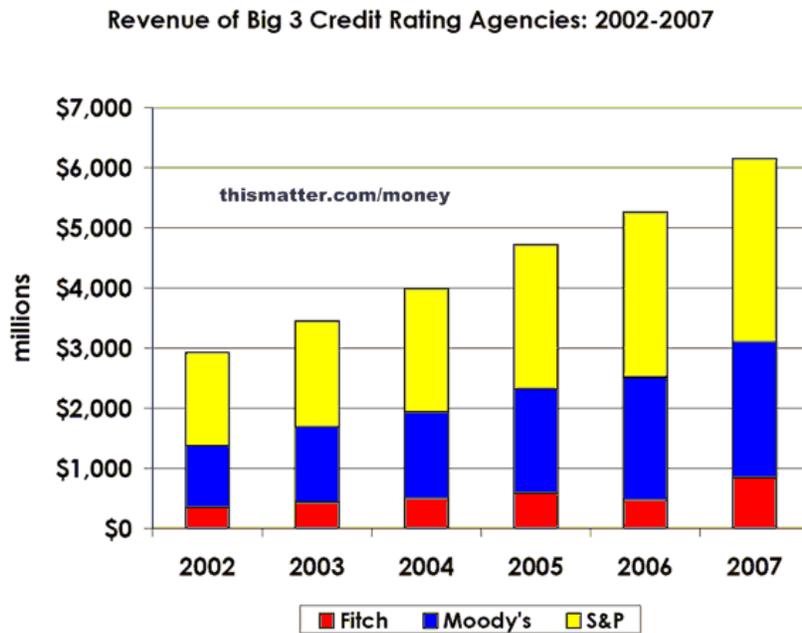
<sup>49</sup> The Financial Crisis Inquiry Commission, Pg. xxv.

<sup>50</sup> Ibid. Pg. 127.

<sup>51</sup> Ibid. Pg. xxv.

**Diagram 7: Revenue of Big 3 Credit Rating Agencies: 2002-2007**

*Source: [thismatter.com/money](http://thismatter.com/money)*



Another source of the mis-ratings as noted was a lack of information and poor modeling used by the rating agencies. A large percentage of the time the lending bank would pass on only minimal information about the mortgage holder to the rating agency, especially when the bank only had limited documentation on the borrower. Then, even if the rating agency was given some of the information about the borrower, the methodology for analyzing that information was flawed. The rating agencies used a process of historical model referencing where they would correlate a series of mortgages with a past security and then analyze the current mortgages based on risk profiles of the past mortgages. The historical model would incorporate with its rating assessment a 10 to 15% buffer to account for an increased risk potential and variance that current mortgages hold. The issue with this model is that historically there has never been a housing bubble as volatile as this nor have banks ever issued loans to people with such bad credit and at such low standards. The combination of lending to people who posed a greater risk, giving them

up to 110% LTV rates, and doing so during a housing bubble where, if it popped, so too would the ability for them to pay back their loan, meaning that these risk analyses were useless.

This did not matter to the rating agencies for the most part because, at the time, there was little concern for the future of the security or the downgrading to come. By just 2008 almost 73% of MBS tranches rated by Moody's had been downgraded to junk and today 83% of all AAA tranches rated in the years preceding the financial crisis have been downgraded to 'not investor grade' quality.<sup>52</sup> With so many products being rated much safer than they might otherwise have been it was only a matter of time before the risk became apparent, ultimately the result in a drop in home values, even one as small as 1%. The data analysis will be show the downgrading of tranches in relationship to individual mortgage data including credit score and LTV information in an effort to show a relationship between tranches and their borrower makeup, historically vs. today, showing how lending practices have changed.

The main point I feel that should be taken away here is that the defect in the rating agencies is that in the years leading up to the financial crisis, the average mortgage became riskier and riskier as a greater percentage of borrowers were subprime or low quality. At the same time a greater percentage of tranches were rated AAA, the least risky of all. While tranches are a very important aspect of a security, allowing people to choose the risk they want to accept, the rating agencies did not properly understand the actual risk of actual securities prior to the financial crisis and mis-rated a great number of the tranches. The process of rating securities has changed significantly over the past few years, but the job of the rating agency to rate securities and inform the client remains the same.

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<sup>52</sup> The Financial Crisis Inquiry Commission, Pg. 122.

## 7. Summary Statistics

This section exhibits summary statistics for a selection of variables within my data pool. These variables all have quantifiable numerical data, the summaries of which are listed in a series of three tables, one for each year. This is meant to show both what ranges the specific variable data encompasses for each of the three years and how the averages of those variables change. The variables below are defined in Appendix C. There are two extra variables included below which are not standard numerical observations but dummy variables. These are %Delinquent, which is the percent of total mortgages that became delinquent for each year, and %DocFull, which is the percent of total mortgages that had full documentation at issuance. There are further graphs on the next page which show the change in means of each variable over the three years to give a visual perspective of the data.

**2003**

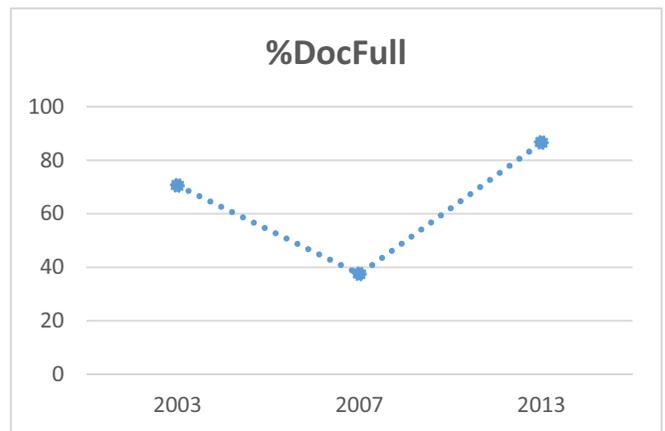
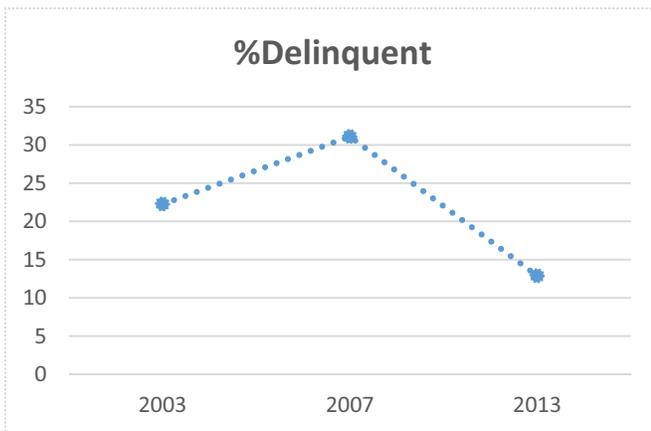
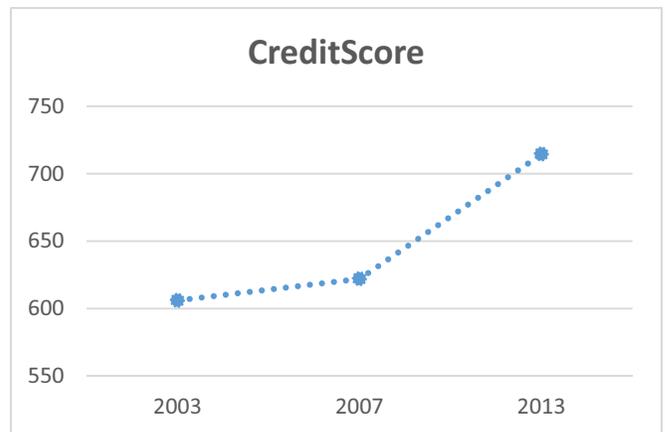
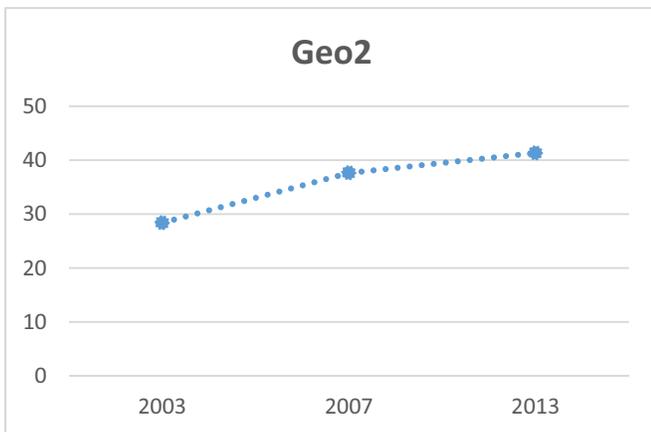
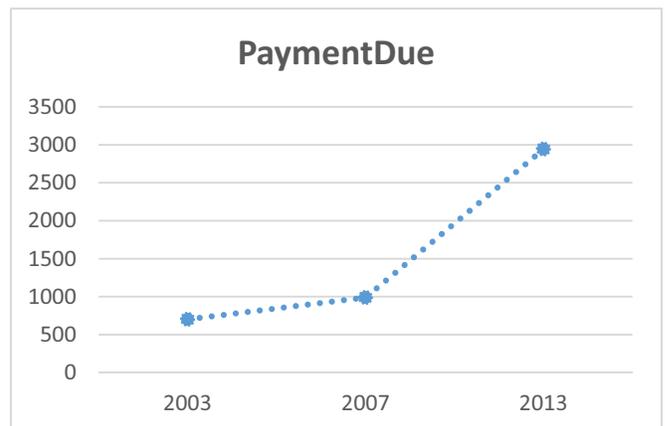
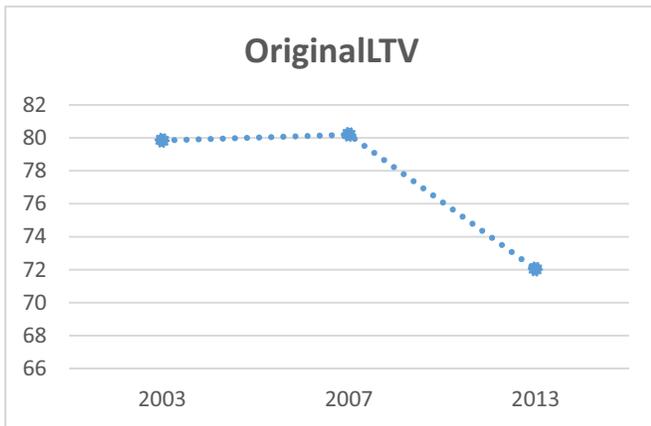
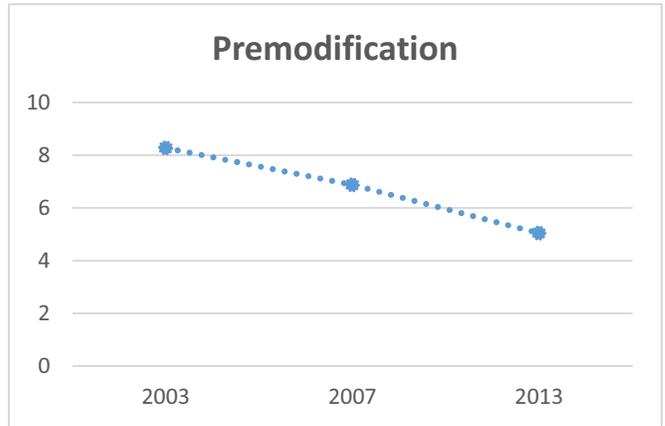
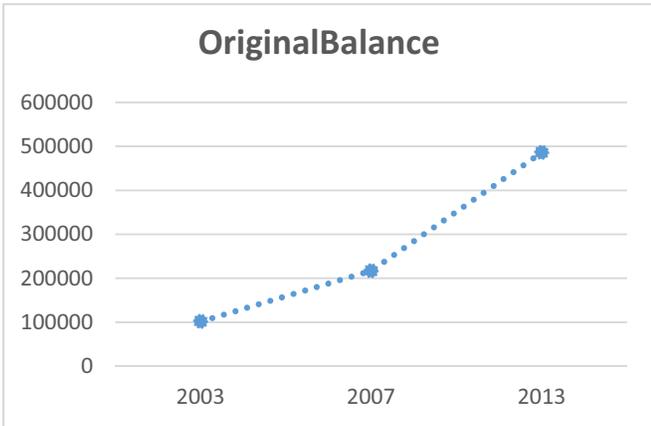
| Variable                   | Obs     | Mean     | Std. Dev. | Min      | Max      |
|----------------------------|---------|----------|-----------|----------|----------|
| OriginalBalance, \$        | 3019    | 101822.3 | 74757.78  | 12300    | 742500   |
| Premodification, %         | 3019    | 8.273557 | 2.011192  | 1.5      | 15.875   |
| PaymentDue, \$             | 3019    | 702.2771 | 477.8161  | 17.7     | 5612.11  |
| OriginalLTV, %             | 3019    | 79.84432 | 13.64844  | 17       | 119      |
| CreditScore, #             | 3019    | 606.0371 | 72.0712   | 385      | 814      |
| AvgHomePrice, \$ Thousands | 3019    | 295.4644 | 96.6279   | 168.8    | 611.08   |
| AvgIncome, \$              | 3019    | 31424.71 | 4011.302  | 23970    | 48451    |
| AvgRatingChange, #         | 2724    | 10.75448 | 4.238297  | 5.333333 | 19.81818 |
| Geo2, # (States 1-52)      | 3019    | 28.40079 | 13.14225  | 1        | 51       |
| %Delinquent, %             | 22.259  | NA       | NA        | NA       | NA       |
| %DocFull, %                | 70.5532 | NA       | NA        | NA       | NA       |

**2007**

| Variable                   | Obs    | Mean     | Std. Dev. | Min     | Max      |
|----------------------------|--------|----------|-----------|---------|----------|
| OriginalBalance, \$        | 13488  | 217092.2 | 166660    | 9750.36 | 2500000  |
| Premodification, %         | 13488  | 6.873601 | 2.544406  | 1       | 14.031   |
| PaymentDue, \$             | 13488  | 988.9886 | 825.8395  | 11.57   | 27769.99 |
| OriginalLTV, %             | 13488  | 80.19669 | 14.2299   | 7       | 102      |
| CreditScore, #             | 13488  | 622.012  | 65.40146  | 416     | 823      |
| AvgHomePrice, \$ Thousands | 13488  | 433.8326 | 130.6624  | 202.09  | 684.37   |
| AvgIncome, \$              | 13488  | 40841.62 | 5330.369  | 29497   | 65329    |
| AvgRatingChange, #         | 9338   | 17.51196 | 0.8703363 | 16      | 19.5     |
| Geo2, # (States 1-52)      | 13488  | 37.65414 | 12.18194  | 1       | 51       |
| %Delinquent, %             | 31.094 | NA       | NA        | NA      | NA       |
| %DocFull, %                | 37.5   | NA       | NA        | NA      | NA       |

**2013**

| Variable                   | Obs    | Mean      | Std. Dev. | Min    | Max       |
|----------------------------|--------|-----------|-----------|--------|-----------|
| OriginalBalance, \$        | 4493   | 486130.7  | 432853    | 403.17 | 3225000   |
| Premodification, %         | 4493   | 5.043334  | 2.027325  | 2      | 13.99     |
| PaymentDue, \$             | 4493   | 2943.211  | 1950.545  | 77.67  | 22426.7   |
| OriginalLTV, %             | 4493   | 72.03049  | 15.13903  | 5      | 100       |
| CreditScore, #             | 4493   | 714.5618  | 83.29443  | 422    | 839       |
| AvgHomePrice, \$ Thousands | 4493   | 421.9508  | 105.0296  | 207.23 | 656.34    |
| AvgIncome, \$              | 4491   | 57018.51  | 5626.815  | 39622  | 71322     |
| AvgRatingChange, #         | 4493   | 0.1066937 | 0.2418396 | 0      | 0.8333333 |
| Geo2, # (States 1-52)      | 4493   | 41.35544  | 10.18641  | 1      | 52        |
| %Delinquent, %             | 12.887 | NA        | NA        | NA     | NA        |
| %DocFull, %                | 86.601 | NA        | NA        | NA     | NA        |



## **8. Data Analysis**

My thesis utilizes a series data set that includes a combined total of 21,000 individual mortgages from 2003, 2007, and 2013. This data was culled from multiple MBS offerings made by Goldman Sachs in each of the three years listed. These were found on the Bloomberg Terminal under Goldman Sach's Securities heading. Years 2003 and 2007 occurred before the financial crisis, an important point because it is the trigger of my question. 2013 occurred after the financial crisis. My goal is to look at whether mortgage lending standards have changed since the financial crisis. I used 2003 and 2007 as my data for pre-financial crisis standards and 2013 as post-financial crisis standards. This results in an effective comparison method and also helps to show how standards potentially decreased between 2003 and 2007 as banks began lending to lesser qualified individuals during the subprime lending push.

My data analysis is broken up into two parts. The first section looks at the visual representation of specific variables and how they relate to another specific variable. This is shown in either a two-way scatter plot design or a bar graph design. No dummy variables are included in these graphs as the numerical values need to be over one to be effective in a visual way. There will be more information on this in the first section.

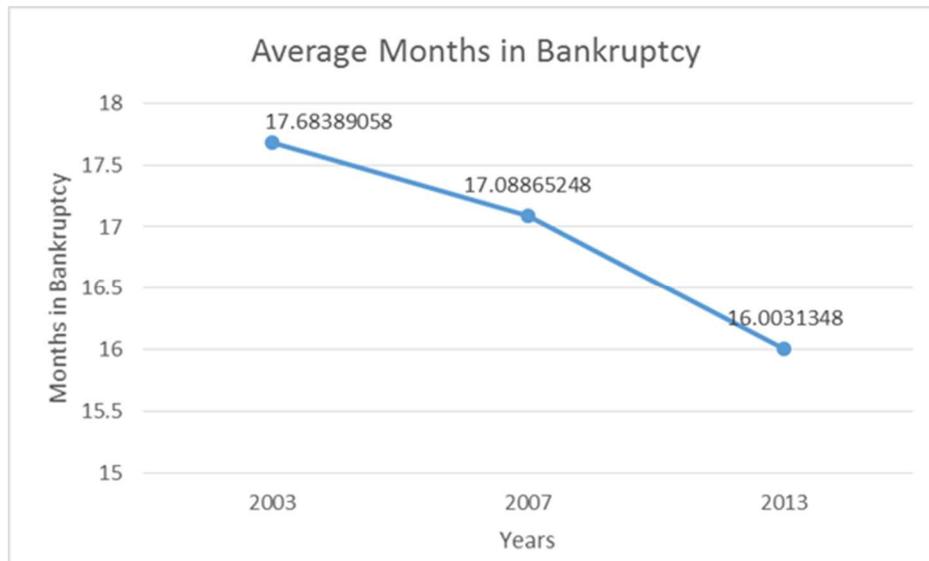
The second section looks at a series of regressions utilizing both dummy and non-dummy variables to identify whether they are significant dependent variables and how the terms interact. There will also be a kind of stepwise regression included to look at the effects on a dependent variable of a large selection of independent variables, both dummy and non-dummy. There will be more on this method and the result in the second section. The effect of both of these methods will be to see whether there has been a change in lending standards since the financial crisis or not.

## Section A: A First Look at the Key Data

- The volume of loans securitized grew substantially between 2003 and 2007 and then dropped during the financial crisis due to the poor performance of the securities.
- During 2003, average initial ratings for the securities were in the high As (4.33), around a AA- or Aa3 rating. These were re-rated to an average of B or B2 after the financial crisis and the re-organization of rating agencies rating policies and analysis software.
- During 2007, average initial ratings for the securities were even higher than 2003, around 2.1 or an AA+ or Aa1. This means that they were as good as US government securities in terms of risk of default that the mortgages represented. This being at a time when sub-prime and NINJA were very prevalent. They were re-rated to an average of 13.9, or a B1 or B+. This indicates bigger rating drop than seen for 2003 tranches.

**Diagram 8: New vs Original Tranche Ratings**

*Source: Excel*



- 2013 on the other hand shows significantly different data on initial ratings. Using the same tranche classifications, the average initial ratings are around the AA+ rating, similar to 2007, however a large portion of the tranches remain unrated by the rating agency as they are unable to accurately rate them given the available information. This indicated significantly higher standards for rating tranches today as opposed to pre-crisis.

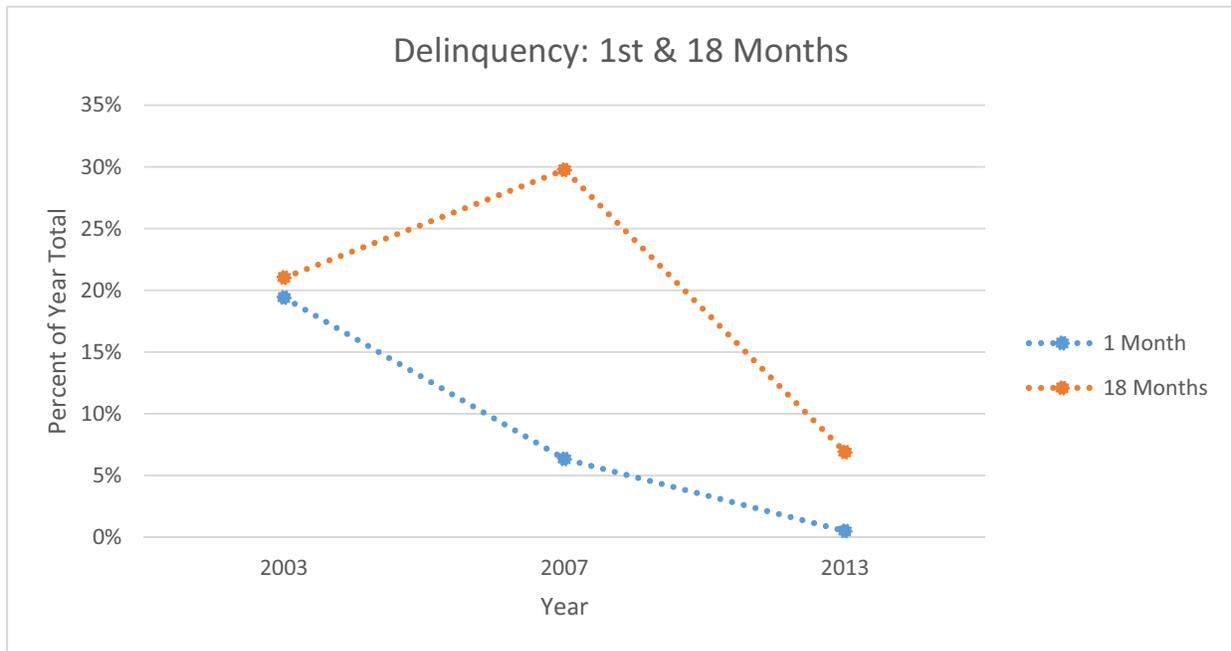
- There is negligible change in the ratings of the 2013 set as most of the tranches still maintain their original rating. Rating agencies are getting the correct rating the first time this time as far as can be seen from this data.
- In terms of U.S. state composition of the securities, instead of having a broad base for the mortgages to spread the risk, there are groupings of these mortgages from 2003 and 2007 where many are found in states like California, Arizona, Florida, and Nevada, states identified as having the highest rates of sub-prime mortgage issuances.<sup>53</sup>
- With my data I was able to look at the average credit scores of all the mortgages from the securities I picked in these years. The data is shown in a graph below and shows how the average FICO score goes up slightly between 2003 and 2007 and then jumps up to a much higher number in 2007.
- This shift is directly related to the increase in loans made to people with better credit given the knowledge of the banks that loaning to people with bad credit results in negative outcomes.
- A credit score of below 650 is deemed poor and should in many cases make a person ineligible for a house loan.
- A reasoning for the rise in credit scores from 2003 to 2007 is the fact that many more people were buying houses on speculation or as investments during 2007 as the housing bubble peaked. These people had the credit scores based on past performance, so multiple good performance loans during the bubble would increase ones credit score. Many buyers looking for investments represented businesses which meant their credit score, or the one they were able to use, was quite high given a business will usually maintain better loan track-records. The fact it rose does not mean the normal public had on average a better credit score.
- Looking at the loan to value (LTV) numbers from over the years it is clear that the average rose from 2003 to 2007 and then dropped slightly to 2013. A key part of the subprime mortgage was the fact that the (LTV) could be anywhere from 80 to 110% depending on the borrower and the banks willingness to lend money. This was very reckless. Today banks lend far less to people even with good FICO scores and more assets due to regulations and fear of risk.

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<sup>53</sup> Mayer, Chris, and Karen Pence. *Subprime Mortgages: What, Where, and to Whom?* 2008-29.

- When looking at the percentage of the accounts in default we see that that percentage increases from 2003 to 2007 of accounts in default followed by a drop in mortgage delinquency in 2013.
- The delinquency rate is very important to show just what effect the collapse of the housing bubble had on homeowners and their mortgages, of which the basis for repayment depended on an increase in the underlying house price.
- As we can see, many of the mortgages made in 2007 defaulted, over 30%, showing just how risky those mortgages were. And yet at that time the ratings associated with the securities were very high, to the point of government bond standards. That disconnect in logic is something that was prevalent throughout the rating agencies.
- The average coupon rate for mortgages in nominal terms has fallen consistently over the years as has the modified coupon rates for any mortgages that were adjustable rates. The government had a large influence in making an adjustable rate mortgages receive special treatment in the form of low coupon rates so many from 2007 have interest rates of just 1 or 2 percent.
- Another important indicator I looked at is the average number of months a mortgage was delinquent normalized for the number of months the mortgages have been in existence. The result shows a downward trend indicating that over the same period the average delinquency rate went down. This means the mortgage lending practices and standards in theory have gone up.
- One last very important data point is the delinquency rates of mortgages issued in the three different years and how those change from the 1<sup>st</sup> to 18<sup>th</sup> months and how they compare across the three years. The 18<sup>th</sup> month is the eighteenth month of payment that the borrower has made for their mortgage, an event which has occurred for all mortgages from all three years. This therefore offers a point in time later during the mortgage to analyze when looking to see if the borrower continues their payments after a period of time. As can be seen, 2007 has the highest delinquency rate, both in the first month and then in the 18<sup>th</sup> with the biggest growth during that period.

**Diagram 9: Delinquency Rates: 1<sup>st</sup> and 18<sup>th</sup> Months into the Mortgage**  
*Source: Bloomberg, Excel*



### Section B: Graphical Data Analysis

The data I collected during my research phase for my thesis has provided me with a substantial platform from which I can attempt to conclude whether or not the lending standards have changed from the years prior to the financial crisis to today. While regression analysis is very important and will be utilized in my paper to determine the significance of dependent and independent variable relations, there are other ways to view my data. One of those ways is through graphical analysis in the form of scatter plots and/or histograms. While this method relies more on a visual interpretation, it is very important and extremely helpful in understanding the relationship between two variables and how that changes over time.

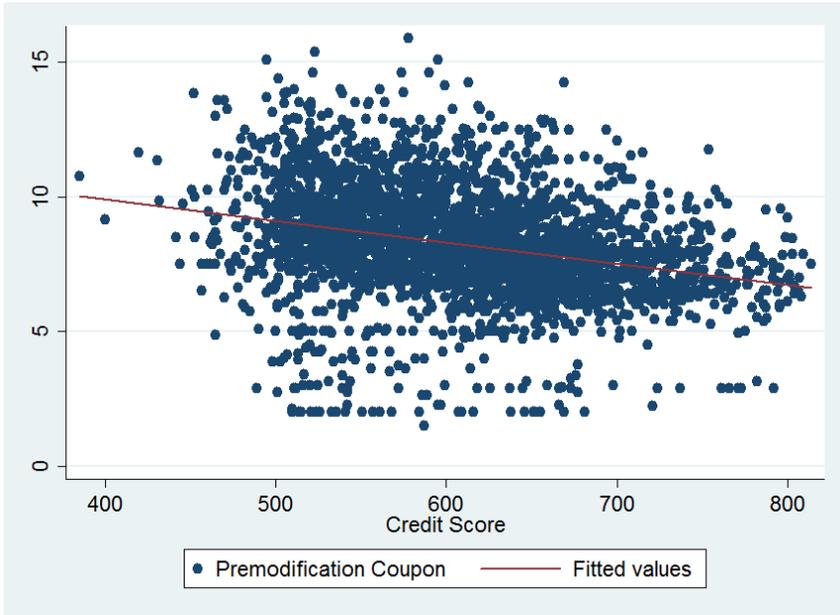
Using Stata it was possible to create six different scatter plots series and one histogram series which are presented below. The scatter plots compare two different non-dummy variables, meaning the numerical data fluctuates on a continuum, instead of being 1 or 0. The focus was to

use the most significant and visually interesting variables for the plots. This is in an effort to present an argument for whether or not lending standards have changed. The specific charts are described on each page, however the variables used were:

- **Credit Score:** *A statistically derived numeric expression of a person's creditworthiness (ex. FICO)*
- **Average Home Price:** *The average home price in that state during the year in question: 2003, 2007, 2013*
- **Average Rating Change:** *The number of rating classes that the tranche has fallen since it was initially rated. This only applies to tranches that have been re-rated*
- **Geo2:** *A numerical value assigned to each state plus D.C. and Puerto Rico (1-52) that denotes the states standing in terms of volume of subprime mortgages issued in that state in that year: 2003, 2007, 2013. 52 is the state with the most subprime mortgages issued and 1 is the least*
- **Average Income:** *The average income of that state during the year in question: 2003, 2007, 2013*
- **Original LTV:** *The ratio of the original loan balance divided by the appraisal value of the property*
- **Original Balance:** *The balance of the loan at the time of origination*
- **Premodification Coupon:** *Loan rate before ARM rate change*

The scatter plots are arranged in chronological order with the oldest year at the top of the page and the most recent at the bottom, going 2003, 2007, 2013 from the top to the bottom of the page. The same applies to the histogram. The histogram is there as a visual representation of the number of mortgages out of the total data set which were issued in that state in each year.

At the end of the set of seven series displays is a set of just two years, 2007 and 2013, comparing the original loan to value to the original balance. This is interesting given the new regulations that came into effect after the financial crisis, specifically from Dodd-Frank, and the effects of which are clearly visible in the scatter plot.



2003

**Series 1: Pre-modification Coupon – Credit Score**

Two-way Scatter Plot with Linear Regression  
*Source: Stata*

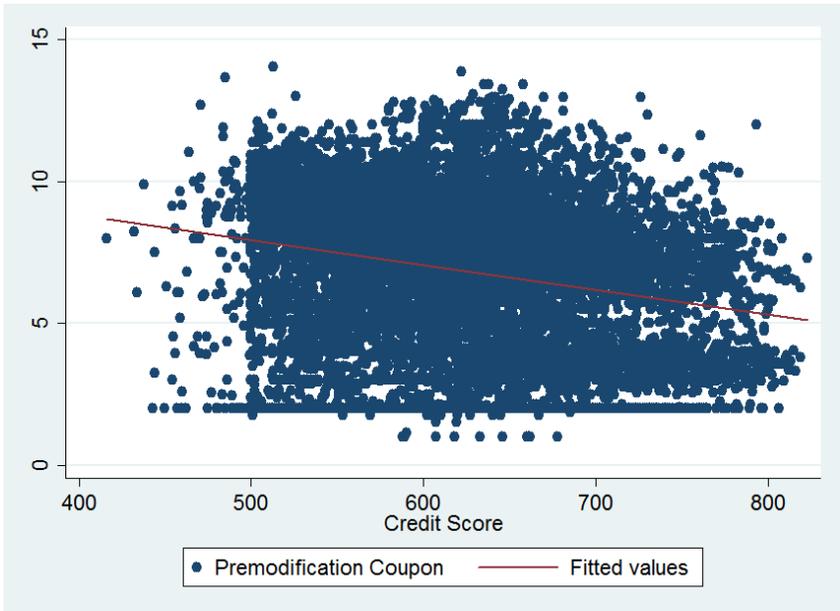
**Interpretation**

This selection of three scatter plots shows the credit score of each mortgage as compared to the premodification coupon, or coupon that it received when it was originated. This includes both adjustable and fixed rate mortgages. In theory, as a person's credit score gets lower, their coupon rate should get higher as the person has a higher inherent risk of defaulting.

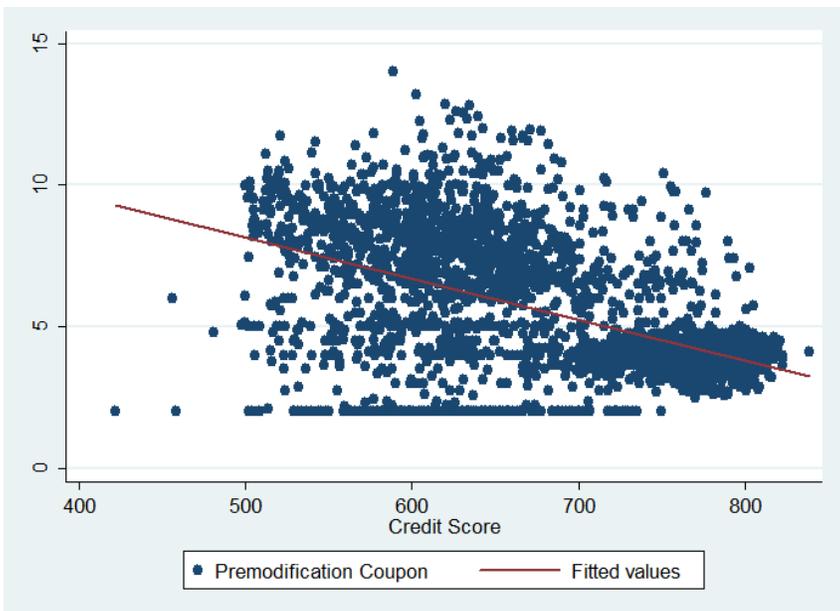
In 2003, this theory holds true for the majority of mortgages. There are externalities to some mortgages (govt. sponsoring) which change the situation and the coupon designation process. That is what creates the outliers.

In 2007 there is still a downward trend for coupon rate to credit score following the standard theory. This also holds true in 2013.

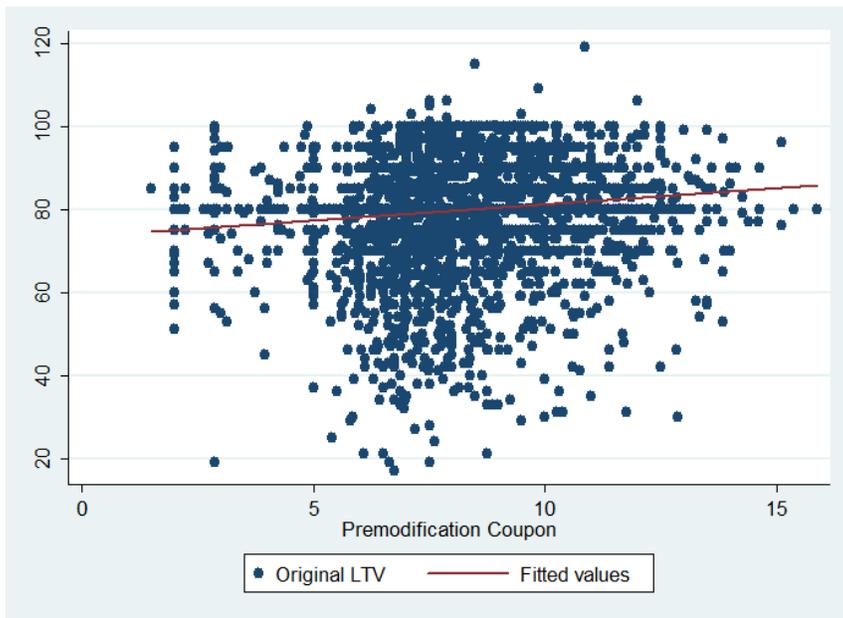
It is apparent then that during the subprime mortgage heavy years prior to the financial crisis and in the years since, the theory of coupon rate to credit score has held true, instead of flattening in the years prior. The mean coupon did drop from 2003 to 2007, indicating a drop in the average coupon rate charged. This shows how banks were reacting to U.S. interest rates dropping and the freeing up of credit.



2007



2013



2003

**Series 2: Original Loan-to-Value – Premodification Coupon**

Two-way Scatter Plot with Linear Regression

Source: Stata

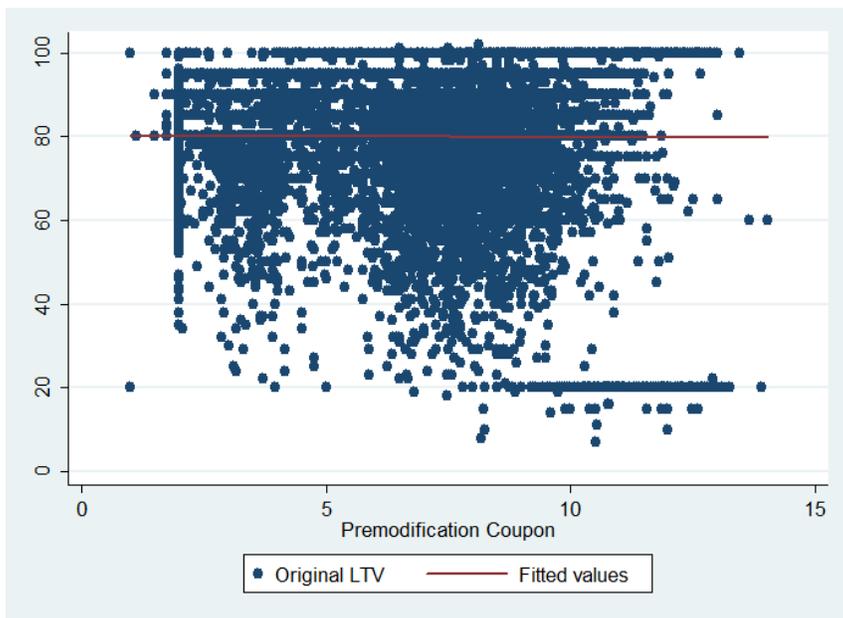
**Interpretation**

This selection of three scatter plots shows the premodification coupon rate as compared to the original loan-to-value. The assumption that would be placed on this comparison is that as the OLTV rises, so does the coupon rate. That is because with a higher OLTV comes a higher risk on the bank's part and therefore they want more in return from the customer.

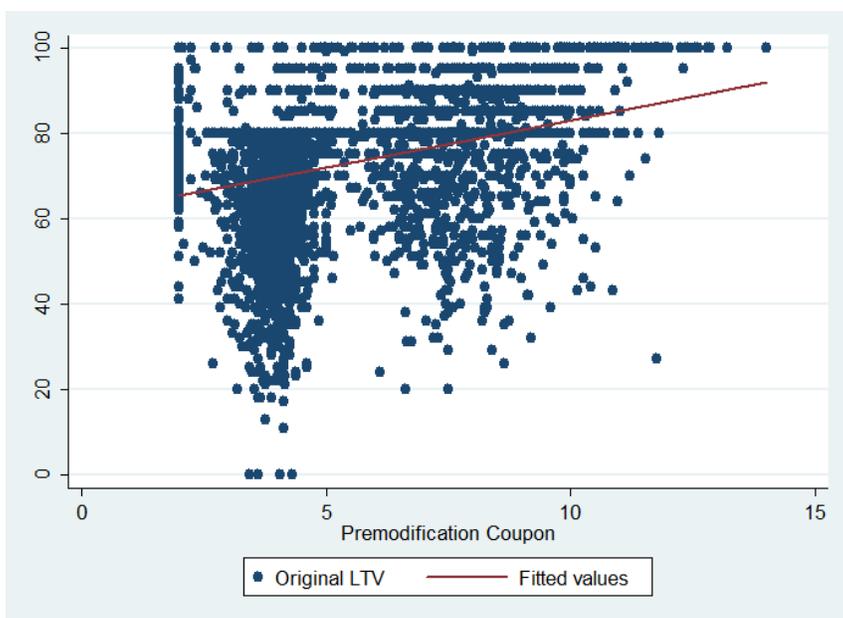
2003 shows a slight upward trend following my predicted path. 2007 shows a completely flat line of best fit indicating no change as the OLTV rises. 2013 exhibits a distinctly upward sloping line indicating a strong correlation between the OLTV rising and the coupon rising.

It would appear that both 2003 and 2013 both follow the theoretical expectation to some degree, however 2007 does not. One reason for this is that in 2007, a bank was securitizing the mortgage so fast that it did not consider or care about how high the OLTV was in relation to the coupon rate. They were not liable for any of the mortgage after its sale.

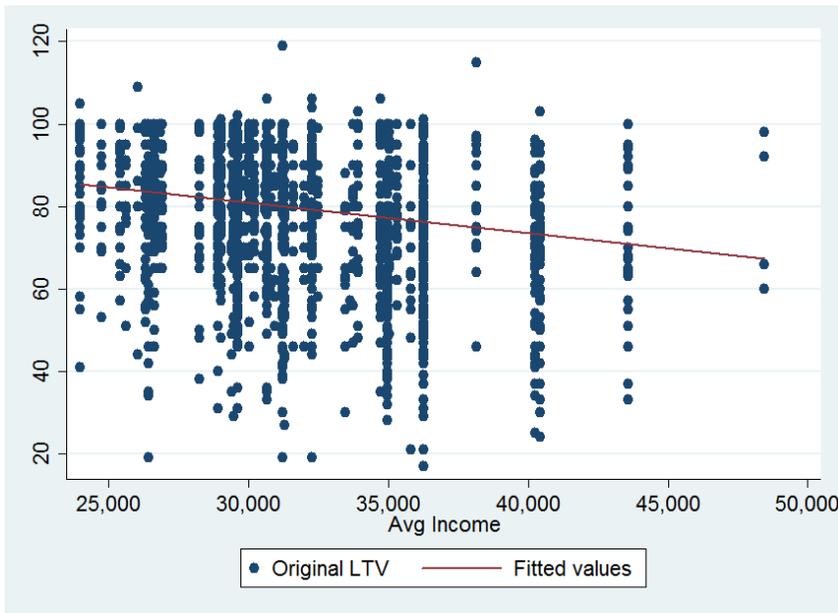
Securitization was less popular in 2003, meaning the line should be somewhat sloped and in 2013 the banks are now liable for a percentage of the mortgage during its entire life, therefore making them more conscientious about the coupon rate.



2007



2013



2003

**Series 3: Original Loan-to-Value – Average Income (in that state)**  
Two-way Scatter Plot with Linear Regression  
*Source: Stata*

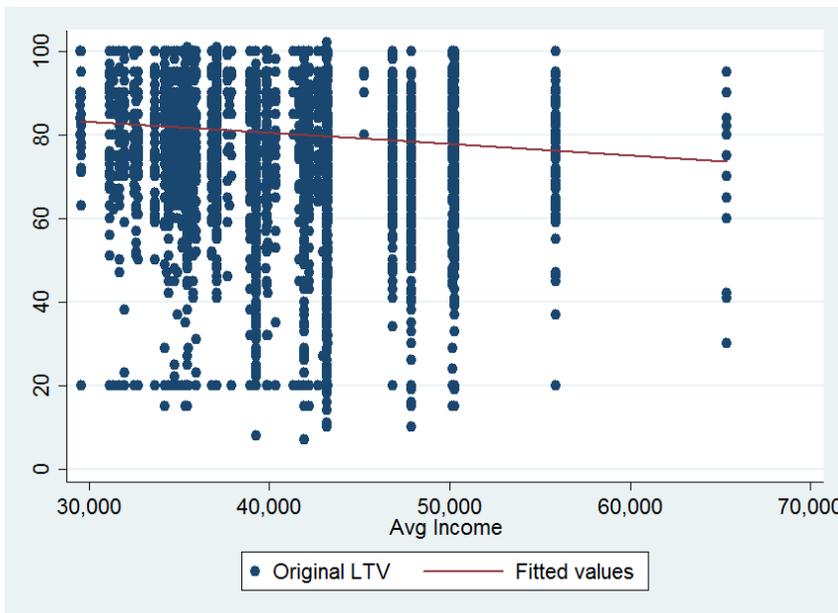
**Interpretation**

This series of graphs shows the relationship between average income and the original loan-to-value. The expectation is that as the avg. income for that state rises, the OLTV per mortgage would fall on average. This is because the more money on average a person makes, the less in theory they might require from the bank. That of course could change if the individual proceeds to buy a very expensive home beyond their means.

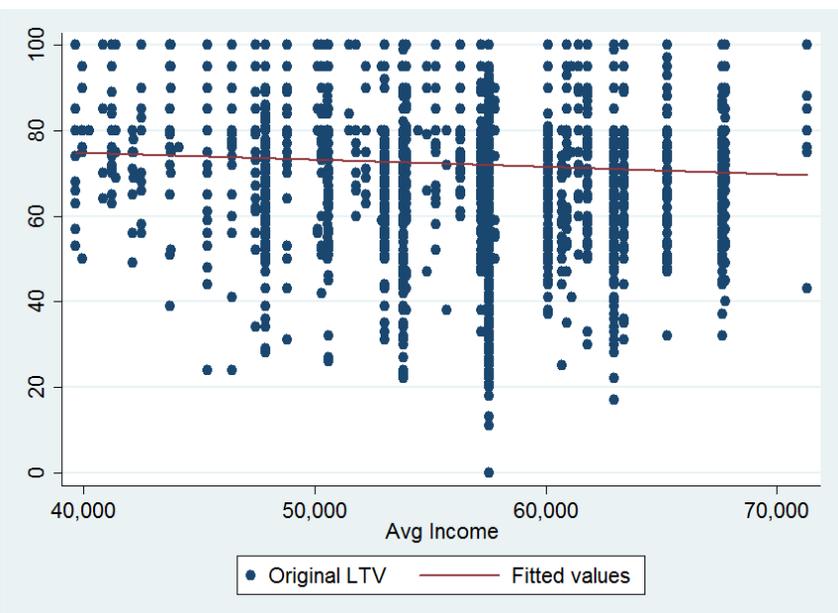
An important point to note is the visual representation of the data. Given each state has a specific avg. income, all of the mortgages from that state will show up in a line, their position now defined by the OLTV. As a result, each line represents a specific state given its avg. income.

In 2003 there is a downward trend, following the expectation above. This is also present in 2007, although less pronounced. 2013 has a best fit line of similar slope to 2007 and a better distribution of OLTV's across the various avg. income states.

The result of this test series is that the expectation holds true and as a state's average income rises, the OLTV falls.



2007



2013

**Series 4: Original Loan-to-Value – Credit Score**

Two-way Scatter Plot with Linear Regression

Source: Stata

**Interpretation**

In this series, the three scatter plots compare the mortgages original loan-to-value to the credit score of the mortgage holder. The assumption is that as a person with a higher credit score should be able to receive a higher OLTV.

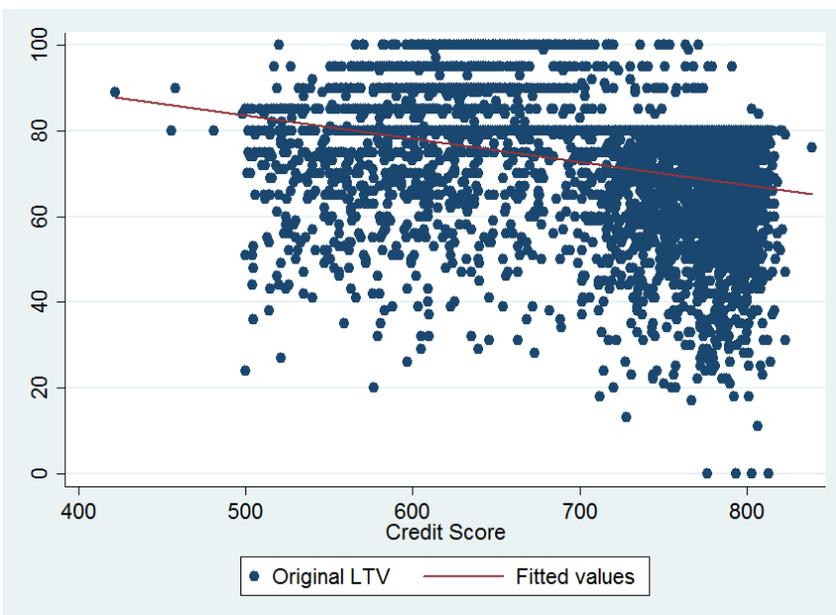
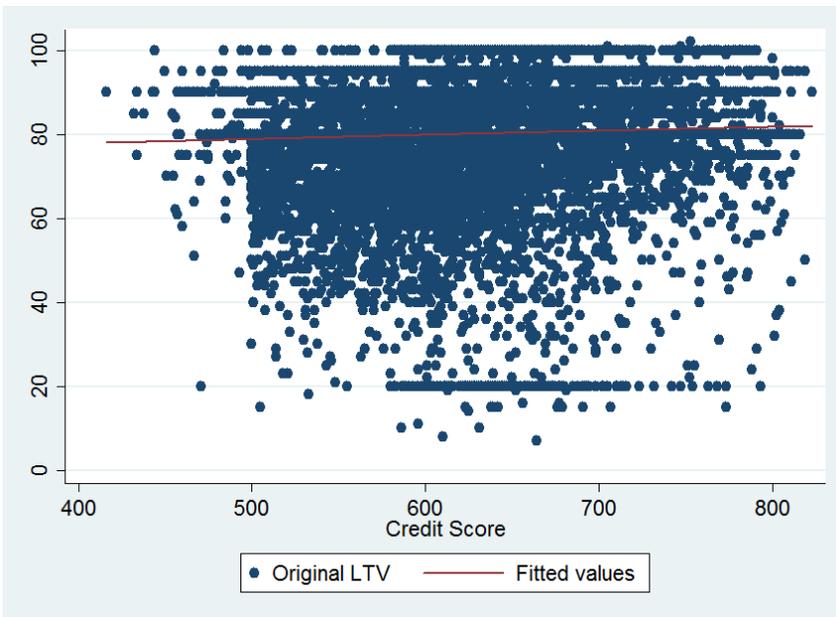
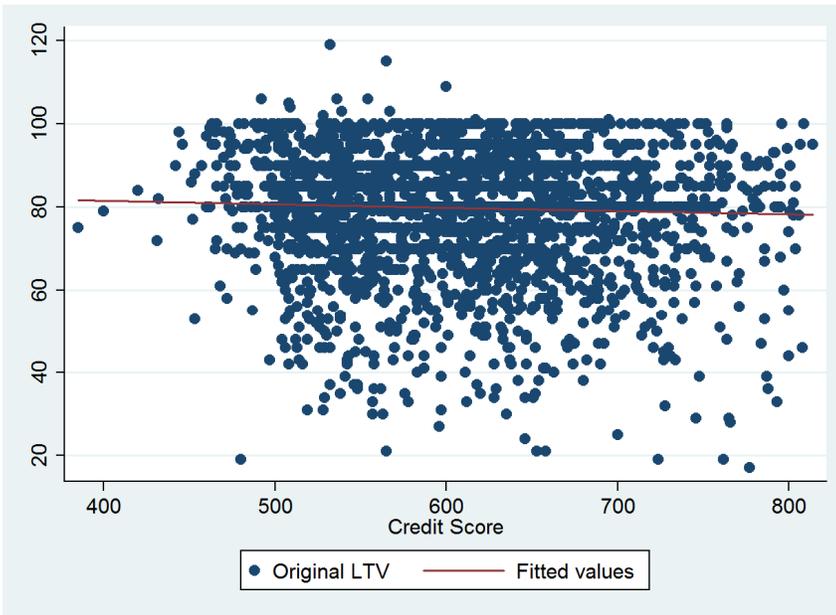
In 2003, the relationship is that as CS rises OLTV does not necessarily rise or fall, meaning there is little relationship. 2007 exhibits a similar result with a similar mean. 2013 shows a distinct downward trend, meaning as CS rises OLTV falls.

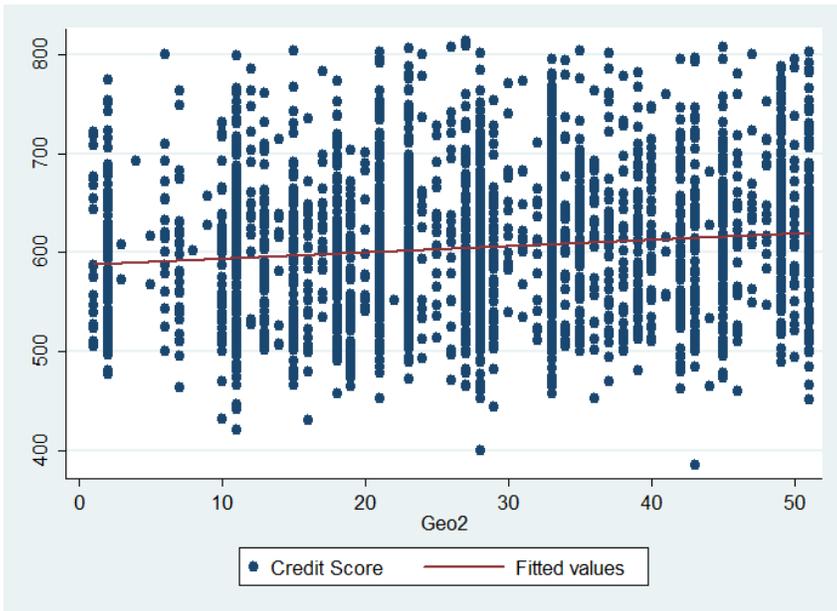
These are interesting results for year 2013 as it indicates a person with a higher CS requires less money to put down on a house. This may mean they have more money of their own initially and require less from the bank.

2003

2007

2013

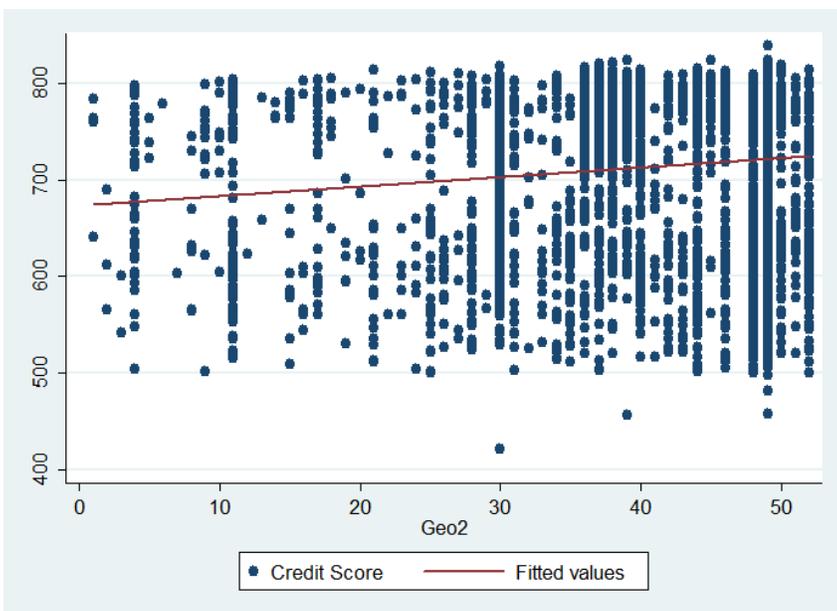




2003



2007



2013

**Series 5: Credit Score – State Geographic’s (Geo2)**

(1 is the state with the lowest number of subprime mortgages issued, 52 is highest)

Two-way Scatter Plot with Linear Regression

Source: Stata

**Interpretation**

This series looks at the relationship between credit score and the states as ranked by amount of subprime mortgages issued in that state. The expectation here is that the more subprime lending there is in a state, the lower the average credit score will be for mortgages issued in that state.

For 2003, 2007, and 2013 this is not the case as they all have an upward trend in their credit scores. This ultimately means that states with more subprime lending do not automatically have more mortgages being issued to people with worse credit. What it does mean is that my data selection contains mortgages of better quality than the average of that state. The conclusion is that for my data, the more subprime loans issued in a state the better ones credit score will be, on average.

### Series 6: Credit Score – Average Home Price

Two-way Scatter Plot with Linear Regression  
*Source: Stata*

#### Interpretation

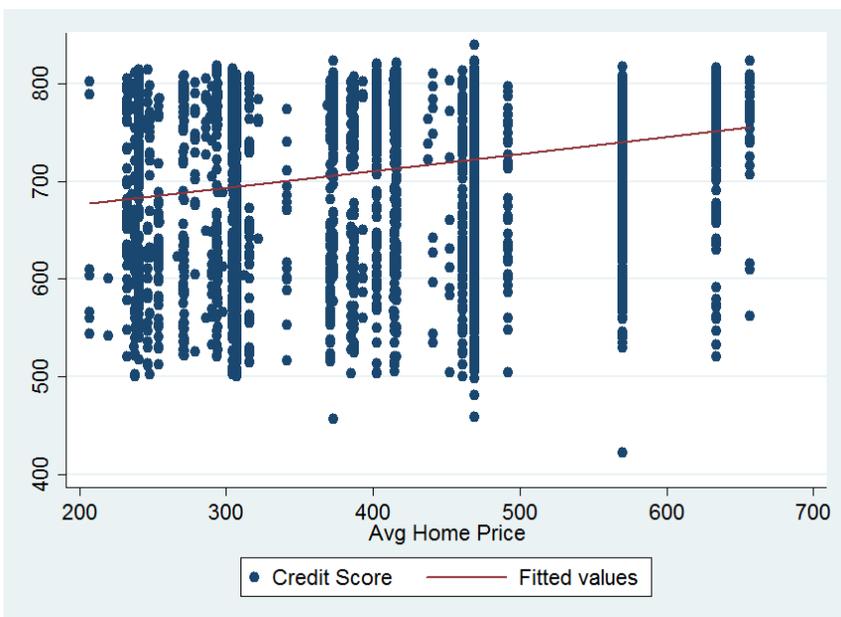
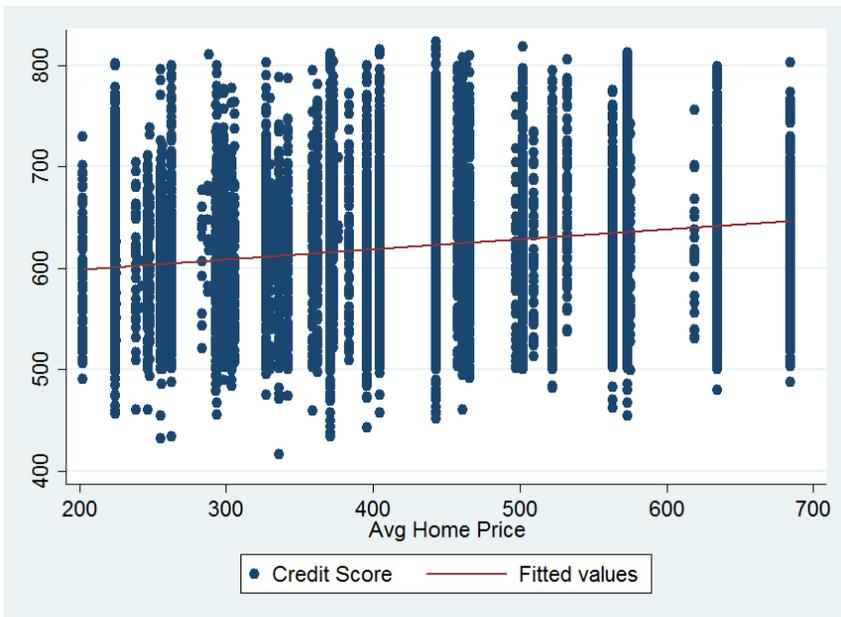
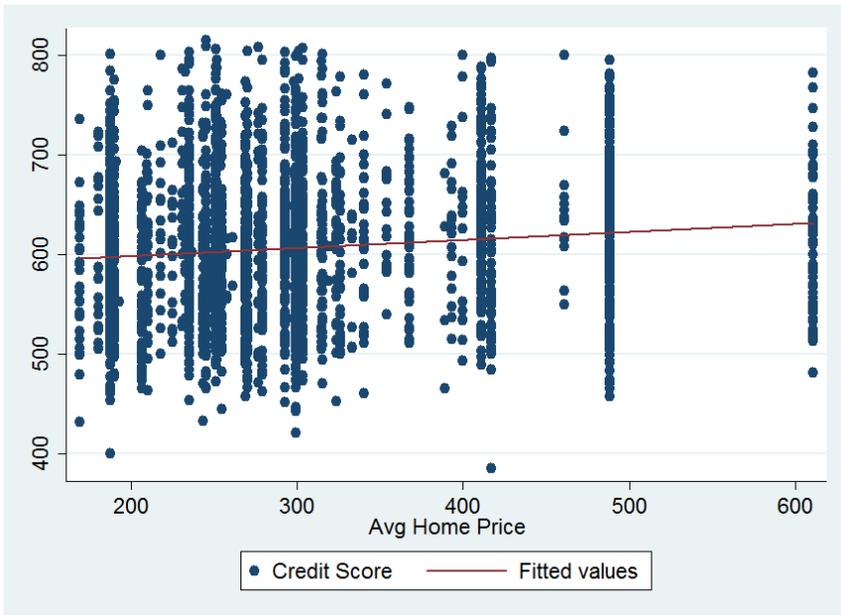
This series of three scatter plots looks to compare the average home price by state of that mortgage with the credit score of that mortgage. The expectation is that as the average home price rises, the credit score would rise as well, if the expectation is that a person with more money has a better credit score. It is understood that this does not always hold true.

In 2003, 2007, and 2013 this assumption holds true as all three years exhibit an upward trending CS to AHP ratio. On assumes that within my data selection, those with higher credit scores either chose to live in states with more expensive houses. It is important to note that as house prices rose from 2003 to a peak in 2007, there was a shift right, towards a higher AHP across all states. This can be seen when comparing plots 2003 and 2007 together.

2003

2007

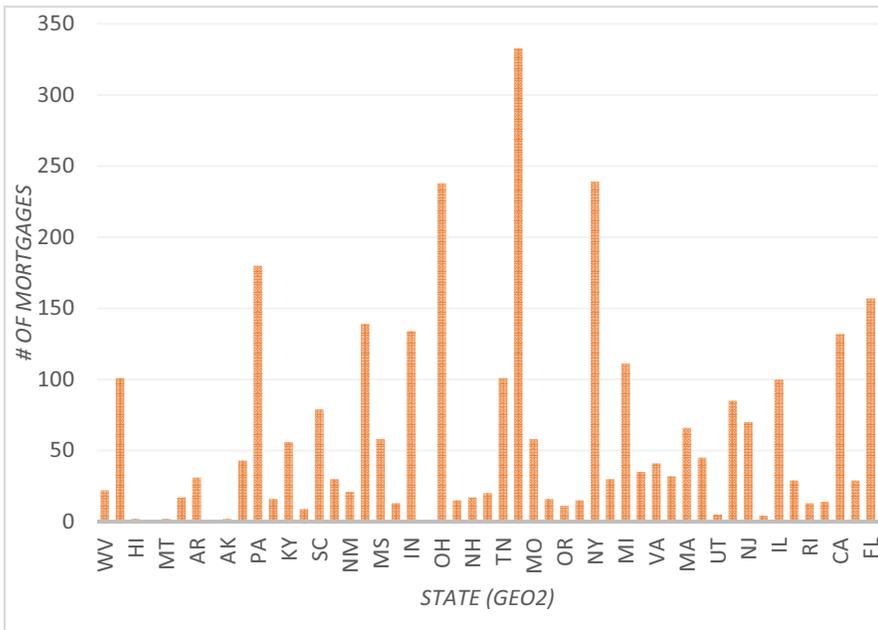
2013



**Series 7: State Mortgage Issuance Distribution, by Year**

Bar graph of volume

Source: Excel



2003

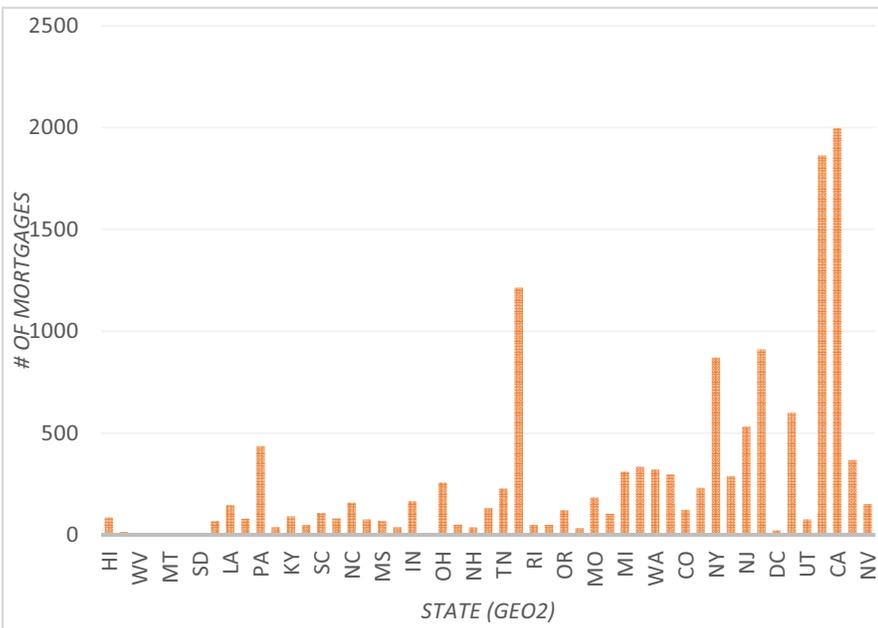
**Interpretation**

This selection of three bar graphs shows the number of mortgages originated in each state in that year, out of my data group. The State (Geo2) variable shows the each of the 52 states and territories in ascending order, left to right, from the location with the least subprime mortgages originated to most.

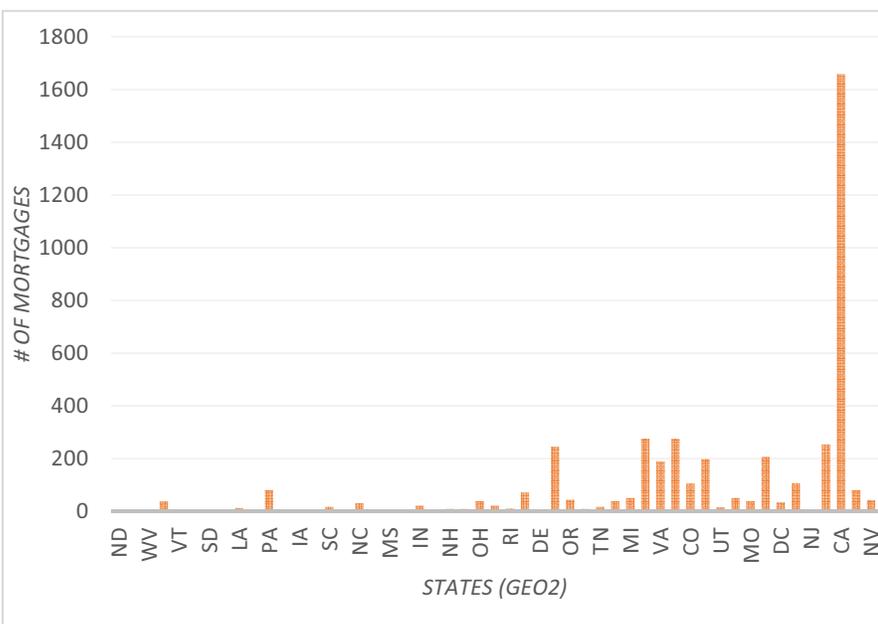
As can be seen, 2003 shows a more normal distribution where the volume of mortgages are originated in all states to some degree. This is compared to 2007, the height of the subprime lending period, where there is a significant bias of mortgages towards the states originating more subprime loans.

In the graph for 2013, the distribution appears to be biased towards the state of California specifically and with a slightly less biased, although by no means even, distribution towards the subprime states in 2013.

What is visualized here is that 2003 represented a more evenly distributed mortgage spread amongst the states than did 2007 or 2013. 2007 is the most uneven distribution as it appears while 2013 appears to be less heavily weighted, barring CA's mortgages which appear to be the result of the securities focus in 2013.



2007



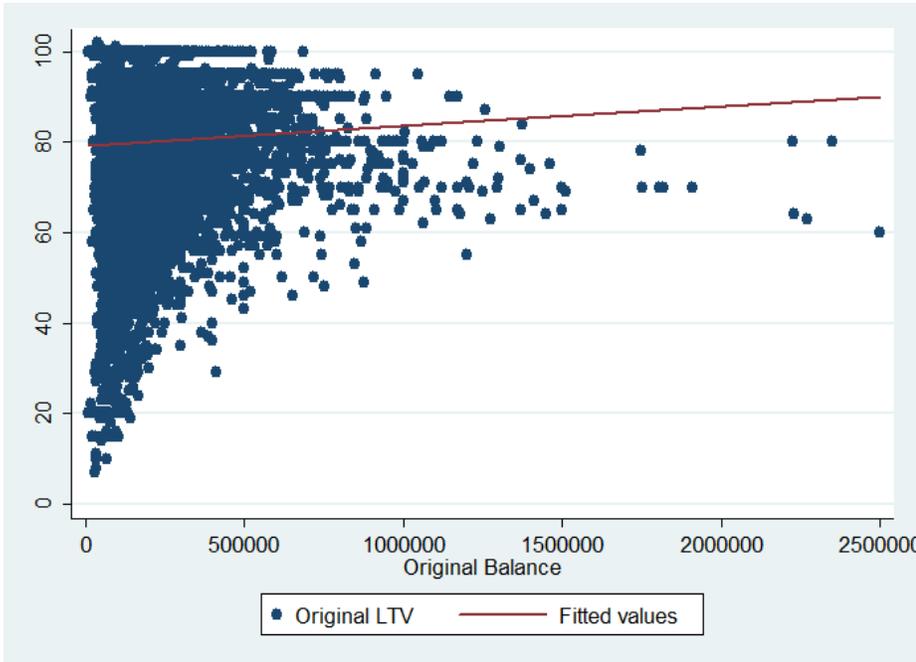
2013

### Series 8: Original Balance – Original Loan-to-Value

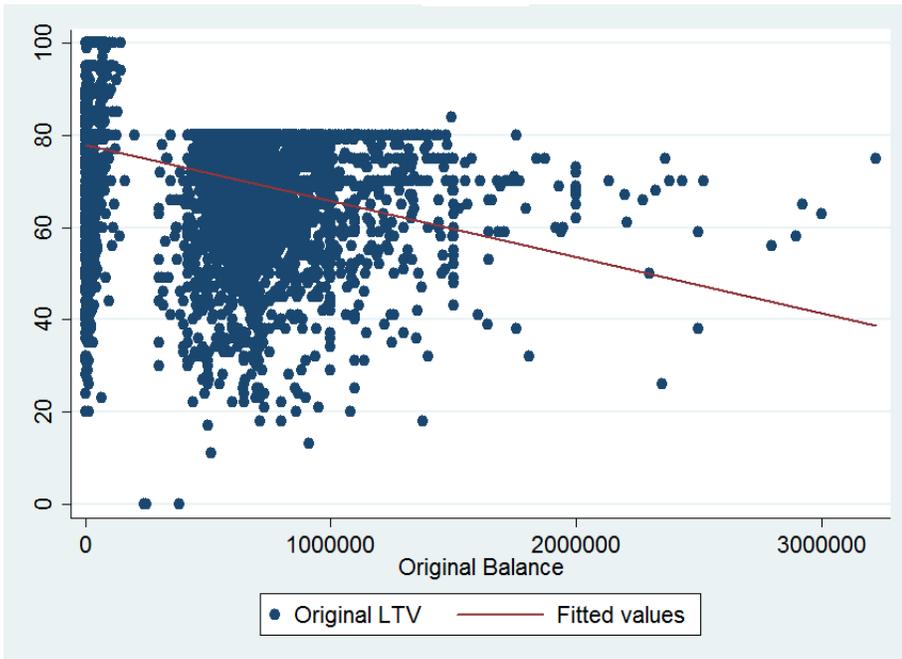
Two-way Scatter Plot with Linear Regression

Source: Stata

2007



2013



#### Interpretation

This small two year series is an example of what has changed in the lending practices since the financial crisis. Since the implementation of new, stricter lending regulations by the government through bills like Dodd-Frank, there are easily identifiable new requirements for lenders.

This is an example of what has happened to the OLTV allowance for a bank as the original balance rises. A higher OLTV means more risk for the bank as they have lent more of the home's value to the borrower. In 2007 it's clear that a person with any loan value could receive up to 100%, or more in certain circumstances, of the home's value.

Since the financial crisis, the government has capped that percentage at just 80% for all loans over the value of around \$40,000. This allows them to qualify for government insurance programs and therefore is an important regulation. This cap is clearly visible and is an important example of how regulations have really changed since the financial crisis.

## 9. Regression Specifications and Interpretations

This section analyzes the results of the regressions to see if there are any identifiable trends within them that identify changing lending standards from pre to post-recession. The regressions were chosen as they utilized what I believe were the variables that were most likely to give significant results as to whether the standards have changed or not. Factors such as credit score, geographic location, and original balance were the most important when trying to analyze the quality of a borrower and identify whether a bank was discerning between those who were worthy and those who were not. Factors like premodification coupon, original loan-to-value, documentation, and use of the home are also important as they signify how a bank reacted to the quality of a borrower. Some results of the regressions are listed in these analyses. The regressions themselves can be found in the following section.

### **Series 1: Effect on Original Loan-to-value**

The first series of four regressions are in Table 1 and are:

$$\text{OriginalLTV}_i = \alpha + \beta_1 \text{CreditScore}_i + \varepsilon_i$$

$$\text{OriginalLTV}_i = \alpha + \beta_1 \text{CreditScore}_i + \beta_2 \text{DocNF}_i + \varepsilon_i$$

$$\text{OriginalLTV}_i = \alpha + \beta_1 \text{CreditScore}_i + \beta_2 \text{occupINV}_i + \varepsilon_i$$

$$\text{OriginalLTV}_i = \alpha + \beta_1 \text{Geo2}_i + \varepsilon_i$$

Where  $i = \text{years } 2003, 2007, \text{ and } 2013$

Table 1 looks at what factors affect the original loan-to-value using different combinations of significant independent variables. This is done over each period (2003, 2007, and 2013) going horizontally from left to right. This is in an effort to see how the significance levels change from pre to post recession. The first regression just looks at credit score (*CS*) against *OLTV*. While significant, the effect of a change in *CS* on *OLTV* in 2003 is minimally negative. In 2007 it changes to being positive and become more significant, however it is still

small. In 2013 it has again become negative but has a slightly larger coefficient. The interpretation here is that as credit score went up in 2007 so did the *OLTV* whereas in 2003 and 2013, the *OLTV* went down. This was an unexpected result however it might be an indication of the wariness of banks today towards lending out even towards qualified borrowers.

The second regression of Table 1 is numbers 4, 5, and 6 on the top section. This regression now incorporates the effect of having limited or no documentation on the *OLTV* that a lender would allow. The coefficients for *CS* have risen in 2007 and 2003 indicating a positive effect from no documentation, although they still affect the *OLTV* in the same direction. Having no documentation follows a logical pattern in 2003 and 2007 however its effect on 2013 is strange. I expected the effect in 2007 to be positive or close to positive given how relaxed the banks' lending standards were however having no documentation brings the *OLTV* down. In 2013 though it raises the *OLTV* when having no documentation, a completely irrational result in a time when lending standards are supposed to be more stringent. This is a major indicator then that lending standards have indeed not increased as much as public opinion may believe.

The third regression in the second row, columns 1, 2, and 3, looks at *CS* and whether the mortgage was for an investment property against the *OLTV*. The results are again the same for *CS* as they originally were. My expectation for using a mortgage for investment purposes rather than occupying the home was that the *OLTV* should have dropped as the bank would feel the person was less committed to the home by not living in it. This turned out to be the case as in all three years as the effect of *occupINV* is negative and significant in all cases. Looking at the data the banks become less concerned with occupancy in 2007 as the number becomes less negative while in 2013 it then becomes more negative, going to -5.356. This should indicate a banks increased wariness of mortgage purposes and an effort to combat that impact.

Regression four, in the bottom right of the chart areas, columns 4, 5, and 6, looks at just the effect of the geographic area on the *OLTV*. *Geo2*, as listed in the Appendix C, represents the state or territory in which the mortgage was originated, with 1 being the state with the lowest subprime mortgages issued and 52 being the highest. The regression indicates that the higher the states value, meaning more subprime mortgages issued, the lower the *OLTV*. This is surprising from 2007 as I expected the lenders to give borrowers from subprime states the same if not higher *OLTVs*. For 2013 though this makes sense that the more subprime loans issued in a state the lower the *OLTV*. This indicates a potential move by the banks to limit the amount of money they are lending out and corresponds with Dodd-Frank's new regulations limiting *OLTV* limits.

## **Series 2: Effects on the Premodification Coupon Rate**

This series of four regressions in Table 2 are:

$$\text{PremodCoupon}_i = \alpha + \beta_1 \text{CreditScore}_i + \varepsilon_i$$

$$\text{PremodCoupon}_i = \alpha + \beta_1 \text{Geo2}_i + \varepsilon_i$$

$$\text{PremodCoupon}_i = \alpha + \beta_1 \text{OriginalLTV}_i + \varepsilon_i$$

$$\text{PremodCoupon}_i = \alpha + \beta_1 \text{DocNF}_i + \varepsilon_i$$

Where  $i = \text{years } 2003, 2007, \text{ and } 2013$

The goal of Table 2 is to see what effects, if any, these four independent variables have on the premodification rate that a borrower receives. This is aimed at understanding how a bank reacts to the personal traits of a borrower including their qualifications, loan request type, and location. The three period nature of this regression makes it effective for observing whether banks adjusted the coupon rate that they were charging their borrower more today than they did pre financial crisis when they were less qualified to borrow.

Regression 1 looks at how the borrower's credit score effects the coupon rate that he receives. For all three periods the coefficient is significant to the 1% level and is lightly negative.

This means that as the credit score of the borrower goes up, the coupon rate goes down. This is the greatest case in 2013 where the coupon rate falls the most for each value the credit score increases. This means that banks were perhaps more confident in borrowers in 2013 than they were in 2007 and offer better rate reductions. One would have expected that this should have happened in 2007 and 2003 but to a greater extent however given the volume of low teaser rates being given pre financial crisis, it's possible that the effect of a higher *CS* had less overall effect.

Regression 2, in columns 4, 5, and 6 of the top bar shows the effect on a changing geographic location, *Geo2*, to the borrower's credit score. *Geo2* is the percent of mortgages being issued in a state to subprime borrowers where 1 is the state with the lowest percentage of subprime loans and 52 is the one with the highest. The results do not go exactly as I would have expected. While all three coefficients are significant to 1%, the effect of a state's number increasing is a decrease in the average *premodcoupon* rate being charged. The coefficient is even the highest in 2007 when being in a state with more subprime mortgages meant you were more likely to have a lower premodification coupon rate. Given that this is the case for all three years, the most important factor then is that from 2007 to 2013, the number drops from -.0516 to -.0284, meaning that by being in a state with more subprime loans means you are slightly less likely to have a lower coupon rate, however that is still the case.

Regression 3 on the left hand side, columns 1, 2, and 3 of the bottom bar shows what effect the *OriginalLTV* has on the *premodcoupon* rate. The expectation is that the higher the *OLTV*, the higher the coupon rate given the more risk the bank is taking by making the loan. This is the case in both 2003 and 2013, however it is not the case in 2007. The coefficient in 2007 though is not significant to at least 10% so the result may not be as reliable. The results for 2003 and 2013 show that as the *OLTV* goes up so does the premod coupon, especially in 2013 where it

is more than double the 2003 rate. This represents an effort by the banks to increase the regulations on *OLTV* rates as stipulated by new legislation. This is an important indicator of the changing lending standards as far as my data is concerned.

Regression 4 on the right hand side, columns 4, 5, and 6 of the bottom bar represents the effect of having no documentation on the premodification coupon rate. Again the expectation is that with limited or no documentation a bank would be more likely to charge you a higher coupon rate as you are significantly higher risk to them. In 2003 and 2013 this is the case however 2007 again is the anomaly. In 2007 having no documentation decreases your average coupon rate of  $-.181$  while 2003 shows an increase of  $.623$  and 2013 of  $1.978$ . This is a strong indicator of an average movement by banks to raise rates for those who have missing documentation or raise flags when taking out a mortgage. The fact that the coupon rate in 2013 goes up by as more than three times the 2003 rate and 12 times the 2007 rate shows a significant improvement in standards.

These four regressions have exhibited both unexpected and expected results. In most cases 2003 and 2013 exhibited better lending standards than did 2007 at the peak of the subprime residential mortgage lending periods. This series of regressions focussed on comparing borrower traits to lender decisions is very important to the overall understanding of the change that has occurred. The results do indicate that lending standards have increased to some degree from 2007 to 2013.

### Series 3: Effects on First Month Delinquency Rates

This is a series of six regression in Table 3 which are:

$$Del1_i = \alpha + \beta_1 CreditScore_i + \varepsilon_i$$

$$Del1_i = \alpha + \beta_1 OriginalLTV_i + \varepsilon_i$$

$$Del1_i = \alpha + \beta_1 LTARM_i + \varepsilon_i$$

$$Del1_i = \alpha + \beta_1 occupINV_i + \varepsilon_i$$

$$Del1_i = \alpha + \beta_1 occupOO_i + \varepsilon_i$$

$$Del1_i = \alpha + \beta_1 Geo2_i + \varepsilon_i$$

Where  $i = \text{years } 2003, 2007, \text{ and } 2013$

Table 3 looks at the external effects that these multiple independent variables have on the immediate first month delinquency rates of residential mortgages originated in the three periods. This is an excellent indicator of the quality of a borrower because it gives a tangible result from the mortgage which can be gauged across all three periods. The intention is to see if the delinquency rates rise or fall from period to period and pre-crisis to post-crisis. This will give an indication of whether banks were in fact lessening their risky lending policies. The reason the delinquency of the first month is very useful is that it is standard across all three periods. Some lenders offered teaser periods of 4, 6, 12, or 24 months depending on how enticing they wanted their offer to be. This meant that the bank was paying the mortgage during that period. When the teaser period ends, that is when the *Del1* comes into effect. If a borrower fails to pay on the first month, it's immediately recorded. If the delinquency rate is higher for one period than another in relation to an independent variable, that is a significant factor and one the lenders may have overlooked.

Regression 1 looks at the effect a change in *CreditScore* has on the delinquency rate. For all three periods the coefficient is significant to the 1% level but is very small in the negative direction. This means that as the *CS* goes up, the delinquency rate will on average fall. This

intuitively makes sense. This value declines from 2007 to 2013. This could be because delinquency rates in the first month for 2007 mortgages were much higher than for those in 2013. As a result, increasing your *CS* in 2007 had a larger effect on whether you would be delinquent than it did in 2013 when fewer people were delinquent across the range of credit scores.

Regression 2 on the top bar, right hand side, columns 4-6, shows the *DelI* as a function of the *OLTV*. The values are less significant for 2007 and 2013 at 10% level and the coefficients are small, similar to the last regression. The results do show however that as the *OLTV* rises, so does the delinquency rate. This is reasonable given the higher the LTV the more risk a borrower and lender are accepting. The value increases from 2007 to 2013, an indication that the higher the *OLTV* in 2013, the more likely the person was to be delinquent as compared to 2007. This could result from new restrictions on the LTV sizes allowed meaning a smaller change in the LTV could mean a bigger change to the person's delinquency.

Regression 3, middle bar, columns 1-3, looks at the change to *DelI* when the mortgage is adjustable rate or not. In this instance, in 2003 and 2013, the coefficient is negative while 2007 is positive. This could result from those two periods offering ARMs to people with better qualifications than they did in 2007. Regression 4, middle bar, columns 4-6, shows the change to *DelI* when the mortgage was being used to purchase an investment property. Here the resulting data supports the notion that delinquency in all three periods went down when the property was an investment. This was an unexpected result however as the literature I have read supported the fact that investment properties were riskier for a bank, especially in 2007. The coefficients are very small here.

Regression 5, bottom bar, columns 1-3, shows what happens to delinquency when the property was owner occupied. Here the resulting coefficients are positive for all three periods. This means that a person who had a mortgage on a house that he lived in was more likely to become delinquent in the first month than someone who did not. This could be because people who owned their own homes had received mortgages too large for their means or that they expect the bank to renegotiate in some cases with them in an effort to not lose the entirety of the mortgage. Regression 6, bottom bar, columns 4-6, shows the delinquency rate as a function of the geographic location of the mortgages' origination. Here the results are negative for each year, although the coefficients get smaller for each year. This means that as *Geo2* rises, the delinquency rate falls. This is counter intuitive given that as *Geo2* rises, that means the state has a higher percentage of subprime mortgages issued in it than the last state or territory, 1-52. The value is very small in 2007 and is barely a 10% significant result meaning that the delinquency rate across states is relatively stable, meaning poor lending throughout. This was an unexpected result.

These six regressions were beneficial in seeing how delinquency rates changed across the three periods and from pre to post financial crisis. The unifying factor is that all mortgages have a first month's payment period and a delinquency if unpaid. This means that tracking lending practices and the quality of borrowers is possible. While some of the results were different from expectations, there were some significant results like *CreditScore* and *OLTV* and their effects on *Del1*.

#### Series 4: Effect on Credit Score

This is a series of five regressions in Table 4 and are:

$$\text{CreditScore}_i = \alpha + \beta_1 \text{LTARM}_i + \varepsilon_i$$

$$\text{CreditScore}_i = \alpha + \beta_1 \text{occupINV}_i + \varepsilon_i$$

$$\text{CreditScore}_i = \alpha + \beta_1 \text{occupOO}_i + \varepsilon_i$$

$$\text{CreditScore}_i = \alpha + \beta_1 \text{Geo2}_i + \varepsilon_i$$

$$\text{CreditScore}_i = \alpha + \beta_1 \text{DocNF}_i + \varepsilon_i$$

Where  $i = \text{years } 2003, 2007, \text{ and } 2013$

Table 4 looks to see what effect these multiple indecent variables have on Credit Score.

This is in an effort to understand how external variable affect *CS* just as *CS* has done to other dependent variables. This is in an effort to see how, over time, credit scores are ultimately affected by certain residential mortgage variabilities. The first regression regresses the dummy of a loan type being an adjustable rate mortgage to the credit score. For years 2003 and 2013, the coefficient is negative. This indicates that a person receiving an adjustable rate mortgage has, on average, a lower credit score. This makes sense as lenders are more likely to keep rates adjustable when the quality of the borrower decreases. For 2007 though the effect is positive, meaning that an adjustable rate mortgage associated with a borrower of a higher credit score. This could occur for a number of reasons including lenders looking to entice more borrowers with teaser rate ARMs. It could also be because the average credit score was lower in 2007. As a result, even a person with a higher credit score for 2007 would still have had a poor *CS*. As a result, ARMs were being given to people with higher scores because banks knew they were still risky borrowers. This is a good indication of how lending practices shifted significantly over the three periods.

The second regression in columns 4, 5, and 6 on the top row looks at the effect of a mortgage being used to purchase an investment property has on the average credit score of the

borrower. It is evident that, in 2003 and 2007, being an investment borrower meant you had a higher credit score. In 2013 though, this changes dramatically and an investment borrower had a lower average credit score. This could be the case because a borrower's pre financial crisis had had good track records investing and had better credit scores or that the majority of investors had such bad credit scores that those who were choosing to take mortgage out for investment purposes were in fact more qualified borrowers. In 2013 though that has changed, and those who are borrowing for investment purposes are in fact on average those with worse credit scores.

The third regression, in the second bar, columns 1, 2, and 3 regresses the mortgage being used for Owner Occupancy purposes against *CS*. Like the last regression this focusses on the purpose of the mortgage and what kind of qualifications that borrower has. For all three years the significance level is strong and the coefficient is negative, indicating that a person taking out a mortgage to buy a home to live in on average has a lower credit score than those who are not. That is surprising for 2003 where I would have expected borrowers to have higher credit scores when they were going to live in their own homes. For 2013 it is an indication that perhaps banks are indeed more lenient on those borrowing to live in their own homes as they might have a stronger attachment to the property. It is unclear though how exactly the lending standards would have gone down for those owning their own home today from 2007 when average credit scores were lower.

Regression four looks at the geographic location of the borrower compared to his credit score. In contradiction to what I believed would happen, the credit score on average goes up the higher the number listed in *Geo2*. As I mentioned, the higher the value of *Geo2* the more subprime mortgages were issued in that area. I am expecting the more subprime loans to cause a negative trend with the credit scores where the average borrower would have a lower average

credit score, however, that is not the case. This could be because the states with more subprime mortgages issued also have more mortgages issued in general, balancing out those with poor credit score to those with good scores.

Regression five shows the effect of having no documentation on a person's credit score. The results follow expectations for all years and is statistically significant to a 1% level for all as well. In 2003 and 2013, having no documentation has a negative effect on the *CS* meaning the borrower with no docs is a less qualified borrower which is logical. For 2007 however the borrower with no docs has a higher average credit score. Given the fact that so many borrowers had limited or no documentation in 2007, this is a somewhat logical result. While you would still expect the avg. *CS* to fall, with so many people falling into this category it is expected that even a higher *CS* borrower may have no docs. The results from these regression in general followed my expectations except in a couple of cases. The changes from 2007 to 2013 do for the most part follow the presumption that lending standards have risen since the financial crisis however anomalies like *LTARM* and *occupOO* decreasing the average credit score test this assumption.

### **Series 5: Effect on Multiple Dependent Variables**

This series contains six different regressions in Table 5 which are:

$$\text{CreditScore} = \alpha + \beta_1 \text{YEAR} + \varepsilon_i$$

$$\text{AccDF} = \alpha + \beta_1 \text{YEAR} + \varepsilon_i$$

$$\text{Del1} = \alpha + \beta_1 \text{YEAR} + \varepsilon_i$$

$$\text{Del18} = \alpha + \beta_1 \text{YEAR} + \varepsilon_i$$

$$\text{DocNF} = \alpha + \beta_1 \text{YEAR} + \varepsilon_i$$

$$\text{OLTV} = \alpha + \beta_1 \text{YEAR} + \varepsilon_i$$

The regressions within Series 5 in Table 5 take a slightly different approach to analyzing the data than the first four series. Here the data is coming from one large pool of all the

residential mortgages from over the three years. They are identified by the years they come from. Instead of analyzing each year separately, I am looking at the effect that an increase in the *YEAR* has on the dependent variables listed. *YEAR* goes from 1 – 3 with 1 equaling 2003, 2 equaling 2007, and 3 equaling 2013. This is in an effort to see what effect, if any, changing the year has on the various variables from a complete collection.

Regression 1 looks at the effect increasing the *YEAR* has on the *CS*. According to the data, as the years go up, so does the credit score. The increase is actually significantly more than I expected being 59.16 per year changed with a 1% significance level. This indicates an average increase in the *CS* over the years which is true for 2013 however slightly unexpected for 2007. The result may be the case due to the significantly higher average *CS* in 2013 than in 2007, perhaps offsetting the drop in 2007.

Regression 2 shows the change increasing the *YEAR* has on likelihood of the account defaulting. The data indicates that as the years go up, the default rate goes down, which is to be expected for 2013. This is an indication of better lending practices by banks if accounts default less. Regression 3 shows the change in year effect on the Delinquency rate in the first month. The data indicates that as the year increases the likelihood for a delinquency in the first month decreases. This was to be expected after looking at all the data given the total delinquency rate drops over all three years in the first month. This was shown in Diagram 9. This means that even as the delinquency rate increases for the in 2007, it falls significantly more in 2013 so as to offset the increase and result in a negative coefficient with a strong  $R^2$ . This is a significant result for the total regression and is a promising result and characteristic of better lending standards.

Regression 4 presents the data for the change in the *YEAR* on the delinquency rate in the 18<sup>th</sup> month. Here the coefficient is decreasing, indicating a reducing delinquency rate in the 18<sup>th</sup>

month as you move through 2007 to 2013. This is an indicator that perhaps some mortgages righted themselves or that the lending practices in 2013 have resulted in a more stable long-term lending, which is what I believe to be the case. Regression 5 looks at the *YEAR* and its effect on the likelihood of a mortgage not having full documentation. The result shows a negative coefficient, indicating that as the *YEAR* increases, the number of loans without full documentation decreases. The data corroborates this however for 2007 this perhaps does not exactly represent what change occurs however it is close and significant. This result does suggest that banks are more likely to loan to people only with full documentation today as opposed to 2003 and 2007, indicating better lending standards.

The final regression looks at the *YEAR* and its effect on the *OLTV*. The result is a negative 4.451 indicating that as the year goes up, the *OLTV* decreases. This is an expected result that follows what legislation today has stipulated. Dodd-Frank has set caps on the *OLTVs* permitted and lenders have on their own accord implemented tighter restrictions. This follows with the idea of stronger lending standards. This series of six regressions looked to see throughout the 21,000 mortgages within the data what effect the changing year really had on the dependent variables. This was different from a standard divided regression like the four series preceding this one and in some cases resulted in skewed results however for the most part the results indicate a strengthening of lending standards and mortgage qualities, especially in the jump from 2007 to 2013.

## 10. Data Regressions

This section looks to analyze the collected data to understand how lending standards have changed since the financial crisis. This is to be done through regression analysis of multiple nominal<sup>54</sup> and dummy<sup>55</sup> variables. I use regressions that focus on one or a few independent variables regressed against a dependent variable. This will be done across all three time periods (2003, 2007, 2013), individually and collectively, in an effort to show the changing lending standards that banks employed. I will also use multiple regressions on entire list of mortgages across all years to see how the changing year within the entire data set affects certain dependent variables.

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<sup>54</sup> This is a variable containing a string of data that usually extends well beyond 1 and 0 as in the case of the dummy variable. An example of this is age or credit score where there is a large range of values.

<sup>55</sup> A dummy variable is an artificial variable created to reflect another string variable's data. The dummy variable has results of either 0 or 1. If the dummy variable is meant to reflect whether a mortgage was adjustable rate, it will indicate 1 when the mortgage is and 0 when it isn't. This isolates that specific factor so when regressing the data, one can use that dummy variable to identify how that factor is affected or affects the rest of the data.

**Table 1: Effects of Significant Variables on the Original Loan-to-Value**

The four regressions below look at how the independent variables affect the original loan-to-value during the three different periods: 2003, 2007, and 2013. The information was sourced from Bloomberg and isolated in each year's period in an effort to identify the variables significance in relation to the original loan-to-values and how that significance changes over the three time periods. The dependent variable is the OLV as that is a variable which would be affected by the independent variables during a lender's determination of how much a borrower should be allowed to receive. The standard errors are shown in parentheses under the estimated coefficients. The significance levels for the coefficients are given as \*\*\*1%, \*\*5%, and \*10%.

|                                 | (1)                     | (2)                     | (3)                     | (4)                     | (5)                    | (6)                     |
|---------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------------------------|-------------------------|
| <b>REGRESSOR:</b>               | <b>OLTV, 03</b>         | <b>OLTV, 07</b>         | <b>OLTV, 13</b>         | <b>OLTV, 03</b>         | <b>OLTV, 07</b>        | <b>OLTV, 13</b>         |
| <b>CreditScore</b>              | -0.00807**<br>(0.00344) | 0.00966***<br>(0.00187) | -0.0540***<br>(0.00259) | -0.00873**<br>(0.00344) | 0.0140***<br>(0.00187) | -0.0490***<br>(0.00276) |
| <b>DocNF</b>                    | NA                      | NA                      | NA                      | -1.779***<br>(0.545)    | -4.309***<br>(0.252)   | 3.452***<br>(0.676)     |
| <b>Constant</b>                 | 84.74***<br>(2.102)     | 74.19***<br>(1.171)     | 110.6***<br>(1.863)     | 85.66***<br>(2.118)     | 74.21***<br>(1.158)    | 106.6***<br>(2.021)     |
| <b>Regression summary stats</b> |                         |                         |                         |                         |                        |                         |
| <b>R-squared</b>                | 0.002                   | 0.002                   | 0.088                   | 0.005                   | 0.023                  | 0.094                   |

| <b>REGRESSOR:</b>               | <b>OLTV, 03</b>         | <b>OLTV, 07</b>        | <b>OLTV, 13</b>         | <b>OLTV, 03</b>       | <b>OLTV, 07</b>        | <b>OLTV, 13</b>       |
|---------------------------------|-------------------------|------------------------|-------------------------|-----------------------|------------------------|-----------------------|
| <b>CreditScore</b>              | -0.00696**<br>(0.00345) | 0.0117***<br>(0.00190) | -0.0544***<br>(0.00259) | NA                    | NA                     | NA                    |
| <b>occupINV</b>                 | -4.001***<br>(1.145)    | -3.244***<br>(0.542)   | -5.356***<br>(1.621)    | NA                    | NA                     | NA                    |
| <b>Geo2</b>                     | NA                      | NA                     | NA                      | -0.173***<br>(0.0186) | -0.182***<br>(0.00994) | -0.260***<br>(0.0218) |
| <b>Constant</b>                 | 84.26***<br>(2.103)     | 73.10***<br>(1.183)    | 111.0***<br>(1.864)     | 84.75***<br>(0.583)   | 87.07***<br>(0.393)    | 82.78***<br>(0.930)   |
| <b>Regression summary stats</b> |                         |                        |                         |                       |                        |                       |
| <b>Observations</b>             | 3,019                   | 13,488                 | 4,493                   | 3,019                 | 13,488                 | 4,493                 |
| <b>R-squared</b>                | 0.006                   | 0.005                  | 0.091                   | 0.028                 | 0.024                  | 0.031                 |

**Table 2: Effects of Significant Variables on Premodification Coupon**

These four regressions look at how the independent variables affect the premodification coupon rate that a borrower pays for a period of time depending on teaser periods and whether the mortgage is adjustable or not. This is shown during the three periods: 2003, 2007, and 2013. The importance of this is to show how the rate reacts to the quality of the borrower over the three periods. This will show how changing lending standards effect lender practices. The information was sourced from Bloomberg and isolated in each year's period. The standard errors are shown in parentheses under the estimated coefficients. The significance levels for the coefficients are given as \*\*\*1%, \*\*5%, and \*10%.

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|                                 | (1)                       | (2)                       | (3)                       | (4)                       | (5)                       | (6)                       |
|---------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| <b>REGRESSOR:</b>               | <b>Pre modCoupon 2003</b> | <b>Pre modCoupon 2007</b> | <b>Pre modCoupon 2013</b> | <b>Pre modCoupon 2003</b> | <b>Pre modCoupon 2007</b> | <b>Pre modCoupon 2013</b> |
| <b>CreditScore</b>              | -0.00795***<br>(0.000487) | -0.00869***<br>(0.000327) | -0.0145***<br>(0.000292)  | NA                        | NA                        | NA                        |
| <b>Geo2</b>                     | NA                        | NA                        | NA                        | -0.0303***<br>(0.00273)   | -0.0516***<br>(0.00174)   | -0.0284***<br>(0.00294)   |
| <b>Constant</b>                 | 13.09***<br>(0.297)       | 12.28***<br>(0.204)       | 15.39***<br>(0.210)       | 9.134***<br>(0.0855)      | 8.815***<br>(0.0690)      | 6.220***<br>(0.125)       |
| <b>Regression summary stats</b> |                           |                           |                           |                           |                           |                           |
| <b>R-squared</b>                | 0.081                     | 0.050                     | 0.354                     | 0.039                     | 0.061                     | 0.020                     |
|                                 |                           |                           |                           |                           |                           |                           |
| <b>REGRESSOR:</b>               | <b>Pre modCoupon 2003</b> | <b>Pre modCoupon 2007</b> | <b>Pre modCoupon 2013</b> | <b>Pre modCoupon 2003</b> | <b>Pre modCoupon 2007</b> | <b>Pre modCoupon 2013</b> |
| <b>OriginalLTV</b>              | 0.0172***<br>(0.00266)    | -0.00130<br>(0.00154)     | 0.0396***<br>(0.00191)    | NA                        | NA                        | NA                        |
| <b>DocNF</b>                    | NA                        | NA                        | NA                        | 0.623***<br>(0.0795)      | -0.181***<br>(0.0452)     | 1.978***<br>(0.0838)      |
| <b>Constant</b>                 | 6.904***<br>(0.216)       | 6.978***<br>(0.125)       | 2.188***<br>(0.140)       | 8.090***<br>(0.0431)      | 6.986***<br>(0.0358)      | 4.778***<br>(0.0307)      |
| <b>Regression summary stats</b> |                           |                           |                           |                           |                           |                           |
| <b>Observations</b>             | 3,019                     | 13,488                    | 4,493                     | 3,019                     | 13,488                    | 4,493                     |
| <b>R-squared</b>                | 0.014                     | 0.000                     | 0.088                     | 0.020                     | 0.001                     | 0.110                     |

**Table 3: Effects of Significant Variables on Delinquency Rate of First Months Payment**

These six regressions look at how the independent variables affect the delinquency of payment during the first month of mortgages issued in the three periods: 2003, 2007, and 2013. This is there in an effort to examine how variables like credit score or geography affect how likely an account is to default immediately. This allows for the interpretation of lending standards and how they have changed over the three years. The information was sourced from Bloomberg and isolated in each year's period. The standard errors are shown in parentheses under the estimated coefficients. The significance levels for the coefficients are given as \*\*\*1%, \*\*5%, and \*10%.

|                                 | (1)                       | (3)                        | (5)                        | (2)                      | (4)                    | (6)                     |
|---------------------------------|---------------------------|----------------------------|----------------------------|--------------------------|------------------------|-------------------------|
| <b>REGRESSOR:</b>               | <b>Del1 2003</b>          | <b>Del1 2007</b>           | <b>Del1 2013</b>           | <b>Del1 2003</b>         | <b>Del1 2007</b>       | <b>Del1 2013</b>        |
| <b>CreditScore</b>              | -0.00136***<br>(9.68e-05) | -0.000530***<br>(3.18e-05) | -5.60e-05***<br>(1.28e-05) | NA                       | NA                     | NA                      |
| <b>OriginalLTV</b>              | NA                        | NA                         | NA                         | 0.00242***<br>(0.000526) | 4.71e-05<br>(0.000148) | 0.000130*<br>(7.03e-05) |
| <b>Constant</b>                 | 1.016***<br>(0.0591)      | 0.393***<br>(0.0199)       | 0.0451***<br>(0.00918)     | 0.000494<br>(0.0426)     | 0.0597***<br>(0.0120)  | -0.00428<br>(0.00518)   |
| <b>Regression summary stats</b> |                           |                            |                            |                          |                        |                         |
| <b>R-squared</b>                | 0.061                     | 0.020                      | 0.004                      | 0.007                    | 0.000                  | 0.001                   |

| <b>REGRESSOR:</b>               | <b>Del1 2003</b>      | <b>Del1 2007</b>       | <b>Del1 2013</b>        | <b>Del1 2003</b>      | <b>Del1 2007</b>        | <b>Del1 2013</b>        |
|---------------------------------|-----------------------|------------------------|-------------------------|-----------------------|-------------------------|-------------------------|
| <b>LTARM</b>                    | -0.00582<br>(0.0190)  | 0.00680<br>(0.00495)   | -0.00111<br>(0.00343)   | NA                    | NA                      | NA                      |
| <b>occupINV</b>                 | NA                    | NA                     | NA                      | -0.0780**<br>(0.0331) | -0.0291***<br>(0.00916) | -0.00521<br>(0.00800)   |
| <b>Constant</b>                 | 0.195***<br>(0.00792) | 0.0619***<br>(0.00240) | 0.00524***<br>(0.00113) | 0.198***<br>(0.00738) | 0.0651***<br>(0.00216)  | 0.00521***<br>(0.00107) |
| <b>Regression summary stats</b> |                       |                        |                         |                       |                         |                         |
| <b>R-squared</b>                | 0.000                 | 0.000                  | 0.000                   | 0.002                 | 0.001                   | 0.000                   |

| <b>REGRESSOR:</b>               | <b>Del1 2003</b>      | <b>Del1 2007</b>       | <b>Del1 2013</b>     | <b>Del1 2003</b>          | <b>Del1 2007</b>         | <b>Del1 2013</b>           |
|---------------------------------|-----------------------|------------------------|----------------------|---------------------------|--------------------------|----------------------------|
| <b>occupOO</b>                  | 0.0868***<br>(0.0277) | 0.0488***<br>(0.00566) | 0.00539<br>(0.00487) | NA                        | NA                       | NA                         |
| <b>Geo2</b>                     | NA                    | NA                     | NA                   | -0.00238***<br>(0.000546) | -0.000320*<br>(0.000172) | -0.000382***<br>(0.000104) |
| <b>Constant</b>                 | 0.114***<br>(0.0266)  | 0.0226***<br>(0.00517) | -0<br>(0.00475)      | 0.262***<br>(0.0171)      | 0.0755***<br>(0.00682)   | 0.0209***<br>(0.00445)     |
| <b>Regression summary stats</b> |                       |                        |                      |                           |                          |                            |
| <b>Observations</b>             | 3,019                 | 13,488                 | 4,493                | 3,019                     | 13,488                   | 4,493                      |
| <b>R-squared</b>                | 0.003                 | 0.005                  | 0.000                | 0.006                     | 0.000                    | 0.003                      |

**Table 4: Effects of Significant Variables on Credit Scores**

The five regressions below look at how the independent variables affect the credit scores of borrowers during the three different periods: 2003, 2007, and 2013. The information was sourced from Bloomberg and isolated in each year's period in an effort to identify the variables significance in relation to credit scores and how that significance changes over the three time periods. The dependent variable is the credit score. The standard errors are shown in parentheses under the estimated coefficients. The significance levels for the coefficients are given as \*\*\*1%, \*\*5%, and \*10%.

|                                 | (1)                    | (2)                    | (3)                    | (4)                    | (5)                    | (6)                    |
|---------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| <b>REGRESSOR:</b>               | <b>CreditScore, 03</b> | <b>CreditScore, 07</b> | <b>CreditScore, 13</b> | <b>CreditScore, 03</b> | <b>CreditScore, 07</b> | <b>CreditScore, 13</b> |
| <b>LTARM</b>                    | -20.81***<br>(3.446)   | 24.22***<br>(1.311)    | -43.86***<br>(3.955)   | NA                     | NA                     | NA                     |
| <b>occupINV</b>                 | NA                     | NA                     | NA                     | 30.64***<br>(6.012)    | 51.18***<br>(2.418)    | -29.45***<br>(9.330)   |
| <b>Constant</b>                 | 609.6***<br>(1.434)    | 616.3***<br>(0.636)    | 719.3***<br>(1.298)    | 604.5***<br>(1.340)    | 619.2***<br>(0.570)    | 715.1***<br>(1.253)    |
| <b>Regression summary stats</b> |                        |                        |                        |                        |                        |                        |
| <b>R-squared</b>                | 0.012                  | 0.025                  | 0.027                  | 0.009                  | 0.032                  | 0.002                  |
| <b>REGRESSOR:</b>               | <b>CreditScore, 03</b> | <b>CreditScore, 07</b> | <b>CreditScore, 13</b> | <b>CreditScore, 03</b> | <b>CreditScore, 07</b> | <b>CreditScore, 13</b> |
| <b>occupOO</b>                  | -36.54***<br>(5.003)   | -3.516**<br>(1.521)    | -18.22***<br>(5.680)   | NA                     | NA                     | NA                     |
| <b>Geo2</b>                     | NA                     | NA                     | NA                     | 0.629***<br>(0.0992)   | 0.815***<br>(0.0457)   | 0.993***<br>(0.121)    |
| <b>Constant</b>                 | 639.9***<br>(4.817)    | 625.0***<br>(1.391)    | 731.9***<br>(5.535)    | 588.2***<br>(3.104)    | 591.3***<br>(1.808)    | 673.5***<br>(5.158)    |
| <b>Regression summary stats</b> |                        |                        |                        |                        |                        |                        |
| <b>Observations</b>             | 3,019                  | 13,488                 | 4,493                  | 3,019                  | 13,488                 | 4,493                  |
| <b>R-squared</b>                | 0.017                  | 0.000                  | 0.002                  | 0.013                  | 0.023                  | 0.015                  |
| <b>REGRESSOR:</b>               | <b>CreditScore, 03</b> | <b>CreditScore, 07</b> | <b>CreditScore, 13</b> |                        |                        |                        |
| <b>DocNF</b>                    | -9.231***<br>(2.873)   | 18.23***<br>(1.153)    | -87.25***<br>(3.408)   |                        |                        |                        |
| <b>Constant</b>                 | 608.8***<br>(1.559)    | 610.6***<br>(0.911)    | 726.3***<br>(1.248)    |                        |                        |                        |
| <b>Regression summary stats</b> |                        |                        |                        |                        |                        |                        |
| <b>Observations</b>             | 3,019                  | 13,488                 | 4,493                  |                        |                        |                        |
| <b>R-squared</b>                | 0.003                  | 0.018                  | 0.127                  |                        |                        |                        |

**Table 5: Changes over Year Periods on Multiple Dependent Variables**

This regression differs slightly from the other four as it utilizes the YEAR variable as the independent variable. This utilizes the master sheet containing data from all three years differentiated by the YEAR variable. This shows from a different perspective how much influence the changing time period has on the dependent variables, some of which are dummy variables. The information was sourced from Bloomberg and isolated in each year's period. The standard errors are shown in parentheses under the estimated coefficients. The significance levels for the coefficients are given as \*\*\*1%, \*\*5%, and \*10%.

|                                 | (1)                 | (2)                     | (3)                     | (4)                     | (5)                    | (6)                  |
|---------------------------------|---------------------|-------------------------|-------------------------|-------------------------|------------------------|----------------------|
| <b>REGRESSOR:</b>               | <b>CreditScore</b>  | <b>AccDF</b>            | <b>Del1</b>             | <b>Del18</b>            | <b>DocNF</b>           | <b>OLTV</b>          |
| <b>YEAR</b>                     | 59.16***<br>(0.846) | -0.0641***<br>(0.00507) | -0.0898***<br>(0.00289) | -0.0907***<br>(0.00489) | -0.133***<br>(0.00573) | -4.451***<br>(0.168) |
| <b>Constant</b>                 | 517.1***<br>(1.823) | 0.392***<br>(0.0109)    | 0.256***<br>(0.00623)   | 0.424***<br>(0.0105)    | 0.747***<br>(0.0123)   | 87.61***<br>(0.363)  |
| <b>Regression summary stats</b> |                     |                         |                         |                         |                        |                      |
| <b>Observations</b>             | 21,000              | 21,000                  | 21,000                  | 21,000                  | 21,000                 | 21,000               |
| <b>R-squared</b>                | 0.189               | 0.008                   | 0.044                   | 0.016                   | 0.025                  | 0.032                |

## 11. Conclusion

Throughout my thesis I have discussed the ways in which mortgage lending practice relaxed or deteriorated in the years preceding the financial crisis and how those changes affected people and the entire U.S. economy. It is difficult to answer definitively the question of whether or not lending standards have actually improved, as opposed to new legal statutes being created but nothing being implemented. However, the numerical data analysis presented in this paper along with analysis of news and government documents offers some insight into how the quality of mortgages has changed over the three periods and what that means for the mortgage industry today. The fact, though, that standards have changed at all is significant in and of itself, and from the data it would appear that lending standards have indeed improved. This result is ascertained by looking at both the regressions and the summary statistics for changes in the most important aspects of mortgages that help to identify lending standards.

The variables which are the most important in my data in relation to lending standards are *CreditScore*, *OriginalLTV*, *OriginalBalance*, *%DocFull*, *%Delinquent*, *Del1*, and *Del18*. These variables give important data on two areas of the mortgage lending process: they show the original qualifications of the borrower when the loan was made and they show the outcome of the mortgage and the effective risk of the borrower. These are both equally as important when looking at lending practices and the effectiveness of a change in practices. In the *Interpreting the Data* section the analysis goes through the specifics of each regression and the relationship between the variables. In order to fully understand the conclusion it is necessary to see the effective changes in the specific variables listed above so that the story can be seen, starting with the variables referring to the various factors of the mortgage.

The Credit Score of a borrower is one of the most important factors that a bank should be looking at when it agrees to give an individual a mortgage. The score should give an accurate picture of the person's past history when taking out loans and using items like credit cards. When regressing the credit score against variables such as *OLTV*, *Dell*, *DocNF*, and *Premodcoupon*, the results were all significant to a high degree and showed the credit score on average was lower in 2007 when relating to any coupon rate, *OLTV* size, or delinquency rate. In data presented earlier it was clear to see that the average credit score was lower in 2003 than it was in 2007, and there was a greater correlation between a lower credit score and a riskier mortgage profile in 2007 than in 2003. This can be seen with the coupon rate in 2007 where a lower credit score was associated with a coupon rate lower than that of a mortgage in 2003 and 2013. A higher credit score also indicates a higher *OLTV* in 2007 and lower in 2003 or 2013 which would be the expected relationship given that a person with worse credit should have a lower *OLTV* as the bank attempts to limit its exposure to a riskier client more. A higher credit score in 2007 decreases the likelihood of a delinquency in the first month less than it does in 2003, meaning a better credit score in 2007 has a higher likelihood of being delinquent as opposed to the other years. Lastly is the documentation where having incomplete docs in 2007 would result in a borrower having a higher average credit score. This is contradictory to how the relationship should go where having incomplete docs would indicate a person with worse credit. These results indicate the lower the credit score the worse the mortgage will be to a greater degree in 2007 than in 2003 and 2013.

The *OLTV* of mortgages in the three periods also results in significant regression results as well as a downward trending average. When looking at the relationship between the coupon rate and *OLTV*, the finding is that as the *OLTV* increases in 2007, the coupon rate falls, as

opposed to in 2003 and 2013 where the coupon rate rises as the *OLTV* rises. This means that the more risk the bank assumed, the less it was charging the customer, which makes little sense from a practical perspective and denotes a lack of care or understanding on the bank's part. In 2007 there was a strong negative correlation between having incomplete documentation and the *OLTV*, representing in this case that borrowers without complete documentation received a lower *OLTV* than did mortgages of the same calibre in other years. This was an unexpected result. Shown earlier, the average *OLTV* dropped by 8 percentage points to 72% in 2013 from a constant average rate of around 80% in both 2003 and 2007, the result of both banks reducing the risk profile and new government regulations.

The variable *Original Balance (OB)* is important because it shows how much a bank was willing to give away depending on borrower qualifications and what risk level the bank was willing to take on a mortgage of that size. One would expect that the higher the *Original Balance*: the lower the *OLTV* would be, the higher the coupon rate, and the higher the *CreditScore* of the borrower would be. In 2007 there was actually an upward trend in terms of *OB* in relation to *OLTV* meaning the larger the mortgage the greater the *OLTV*, putting the bank in a more risky position as opposed to other years like 2013 where there is a steep downward trend the higher the *OB*. There also appears to be a cap on the *OLTV* allowed on mortgages with an *OB* over a certain amount as shown earlier. The *OB* average has actually increased on average over all three years indicating either the ability for the bank to take on larger mortgages or the lower perceived risk of today's mortgages. One item to note is that in fact the higher the *OB* was in 2007 the higher the credit score, meaning that a higher *OLTV* was not necessarily riskier from a *CS* standpoint but merely a cash outlay perspective.

The last variable relating to the qualifications of the borrower is the *%DocFull*. During the years prior to the financial crisis, the government had relaxed the amount of borrower verification required for a mortgage being sold to a government sponsored enterprise like Fannie Mae. As a result, the percent of people receiving a loan without providing banks full documentation dropped to 40% in 2007 from 71% in 2003. The number then rose significantly after the financial crisis to 88% in 2013 after strict restrictions were imposed by the Fed in an effort to limit risk in the system. As mentioned, when relating documentation to credit score in regression Table 4, a person with full documentation is likely to have a higher credit score than someone with *DocNF* in 2003 and 2013, while having full documentation in 2007 corresponds to a lower credit score. The positive correlation in 2013 is very dramatic with an increase of 87.25 to the FICO score for full docs. A person with *DocFull* will also receive a lower coupon rate in 2003 and 2013 as opposed to 2007 when they would have had a higher rate. This could be the result of such a large number of unqualified borrowers receiving teaser rates that qualified borrowers received higher, albeit standard, mortgage rates. The progression for the most part appears to be that the number of mortgage holders who had full documentation diminished in the years running up to the financial crisis and then returned to high levels afterwards, indicating better standards being imposed.

While the initial loan data is important for seeing how standards have changed, looking at the result of the mortgage and whether they were paid back or not is also very important. The delinquency rate of mortgages is significant because it gives important data on whether an unqualified borrower followed through on his mortgage payments or was in over his head, how quickly they failed to repay their loan, and what efforts were made to rectify the issue. The *Delinquency* rate gives a complete number of those loans that were delinquent or had failed by

the end of their term period or their status today if they are still active. The percentage of delinquent loans rose from 22% in 2003 to 31% in 2007. In 2013 just 13% of all loans were delinquent, a significant improvement on the retention rate of payment by borrowers.

The more accurate identifier of delinquency rates in relation to the question asked here is *Del1* and *Del18*, which identify whether a loan is delinquent at the first month of payment and the 18<sup>th</sup> month of payment or not. The first month comes after the end of the teaser period offered by the bank, effectively where the bank is effectively paying off the loan for the borrower. This teaser period could last from zero to 24 months depending on the loan. Diagram 9 presented earlier in this paper describes the percent of each year's total mortgages that was delinquent in either the 1<sup>st</sup> or 18<sup>th</sup> month. The results from this are quite interesting because first year delinquency rates are actually significantly higher in 2003 than 2007. That being said, most of the people who were delinquent in the first month were also delinquent in the 18<sup>th</sup> month in 2003. In 2007, while the first month's delinquency rate is only about 6%, it jumps to 30% by the 18<sup>th</sup> month. In 2013, while there are still some delinquent mortgages, the numbers have significantly dropped at both time periods. This could be the result of fewer mortgages with teaser periods being made as well as higher standards and lower *OLTV* rates, making mortgage payments more manageable.

When looking at *Del1* regressed against *CreditScore*, the indication is that while the resulting change from an increase in the credit score is minimal for each percentag point increase, the delinquency rate goes down in each year the higher the credit score. Having an ARM loan type in 2007 will increase your likelihood of delinquency while in 2003 and 2013 it decreases your likelihood. Another interesting result was that mortgages used to purchase investment properties were actually less likely to be delinquent in all three years. That is

contradictory to the *occupOO* properties that are inhabited by the owners. The fact that investment properties are less likely to be delinquent could result from the fact that they are purchased by real estate groups or finance businesses which would be more likely to be able to continue payments than the average person during a downturn in the economy. This follows the same logic that investment property mortgages had, on average, higher credit scores than did owner occupied properties. The result from analysing delinquency rates in general and in the first and eighteenth months is that the rates became significantly worse from year 2003 to 2007, prior to the financial crisis, followed by a dramatic reduction in delinquencies.

Throughout the analysis and discussion in this paper there have been a number of conclusions drawn from the results presented, all working to help answer the question of whether lending standards have indeed improved since the financial crisis. The answer to that is, on the whole, yes they have. Average credit scores for borrowers accepted have gone up, visualized in appendix F, loan-to-value rates have gone down, delinquency rates have risen, and clearly defined rules for coupon rates and total loan sizes allowed have been visibly followed. This is corroborated by a number of news sources which agree that lending standards were in fact increased substantially post financial crisis. It is noted by both the *New York Times* and the *Wall Street Journal* that in 2014 lending standards were substantially relaxed by Fannie Mae, Freddie Mac, and the Fed.<sup>56</sup> This was done in an effort to increase the availability of mortgages to the public, freeing up credit. What this means is twofold. Firstly, the papers acknowledge that lending standards were higher in the years following the financial crisis than they were before. Secondly, it means that in effect the government is re-opening the ‘mortgage door’ to potentially

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<sup>56</sup> Light, Joe. “Mortgage Lenders Set to Relax Standards; Agreement with Fannie, Freddie Potentially Paves Way for More Applicants to Qualify for Loans.” *Wall Street Journal*. Nov 28, 2014. Web  
Eavis, Peter. “U.S. Regulators Approve Eased Mortgage Lending Rules.” *New York Times*. Investment Banking. Oct 21, 2014.

unqualified borrowers. It is very likely therefore that as time passes, the stricter lending standards that came about during the shell shock period after the crisis may disappear over time as both the public and private sector become less worried about the potential problem which exists. One can hope though that the banks have learned from the mistakes made and that lenders will sell mortgages in an ethical manner only to those who can afford truly afford them.

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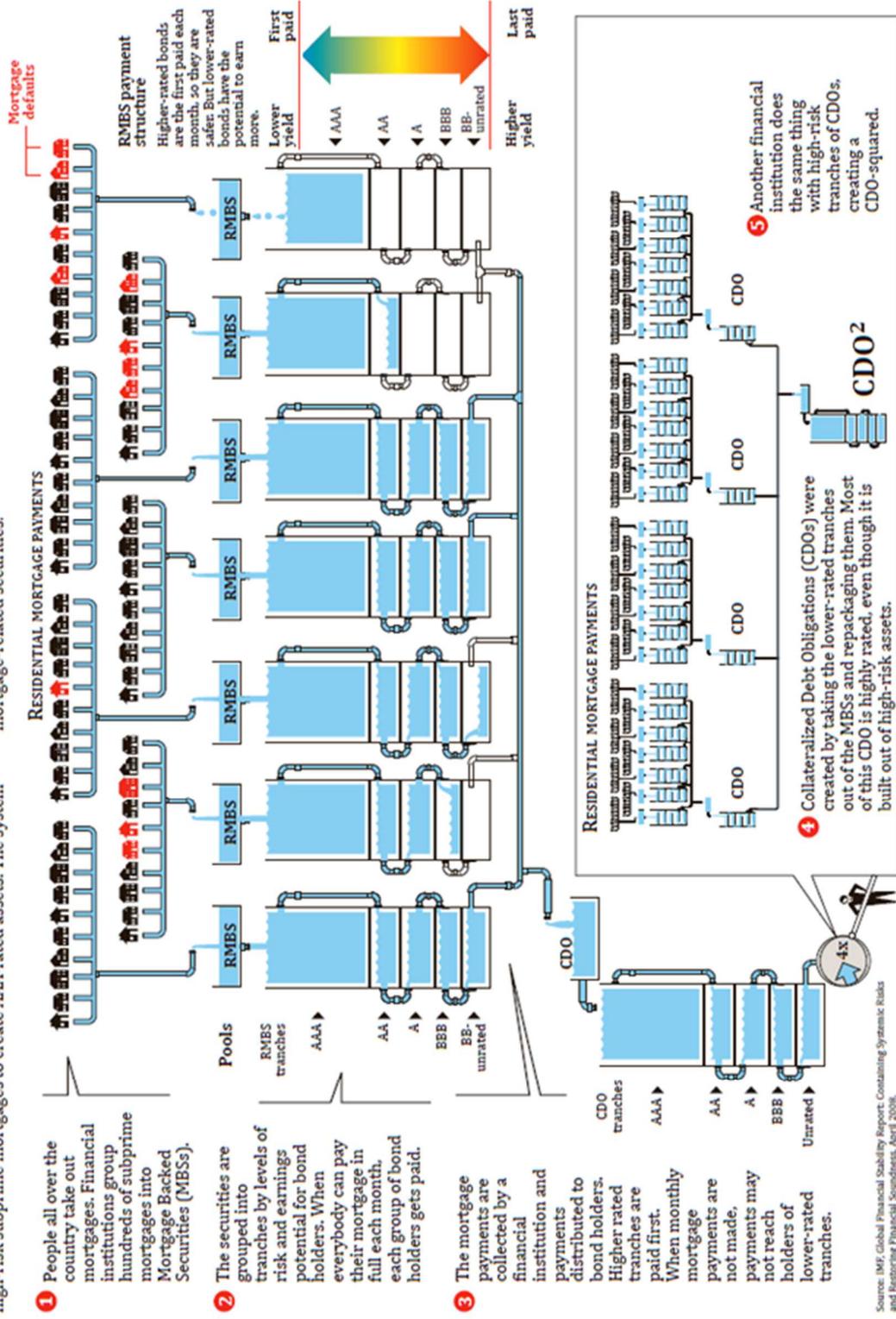


## Appendix B:

*A guide to the construction and risk dispersal of an Asset Backed Security using home equity loans as the composition.*

### THE THEORY OF HOW THE FINANCIAL SYSTEM CREATED AAA-RATED ASSETS OUT OF SUBPRIME MORTGAGES

In the financial system, AAA-rated assets are the most valuable because they are the safest for investors and the easiest to sell. Financial institutions packaged and re-packaged securities built on high-risk subprime mortgages to create AAA-rated assets. The system worked as long as mortgages all over the country and of all different characteristics didn't default all at once. When homeowners all over the country defaulted, there was not enough money to pay off all the mortgage-related securities.



Source: IMF, Global Financial Stability Report, Containing Systemic Risks and Restoring Financial Soundness, April 2008.

## Appendix C

*A list of the variables used and their meaning according to Bloomberg*

**Loan ID:** *A unique identifier for each loan within each loan group*

**Pay History:** *Lists the historical “state” of a loan with most recent status on “left hand side”. Payment string types are:*

*C=Current, 3=30 Day Delinquent, 6=60 Day Delinquent, 9=90 Day Delinquent,*

*F=Foreclosure, R=REO, P=Paid Off, L=Liquidated, S=Subsequent Loss or Recovery,*

*M=Modified, ^=Loan Not Reported for Period*

**Current Balance:** *The amount of principal owed to the deal by the obligor, minus any services advanced principal*

**Original Balance:** *The balance of the loan at the time of origination*

**Groups:** *The collateral group the loan is in according to the prospectus*

**Modification Type:** *The type of loan modification that occurred during the last modification (ie. Rate Modifications, Recapitalization, ARM→Fixed, Term Adjustment, IO→Fixed, Principal Forgiveness*

**Modification Date of Last Modification:** *The most recent date a loan was modified*

**Gross Coupon:** *Gross Coupon is the loan rate before fees are taken out*

**Premodification Coupon:** *Loan rate before ARM rate change*

**Payment Date:** *The sum of Principal and Interest on a loan*

**Original Payment:** *The original monthly payment schedule for the borrower*

**IO Remaining:** *the remaining number of months left in the IO loan*

**Documentation:** *Doc Types: Full Doc, Limited Doc, No Doc*

**Original LTV:** *The ratio of the original loan balance divided by the appraisal value of the property*

**Amortized LTV:** *LTV adjusted to date by taking into account past scheduled prepayments*

**HALTV:** *HPI Adjusted LTV, LTV Adjusted for HPI by MSA level*

**Credit Score:** *A statistically derived numeric expression of a person’s creditworthiness (ex. FICO)*

**Age:** *Loan age in months*

**Mths to Mat:** *Months to maturity, the number of months the entire remaining balance is due*

**Loan Type:** *current amortizing state of the loan: “ARM” for adjustable rate mortgage. “Fixed” for fixed rate mortgage*

**ARM Index:** *A benchmark index to which an adjustable rate mortgage is tied to (Ex. 3mo Libor*

**ARM Initial Reset:** *The period of an introductory or teaser interest rate on an ARM loan.*

**ARM Life Cap:** *the maximum % a loan can be adjusted over its lifetime*

**ARM Life Floor:** The minimum % of interest a loan will have regardless of how low interest rates are

**ARM periodic rate cap:** The maximum % a loan can be adjusted on its reset date

**ARM Periodic Rate Floor:** The amount the rate can go down on a rate reset of an ARM loan (eg. If the rate is 0.06 and the reset decrease cap were 0.02, then it cannot drop below 0.04)

**ARM margin:** A fixed percentage % that is added to an index value to determine the fully indexed interest rate of an adjustable rate mortgage (ARM)

**Geographic's:** State the loan was underwritten in

**Account Status:** Current loan status of loan using appropriate convention as per the servicer (OTS or MBA). Payment string types are: C=Current, 3=30 Day Delinquent, 6=60 Day Delinquent, 9=90 Day Delinquent, F=Foreclosure, R=REO, P=Paid Off, L=Liquidated, S=Subsequent Loss or Recovery, M=Modified

**Property Type:** SF = Single Family, 2F = Two Family, PU = Planned Urban Development, CO = Condominium, TH = Townhouse

**Occupancy:** Owner Occupied, Vacation, Investment Property

**Purpose:** Loan Purpose, A code describing the reason a loan was purchased: EQ=Equity Take Out, PR=Purchase, RE=Refinance

**MSA** is the Metropolitan Statistical Area that a loan was originated in

**Total fees charged on a loan:** Total Fee = coupon – Net Coupon

**Lien Status:** The order in which the owner of the loan has the right to recover proceeds at liquidation

**Months in Bankruptcy, Foreclosure, or REO:** Number of consecutive months the loan has been in Bankruptcy, Foreclosure, or REO

**Balloon:** Indicated if loan amortization includes balloon which means the mortgage does not fully amortize over the term of the note, this leaving a balance due at maturity

## **Variables Added to Bloomberg Data**

**Average Initial Rating:** The tranche rating that the RMBS received when it was initially rated by the rating agencies in the year it was created

**Average Current (New) Rating:** The tranche rating that the RMBS holds today as it has been rated by the rating agencies. That may be different from the initial rating (re-rated) or the same as its initial rating

**Average Rating Change:** The number of rating classes that the tranche has fallen since it was initially rated. This only applies to tranches that have been re-rated

**Average Home Price:** The average home price in that state during the year in question: 2003, 2007, 2013

**Average Income:** The average income of that state during the year in question: 2003, 2007, 2013

**Geo2:** *A numerical value assigned to each state plus D.C. and Puerto Rico (1-52) that denotes the states standing in terms of volume of subprime mortgages issued in that state in that year: 2003, 2007, 2013. 52 is the state with the most subprime mortgages issued and 1 is the least*

## **Appendix D**

*Ben Bernanke, Chairman of the Federal Reserve Board, Discussing the Housing Bubble Response.*

“That conclusion suggests that the best response to the housing bubble would have been regulatory, not monetary. Stronger regulation and supervision aimed at problems with underwriting practices and lenders’ risk management would have been a more effective and surgical approach to constraining the housing bubble than a general increase in interest rates.”<sup>57</sup>

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<sup>57</sup> Bernanke, Chairman Ben S. “Monetary Policy and the Housing Bubble.” The Annual Meeting of the American Economic Association. 3 Jan, 2010.

## Appendix E

The Telegraph's Alex cartoon representing one interpretation of the effect of the financial crisis.<sup>58</sup>



<sup>58</sup> Alex. "Alex Cartoon: September 30, 2010." *The Telegraph* [London, UK]. 30 Sept, 2010. Web.

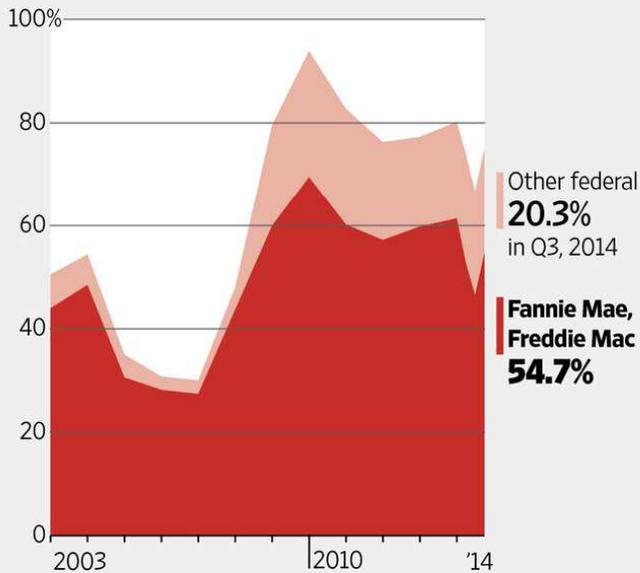
## Appendix F

*A visual representation created by the Wall Street Journal depicting the number of mortgages being purchased by government sponsored enterprises and all the credit scores of mortgage recipients in each year since 2002.<sup>59</sup>*

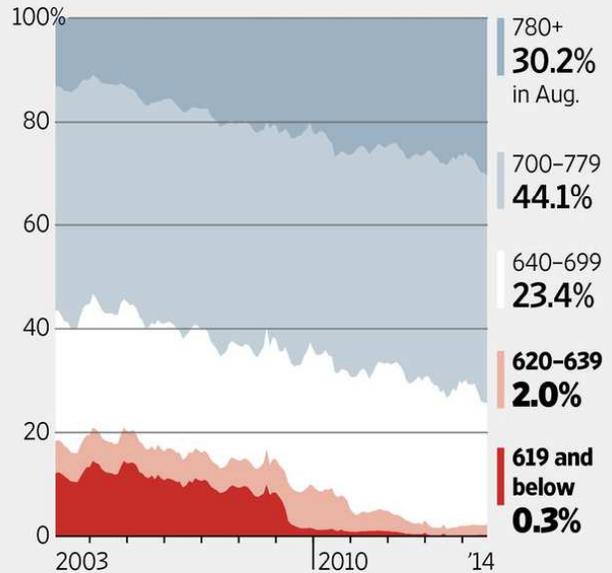
### Keeping Score

Fannie Mae and Freddie Mac, and other government loan guarantors, have taken on a greater role in the mortgage market since the recession, now backing most new originations. But lenders say that a lack of clarity on standards has kept them from extending loans to borrowers with the lowest credit scores.

**New mortgages receiving government backing**



**New mortgages by recipient credit score**



Sources: Inside Mortgage Finance (backer share); CoreLogic (share by credit score)

The Wall Street Journal

<sup>59</sup> Light, Joe. "Mortgage Lenders Set to Relax Standards; Agreement with Fannie, Freddie Potentially Paves Way for More Applicants to Qualify for Loans." *Wall Street Journal*. Nov 28, 2014.

## Appendix G

*A quote from an article in the Economist on March 22<sup>nd</sup>, 2007, written at the beginning of the financial crisis and quite directly alluding to my topic and the lack of adequate lending standards.*

“JUNE is National Homeownership Month in America. National Foreclosure Month would be more apt. Some corners of the mortgage market—notably “subprime” loans aimed at those with poor credit records—have a nasty case of dry rot. One subprime borrower in eight is behind with the payments. As the introductory “teaser” rates on more loans expire and monthly payments outrun the means of more borrowers, hundreds of thousands of Americans are set to be thrown onto the street.”

“Many [subprime borrowers] appear to have been encouraged to take out loans by brokers more bothered about their fees than their clients' ability to repay their debts. And the lenders who advanced the money—dozens of which have had to shut up shop—underestimated the rate of default. Generously, you could ascribe this to the relative youth of the subprime market. Less generously, you might point to the effect of “securitisation” on lenders' incentives: knowing that loans could be lumped together and sold, and then chopped, repackaged and sold again, made for slack judgment.”<sup>60</sup>



<sup>60</sup> Fryer, James. “The trouble with the Housing Market.” *The Economist*. Mar 22, 2007. Web.

## Appendix H

*This is another quote from the economist, this one written 5 months after the previous article on August 2<sup>nd</sup>, 2007. It directly relates to my topic and how relaxed lending standards paved the way for increased chaos in the U.S. economy.*

“For the past few years, too much money has been lent too cheaply and too easily to too many people, whether it was speculators trying to make a fast buck in Miami condominiums or private-equity groups financing their latest multi-billion-dollar takeover. This wake-up call came too late to save the American housing market from frenzy and subsequent bust. ... As standards are tightened, many of the reckless practices that have become the norm in corporate lending will be abandoned. We will now hear a lot less about firms getting “covenant lite” loans, under which lenders give up their rights to monitor the behaviour of borrowers; or “payment-in-kind notes”, which allow borrowers to substitute more IOUs for interest payments.”<sup>61</sup>



<sup>61</sup> Potts, Aidan. “A Good Time for a Squeeze” *The Economist*. Aug 2, 2007. Web.