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Διπλωματική Εργασία

GLOBAL FINANCIAL CRISIS

A focus on the U.S. 2007-2009 Crisis

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Abstract

This paper discusses the global financial crisis with a main focus on the U.S. crisis during the period 2007-2009. The causes as well as the events and factors that led to the build- up of the financial crisis in the United States are thoroughly analyzed. Towards the end of this paper we examine the major events that took place in Europe during the same period and later due to the global financial crisis.

What is a Financial Crisis?

Financial systems are built on belief. The word *credit* derives from the Latin verb *credo* meaning *believe*. Every financial crisis is a crisis of confidence.

A financial crisis occurs when a panic or fear of panic affects the overall functioning of the financial system. In other words, a financial crisis is often associated with a panic or a bank run where investors sell off assets or withdraw money from savings accounts because they fear that the value of those assets will drop if they remain in a financial institution[1]. People basically lose confidence that their money is safe and they pull it out of the system which makes the money remaining in the system even less safe, consequently making everyone even less confident.

Almost all wealth is embodied in long- lived assets that pay off slowly over time. For example a house offers housing services over a long period of time or a piece of machinery will produce some good over a long period of time. Some fraction of that wealth is needed to back short-term safe assets used in transactions (money). Collectively we cannot all convert long-term assets to money at the same time. A panic happens when

[1] Financial Crisis. See https://www.investopedia.com/terms/f/financial-crisis.asp#ixzz5H2BGIbzo (last checked on May 15, 2018).

enough people get nervous about whether or not their money is safe and try to convert it to something that they're sure about. But if the panic happens and drains banks and other financial institutions' ability to do any lending then all of a sudden this can have an effect on the real economy. So the panic is the event where we lose confidence in our ability to transform long- lived assets into money type substitutes and a financial crisis is the reaction to that.

What causes Financial Crises- Why are they so damaging?

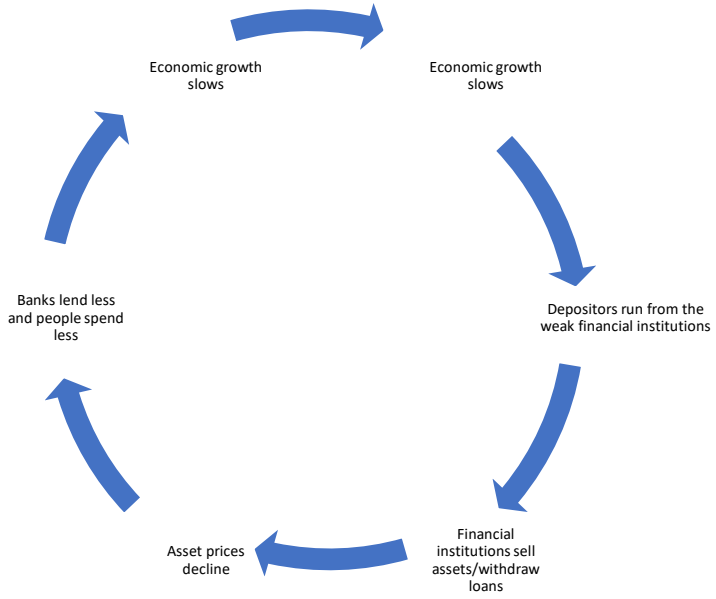
Financial systems themselves are inherently fragile and financial distress in the financial system can cause severe damage to the real economy. Apart from that, policymakers often mismanage the response to that distress.

Financial systems play a critical role in the economy. They basically take the savings of savers and loan or invest those resources in activity that has some positive return. People lend the financial systems their money for a very short period and expect it to be available on demand. Banks and other firms on the other hand take those resources and lend them for longer periods of time to support those who want to borrow in order to finance the purchase of a home or a business etc.

The structure of a typical bank has a thin base of common equity-capital, a set of other forms of borrowing, long and short deposits, secured and unsecured and those finance the assets. This basic structure, by design is fundamentally fragile exactly because the equity cushion is thin and the large share of remaining sources of funds used to fund the loans of the assets of the institution can run, meaning can be withdrawn in a crisis. And a bank doesn't have the ability to sell assets quickly to meet withdrawals of funds in extremis, which explains its inherent fragility.

Subsequently, because the financial system is so closely linked with rest of the economy its impact on the latter, as mentioned above, can be severe. One way to illustrate this is by showing the cycle in the below table

Figure 1. The doom loop



In detail, a shock[2] occurs and the economy slows. That in return creates the fear of loses and so depositors begin to withdraw their funds from what they perceive to be the weaker institutions. Those institutions then sell assets or withdraw loans to meet the demand for the above withdrawals. That in return causes asset prices and the prices of financial securities to decline. In response to that, banks lend less and that further intensifies the slowdown of the economy.

Third, an extremely important factor in financial crises is how the policymakers respond to the distress. The truth is that policymakers tend to mismanage their response. In fact their initial response often worsens the crisis. That happens either because they are too slow to react (it is often

[2] Perhaps a change in government policy or an unexplained failure of a firm thought to have been successful. See Robert Z. Aliber and Charles P. Kindleberger, *Manias, Panics and Crashes: A History of Financial Crises*, Seventh Edition, Palgrave Macmillan, 2015.

difficult for them to appreciate the magnitude of the crisis) or they are concerned about moral hazard. Sometimes it is because of basic conservatism in policy (they consider it better to move slowly) and other times because of lack of knowledge with regards to which action or measure will be effective.

There are many causes of financial crises and many factors that contribute to the risk of them occurring. Below, we will discuss the causes of the financial crisis in the U.S. during the period 2007- 2009.

Causes of the Financial Crisis in the U.S. 2007-2009

It is important to distinguish between triggers and vulnerabilities[3] in every crisis. In the U.S. financial crisis that occurred during the period of 2007-2009 although there were a number of developments that contributed to triggering it, the most prominent one was the prospect of significant losses on residential mortgage loans to subprime borrowers[4], that became apparent shortly after house prices began to decline. With more than $1 trillion in subprime mortgages[5] outstanding, the potential for losses on these loans was large in absolute terms. However, prospective

[3] Triggers are the particular events or factors the touched off- triggered the crisis whereas vulnerabilities are the structural weaknesses in the financial system and in regulation and supervision that propagated and amplified the initial shocks. See Ben S. Bernanke, *Testimony to the Financial Crisis Inquiry Commission*, 2010. Available at https://www.federalreserve.gov/newsevents/testimony/bernanke20100902a.pdf (last checked on May 30 2018)

[4] Subprime is a classification of borrowers with a tarnished or limited credit history. Lenders will use a credit scoring system to determine which loans a borrower may qualify for. Subprime loans carry more credit risk, and as such, will carry higher interest rates as well. Approximately 25% of mortgage originations are classified as subprime. The term subprime gets its name from the prime rate, which is the rate at which people and businesses with excellent credit history are allowed to borrow money. Occasionally some borrowers might be classified as subprime despite having a good credit history. The reason for this is because the borrowers have elected to not provide verification of income or assets in the loan application process. See https://www.investopedia.com/terms/s/subprime.asp#ixzz5Hk5yhONV (last checked on May 30 2018), Also see below p. 17

[5] Subprime was only about one-seventh (1/7) of the mortgage market and $1 trillion out of the nation's $55 trillion in financial assets. See Timothy F. Geithner, *Stress Test*. New York, Crown Publishing Group, 2014, p.112

subprime losses were not large enough on their own account for the magnitude of the crisis, as *Ben Bernanke*[6] remarked in his testimony before the Financial Crisis Inquiry Commission in September of 2010. It was the system's vulnerabilities as well as the government's crisis-response toolkit that led to such a severe crisis which had devastating effects on the broader economy. As it will be thoroughly analyzed below by the summer of 2007 critical events started to unfold that were triggered by fears of subprime losses that had been growing during the first half of the year[7]. On July 30 2007, *IKB Deutsche Industiebank AG*, a medium sized German bank announced that in order to meet its obligations, it would be receiving extraordinary support from its government-owned parent and an association of German banks[8]. In 2002 *IKB* created an off- balance- sheet commercial program called *Rhineland* to purchase a portfolio of structured finance securities backed by credit card receivables, business loans, auto loans and mortgages. It made money by using less expensive short- term commercial paper to purchase higher- yielding long-term securities, a strategy known as "*securities arbitrage*". By the end of June, *Rhineland* owned $18.9 billion of assets, 95% of which were CDOs[9] and CLOs[10]. At

[6] Ben Shalom Bernanke is an American economist at the Brookings Institution **who served two terms as Chairman of the Federal Reserve** from 2006 to 2014. See https://en.wikipedia.org/wiki/Ben_Bernanke (last checked on May 28 2018)

[7] See Ben S. Bernanke, Ibidem

[8] See Ben S. Bernanke, Ibidem, p. 2

[9] A collateralized debt obligation (CDO) is a structured financial product that pools together cash flow-generating assets and repackages this asset pool into discrete tranches that can be sold to investors. A collateralized debt obligation is named for the pooled assets — such as mortgages, bonds and loans — that are essentially debt obligations that serve as collateral for the CDO. The tranches in a CDO vary substantially in their risk profiles. The senior tranches are generally safer because they have first priority on payback from the collateral in the event of default. As a result, the senior tranches of a CDO generally have a higher credit rating and offer lower coupon rates than the junior tranches, which offer higher coupon rates to compensate for their higher default risk. Collateralized debt obligations are created by as many as five parties: Securities firms, who approve the selection of collateral, structure the notes into tranches and sell them to investors; CDO managers, who select the collateral and often manage the CDO portfolios; Rating agencies, who assess the CDOs and assign them credit ratings; Financial guarantors, who promise to reimburse investors for any losses on the CDO tranches in exchange for premium payments; and Investors such as pension funds and hedge funds. See https://www.investopedia.com/terms/c/cdo.asp#ixzz5HlSVPR4Z (last checked on May 30 2018)

[10] Collateralized loan obligations, that is securitized leveraged loans. In more detail, a collateralized loan obligation (CLO) is a security backed by a pool of debt, often low-rated corporate loans. Collateralized

least $10.8 of that was protected by *IKB* through liquidity puts. It should be noted that German regulators at that time did not require *IKB* to hold any capital to offset potential *Rhineland l*osses[11]. *IKB*'s problem was that its above mentioned *Rhineland* off- balance- sheet vehicle was no longer able to roll over the asset- backed commercial paper (ABCP) it had been issuing in U.S. markets to fund its large portfolio of asset- backed securities. Although none of the securities in the *Rhineland* portfolio were in default and only some were subprime- related, commercial paper investors had become concerned about *IKB*'s ability to meet obligations in the event that the securities *Rhineland* held were downgraded. Within a couple of weeks investors around the world were pulling back funding and by end of August the outstanding U.S. ABCP fell almost $200 billion[12]. Lenders in the commercial paper market and other short- term money markets who place a high value on safety and liquidity, withdraw their funds should the safety of their investments come into question; That is easier than to invest time and resources to evaluate in detail whether their investment is in fact safe. Consequentially, although subprime mortgages composed only a small part of the portfolios of most structured credit vehicles, cautious lenders pulled back even from those that had no exposure to them. The resulting funding pressure was in turn transmitted to major banks that had sponsored or provided funding guarantees to vehicles. As *B. Bernanke* remarks in his statement before the FCIC, over subsequent quarters, instability in global money markets worsened and

loan obligations are similar to collateralized mortgage obligations (CMO), except that the underlying loans are of a different type and character. With a CLO, the investor receives scheduled debt payments from the underlying loans, assuming most of the risk in the event borrowers default. In return for taking on the default risk, the investor is offered greater diversity and the potential for higher-than-average returns. See https://www.investopedia.com/terms/c/clo.asp#ixzz5HlOacfY0 (last checked on May 30 2018)

[11] See 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, authorized ed*. New York, Public Affairs, 2011, p. 246- 247

[12] See Ben S. Bernanke, Ibidem, p. 2

posed an increasingly serious threat to the functioning of a range of financial markets and institutions. The disruptions caused to the latter ultimately proved far more damaging than the subprime losses themselves[13]

Another, less known trigger was a sudden stop in syndicated lending to large relatively risky corporate borrowers[14].

Further, in the eve of the crisis, the U.S. was coming off a long period during which belief in a more stable future produced a large boom in lending and in financial assets[15]. There was a vast increase in debt relative to income with most of the increment financed outside the core of the banking system, thus creating conditions for panic and collapse.

Monetary policy also played it's role in the crisis. Real interest rates in the U.S. (and around the world) were very low. There was a large increase in savings in the most populous parts of the world (see China) which over time flowed into the United States. That held down rates even as the Fed tightened. There was also a lot of fraud and predation in the U.S. financial system and the regulatory structure was very Balkanized and segmented. No single institution or organization was accountable for the entire system.

[13] See Ben S. Bernanke, Ibidem, p. 3
[14] See Ben S. Bernanke, Ibidem, p. 3- 4
[15] Following the Great Depression there was a period of 70 years of relative calm. Nonetheless there were many periods of financial distress. One such example was the S & L crisis. See https://www.federalreservehistory.org/essays/savings_and_loan_crisis (last checked on May 30 2018) But the losses during these events were very mild compared to the losses experienced in the Great Depression. This led people to believe, as the memory of the 1929 crisis faded, that they were lining in calmer financial environment. There seemed to be less risk of loss in income, less risk of acute periods of high unemployment and less risk of deep and long-lasting recessions. People were more confident that the value of their homes would rise, thus borrowed larger amounts relative to their income from lenders who were also confident because the loan was backed by what they expected to be a rising value of that financial asset.

Vulnerabilities

In the years after the crisis although attention turned to financial reform and there was much discussion about shortcomings of the public sector policies and responses, many key vulnerabilities of the 2007-2009 crisis were products of private- sector arrangements.

Leading up to the crisis the shadow banking system, as well as some of the largest global banks, had become dependent on various forms of short- term wholesale funding[16] as we will analyze further below. The reliance of shadow banks on short- term uninsured funds made them subject to runs.

Many types of shadow banks lacked meaningful prudential regulation including various special purpose vehicles (such as CLOs mentioned above), ABCP vehicles, hedge funds[17] and many nonbank mortgage- origination companies. No regulatory body restricted the leverage and liquidity policies of shadow banks and few if any regulatory standards were imposed on the quality of their risk management or the prudence of their risk-taking. Of these shadow banks both special purpose vehicles and nonbank mortgage originators contributed significantly to the crisis; Hedge funds on the other, generally did not, probably because the

[16] Such funding forms included commercial paper, repurchase agreements (repos), certain kinds of interbank loans, contingent funding commitments (such as commitments that investment banks provided for auction rate securities used primarily to finance municipalities) and others. See Ben S Bernanke, Ibidem, p. 5

[17] Hedge funds are alternative investments using pooled funds (funds from many individual investors that are aggregated for the purposes of investment) that employ numerous different strategies to earn active return, or alpha, for their investors. Hedge funds may be aggressively managed or make use of derivatives and leverage in both domestic and international markets with the goal of generating high returns (either in an absolute sense or over a specified market benchmark). It is important to note that hedge funds are generally only accessible to accredited investors as they require less SEC regulations than other funds. See https://www.investopedia.com/terms/h/hedgefund.asp#ixzz5HmSZiJB1 (last checked on 30 May 2018)

concerns about them meant they were subject to more effective market discipline.

Although vulnerabilities associated with short term wholesale funding can be seen as a structural weakness of the global financial system, they can also be viewed as a consequence of poor risk management by issuers and investors. Private- sector risk management also failed to keep up with financial innovation in many cases[18].

Excessive leverage was also an important vulnerability that contributed to the crisis. Many households, businesses and financial firms took on more debt than they could handle, reflecting more permissive standards on the part of lenders. It is important to note that leverage tends to be procyclical, rising in good times, when confidence of lenders and borrowers is high and falling in bad times when confidence turns to caution. This procyclicality increases financial and economic stress in the downturn. For example the decline in required down payments on home purchases seen before the crisis was sharply reversed afterwards with required down payments of 20%- 30% of the house price. The tougher requirements reduced the pool of potential homebuyers and with fewer homebuyers pressure on home prices increased. That meant that lower house prices helped improve affordability but also weakened positions of current homeowners, reducing their capacity to service their mortgages, to purchase new homes and to consume goods and services[19].

The public sector also had important vulnerabilities which exacerbated the crisis and made its response less effective. The

[18] See Ben S. Bernanke, Ibidem, p. 7
[19] See Ben S. Bernanke, Ibidem, p. 9- 10

vulnerabilities included both gaps in the statutory framework and flaws in the performance of regulators and supervisors.

The Federal Reserve consists of twelve regional banks with the New York Fed being the largest and most influential of all. It is Washington's best window into Wall Street. Its president serves as vice chair of the Fed committee that sets monetary policy. Its staff buys and sells government securities to implement monetary policy. It also shares responsibility for supervising some of America's biggest banks including *Citigroup*, *JP Morgan Chase* and the *Bank of New York Mellon*. In 2003 *Timothy F. Geithner* became the president of the *Federal Reserve Bank of New York*[20]. In his very first public speech in March 2004 he warned bankers that the wonders of the new financial world would not necessarily prevent catastrophic failures of major institutions and should not inspire delusion of safety on Wall street. He also suggested that financial innovation was driving risk and leverage into corners of the system with weaker supervision (see below) and that the tools for monitoring systemic risk were not keeping up. Finally, he stressed that it was important that the bankers who run financial institutions build sufficient cushion against adversity[21]. His words of caution would be justified a couple years later.

Although the Fed was seen as America's financial stability regulator, in reality its authority was very limited and its power to constrain risk in the financial system did not extend to the entire financial system. The Fed shared responsibility for supervising commercial banks with insured deposits. If one of those banks ran into liquidity problems it could turn to the Fed for an emergency loan that could prevent a run. The main problem though was that a huge swath of the financial system such as

[20] Timothy Geithner. See https://en.wikipedia.org/wiki/Timothy_Geithner (last checked on May 30 2018)
[21] See Timothy F. Geithner, Ibidem, p. 80-81

investment banks, *Fannie Mae* and *Freddie Mac* as well as many other large firms that behaved like banks[22] were outside of the Fed's jurisdiction, therefore outside of its safety net. These non- banks or as they are referred to as "shadow banks"[23] were borrowing short and lending long; But they were not subject to the capital requirements and other safeguards imposed on banks to limit risk. Apart from that they did not have deposit insurance to prevent runs and they would not be able to access the discount window if they faced runs.

Overall, more than half of America's financial liabilities had migrated outside of banks and beyond the Fed's direct purview. There is nothing inherently dangerous about risk outside the traditional banking sector unless the risk is concentrated in large bank-like entities with leverage and short term funding without bank-like regulations and that is exactly what happened in the United States[24].

So there were serious gaps in the statutory framework of financial regulation before the crisis. But even when authorities did exist they were not always used forcefully or effectively enough by regulators or supervisors. For the most part, bank regulators did not do enough to force large financial institutions to strengthen their internal risk- management systems or to curtail risky practices. Moreover although the absence of macroprudential authorities was an important statutory gap, regulators could have done more to try to identify risks to the broader financial system. Stronger bank capital standards and more attention to liquidity

[22] Although these institutions behaved liked banks they were not obligated to obey to bank safety and soundness rules. See Timothy F. Geithner, Ibidem

[23] Shadow banks are financial entities other than regulated depository institutions (commercial banks, thrifts and credit unions) that serve as intermediaries to channel savings into investment. Securitization vehicles, ABCP vehicles, money market funds, investment banks, mortgage companies and a variety of other entities are part of the shadow banking system. See Ben S Bernanke, Ibidem, p. 4

[24] The " The Rise of Shadow Banking"- Financial Sector Liabilities Chart illustrates that the growth in the financial sector of credit from the 1980s through 2007 was almost entirely outside the traditional banking system. See Timothy F. Geithner, Ibidem, p. 82

risks faced by banks and other financial institutions would have made the financial system more resilient.

Once a crisis occurs, timely and effective government action is critical to containing the severity of financial disruptions and their economic effects. Ultimately financial stability was regained through congressional action to recapitalize the banking system, the provision of liquidity by the Fed and of debt and deposit guarantees by the Federal Deposit Insurance Corporation and through important actions by the Treasury Department. However, the crisis revealed large gaps in the government's ability to respond quickly, effectively and with minimum cost to taxpayers and the economy[25].

Many vulnerabilities that amplified the crisis are linked with the problem of so- called "*too big to fail*" firms[26]. In the midst of the crisis, providing support to such a firm usually represents the best of bad alternatives. Without such support though there could be substantial damage to the economy. However, "*too big to fail*" creates several problems in the long run. Fist of all it generates a severe moral hazard. If creditors believe that an institution will not be allowed to fail, they will not demand as much compensation for risks they otherwise would, thus weakening market discipline. Secondly, "*too big to fail*" creates an uneven playing field between big and small firms[27]. Last these firms can themselves become major risks to overall financial stability as seen in the 2007-2009 U.S. crisis.

[25] See Ben S. Bernanke, Ibidem, p. 12-19
[26] A "*too big to fail*" firm is one whose size, complexity, interconnectedness and critical functions are such that, should the firm go unexpectedly into liquidation, the rest of the financial system and the economy would face severe adverse consequences. See Ben S Bernanke, Ibidem, p. 20
[27] See Ben S Bernanke, Ibidem, p. 21

Some have argued that monetary policy contributed significantly to the bubble in housing prices which in turn triggered the crisis among other factors. This was not the case though as it thoroughly discussed later on. Generally, it is financial regulation and supervision, rather than monetary policy, that provide more targeted tools for addressing credit- related problems. Enhancing financial stability through regulation and supervision leaves monetary policy free to focus on stability in growth and inflation for which it is better suited.

The Events during the 2007-2009 period and Critical Factors of the Financial Crisis in the U.S.

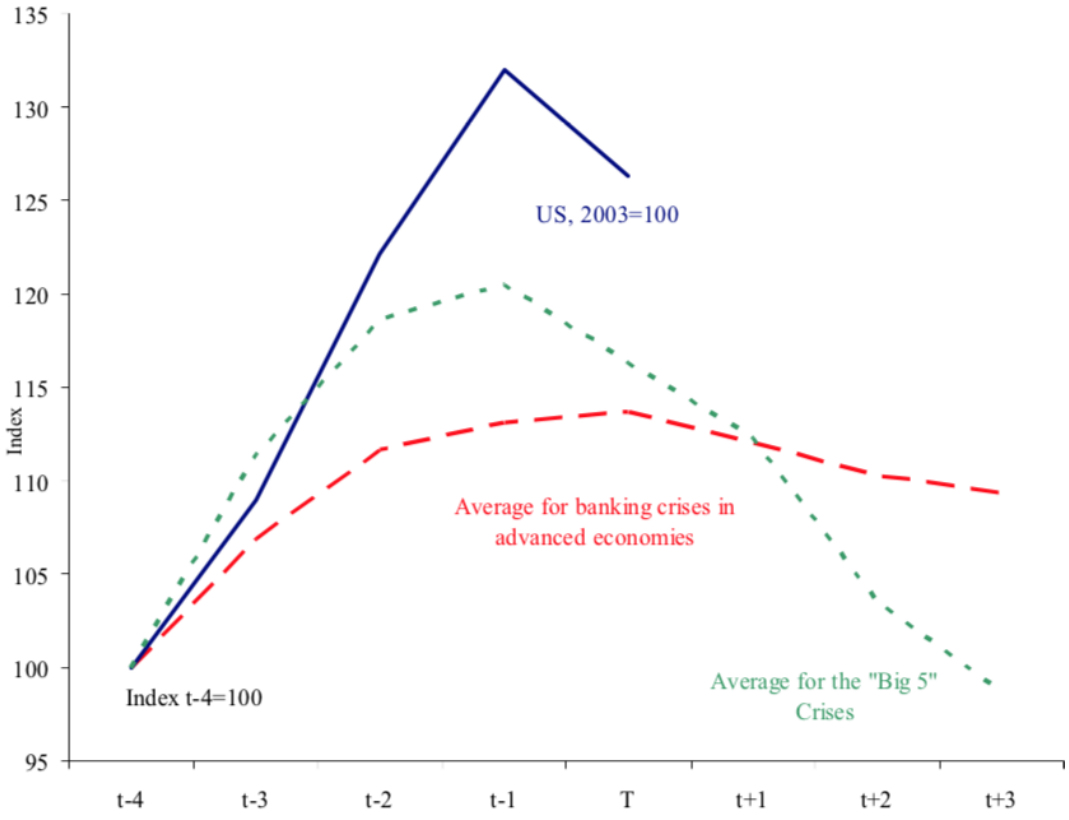
Housing Crisis- Housing Bubble

In 2008 *Riehart and Roghohh*[28] published a paper that identified the big five crises, among others, in developed countries since World War II. These were the crises in Spain in 1977, in Norway in 1987, in Finland and Sweden in year 1991 and finally, in Japan in 1992. As shown in their chart below there was a significant run-up in housing prices prior to the financial crisis. The dotted green line shows the average house price appreciation in the big five crises. During the four years prior to these crises (T) house prices rose by about 20%. The blue line represents the movement of house prices in the U.S. in the four years that preceded the crisis. This paper was published before the failure of *Lehman Brothers* and the data came significantly before the *Bear Stearns* events. When they wrote this paper in 2008 the housing market in the U.S. had gone up 30% and was already

[28] Carmen M. Reinhart, Kenneth S. Rogoff, 2008, *Is the 2007 U.S. Sub-Prime Financial Crisis So Different? An International Historical Comparison*, NBER Working Paper No. 13761

down 5%. In other words there was a larger appreciation in house prices in the U.S. than in the big five cases.

Figure 2. Real Housing Prices and Banking Crises



Source: Carmen M. Reinhart, Kenneth S. Rogoff, 2008, NBER Working Paper No. 13761

To understand the housing crisis it is essential to first comprehend what a mortgage is. A mortgage loan, or simply a mortgage, is used either by purchasers of real property to raise funds to buy real estate, or alternatively by existing property owners to raise funds for any purpose, while putting a lien on the property being mortgaged[29]. In the United States

[29] The loan is "secured" on the borrower's property through a process known as mortgage origination (a specialized subset of loan origination which is the process by which a borrower applies for a new loan, and a lender processes that application. Origination generally includes all the steps from taking a loan application up to disbursal of funds or declining the application). This means that a legal mechanism is put into place which allows the lender to take possession and sell the secured property ("foreclosure" or "repossession") to pay off the loan in the event the borrower defaults on the loan or otherwise fails to abide by its terms. See https://en.wikipedia.org/wiki/Mortgage_loan . Alternatively see https://www.investopedia.com/terms/m/mortgage.asp (last checked on May 30 2018)

the standard mortgage has a 30 year term fixed interest rate. There are alternatives to this though. The most common alternative is the adjustable rate mortgage or ARM. This is a mortgage loan with the interest rate on the note periodically adjusted based on an index which reflects the cost to the lender of borrowing on the credit markets[30]. The index most commonly used in the U.S. is the LIBOR[31]. An example of such a loan is the 5/25 meaning that the borrower has a fixed rate for five years and after that it adjusts every year. The initial fixed rate will typically be lower than that of the 30- year fixed mortgage. This type of loan could be to the advantage of a borrower if he is sure that he will be selling the house within the next five years. There are even more flexible options; For instance negative amortization loans[32] or balloon payments[33] as well as pre- payment penalties[34], that allow payment sizes to be lower in the early years of the loan. These alternative structures grew in popularity over the years in the United States.

Another distinction in mortgages is between prime and non- prime mortgages. Prime mortgages are also known as conforming or agency mortgages. They are called that way because they "*conform*" to the standards set by the government- sponsored enterprises (GSEs)[35]. Well known government enterprises are *Fannie Mae* and *Freddie Mac*. The standards set are: a) a maximum loan size, b) a certain "loan-to-value"

[30] See https://en.wikipedia.org/wiki/Adjustable-rate_mortgage (last checked on May 30 2018)
[31] See https://en.wikipedia.org/wiki/Libor (last checked on May 30 2018)
[32] A negatively amortizing loan is a loan with a payment structure that allows for a scheduled payment to be made where the payment made by the borrower is less than the interest charge on the loan. When a payment is made which is less than the interest charge at the time, deferred interest is created. The amount of deferred interest created is added to the principal balance of the loan, leading to a situation where the principal owed increases over time instead of decreases. See https://www.investopedia.com/terms/n/negativelyamortizingloan.asp#ixzz5HslECpuD (last checked on May 30 2018)

[33] See https://www.investopedia.com/terms/b/balloon-payment.asp (last checked on May 30 2018)
[34] See https://www.investopedia.com/terms/p/prepaymentpenalty.asp (last checked on May 30 2018)
[35] See https://en.wikipedia.org/wiki/Government-sponsored_enterprise (last checked May 30 2018)

(LTV) ratio meaning that the value of the underlying property would have to have a certain level relative to the loan size. Also c) a certain credit score for the borrower is required and d) there are occupancy rules. Last there are e) income limits that need to be met as well as documentation that needs to be submitted. Once these criteria are met *Fannie Mae* and *Freddie Mac* in the U.S. are permitted to buy those loans from the banks. That way the bank sells the loan to a government agency and takes it off its balance sheet. Another aspect of this instrument is that the government agency can guarantee the loan in such a way that if the borrower of the prime loan doesn't make its payments the government will pay the principle and interest to whoever holds the loan. This allows the loans to be packaged into securities that are called mortgage backed securities which are backed not only by the houses themselves but by the government guarantee as well. There are some downsides though, as the government cannot guarantee that the borrower will not prepay his mortgage due to the change of interest rates or any other reason. It should be noted that there is also a category of loans the meet all of the above requirements but are quite large, known as "*Jumbo loans*" or very large, known as "*Super- Jumbo Loans*". These are generally considered safe loans but are not guaranteed by the government so they do not fall under the category of "*conforming loans*".

Non- prime mortgages are categorized into subprime and near-prime or Alt- A loans. Although the categories are not rigidly defined subprime loans are generally targeted to borrowers who have tarnished credit histories and little savings available for down payments. Near- prime mortgages are made to borrowers with more minor credit quality issues or borrowers who are unable or unwilling to provide full documentation of assets or income. Some of these borrowers are investing in real estate rather than occupying the properties they purchase. Near- prime mortgages are

often bundled into securities marked as "*Alt- A*"[36]. Subprime mortgages were not a new product of the 2000s but lending to risky borrowers did grow rapidly during that period. The number of subprime mortgages originated nearly doubled from 1.1 million in 2003 to 1.9 million in 2005. Near- prime Alt- A originations grew at an even faster rate from 304,000 in 2003 to 1.1 million in 2005[37].

Figure 3. Number of Subprime and Alt- A Mortgage Originations by Year[38]

Collateral type	2003	2004	2005	2006	2007 (Jan–June)	All
Subprime	1,081,629	1,669,594	1,921,637	1,445,425	233,725	6,352,010
Alt-A	303,969	712,056	1,093,797	921,212	279,114	3,310,148

Source: Christopher J. Mayer, Karen M. Pence and Shane M. Sherlund, *The rise in Mortgage Defaults*, 2008, Finance and Economics Discussion Series

Having in mind the above, one would observe that these types of loans were designed to fail. But in fact, they could make sense if there was a general expectancy by all market participants for house prices to rise. In reality, from 2000 through 2005 house prices rose at an average annual rate of 11% (they then fell at an average annual rate of 10% from mid- 2006 to mid- 2008)[39]. So borrowers felt comfortable taking these risks because they believed house prices would continue to rise. This belief in continued house price appreciation may have influenced other borrowers to buy investment properties; Alt-A mortgages, in particular, were often used by investors. Therefore, one could agree to pay less in the present in exchange

[36] See Christopher J. Mayer, Karen M. Pence and Shane M. Sherlund, *The rise in Mortgage Defaults*, 2008, p. 2. Available at https://www.federalreserve.gov/pubs/feds/2008/200859/200859pap.pdf (last checked on May 30 2018)

[37] This momentum began to change in the middle of 2005, when mortgage rates started to rise and house price appreciation first began to slow. Non- prime lending leveled off in 2006, dropped dramatically in the first half of 2007 and became virtually nonexistent through most of 2008. See Christopher J. Mayer, Karen M. Pence and Shane M. Sherlund, Ibidem

[38] The sample is restricted to thirty-year, first- lien mortgages originated on one- to four family properties in the contiguous United States.

[39] See Christopher J. Mayer, Karen M. Pence and Shane M. Sherlund, Ibidem, p. 21

to give back a portion of the future increase of the house price that was broadly expected. If for example a borrower had put down 5% of the value of the house and three years later the house's value had appreciated 10% then he essentially would have positive equity in his home and could have his mortgage refinanced since a bank would be willing to write him a slightly bigger mortgage because the house would be worth a larger value. He could then pay off the previous loan and the pre- payment penalty without having to pay any extra money.

Indeed, as mentioned in the *Christopher J. Mayer, Karen M. Pence* and *Shane M. Sherlund* paper[40] "when borrowers with positive equity in their homes experience financial difficulties, they are likely to respond by refinancing or selling their homes. Even if a borrower cannot afford the current mortgage, it is more profitable for a borrower to sell the house than to have the bank sell it through a foreclosure. Borrowers with negative equity, however, face no such incentive, and are more likely to default on their loans.". Many nonprime borrowers put down small or no down payments when they purchased their homes, and as a result were likely to have negative equity in their homes when house prices fell. Because house prices in Ohio, Michigan, and Indiana began declining several months before the rest of the country, the share of borrowers with negative equity was initially highest in these states and reached one in three by mid-2008. In California, Florida, Arizona, and Nevada (sand states), where house prices appreciated dramatically in 2004 and 2005 and subsequently dropped sharply, over half of subprime borrowers had negative equity in their homes by mid-2008; elsewhere, about ten percent of subprime borrowers had negative equity by that time. Over 17 percent of the subprime mortgages that originated in California, Florida, Arizona, and

[40] See Christopher J. Mayer, Karen M. Pence and Shane M. Sherlund, Ibidem, p. 22

Nevada in 2005 defaulted by mid-2008, compared with nearly 14 percent nationwide. In 2006, house prices began to drop more sharply than in these states. Around 26 percent of 2006 subprime mortgage originations and 18 percent of 2007 subprime mortgage originations in California, Florida, Arizona, and Nevada were in default as of mid-2008. For the nation as a whole, only 13 and 9 percent of subprime mortgages originated in these years were in default.

Despite the above facts, it should be noted that not only the above types of mortgages failed during this period but prime mortgages did also at a noticeable rate. The housing crisis was also a universal crisis but it was worse in the U.S. than in most of the other countries.

There are three distinct but not exclusive hypotheses about the causes of the housing crisis. The first hypothesis is moral hazard. The second focuses on government failure and the third is often referred to as the bubble thinking hypothesis. There is stronger evidence[41] proving that bubble thinking was the cause of the housing crisis as it will be analyzed below.

Hypothesis one emphasizes on the explanation that well- informed mortgage insiders used the securitization process to take advantage of uninformed outsiders (the so called "inside job"), thus causing the housing crisis. In plain words a confused borrower who had been intentionally misled was convinced to take out a mortgage that was not appropriate for him. The interest rate on the mortgage reset to a higher level after a few years and the higher monthly payment forced the borrower to default. The mortgage broker who knew that the mortgage was hard wired to explode

[41] Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, *Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis*, 2012, Working paper 18082. Available at http://www.nber.org/papers/w18082 (last checked on May 30 2018)

had “no skin in the game” because he would just arrange the loan and get paid a commission. He never had to worry if the loan failed. The bank on the other hand that provided the funds for the loan, resold it out to a third party immediately. Therefore when the loan exploded the borrower lost his home and the investor lost his money but the intermediaries suffered no losses.

In the second hypothesis the housing crisis can be explained by government failure. It emphasizes on government policies that could have been designed to promote certain goals but ended up leading to crisis. In this case demand for housing was driven by government subsidies and incentives in order to expand home ownership. An example of this was the deduction of mortgage interest paid, from income that a taxpayer/borrower was allowed. When weighing his options, a taxpayer had a strong incentive to buy a house versus renting one as rental payments ended up in the landlord’s pocket whereas purchase payments led to tax deductions and exemptions. On the other hand “*The housing and Community Development Act of 1992*” established an affordable housing loan purchase mandate to *Fannie Mae* and *Freddie Mac*. Initially, the 1992 legislation required that 30 percent or more of *Fannie's* and *Freddie's* loan purchases be related to affordable housing . In 1995 the GSEs began receiving affordable housing credit for purchasing mortgage backed securities which included loans to low income borrowers. Under the Bush Administration, HUD (Department of Housing and Urban Development) continued to pressure Fannie and Freddie to increase affordable housing purchases to as high as 56 percent by the year 2008[42]. In other words, *Fannie Mae* and *Freddie Mac* had been acquiring large numbers of subprime and other high risk loans in order to

[42] See Financial Crisis Inquiry Commission, Ibidem, p. 498

meet HUD's affordable housing goals and regulators had failed to monitor them.

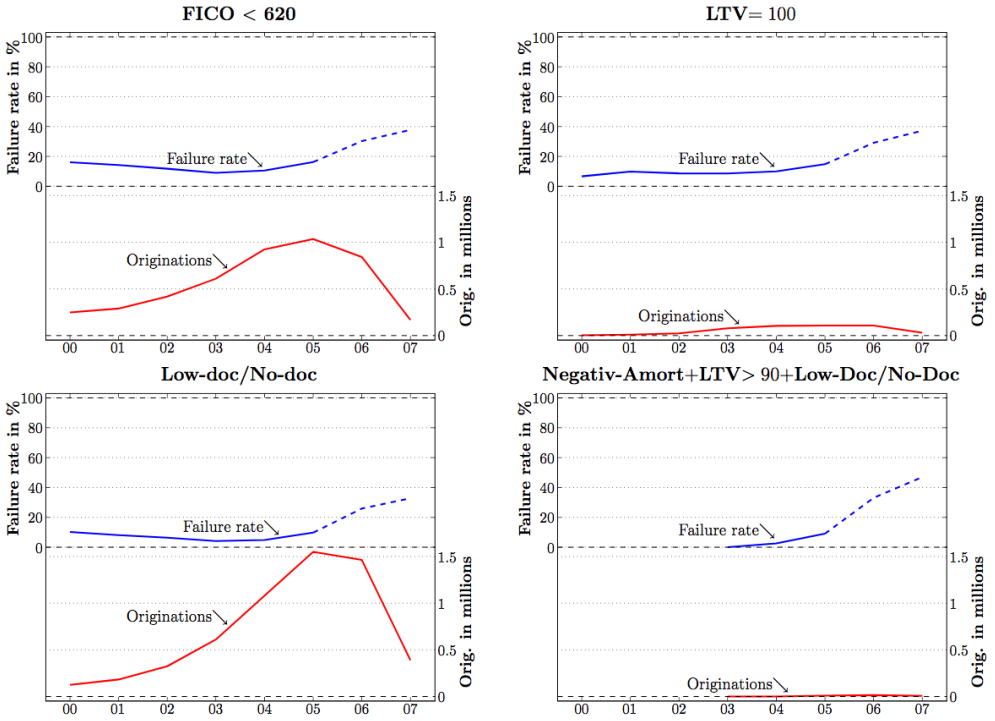
The third hypothesis attributes the housing crisis to bubble thinking. Demand came from consumers who viewed houses as a good investment whose value never decreases. If asked most people will tell you that their house price is likely to rise. This belief often stems from a misconception of the difference between real and nominal prices[43]. Nominal prices will rise as inflation[44] rises. Thus people falsely believe that the real value rises as well which is not true if there is no appreciation relative to the basket of goods that they actually buy. On behalf of the supply side, which consisted of banks and institutional investors, there was also an assumption that housing prices would never fall by very much. Therefore the housing based assets were considered good opportunities. To add a contributing factor to this bubble thinking it should be said that it is more likely to happen after a long period of stability. And in the U.S., despite the recessions, there was indeed a long period of stability since the Great depression and there was no apparent sign that the entire financial or housing system would collapse.

Based on the evidence analyzed below the first theory cannot support the hypothesis that the housing crisis was crated by moral hazard or bad behavior. Some critics of the lending process have argued that the very existence of some types of mortgages is *prima facie* evidence that borrowers were misled. These critics maintain that reduced-documentation loans, loans to borrowers with poor credit histories, loans with no down payments and option ARMs were all "*designed to fail*"[45] so

[43] See https://en.wikipedia.org/wiki/Real_versus_nominal_value_(economics) (last checked on May 30 2018)
[44] See http://www.imf.org/external/pubs/ft/fandd/basics/inflat.htm (last checked on May 30 2018)
[45] The phrase "*designed to fail*" appears in speeches by presidential candidate Hillary Clinton, Senator Charles Schumer of New York and press releases from prominent attorneys general including Martha Coakley of Massachusetts and Catherine Cortez Masto of Nevada. See Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Ibidem p. 7

no reasonable borrower would willingly enter into such transactions. But the fact is that the large majority of loans originated from 2000 through 2005 as shown in the figure below were successful.

Figure 4. Failure Rates and Originations for Selected Nonprime Mortgages



Source: Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis, 2012, Working paper No. 18082. http://www.nber.org/papers/w18082

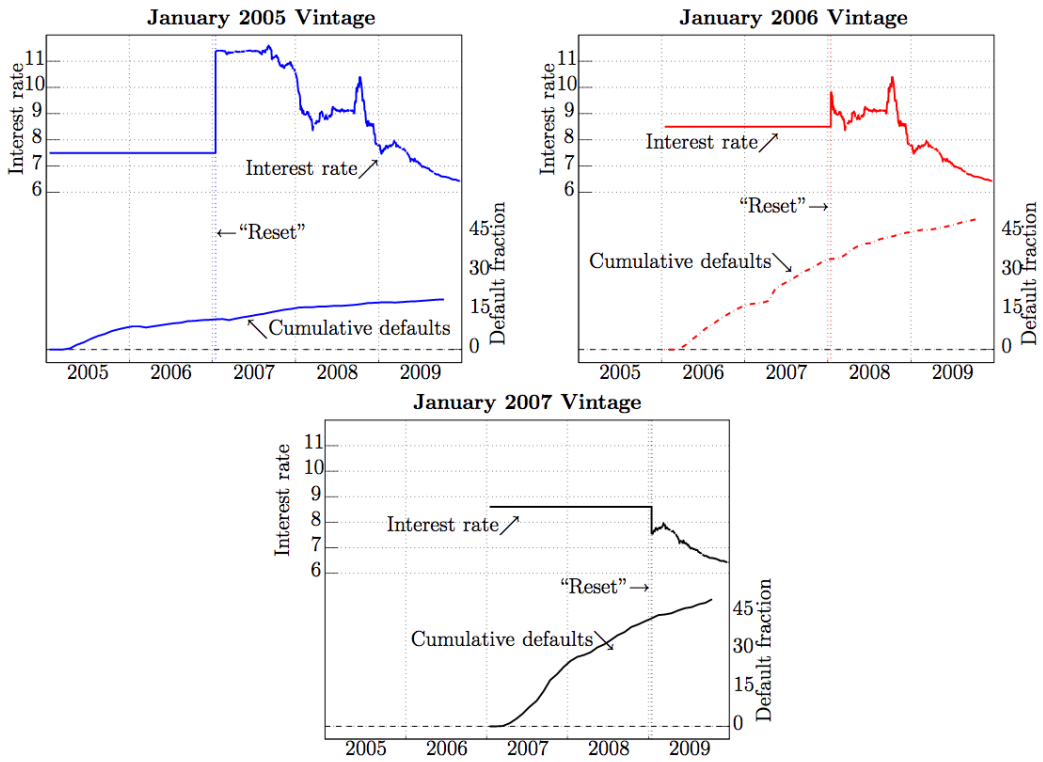
The lower left panel, for example, shows that in 2007 only 10% of borrowers who took out low or no documentation mortgages in 2005 were having serious problems. Additionally, loans requiring no down payments (top right panel) and even risk- layered loans (bottom right panel) originated before 2006 also display failure rates that are well under 10%. Loans in the upper left panel were made to borrowers with credit scores below 620, who typically had a history of serious debt repayment problems. Yet after two years, more than 80% of low- scoring borrowers

who originated loans before 2006 had either seriously avoided delinquency or had repaid their loans. The fact that that failure rates for all the loans in the above figure rose at about the same time suggests that these mortgages were not designed to fail, instead they were not designed to withstand the stunning nationwide fall in house prices that began in 2006[46].

Another theory (the exploding ARM theory) by critics suggests that borrowers took out loans they could not repay because their lenders misled them by granting them loans that initially appeared affordable but became unaffordable later on as well as that the borrowers had not realized that their payments would rise or had been assured that they could refinance to lower- rate mortgages when the resets occurred. What this theory assumes is that borrowers could have avoided foreclosures if they had been offered more traditional products such as 30- year fixed- rate mortgages. The following data though debunks this theory.

Figure 5. Interest Rates and Cumulative Defaults for Three Vintages of Subprime 2/28 Mortgages

[46] See Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Ibidem p. 7- 8



Source: Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis, 2012, Working paper No. 18082. http://www.nber.org/papers/w18082

The above charts show the path of interest rates and defaults for three vintages (the year the loans were taken out) of the most problematic type of ARM, the so- called 2/28s. These mortgages had a fixed rate for the first two years than adjusted to fully indexed rates every six months for the loan's remaining 28 years. Typically the fully indexed rate was a fixed amount over some short- term rate, for example 6 percentage points above the six- month LIBOR. For the January 2005 originated loans the initial interest rate was 7.5% for the first two years. In January 2007 the interest rate rose to 11,4% resulting in a payment shock of 4 percentage points or more than 50% in relative terms. However, the lower part of the January 2005 panel shows no significant problems for the 2005 borrowers two years into their mortgages and after their resets occurred. For the January 2006 loans even though the payment shock was smaller than the above

mentioned of the 2005 loans their delinquency rate was higher. Finally the loans originated in 2007 that reset in January 2009 had the highest delinquency. In detail, these loans fully indexed rates were actually lower than their initial rates but because the contract of a typical 2/28 loan specified that the interest rate could never go below the initial rate they were considered fixed rate loans. But as the lower part of the January 2007 panel indicates, these "fixed- rate" loans had the highest delinquency rates of any vintage shown in the above figure. Basically the majority of foreclosed borrowers- 84%- were making the same payment at the time they defaulted as when they originated their loans. Looking at these figures it is very difficult to come to the conclusion that the reset had any effect on default rates.

Perhaps the most compelling evidence against the first hypothesis, the moral hazard or inside job theory concerns the distribution of gains and losses among market participants. In the table below statistics of losses during the crisis are summarized.

Figure 6. Mortgage- Related Losses to Financial Institutions from the Subprime Crisis as of June 18 2008[47]

	Institution	Loss ($ billions)		Institution	Loss ($ billions)
1	Citigroup	42.9	11	Washington Mutual	9.1
2	UBS	38.2	12	Credit Agricole	8.3
3	Merrill Lynch	37.1	13	Lehman Brothers	8.2
4	HSBC	19.5	14	Deutsche Bank	7.6
5	IKB Deutsche	15.9	15	Wachovia	7.0
6	Royal Bank of Scotland	15.2	16	HBOS	7.0
7	Bank of America	15.1	17	Bayerische Landesbank	6.7
8	Morgan Stanley	14.1	18	Fortis	6.6
9	JPMorgan Chase	9.8	19	Canadian Imperial (CIBC)	6.5
10	Credit Suisse	9.6	20	Barclays	6.3

[47] This date was chosen by the authors prior to the Lehman bankruptcy to avoid contamination from a wider financial crisis.

Source: Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis, 2012, Working paper No. 18082. http://www.nber.org/papers/w18082

Each one of the above institutions as seen above lost more than $6 billion during the financial crisis. Ironically the list omits Bear Stearns, the one firm most closely associated with the subprime market, because in March 2008 *JPMorgan* acquired the firm in an assisted sale to prevent it from filling for bankruptcy. An even closer look at the *Bear Stearns'* story provides evidence against the view that mortgage industry insiders profited at the expense of outsiders. In particular its executives had made major personal investments in the firm's two hedge funds that had heavily invested in subprime- related securities.

The same conclusions, that go against the inside job theory, can be drawn for the below chart which shows the exposure of the "insiders" to very unsafe investments.

Figure 7. Exposure of Financial Institutions to Housing Risk on the Eve of the Crisis

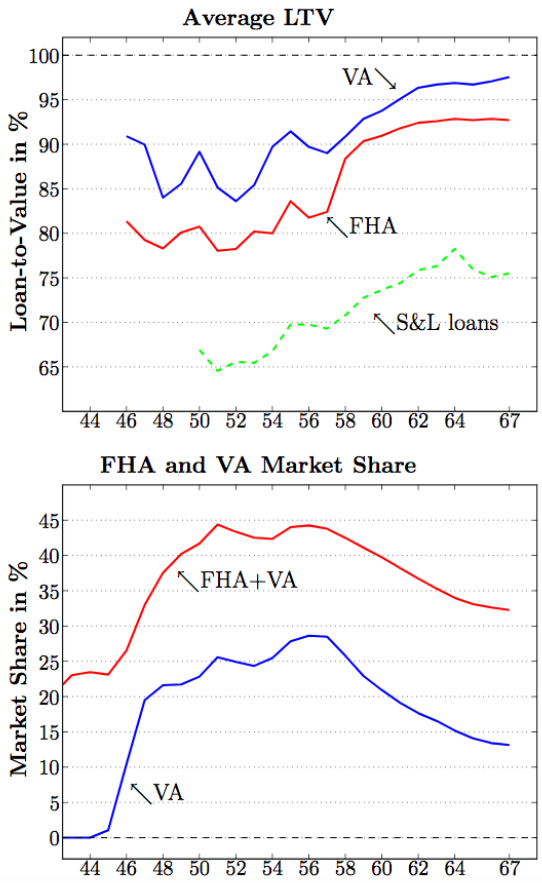
Entity	Loans	HELOC +2nds	Agency MBS	Non-Agency AAAs	CDOs (resi. subs)	Residential subs	Total Exposure
US banks/Thrifts	2,020	869	852	383	90	0	4,212
GSEs/FHLB	444	0	741	308	0	0	1,493
Broker/Dealers	0	0	49	100	130	24	303
REITs	0	0	82	10	0	0	92
Hedge Funds	0	0	50	51	0	24	126
Money Managers	0	0	494	225	0	24	743
Insurance Cos.	0	0	856	125	65	24	1,070
Overseas	0	0	689	413	45	24	1,172
Financial Guarantors	0	62	0	0	100	0	162
Others	461	185	550	21	45	0	1,262
Total	2,925	1,116	4,362	1,636	476	121	10,680

Source: Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis, 2012, Working paper No. 18082. http://www.nber.org/papers/w18082

Futher, evidence for the second hypothesis, that government failure was the main driver for the housing crisis, is equally weak. It is important to adopt a historical perspective in order to understand the weakness of this theory. First of all it should be recognized that the most significant U.S. government involvement in the mortgage market started just after WWII, not in the years that led up to the crisis. In 1944 the GI Bill was enacted into law, also know as the Servicemen's Readjustment Act of 1944[48]. The government promised to take a first- loss position equal to 50% of the mortgage balance, up to $2,000,00 on mortgages originated to returning veterans. The limits on the Veteran's Administration (VA) loans were subsequently and repeatedly raised, while similar guarantees were later added to loans originated through Federal Housing Administration (FHA).

Figure 8. FHA and VA Loan Programs in the Immediate Postwar Era

[48] G. I. Bill. See https://en.wikipedia.org/wiki/G.I._Bill (last checked on May 30 2018)



Source: Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis, 2012, Working paper No. 18082. http://www.nber.org/papers/w18082

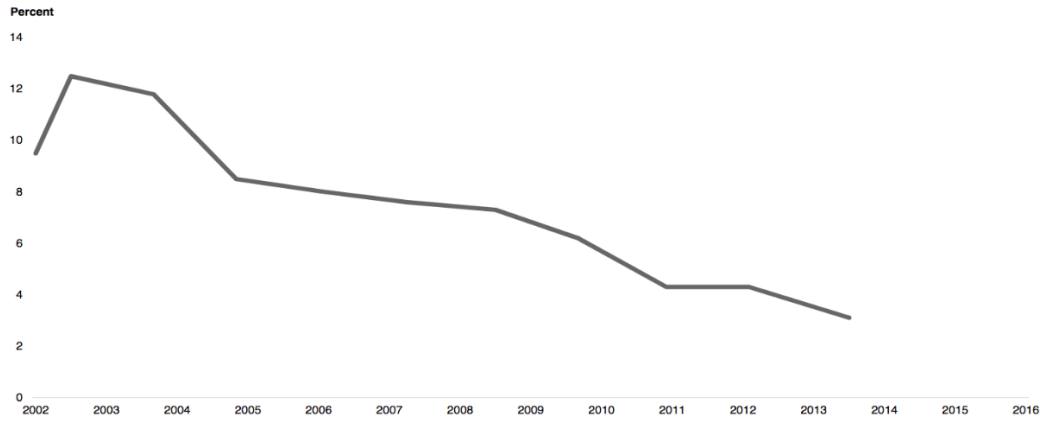
In the figure above, the top panel[49] shows that borrowers took advantage of these government programs to buy houses with little or no money down. By the late 1960s, the average down payment on a VA loan was around 2%. A large fraction of borrowers put down nothing at all. The evidence therefore shows that government involvement in the early postwar mortgage market was broad. The bottom panel in figure 8 shows that together, the FHA and VA accounted for almost half of originations in the 1950s before tailing off somewhat in the 1960s. So mortgages with very

[49] The top panel in figure 8 graphs average loan-to-value (LTV) ratios for various types of loans, including those with FHA and VA insurance.

little or no down payment at all were prevalent decades before the mortgage crisis began.

On the contrary, there is a preponderance of evidence backing "*the bubble theory*". The below chart (figure 9) shows that as of 2004, just as the number of loans were exploding the average expectation for ten year home price increase was 12%. In other words people were expecting for the prices of homes to go up by 12% within ten years. It should be noted that real house prices for about 100 years prior to the housing crisis were approximately flat. Even in 2008 as the financial crisis was beginning, the expectations of home price increase were approximately 8%. So if one expected that home prices would rise he had every reason to take out a loan and buy one even if he believed that in a couple of years he would have to refinance that loan. On the part of the mortgage suppliers, those who were issuing the loans, and the investors, who were ultimately buying them, as prementioned and shown, there was a large loss due to their exposure to the riskiest of the loans. And, as it will be demonstrated below, although they did understand that there would be very bad effects on mortgage backed securities in case of a housing downturn they still invested in them because they believed that that scenario had low probabilities of manifesting.

Figure 9. Ten Year Home Price Expectations



Source: Robert Shiller, Pulsenomics

Figure 10. Conditional Forecasts of Losses on Subprime Investments from Lehman Brothers (August 2005)

Name	Scenario	Probability	Cum Loss
(1) Aggressive	11% HPA over the life of the pool	15%	1.4%
(2)	8% HPA for life	15%	3.2%
(3) Base	HPA slows to 5% by end-2005	50%	5.6%
(4) Pessimistic	0% HPA for the next 3 years 5% thereafter	15%	11.1%
(5) Meltdown	-5% for the next 3 years, 5% thereafter	5%	17.1%

Source: Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis, 2012, Working paper No. 18082. http://www.nber.org/papers/w18082

Figure 11. Views on House Price Appreciation from JPMorgan Analysts

Date of	Data from	Title
12/8/06	10/06	"More widespread declines with early stabilization signs"
1/10/07	11/06	"Continuing declines with stronger stabilization signs"
2/6/07	12/06	"Tentative stabilization in HPA"
3/12/07	1/07	"Continued stabilization in HPA"
9/20/07	7/07	"Near bottom on HPA"
11/2/07	9/07	"UGLY! Double digit declines in August and September"

Source: Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Why did so many people make so many ex post bad decisions? The causes of the foreclosure crisis, 2012, Working paper No. 18082. http://www.nber.org/papers/w18082

In figure 10 different scenarios are displayed. First of all what can be observed is that, for example, in the pessimistic case, *Lehman* analysts suggested that if there was a 0% rise in house prices, meaning they were stable for three years, they would experience a loss of 11,1%. In reality though prices were already as mentioned above stable for more than 100 years in terms of real prices. This shows that their numbers were not well calibrated to history. The next fact that can be identified is that investors knew that subprime investments would turn sour if housing prices fell. The meltdown scenario for housing prices implied cumulative losses of 17,1% on sub- prime backed bonds. Such losses would be large enough to wipe out all but the highest- rated tranches[50] of most deals.[51] What's most interesting though were the probabilities that were assigned to each of these cases. They had only assigned a 5% probability to the meltdown case which actually explains why they were so willing to buy these bonds.

One of course could remark that *Lehman Brothers* failed so it is no surprise that they had gotten the probabilities wrong. But it wasn't only the latter financial institution making predictions that stabilization was on the horizon. *JPMorgan*, the bank with the most resistance during the crisis, and its analysts were convinced six months prior to the worst phase of the housing crisis that the climate would improve as seen in figure 11.

[50]Tranches are pieces of debt or securities designed to divide risk or group characteristics in order to be marketable to different investors. Each portion, or tranche, is one of several related securities offered at the same time but with varying risks, rewards and maturities to appeal to a diverse range of investors. Tranches in structured finance are a fairly recent development, spurred by the increased use of securitization to divide up sometimes-risky financial products with steady cash flows to then sell these divisions to other investors. The word "tranche" comes from the French word for slice. See https://www.investopedia.com/terms/t/tranches.asp#ixzz5I8oqM7FY (last checked on May 30 2018)

[51] See Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Ibidem p. 59

Bubbles are examples of mass delusions and they are always lurking. They do not need securitization, government involvement or non-traditional lending products to get started. Bubbles in many other assets have occurred without any of the above[52]. As the housing bubble inflated it encouraged lenders to extend credit to borrowers who had been constrained in the past since higher house prices would ensure them repayment of the loans. It was, therefore, expectations of higher house prices that made investors willing to use both securitized markets and non-traditional mortgage products- because those markets and products delivered the biggest profits as housing prices rose- not securitization per se.

Global Savings Glut

Safe assets[53] are assets which, in and of themselves, do not carry a high risk of loss across all types of market cycles. Their key feature is their *information insensitivity* meaning that the asset is insensitive to information. Another way to describe the nature of safe assets is that they lack *adverse selection*[54]. Each party participating in a transaction concerning a safe asset has the same information. Examples of such assets are currency, government bonds of stable countries such as Germany and the U.K. as well as insured deposits[55].

[52] From the tulipmania during the 17th century in Holland to the South Sea Company in the 18th century in England and technology stocks in the 1990s in the U.S. See Christopher L. Foote, Kristopher S. Gerardi, Paul S. Willen, Ibidem p. 4. Also see Robert Z. Aliber and Charles P. Kindleberger, Ibidem, p. 18

[53] Safe Asset. See https://www.investopedia.com/terms/s/safeasset.asp#ixzz5I99RtjD8 (last checked on May 30 2018)

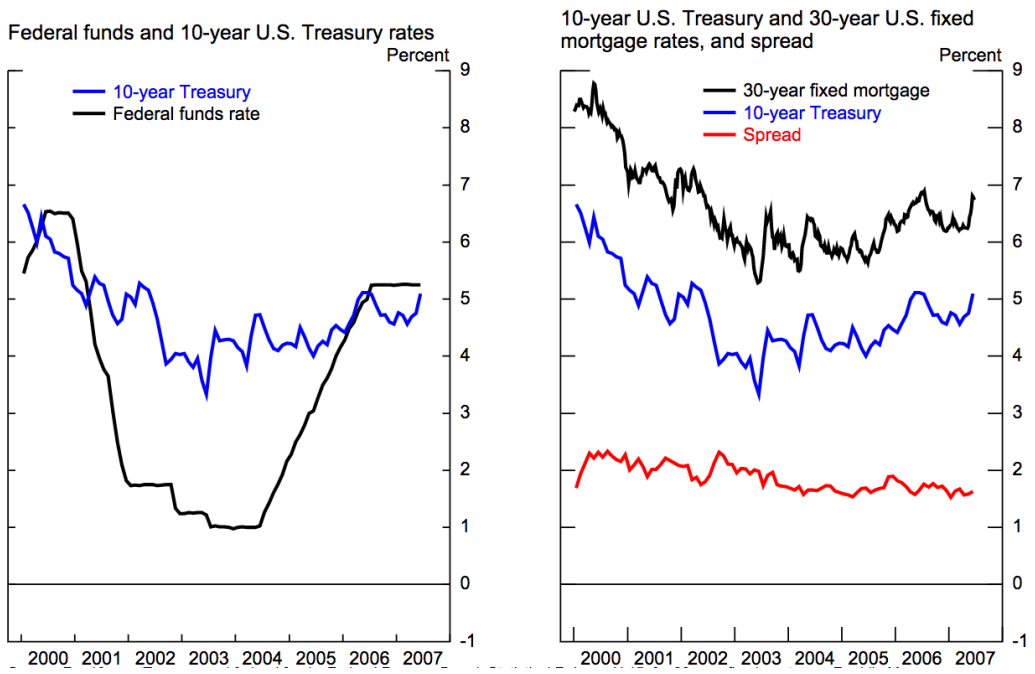
[54] Adverse Selection. See https://en.wikipedia.org/wiki/Adverse_selection (last checked on May 30 2018)

[55] The Federal Deposit Insurance Corporation (FDIC) is a United States government corporation providing deposit insurance to depositors in U.S. commercial banks and savings institutions. The FDIC was created by the 1933 Banking Act, enacted during the Great Depression to restore trust in the American banking system. More than one-third of banks failed in the years before the FDIC's creation,

Prior to the U.S. crisis, over the period of five years, during 2003 through 2007, there was a sudden strong demand for safe assets in the country. How the events unfolded, what caused this phenomenon and what it resulted in is thoroughly analyzed below.

First of all, between 2003 and 2007, short- term interest rates in the United States increased by about 4% while long- term Treasury security yields remained relatively contained at low levels as seen in the following chart

Figure 12. Federal Funds Rate/ 10- Year U.S. Treasury Rate/ 30- Year U.S. Fixed Mortgage Rates



Source: Ben S. Bernanke, Carol Bertaut, Laurie Pounder DeMarco and Steven Kamin, International Capital Flows and the Returns to Safe Assets in the United States, 2003-2007, 2011, Board of Governors of the Federal Reserve System International Finance Discussion Papers No. 1014 http://www.federalreserve.gov/pubs/ifdp/

and bank runs were common. The insurance limit was initially US$2,500 per ownership category, and this was increased several times over the years. Since the passage of the Dodd–Frank Wall Street Reform and Consumer Protection Act in 2011, the FDIC insures deposits in member banks up to US$250,000 per ownership category. See https://en.wikipedia.org/wiki/Federal_Deposit_Insurance_Corporation (last checked on May 30 2018). Also See https://www.fdic.gov/deposit/covered/categories.html (last checked on May 30 2018).

Alan Greenspan[56] famously referred to this development as a "*conundrum*" during which bond yields, both in the U.S. and abroad, fell below levels that were consistent with standard macro fundamentals such as inflation, growth in GDP and fiscal balances. The ten- year Treasury rate, seen above as the blue line, is the long term borrowing by the government. The Federal funds rate is basically the rate at which interbank borrowing occurs and is managed by the Federal Reserve. In fact, the ten-year Treasury rate is an effort to combine short- term rates over a period of ten years. In the early 21st century the Federal Reserve tried to combat the relatively mild recession by lowering the federal rates which is illustrated in the above right chart by the black line which is at it's lowest point in 2003. Following that year it began raising interest rates expecting for the long- term rate to follow which had also hit its lowest point that year (2003) nearing 3%. Despite increasing short- term rates more than 4 percentage points over the next four years, long- term rate moved up only about 1.5%. This, to many economists was a puzzle. The consequence of this can be seen in the right chart. The black line represents the 30- year mortgage rate and the red line demonstrates the spread between the latter and the 10-year Treasury rate (blue line). These move together very closely as shown above which resulted in the mortgage rate being about 1.5%- 2% above the 10-year rate and thus at very low rates which contributed to the house boom and the rise of home prices.

There are a number of explanations for the weakness in Treasury yields during this period including declines in risk premiums and enhanced demands for long- term assets by pension funds and other institutional investors. Additionally, the weakness can be attributed to heavy purchases of securities by emerging market economies running current account

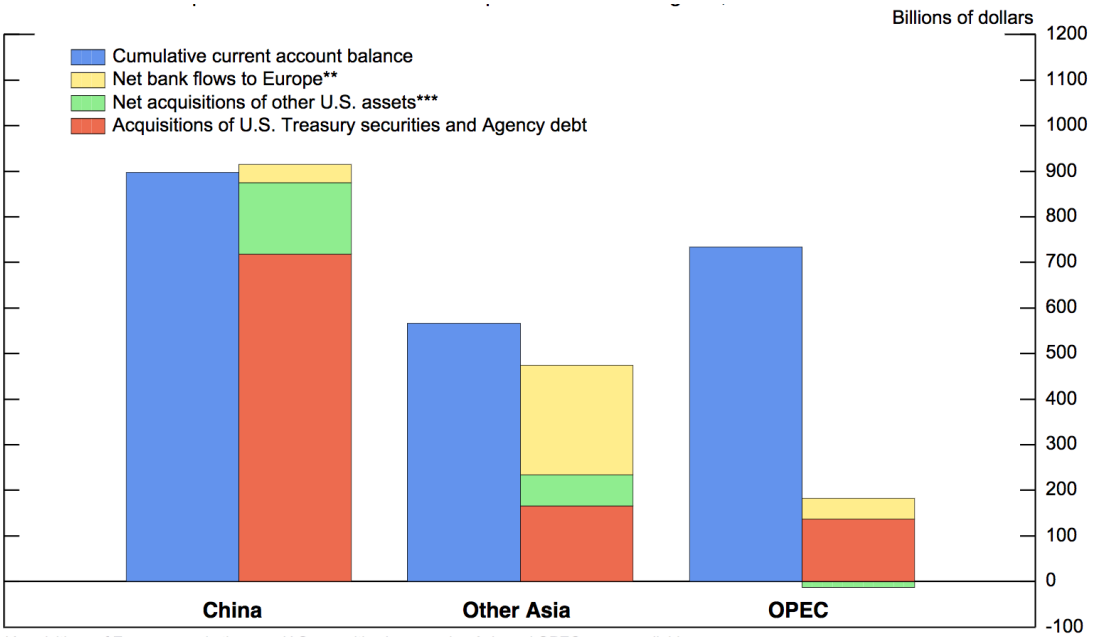
[56] Alan Greenspan. See https://en.wikipedia.org/wiki/Alan_Greenspan (last checked on May 30 2018)

surpluses, particularly emerging Asia and the oil exporters. *Ben Bernanke* argues that in these countries investment rates had fallen short of desired saving, creating a global saving glut that resulted in net capital outflows to the rest of the world and, as a consequence, declines in long- term interest rates[57]. Essentially there was a great demand in long- term government bond assets which kept the price of those assets high. When this happens the return on the bond, namely the rate, is low.

The surpluses in the global savings glut countries were due to the 1997-98 Asian financial crisis which substantially reduced investment in emerging Asia, as well as to the run- up in oil and commodity prices in the following decade which provided commodity exporters with more revenues than they could spend productively at home in the near term. High saving rates in rapidly growing emerging- market economies also contributed to the surpluses. These emerging market economies sought safe, high- quality financial assets that their own governments and financial systems could not provide but were being produced in advanced economies. It is interesting to note that most of the acquisitions of U.S. assets by GSG countries were in the form of official inflows. They were willing to run current account surpluses in order to finance the acquisition of these safe assets. The notable depth, breadth and apparent safety of U.S. financial markets led these emerging economies to direct most of their capital outflows to the United States.

Figure 13. Current account surpluses and certain financial acquisitions of GSG regions, 2003-2007*

[57] See Ben S. Bernanke, Carol Bertaut, Laurie Pounder DeMarco and Steven Kamin, *International Capital Flows and the Returns to Safe Assets in the United States, 2003-2007*, 2011, Board of Governors of the Federal Reserve System International Finance Discussion Papers No. 1014. Available at http://www.federalreserve.gov/pubs/ifdp/ (last checked on May 30 2018)



*Acquisitions of European and other non-U.S. securities by emerging Asia and OPEC are unavailable.
**Bank flows to Europe calculated from BIS data.
***Other U.S. assets comprises corporate securities, bank assets, and other miscellaneous assets included in the Financial Accounts.

Source: Ben S. Bernanke, Carol Bertaut, Laurie Pounder DeMarco and Steven Kamin, International Capital Flows and the Returns to Safe Assets in the United States, 2003-2007, 2011, Board of Governors of the Federal Reserve System International Finance Discussion Papers No. 1014 http://www.federalreserve.gov/pubs/ifdp/

In figure 13 it is shown that on net, China's current account surpluses were used almost wholly to acquire assets in the U.S. more of 80% of which consisted of very safe Treasuries and Agencies[58]. The other emerging Asian economies used their current account surpluses to purchase roughly equal amounts of safe U.S. assets and European bank deposits. Moreover, more than three- forths (3/4) of GSG countries' U.S. security holdings consisted of AAA-rated debt, mainly treasuries and Agencies, whereas these categories accounted for only 36% of total U.S. securities outstanding[59]. GSG acquisitions of U.S. Treasuries and Agencies took these assets off the market, creating a notional scarcity that boosted their price and reduced their yield. Because GSG investments were for purposes of reserve accumulation and guided by considerations of safety and

[58] Agency debt from Fannie Mae and Freddie Mac.
[59] See Ben S. Bernanke, Carol Bertaut, Laurie Pounder DeMarco and Steven Kamin, Ibidem

liquidity, those countries continued to concentrate their holdings in Treasuries and Agencies even as yields on these securities declined. However, other investors were now induced to demand more of assets considered substitutable with Treasuries and Agencies, putting downward pressure on interest rates on these private assets as well. Thus the interest rates on conforming mortgages declined from their levels at the start of the decade.[60]

Apart from the above mentioned countries advanced economies had also a strong demand for U.S. safe assets. The most prominent source of gross capital flows into AAA- rated securities from 2003 to 2007 was Europe[61]. These acquisitions stepped up markedly from the 1998-2002 period and were nearly as large as those of the GSG countries. Unlike the latter countries, Europeans purchased a much wider range of assets, particularly substantial amounts of non- AAA- rated securities such as corporate bonds (which while not receiving the highest rating were nonetheless investment grade)[62]. So European asset preferences were considerably broader than those of GSG countries. European investors held a much smaller share of their portfolio of U.S. assets in Treasuries and Agencies than did GSG countries, while holding a much larger share in AAA- rated asset- backed securities (including private- label Mortgage Backed Securities- MBS), as well as in equities and lower- rated debt.

Furthermore, European investments in the U.S. seem unlikely to have been motivated exclusively by the same above mentioned objectives as the investments of the GSG countries. First of all, reductions in longer-

[60] See Ben S. Bernanke, Carol Bertaut, Laurie Pounder DeMarco and Steven Kamin, Ibidem

[61] Europe is represented as the euro area members during that period with the addition of the United Kingdom.

[62] Taking into account both European purchases of AAA- rated securities and those that were just a little less highly rated, net European acquisitions of apparently safe U.S. assets almost certainly exceeded those of the GSG countries. See Ben S. Bernanke, Carol Bertaut, Laurie Pounder DeMarco and Steven Kamin, Ibidem

term interest rates in Europe undoubtedly generated interest in assets such as U.S. MBS that offered slightly higher returns while still being highly rated. Also, financial globalization likely also motivated acquisitions of U.S. assets. Third, much of the investment in U.S. MBS around the world came from expanding off- balance- sheet vehicles of large global banks, and many of those banks were located in Europe. A final possibility is that the regulatory capital charges levied on banks that set up off- balance- sheet conduits to invest in U.S. MBS were inadequate, which also served to encourage investments in these assets.

Another difference between GSG and European investors, which is also quite interesting with regards to the latter, is that whereas the GSG countries were running current account surpluses and investing their accumulated wealth in U.S. securities, Europe was running roughly balanced accounts and was financing its acquisition of U.S. securities through external borrowing[63].

Given the strength of demand for safe assets and the desire to accommodate that demand it was not surprising that a process that transformed risky loans into highly rated securities was developed. Not only was there a surge in new mortgage loans but the share of these that were considered riskier rose substantially as well and yet remarkably they were rated AAA[64]. Pooling loans and establishing tranches (a process

[63] Its acquisition of external claims was financed by issuance of external liabilities which were tilted towards traditional securities and bank deposits. While capital inflows to purchase European sovereign debt helped finance the acquisition of external assets by Europe as a whole, there is no presumption that these inflows financed external asset accumulation by European governments themselves. Specifically Europe was a net lender abroad to nonbank corporations but was a net recipient of international interbank flows and other deposits from abroad during this period. As became apparent after the financial crisis broke, many European financial institutions were funding their purchases of U.S. assets with short- term dollar denominated liabilities like commercial paper or bank deposits much of which attracted U.S. investors. See Ben S. Bernanke, Carol Bertaut, Laurie Pounder DeMarco and Steven Kamin, Ibidem, p. 10-12

[64] See Ben S. Bernanke, Carol Bertaut, Laurie Pounder DeMarco and Steven Kamin, Ibidem

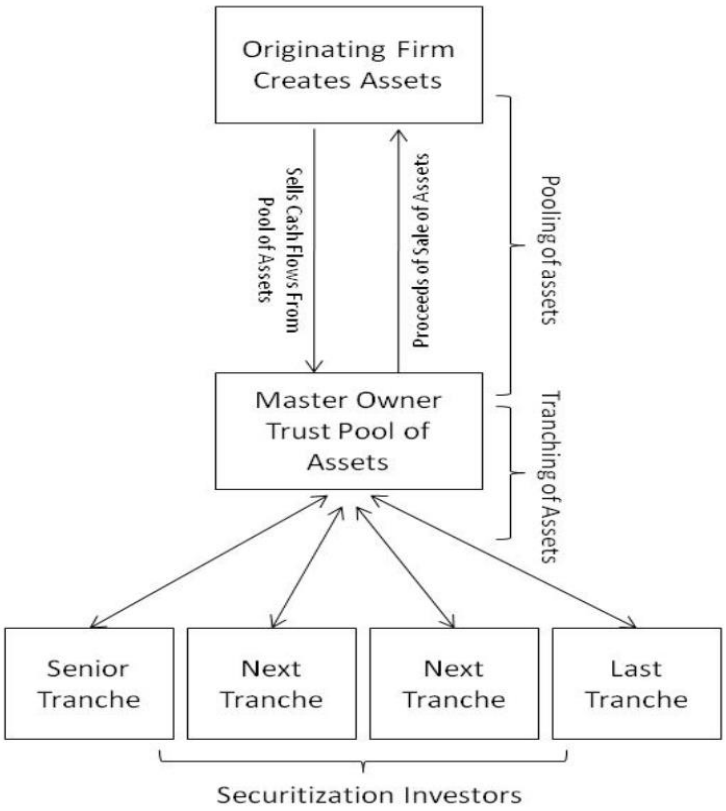
called securitization which is analyzed below) with a pre- established priority ordering for payments allowed many securities to be deemed much safer than the average loan in the underlying pool. There were profits to be made by selling securities at a price that ultimately proved much higher than the value of the underlying collateral. But the willingness of investors to deliberately take on additional risk was limited. They were willing to reach for some additional yield by purchasing AAA- rated MBS rather than Agency debt but they likely would have not absorbed BBB- rated MBS in significant quantities. The combination of heavy demand for highly rated MBS along with the transformation of risky mortgages into highly rates MBS by the financial services industry increased the demand for new mortgage originations.

Consequentially, the subsequent bursting of the housing bubble and the recognition that many of these securities were far riskier than had previously been recognized helped trigger the financial crisis.

Securitization is the process in which certain types of assets are pooled so that they can be repackaged into interest- bearing securities. The interest and principal payments from the assets are passed through to the purchasers of the securities[65].

Figure 14. Securitization Process

[65] See Andreas Jobst, *What is Securitization?*, 2008, Finance & Development.



Source: Gary Gorton, Andrew Metrick, Securitization, 2011, Handbook of the Economics of Finance, Volume 2a, Elsevier

In its most basic form, the process involves two steps. In step one, a company with loans, for example a bank with mortgages on its balance sheet, or companies with other income producing assets such as an auto company which originates auto leases or a credit card company with credit card debt, also called "*the originator*" identifies the assets it wants to remove from its balance sheet and pools them into what is called the reference portfolio. It then sells this asset pool to an *issuer*, such as a special purpose vehicle (SPV), the above "*Master Owner Trust*" in figure 14, which is an entity set up, usually by a financial institution, specifically to purchase the assets and realize their off balance- Sheet treatment for legal and accounting purposes. In step two, the issuer finances the acquisition of the pooled assets by issuing tradable, interest- bearing securities (asset-

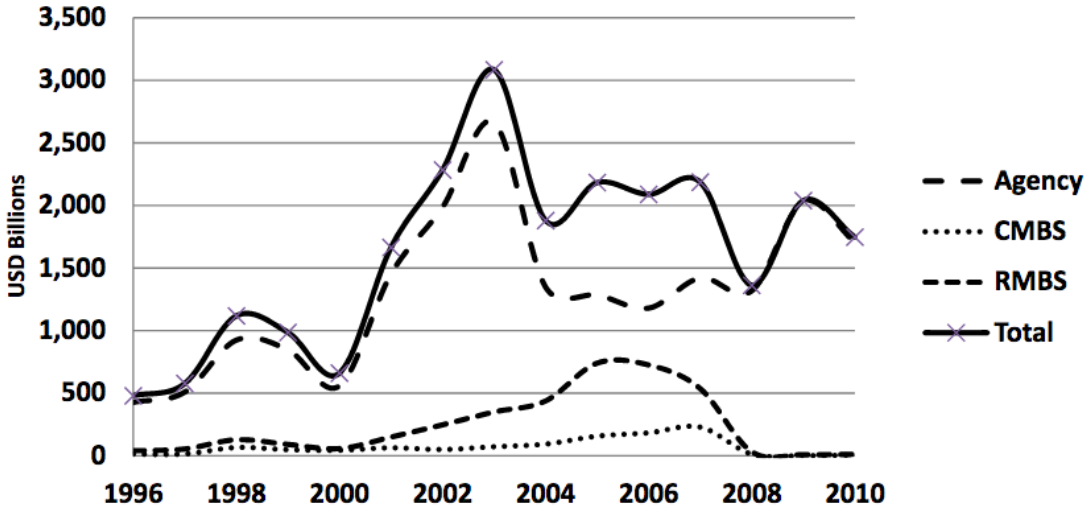
backed securities) that are sold to capital market investors. The investors receive fixed or floating rate payments from a trustee account funded by the cash flows generated by the reference portfolio. In most cases the originator services the loans in the portfolio, collects payments from the original borrowers, and passes them on, less a servicing fee, directly to the SPV or the trustee. The reference portfolio is divided into several slices, called tranches, each of which has a different level of risk associated with it and is sold separately. Both investment return and losses are allocated among the various tranches according to their seniority. The least risky tranche for example has first call on the income generated by the underlying assets, while the riskiest has last claim on that income[66].

Asset- backed securities were at the core of the financial crisis of 2007-2009 because they were to a large extent used as collateral in sale and repurchase agreements and as assets held by asset- backed commercial paper conduits. In July of 2007 ABCP had a value of $1.2 trillion and Repo of around $10 trillion.

Further, in the United States, mortgage- backed securities were issued mainly by GSEs, Fannie Mae and Freddie Mac up until about 2003.

Figure 15. U.S. Mortgage Related Securities Issuance

[66] See Andreas Jobst, Ibidem



Source: Gary Gorton, Andrew Metrick, Securitization, 2011, Handbook of the Economics of Finance, Volume 2a, Elsevier

In the above chart one observes that in the period up to 2003 the lines representing the total amount of MBS being issued and MBS issued by the Agencies almost coincide and in any case are very close together. After 2003, the gap between the two lines begins to grow. This gap illustrates and represents the number of private label mortgage backed securities being issued by other entities. At the bottom we find the RMBS line that signifies the residential mortgage backed securities which consist of residential mortgages that did not qualify for the GSEs guarantee based on the standards and conditions required as studied earlier. Last, the CMBS line reflects commercial mortgage backed securities, securities backed by commercial loans to business which also have no government guarantee.

In the United States in the early 2000s there was also a sharp increase in non- mortgage asset- backed securities.[67]

[67] See Gary Gorton, Andrew Metrick, *Securitization*, 2011, Handbook of the Economics of Finance, Volume 2a, Elsevier, p. 84

Notable Events 2007- 2008

By the summer of 2007, the subprime market was imploding. By that point it was publicly known that the housing market was having significant troubles. Borrowers with "*no-doc*" loans (loans without proof of income), "*liar*" loans (with inflated claims about income) and "*NINJA*" loans (borrowers with no income, no job and no assets) were defaulting in droves. The second largest subprime lender, *New Century Financial* whose market capitalization was approximately $1.75 billion at the beginning of that year went bankrupt on April 2 2007[68]. *Countrywide Financial*[69] revealed that it was running out of cash. Meanwhile the price of insuring bonds backed by subprime mortgages against default was soaring, These events prompted rating agency *Standard & Poor* to warn that hundreds of those bonds could be down-graded.

Bear Stearns, the fifth largest independent investment bank at the beginning of 2007, was also having trouble. *Bear Stearns* had several funds that were part of its asset management division. Two of those funds were specifically active in subprime securities. By early June 2007 they had borrowed up to about $10 billion to make leveraged investments in subprime securities and were unable to make payments on all of that borrowing. They finally collapsed.

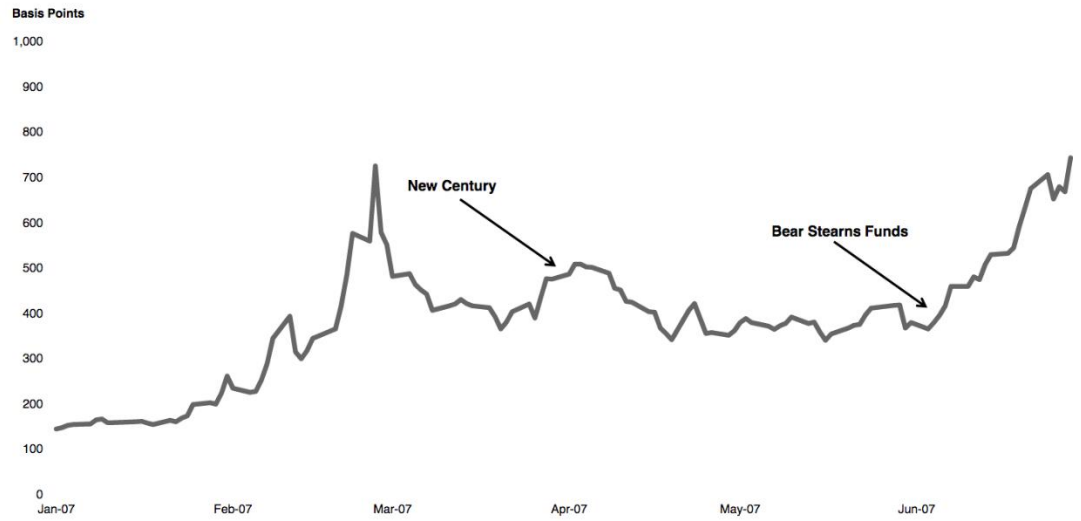
The ABX and in particular the ABX-HE (home equity) index[70] was an index of CDS written on subprime mortgage securitizations. Specifically, this index reflected the average price, across the various dealers in this business, for insuring subprime securities, in five rating

[68] See https://en.wikipedia.org/wiki/New_Century (last checked on May 30 2018)
[69] See https://en.wikipedia.org/wiki/Bank_of_America_Home_Loans (last checked on May 30 2018)
[70] See https://en.wikipedia.org/wiki/Asset-backed_securities_index (last checked on May 30 2018)

categories from AAA down to BBB. Thus, this index depicted the level of riskiness of subprime securitizations, that is, securities that were collateralized by subprime mortgage loans. This index was first released in January 2006 covering the twenty largest subprime securitizations of the last six months of 2005. Up to that point there had been no quantified information about the subprime market. It eventually stopped being released mid-January 2007 because by then subprime activity had slowed down tremendously.

Figure 16. ABX.HE Spreads 2006-1 Series, BBB Rating

January- July 2007



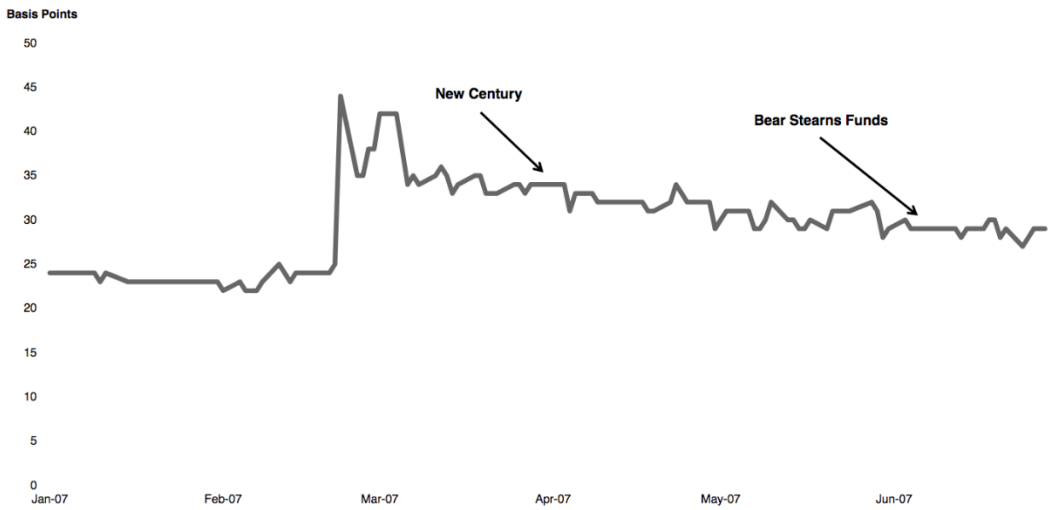
Source: Markit

The line depicted above shows the spread, that is, the risk premium one would have received for insuring against default of the BBB tranche of subprime securitizations issued the last six months of 2005. From January 2007 to the end of February 2007 we notice a large increase of about 550 basis points. Basically one can think of it as a 5.5% increase in the cost to insure oneself against the default of the above securitizations. Increases are also seen around the time of the *New Century* bankruptcy

filing as well as during the suspension of redemptions by Bear Stearns funds.

Figure 17. ABX.HE Spreads 2006-1 Series, AAA Rating

January- July 2007



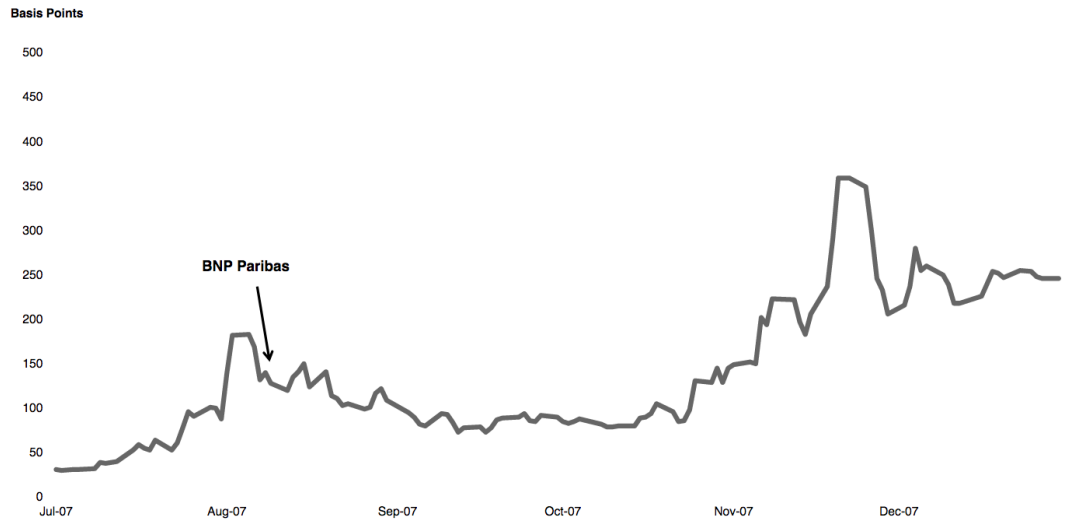
Source: Markit

Accordingly, the spreads for the same period and securitizations can been seen above in figure 17 for AAA rated tranches. Here the picture is different as these securities were considered very safe but by end of February 2007 we do notice a spike of about 20 points. Nevertheless, up to the middle of 2007 AAA rated securities still seemed to not be at risk despite the New Century and Bear Stearns events.

Over the summer months of 2007 however and prior to the BNP Paribas announcement that we will go through later, we begin to notice that even AAA securities are not perceived as safe anymore. This is quite significant because up to this point due to this consideration (that AAA rated securities were very safe) nobody had dedicated resources into researching about them. That resulted in an immediate run and by December of 2007, as shown below, it cost over 350 basis points to insure triple A tranches.

Figure 18. ABX.HE Spreads, 2006-1 Series, AAA Rating

July- December 2007



Source: Markit

In a speech on May 17 2007[71], Chairman *Ben Bernanke* famously said " *given the fundamental factors in place that should support the demand for housing, we believe the effect of the troubles in the subprime sector on the broader housing market will likely be limited, and we do not expect significant spillovers from the subprime market to the rest of the economy or to the financial system.*". This statement clearly turned out to be false even though it was announced at a time when the news about subprime was already well- known. What was not known, however was the location of subprime risk meaning which securitized bonds were exposed to subprime and which financial institutions would need to support their investment vehicles (as in the case of Bear Stearns). Fundamentally the financial system is not equipped to analyze safe investments and it never does. In fact one could point out that not having to dedicate informational resources before purchasing a very safe asset, such as a AAA security, is

[71] See Ben S. Bernanke, *The subprime Market*, May 17 2007. Available at https://www.federalreserve.gov/newsevents/speech/bernanke20070517a.htm (last checked on May 30 2018)

inherent in the notion itself. Not surprisingly therefore, if, for example, one becomes nervous about the solvency of the bank where his savings are deposited he will not analyze whether his fear is well-founded, he will run. The same applies to investors- they run once they start realizing that something perceived very safe at one time, no longer is or seems to be.

Whereas the ABX index was used to measure subprime, a different index was needed to measure the spread of anxiety from subprime into the overall financial system. The LIBOR-OIS was used to do just this. Essentially the latter gives an illustration of "how worried" the market participants are about banks and their exposure to subprime.

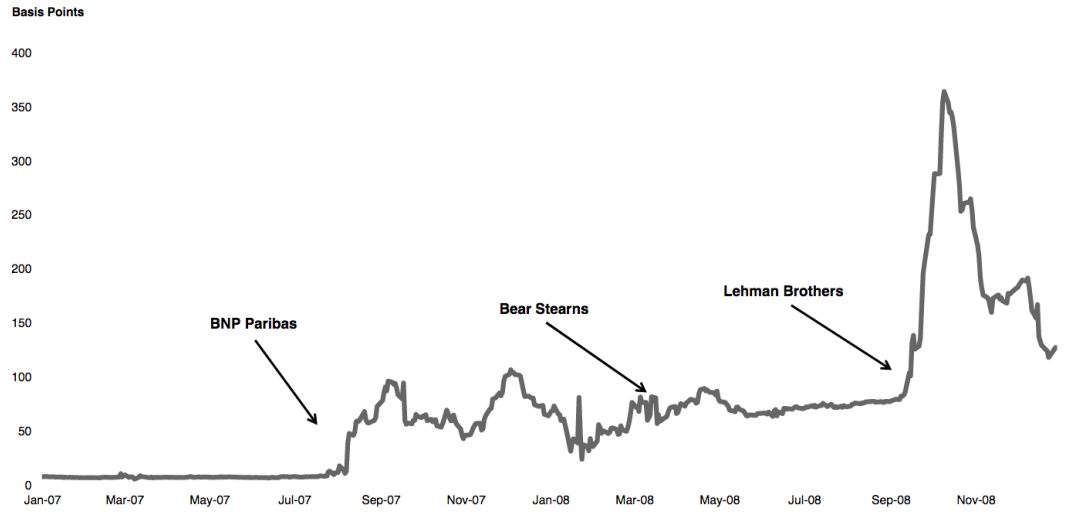
The LIBOR-OIS[72] is made up of two components and it reflects the spread between the LIBOR[73] and the OIS[74]. LIBOR is the London Interbank Offered Rate, which is a measure of the interest rates that banks charge each other for unsecured dollar funding over various time periods (overnight, one- month, three- month etc.). It's basically not an actual rate rather it depicts the cost of unsecured borrowing for banks from other banks and indicates how risky it is considered by market participants to lend to banks. The OIS is the Overnight Index Swap which is a fixed-floating interest- rate swap for various time periods. It is considered to be a good proxy for risk- free interest rates because the amounts owed daily are small and counterparties must continuously post collateral for expected payments.

Historically, the spread has been minimal exactly because throughout most of history there was not much concern that a bank would

[72] See https://www.investopedia.com/articles/active-trading/061114/what-ois-libor-spread-and-what-it.asp (last checked on May 30 2018)
[73] See https://en.wikipedia.org/wiki/Libor (last checked on May 30 2018)
[74] See https://en.wikipedia.org/wiki/Overnight_indexed_swap (last checked on May 30 2018)

not be able to pay back its debts over time horizons like overnight or over one or three months.

Figure 19. 3 Month LIBOR- OIS Spread



Source: Bloomberg

The chart in figure 19 shows the three month LIBOR- OIS spread, that is the difference between the average cost for a bank to borrow in a unsecured way over a three month time horizon and the proxy for what a true risk-free rate would be over the same period. At the beginning of 2007 and up to the end of the first half of that year the spread was at its historical average below 10 basis points despite the nervousness around the subprime markets. The first jump in this spread occurred right around the BNP Paribas announcement that it was unable to price the subprime securities[75]. This created anxiety that led to pressure. Starting from this point any unsecured borrowing by banks became between 50 and 100 basis points more expensive. This had drastic implications on banking institutions especially since they were highly leveraged in some cases nearly 30 to 1 or even 35 to 1[76]. Just a few months later, in early 2008 Bear Stearns would

[75] See Timothy F. Geithner, Ibidem, p. 117

[76] These numbers represent the ratio of debt to equity meaning that for every 1 dollar of their equity the banks had borrowed 30 or 35 dollars respectively.

be rescued by JP Morgan[77]. After the Lehman Brothers event of September 15th 2008 the LIBOR- OIS spread exploded to levels never seen before reaching over 350 basis points. This essentially was a run on the banking system.

How in particular we got to the point of the Lehman Brothers event is explained in detail below.

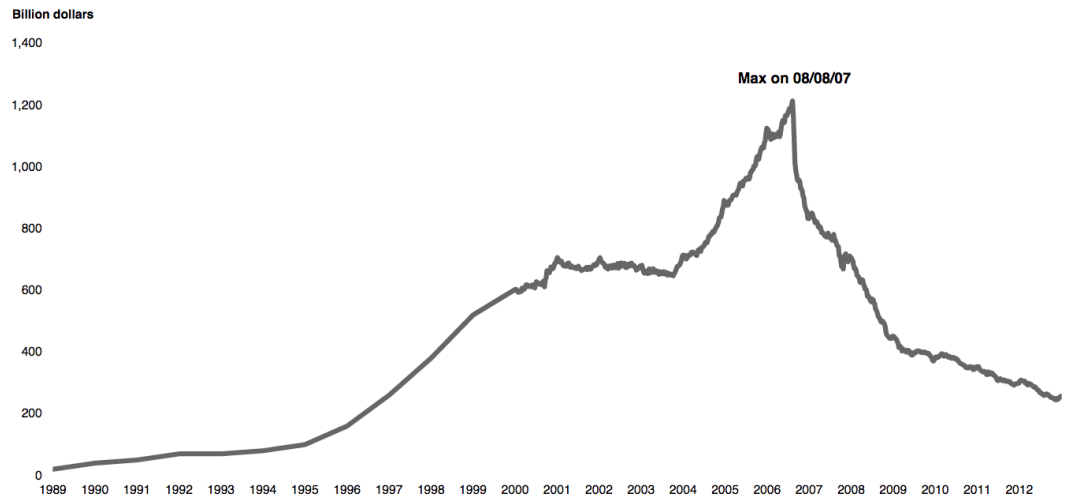
Asset- backed commercial paper (ABCP) is primarily a method of maturity transformation- funding a pool of long- term assets with short-term liabilities. This type of maturity transformation is basically what banks do. They hold onto their balance sheets mortgage debt that will not mature fully for 30 years and the latter becomes part of their assets. They also issue demand deposits, as liabilities, that can be withdrawn at any time. These actions typically lead to maturity transformation. As a result therefore, banks have long maturity assets and short maturity liabilities. Asset- backed commercial paper does the same thing but off the balance sheet. First of all, it is a legal entity. Further it holds assets that have fairly long maturities and issues liabilities that are much shorter. Asset-backed commercial paper is designed to meet specific needs of investors. Often, these investors are money market mutual funds. MMMFs are restricted with regards to the types of investments they are allowed to make, meaning they are allowed to make short- term investments only. If there are not enough short- term investments available then an intermediary buys a long-term investment and then issues short- term paper that can be provided to MMMFs, this being the manufacturing process of short- term assets. It should be mentioned that to ensure that an ABCP conduit is safe there is a credit enhancement provider that guarantees its credit. There is also a liquidity provider, often a bank, that provides alternative sources of funds

[77] See Timothy F. Geithner, Ibidem, chapter 4

in case the investors refuse to roll over their short- term debt. This will enable the conduit to pay back the old investors[78].

Even though ABCP seems similar to securitization it does have important differences. Conduits' investments can be revolving and fluctuate in size. A securitized vehicle on the other, defines what it will be buying from the beginning and then there are no further decision to be made. ABCP vehicles may invest in various asset types thereby creating diversified portfolios whereas a securitized vehicle invests in one type of assets, for example only in mortgage debt or only in auto loans etc. ABCP conduits typically engage in maturity transformation, as opposed to what happens in securitization, relying on liquidity support for potential repayment shortfalls caused by asset and liability mismatches. Finally there is no scheduled amortization of assets and liabilities in CP vehicles so they can last in perpetuity, that is, there is no reason they cannot continually roll over their debt since they are not designed to end at any specific time.

Figure 20. ABCP Outstanding



Source: Fitch Ratings, Federal Reserve Bank of St. Louis

[78] See FitchRatings, *Asset- Backed Commercial Paper explained*. Available at http://people.stern.nyu.edu/igiddy/ABS/fitchabcp.pdf (last checked on May 30 2018)

As the above figure shows Asset- backed commercial paper programs grew rapidly in the 1990s and then again during the global saving glut period from 2003 to 2007. Their growth primarily coincides with the period during which the US government was running surplus (1998-2001)[79] and was therefore decreasing the amount of safe government debt. That is when we start seeing some notable growth in ABCP, with about 600 billion outstanding at the beginning of the 21st century. Then, during the GSG period we notice a rise of ABCPs to about $1.2 trillion. Right after the BNP announcement there was a precipitous fall as illustrated in the graph above during the 4th quarter of 2007 that continued throughout 2008 and beyond. These events made investors nervous that some of these programs had exposure to the subprime securities that BNP Paribas could not value.

As defined in a paper by Covitz, Liang and Suarez[80] an asset- backed commercial run is when a program enters a run during a week in which it does not issue despite having 10% or more of its outstanding paper scheduled to mature. The program continues in a run until it issues again[81]. Nearly 40% of ABCP programs were in a run at the end of 2007. Not all programs were exposed to subprime so they generally should have stayed safe but because there was a climate of general uncertainty all of them were in danger of a run. Once these programs were in a state of run, it was time for the liquidity support providers, meaning in most of the cases the banks, to intervene and start lending the money needed. The latter would have to source the funds in the interbank markets which as mentioned above were

[79] See https://fred.stlouisfed.org/series/FYFSD (last checked on May 30 2018). Also see http://politicalticker.blogs.cnn.com/2010/02/03/cnn-fact-check-the-last-president-to-balance-the-budget/ (last checked on May 30 2018)

[80] See Daniel Covitz, Nellie Liang and Gustavo A. Suarez, *The evolution of a financial Crisis: Collapse of the Asset- Backed Commercial Paper Mar*ket, 2013, The Journal of finance 68, 815-848. Available at https://www.jstor.org (last checked on May 30 2018)

[81] See Daniel Covitz, Nellie Liang and Gustavo A. Suarez, Ibidem, p. 817-818

already charging 50-100 basis points higher rates. By end of 2007 the amount of ABCP outstanding was down by about $350 billion, but this amount was still owned and was ultimately the amount which would have to be funded through the interbank markets. As analyzed in the above paper the programs not only were fewer by August of 2007 but even the ones that remained in the market were perceived as risky enough by investors that maturities shortened significantly. We started seeing new issues maturing in two weeks, one week or even overnight. That meant that even small events could have very rapid effects which was actually what did happen during the panic phase of the crisis.

Northern Rock[82]

Northern Rock was a British lender in North East of England that ended up requiring assistance and suffering a run in September of 2007. What's most interesting about Northern Rock is that it had vey little exposure to subprime. In fact its main problem was that it had exposure to the overall wholesale funding markets that suffered a lot of anxiety in the beginning of summer of 2007.

Northern Rock went public in 1997 and grew at a annual rate of over 20% for the next ten years. It was the 5th largest UK bank by mortgage assets as of June 2007. Northern Rock focused on prime lending and had minimal subprime exposure. Due to its rapid growth which surpassed the traditional deposit pace it relied on nontraditional funding sources (wholesale funding markets) in order to support all of its investments. Some of these nontraditional funding sources though began drying up over summer of 2007 and efforts to organize a private rescue of the bank failed.

[82] See Hyun Song Shin, Reflections on Northern Rock: The Bank Run that Heralded the Global Financial Crisis, 2009 Journal of Economic Perspectives Vol. 23 no.1, p 101- 119. Available at https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.23.1.101 (last checked on May 30 2018)

On September 13th of 2007 news broke that Northern Rock had sought assistance from the Bank of England. Once this became public the run began. And it was not the retail run that made the difference but in fact the wholesale run.

The lesson that came out of Northern Rock can be summarized by what Hyun Song Shin stated in his paper. He said *"… The real question raised by the Northern Rock episode is not so much why retail depositors are so prone to loss of confidence that lead to bank runs … the issue is why sophisticated lenders who operate in the capital markets chose suddenly to deny lending to a bank that had an apparently solid asset book and virtually no subprime lending …"*[83]. And this is important because it expresses exactly what also happened on a larger, global scale and what essentially lead to the global financial crisis.

Monolines- Auction Rate Securities

In the sequence of interrelated events that lead to the financial crisis another factor that played its role was the development in the monoline and auction rate securities sector. Monolines[84] basically provide credit enhancement to municipal bond offerings. Beginning in the 1970s when municipalities would want to issue bonds, and due to the fact that not much was known about them to potential global lenders, in order to raise their credit they would insure these bonds with insurance companies, the monolines. In the 2000s, during the global savings glut, these insurance companies saw an opportunity to expand their activities to structured products such as securitizations. They began insuring structured products such as mortgage- backed securities. This business grew rapidly even

[83] See Hyun Song Shin, Ibidem, p. 102
[84] See Reuters, *What is a monoline bond insurer?*, January 25 2008. Available at https://www.reuters.com/article/us-bondinsurers-monolines/factbox-what-is-a-monoline-bond-insurer-idUKN2535212820080125 (last Checked on May 30 2018)

though these companies were not well capitalized. Further, there was bubble thinking in this sector as it was not expected in any way that all of this insurance would be needed at the same time. As of January 2008 the two largest insurers in this sector, *MBIA*[85] and *Ambac*[86] had a combined amount of $265 billion of guarantees on structured products whereas their equity was nowhere near this amount. When it became clear that even AAA securities were not safe the markets started worrying about their insurers ultimately leading to a vast fall of these companies' stock prices which nearly fell down to zero. This in turn transferred the problem to municipalities that were using these companies to guarantee their bonds.

To go a step further, during the anxiety period of the events noted previously there was a very large market of the so- called auction rate securities or ARS. If for example a small municipality needed to borrow it could do so through the arrangement of an investment bank arranging a bond offering. For small bond offerings, the problem is that there are not too many investors willing to invest as they are afraid that they will later not be able to find buyers to sell their bonds. In this case it can be very difficult to even sell these bonds in the first place nonetheless in the secondary market. In order to solve this problem investment banks have periodic auctions at which interest rates are also reset for the underlying debt. Another parameter to these auctions is that if one is interested in selling its securities but there is no buyer at a particular monthly auction, a broker dealer can purchase them and then unload them in the next auction. This of course involves risk for the broker. These types of auctions were mainly used for municipal bonds. Because the insurers were no longer considered reliable by the markets due to the reasons mentioned above this had an impact on the bonds that were using them as guarantors. Investors

[85] See MBIA https://en.wikipedia.org/wiki/MBIA (last checked on May 30 2018)
[86] See Ambac https://en.wikipedia.org/wiki/Ambac (last checked on May 30 2018)

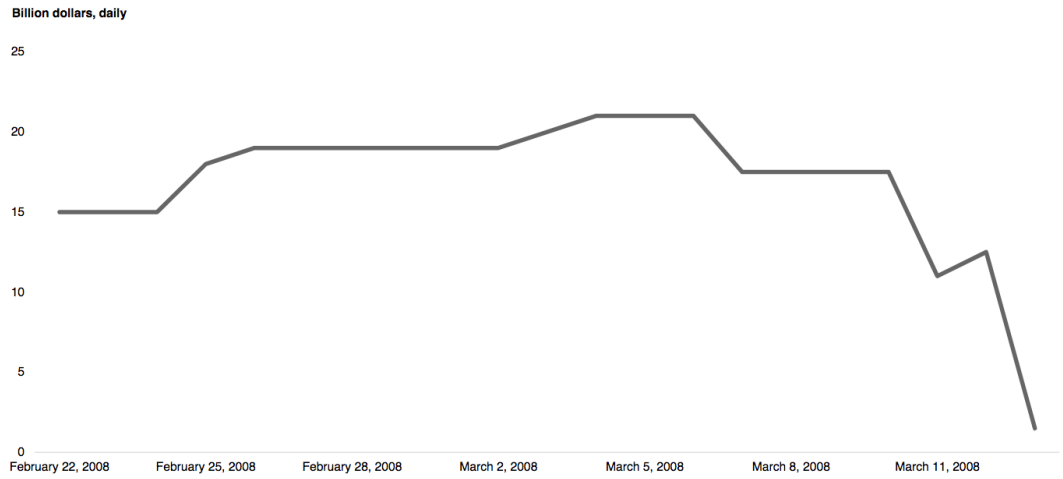
began wanting to sell the bonds through the auctions hoping that the investment banks would take them into their inventory. What began to happen in the beginning of 2008 was that auctions started failing, meaning no buyers would show up and investment banks were unwilling to pick up the unsold inventory. In January 2008 *Lehman Brothers* had its first failed auction and by mid- February of the same year more than 80% of these auctions were failing. This had an impact on municipalities as they were now required to pay higher interest rates on their debt.

From the above we begin to see how the collapse of many different parts of the shadow banking system, even small ones, ended up having real economic effects and how sectors with no association whatsoever with subprime ended up being affected and caught in the meltdown.

Bear Stearns

As mentioned above in June 2007 *Bear Stearns* suspended redemptions in two of its funds and then in July took those funds back onto their balance sheet effectively bailing them out. In other words what it essentially did was it paid off the lenders of the funds and took all of the funds' collateral onto its balance sheet. Although that was indeed a large hit for *Bear Stearns*, it was not enough to wipe out the company's equity and drive it into insolvency.

Figure 21. Bear Stearns Daily liquidity



Source: Securities and Exchange Commission

On February 22 2008 *Bear* seemed to have a liquidity of around $15 billion. On March 11 2008 its liquidity level collapsed to zero from nearly $20 billion it had on March 8 2008. It should be noted that this was an investment bank that had no retail deposits and therefore there was nothing obvious here to run. Even so, within a week, it went from being a substantial organization to being gone.

There are a variety of factors that will basically drain the liquidity from a wholesale financial organization just like retailors do by withdrawing their deposits and those were what drained *Bear Stearns'*. The first was that prime brokerage clients started closing their accounts with the firm. This was a problem because upon withdrawals the institution had to revert the securities of their clients, they were holding, back to them and could no longer lend them in order to receive cash. Another factor that lead to their collapse was the so- called novation of derivatives and collateral calls. Finally, there was a maturity shortening on *Bear Sterns'* secured "repo" loans that eventually lead to a run, draining $20 billion of liquidity in a week.

On March 13 2008 the Federal Reserve supported a *JPMorgan* buyout of *Bear Stearns* that was initially set at $2 per share and was later raised to $10 per share due to a class action filed on behalf of *Bear Stearns'* shareholders. The New York Fed agreed to lend *JPMorgan* $30 billion, backed by $30 billion worth of *Bear's* investment assets, to facilitate the merger.

Government Sponsored Enterprises (GSEs)

Fannie Mae and *Freddie Mac*, both government sponsored enterprises, as discussed earlier, held or guaranteed as of 2008 more than $5 trillion in mortgage debt. They were during that period funding three of every four new U.S. mortgages[87]. Part of the above amount reflected their guarantees on conforming loans and another part of it the loans they had purchased as investments. They had roughly between 30%- 40% of the subprime market share. By July 2008 GSEs were clearly in trouble. On July 11th 2008 the day that *IndyMac*, a California thrift[88] that was once part of the *Countrywide Financial* institution, failed *Fannie's* stock fell to $10.25, down 90% from its peak. One Wall Street analyst had calculated that they had at that point a capital shortfall of $75 billion. In 2008 *Fannie* had raised only $7.4 billion in new capital while *Freddie* had failed to raise anything at all. On September 7th of 2008 these two companies went into government conservatorship[89].

Lehman Brothers

The pivotal event of the panic phase of the financial crisis was the bankruptcy of *Lehman Brothers* on September 15th 2008. As of March

[87] See Timothy F. Geithner, Ibidem, p.169
[88] Thrift Bank. See https://www.investopedia.com/terms/t/thriftbank.asp (last checked on May 30 2018)
[89] See Federal takeover of Fannie Mae and Freddie Mac https://en.wikipedia.org/wiki/Federal_takeover_of_Fannie_Mae_and_Freddie_Mac (last checked on May 30 2018)

2008 the situation at *Lehman Brothers* was just as precarious as it was at *Bear Stearns*. It so happened that *Bear* failed first but it could have just as easily been *Lehman Brothers* at that time. As *Timothy Geithner* states throughout the first half of his book, *Stress test*, as president of the New York Fed his main anxiety was constantly *Lehman brothers*. One initiative that the Federal Reserve took in order to help non-banks during this period was to create the Primary Dealer Credit Facility (PDCF). The point of PDCF was to provide liquidity to the non- bank dealers. *Lehman Brother* did make use of it. Over the next six months following the *Bear Stearns* event *Lehman* tried to improve its capital liquidity. Just before the weekend it declared bankruptcy, *Lehman Brothers* had reported that as of September 10th it had $28 billion in shareholder equity. It also reported that it had about $54 billion in real estate but market participants thought that their value was approximately half of that[90].

Lehman's counterparties in derivatives, in commercial paper and in repo were pulling back in a variety of ways. They shortened the maturity, raised collateral requirements and took bigger haircut in repo transactions. *JPMorgan* put a lot of pressure on *Lehman* during this period making more and more requirements as its counterparty. Over the weekend of September 12th through September 14th the U.S. government tried to arrange a private rescue for *Lehman Brothers*. At that time it insisted that it would not spend public money on the rescue in order to send a message to the markets that it was they that had to play that role. *Bank of America* which was the main candidate to purchase *Lehman* decided to instead buy *Merill Lynch* over that same weekend which was under the same types of pressure. The negotiators then turned to *Barclay's*, a British bank which agreed to purchase *Lehman* but the deal was blocked by UK regulators. Without

[90] See Timothy F. Geithner, Ibidem, p. 183

sufficient liquidity to operate the next day and without any other options Lehman Brothers filed for bankruptcy early in the morning on September 15th of 2008. This would be the final spark leading to the panic phase of the financial crisis.

On September 16th 2008 the *Reserve Primary Fund*, a very large MMMF, "*broke the buck*"[91] basically meaning that the value of its portfolio fell below the amount ($0.995) that it was allowed to round up to the dollar. Its parent entity was not able to provide it with the capital needed in order to avoid this situation. This was due entirely to its exposure to *Lehman Brothers* commercial paper. This fund had lent *Lehman* and the day following its failure the value of that commercial paper plummeted[92]. Because these funds are the classic type of safe assets they are information insensitive so when the *Reserve Primary Fund* "*broke the buck*" there was a run primarily by institutional investors. The run led quickly to panic on the part of all market commentators. Following September 15th an estimated $400 billion ran from prime MMMFs almost all of them flowing into government MMMFs. This was only halted by a government guarantee within days of the *Lehman* failure.

Up to this point we had seen collapse in the general unsecured lending markets. Finally, the secured lending markets began to collapse.

[91] If for example the value of a MMMF's portfolio is worth 99.8 cents on the dollar it is permitted to report it being worth 100 cents on the dollar. See Brake the Buck, https://www.investopedia.com/terms/b/breaking-the-buck.asp (last checked on May 30 2018)

[92] The Reserve Primary Fund was holding $785 million in value of Lehman Brothers debt. The Primary Fund was not unique in holding Lehman's debt at the time of its bankruptcy but other MMFs with Lehman exposures obtained sufficient support to avoid breaking the buck. What distinguished the Primary Fund was the inability of Reserve to provide the capital needed to absorb the MMF's losses. See Patrick McCabe, *The Cross Section of Money Market Fund Risks and Financial Crises*, 2010, working paper in the Finance and Economics Discussion Series, p. 9. Available at https://www.federalreserve.gov/pubs/feds/2010/201051/201051pap.pdf (last checked on May 30 2018)

The Response to the Crisis

As *Timothy Geithner* recounters in his book "*Stress test*" up until about February 2008 the Fed essentially let the crisis burn. It allowed a fair amount of failure among the weaker institutions across the system as seen above in cases such as *New Century*. In this first phase it had decided to only support the banking system and it took measures such as lowering interest rates aggressively and providing banks that fell under its authority with liquidity. During the second phase of the crisis, during March 2008 through the end of the summer of that year, when a surge in job loss appeared and the economy began to shrink the Fed had to step up and take further action. During this time it broke the line between banks and the rest of the system and extended its tools of funding liquidity to investment banks also. It also facilitated, as mentioned before, the merger *of Bear Stearns* with *JPMorgan*. The Secretary of Treasury went to Congress to get authority to help stabilize *Fannie* and *Freddie*.

In the third phase of the crisis, in the early part of September to the end of 2008, employment loss intensified dramatically and the decline of GDP was accelerating therefore requiring even further action on behalf of the Fed. During this period the Federal Reserve extended liquidity into critical markets of the American financial system; And it did so not only to investment banks that were outside of its protection but also to asset- back commercial paper. It provided support to *Citibank*, *Bank of America* and *AIG* and provided $3.5 trillion guarantees to the money market industry. It injected capital into institutions that represented about half of the banking system and provided bridge financing to the automobile industries which were facing the risk of collapse in the recession.

The FDIC had an emergency authority that allowed it to guarantee the creditors of a bank under its supervision. In the case of *WaMu* [93], however, it decided not to use that authority which accelerated the panic during that period. Weeks later it reversed course by facilitating a solution for *Wachovia*. After the TARP[94] was passed it also agreed to provide a mechanism to guarantee new borrowing by bank holding companies, an action which was critical in helping break the panic.

Due to the lack of a consistent strategy on the part of the regulators, saving some and leaving others to burn, even though there was an injection of trillions of dollars of support to the financial sector there was still uncertainty among investors who continued to run in the early period of 2009. That of course meant that banks were still in a stage of retreat, consequentially leaving the American economy without oxygen. The stress that was designed at this time helped resolve that problem. The Fed estimated the scale of losses that firms could face in the event of a worse recession and committed to disclosing that information. It also committed to ensure that these firms had enough capital to survive large losses. This broke the panic because there was now a clear picture of how the system would respond and a reassurance that more failures would not be allowed.

Europe in the Global financial Crisis

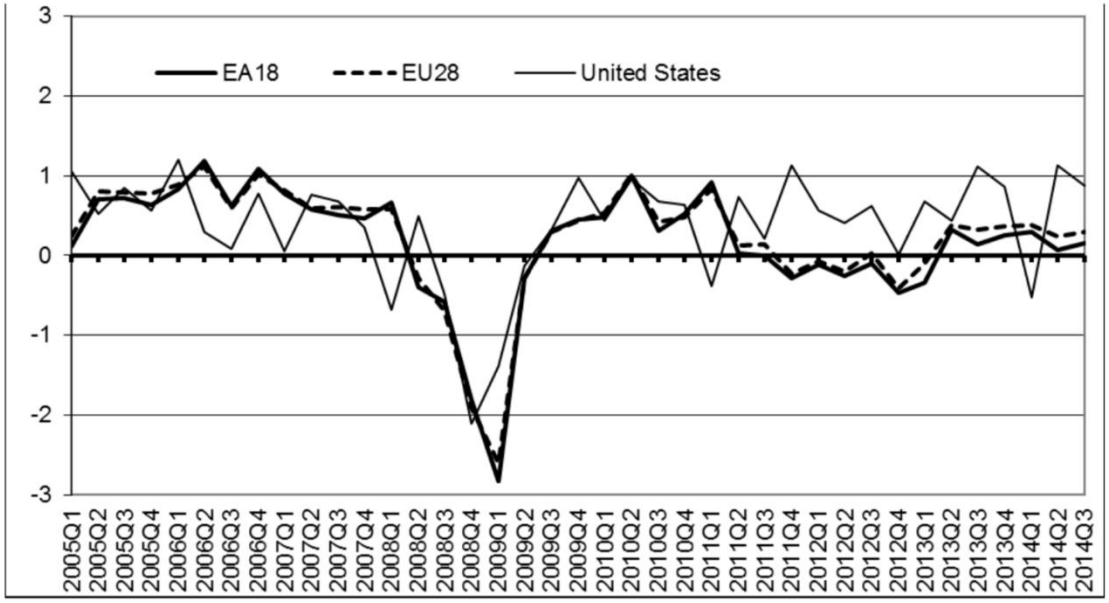
During the same period there were various events occurring throughout European countries. The first fact to note is that Europe has a different monetary structure than the U.S. In the United States there is a single currency whereas in Europe there is a subset of countries with a

[93] Washington Mutual. See https://en.wikipedia.org/wiki/Washington_Mutual (last checked on May 30 2018)
[94] Troubled Asset Relief Program.

mutual currency, the euro[95] and countries within the larger economic area with their own separate currencies. In Europe the crisis started as the global financial crisis but then grew into the so- called Eurozone crisis which was a problem specifically for the countries that shared the single currency of the euro. After a brief recovery from the global financial crisis the eurozone crisis caused a second recession.

Figure 22. EU28, euro area and U.S. GDP growth rates

% change over the previous quarter



Source: Eurostat

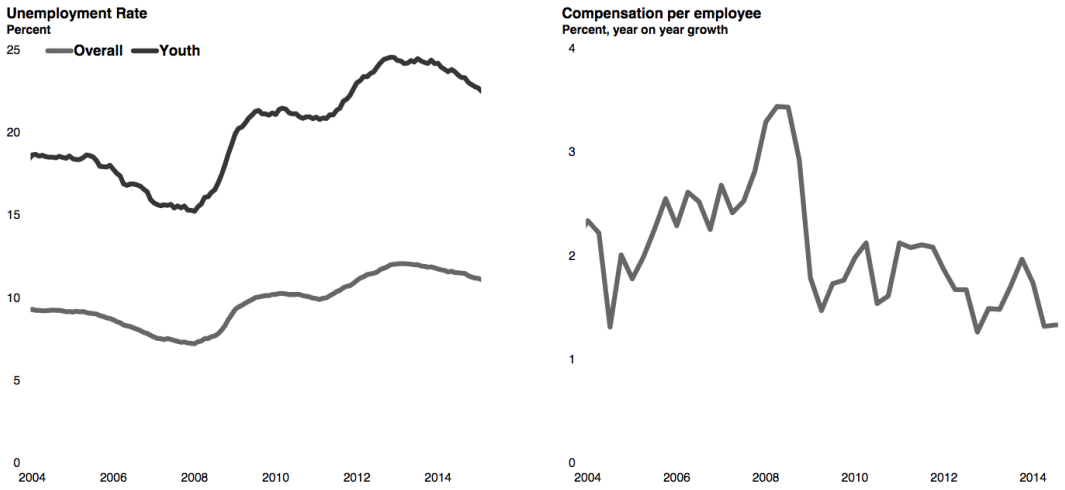
As seen in above chart, 2008 was the last time there was positive growth before the global financial crisis. Towards the second half of 2008 we began seeing negative growth. After two consecutive quarters of negative growth, the Eurozone countries entered a period of recession[96]. As we moved into 2009 the recession deepened until the eurozone actually had -3% GDP quarter on quarter growth. Europe recovered from the

[95] Euro. See https://en.wikipedia.org/wiki/Euro (last checked May 30 2018)
[96] What is recession. See https://www.investopedia.com/terms/r/recession.asp (last checked on May 30 2018)

recession, in early 2010 just like the United States did. There was a weak growth of below 1% for the next year and a half. In 2012 we see the Eurozone reentering recession (double dip recession) from which it did not recover until the end of 2013. As we move towards 2014 we notice the growth remains at very low levels.

The deep recession and then the brief recovery followed by a double dip recession can be depicted not only in the GDP figures but in unemployment rates also.

Figure 23. Unemployment in the Eurozone



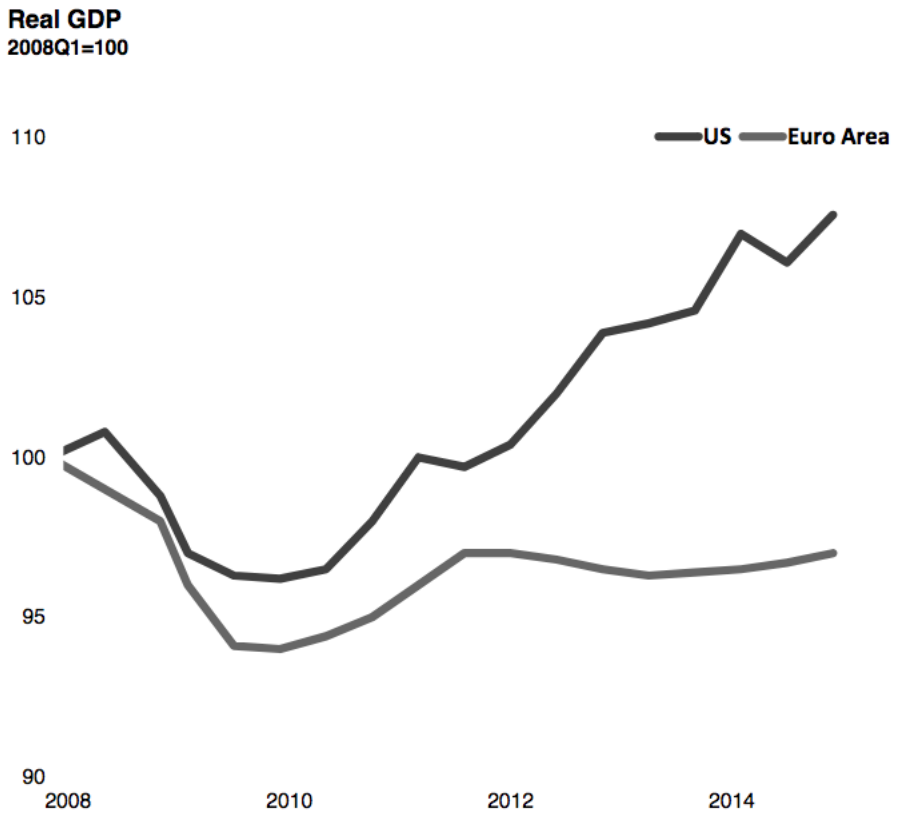
Source: Eurostat

The overall unemployment rate peaked to about 12% in 2013 whereas youth unemployment (the unemployed under the age of 25) was much more significant. It started off at about 17,5% right after the beginning of the global financial crisis and peaked to near 25% in 2013. Such levels of unemployment were very difficult to maintain socially and politically and were one of the reasons for seeing a rise of labor friendly parties in many Eurozone countries including Portugal, Spain, Greece and

Italy that have had the most severe problems. Additionally, we notice that the year on year growth rate for wages also fell right after 2008.

It is important to note that the economic effects of the global financial crisis and its aftermath were much worse in the Eurozone than in the United States. They started off looking fairly similar but while the U.S. started to recover after 2010, the Eurozone ran into a double dip recession.

Figure 24. Real GDP Eurozone- U.S.



Source: Eurostat

As illustrated in the above chart both the Euro area and U.S. real GDP fell during the global financial crisis. Both started to recover but in early 2011 when the U.S. began on a path of upward growth, the Euro area fell back down and only saw the first signs of slight recovery towards the end of 2013.

The global financial crisis was the major economic shock that started the ball rolling but it was the combination of three interlocking crises[97] in the banking sector, in sovereign debt and in growth that caused the crisis in the Eurozone to continue. The euro area faced a banking crisis where banks were experiencing a capital shortfall and interbank liquidity was restrained. At the same time it was facing a sovereign debt crisis during which Greece could not pay its debts in full and bondholders were concerned about other sovereigns as well. Finally, there was a macroeconomic crisis developing where slow growth and relative uncompetitiveness in the periphery added to the burden of some of the indebted nations.

When a banking crisis creates too many banking failures, it can in return lead to sovereign default as the latter tries to support the banks. When a country has a debt crisis, it can default or have it's debt restructured. Much of that sovereign debt is usually held by banks in that same country or in closely related countries. The sovereign debt crisis has a direct effect on growth and competitiveness in the country mainly because of austerity. The austerity measures imposed, such as cuts in government spending and larger taxation are an attempt to relieve the sovereign stress but actually end up harming the economy at least in the short run. Weak growth will result in even more problems for indebted sovereigns often leading to a default. Furthermore, growth and competitiveness also interact with a banking crisis. A weak economy will damage balance sheets of banks, weakening the latter. Once banks are weak and feel they do not have sufficient capital they reduce lending, thus slowing growth.

[97] See Jay C. Shambaugh, *The Euro's Three Crises*, 2012, Brookings Papers on Economic Activity

What differentiates the situation of the Eurozone from that of the U.S. is that in the case of the United States there was never a sovereign debt crisis and therefore there was less need for austerity. In fact in the U.S. the government implemented a stimulus program which helped significantly in the recovery.

The causes of the crisis in Europe were much the same as they were in the United States. There was excessive lending which in some countries led to a housing bubble and in other countries to a fast expansion of credit on the part of banks.

As mentioned above *Northern Rock* was the first bank casualty of the global financial crisis. European countries tried a variety of different actions to respond to this global crisis. On October 8th the U.K. announced a bank rescue package that included a liquidity scheme of $200 billion, a bank recapitalization fund and a guarantee of interbank lending. A similar combination of lending capital and guarantees was followed by countries in the Eurozone whose commitments totaled about $1.3 trillion. All together the European countries dedicated a vast amount of aid to their financial institutions. The largest supplier of aid overall was the United Kingdom which incidentally had the strongest recovery of these countries since the global financial crisis. One of the challenges faced, during this period though, by some of the European countries was that they did not have the capacity to provide such aid to their banks. Spain and Ireland, for example, which were experiencing housing bubbles in the period leading to the crisis lacked the capacity to support their banks with severe consequences especially in Ireland's case.

In Ireland, in the 2000s, loans increased much faster than GDP. During the savings glut period of 2003- 2007 the gap between GDP and total lending began to grow significantly. In 2008 the total amount of

lending in Ireland was over 400 billion euros compared to the Irish GDP which was 180 billion euros. So by 2008, Irish banks had lent 300% of the country's GDP. Of course this lending trend coincided with a housing bubble in Ireland. As house prices rose, the construction industry responded by building. In order to fund all of this activity Ireland's banks had to turn to non- traditional funding sources. The gap, during the period of 2002 through 2008, between deposits in seven large banks in Ireland and the amount of loans they were lending was at the beginning 26 billion only to grow to the amount of 129 billion euros by 2008. Two weeks after the *Lehman* failure, Irish banks were unable to fund the above gap that had grown 100 billion euros from 2002 to 2008. On September 30 2008 the Irish government responded by guaranteeing a total of 375 billion euros of liabilities for seven banks, which was about two times its GDP. This, though, was too big of a burden for the Irish government which ultimately required an international bailout in November of 2010.

Iceland, a small country with a population of about 320,000, was dominated during the 2000s by three banks, *Glitnir*, *Kaupthing* and *Landsbanki*, collectively referred to as *GKL*. Iceland is not in the eurozone and has its own currency. It is part of the European Economic Area though and participates in various free trade agreements with the rest of the European Union.

GLK engaged in a lending boom during the 2000s. In 2003 these three banks' total assets totaled two times Iceland's GDP. During the global savings glut period these three banks accumulated a significant amount of assets which by June of 2008 was 10 times the GDP of Iceland[98]. The lending boom was backed by various types of external funding. The

[98] See Robert Z. Aliber and Charles P. Kindleberger, Ibidem, p. 50- 52. Also see https://en.wikipedia.org/wiki/2008%E2%80%932011_Icelandic_financial_crisis (last checked on May 30 2018)

GLK banks were funding themselves largely through wholesale funding markets but in February of 2006 nervousness of foreign investors resulted in a pushback and so the banks turned to a different type of external funding, online accounts which were promoted under various names such as "*Ice Save*", "*Edge*" and "*Save and Save*". These were accounts that one could open from anywhere in Europe which paid higher rates that one could receive from local banks. In the middle of 2007 we began to notice an explosion in the credit default swaps for each of these three banks. After the *Northern Rock* run of September 2007 there was increased pressure on all of these banks and the online accounts begin a slow run or as referred to, a bank jog. After the *Lehman* event the jog turned into a sprint and *GKL* were unable to keep up their short- term funding either from wholesale funding markets or from online accounts. Over the week of October 6th 2007 Iceland nationalized all three banks. That of course did not mean that they would be able to pay all of their depositors so they took a very controversial decision to pay back only their domestic clients. This resulted in Iceland being put on a watch list of regimes considered to be rogue organizations by Her Majesty's Treasury in the U.K.

To analyze further the Eurozone crisis we brake it into three phases. The first phase was from December of 2009 until July of 2011. The emphasis during this period was on the weaknesses and bailouts for smaller countries of the Eurozone such as Greece, Ireland and Portugal. In the second phase, from July 2011 to July 2012, the crisis spread to larger countries, like Italy and Spain causing a double dip recession. The third phase which began in July of 2012 was related to the policies that were adapted during the earlier phases of the crisis and the battle being played out with regards to them.

During the first phase of the Eurozone crisis a set of countries, Greece, Ireland and Portugal started falling under the pressure of the global financial crisis. The beginning of the first phase can be marked in December 2009 when the new government in Greece acknowledged that the country's actual debt was significantly higher than what was previously stated by the preceding government. The debt measured at about 300 billion euros and was 113% of GDP (later revised to 130% of GDP)[99] which by far exceeded the eurozone limit of 60% debt to GDP that was set by the Maastricht treaty[100]. The Greek debt and deficit continued to be revised upwards as various accounting irregularities came to light. In early 2010 there were heavy concerns about Greece and other indebted Eurozone countries, most notably Ireland and Portugal. The situation in Portugal was more about fiscal problems and slow growth and not that much about accounting irregularities in the measurement of the debt. In May of 2010 there was a bailout of 110 billion euros for Greece, following a bailout of 85 billion euros for Ireland in November of 2010 and of 78 billion euros for Portugal in May 2011[101]. The bailouts received though, were with conditions set by the Troika[102] such as various types of government spending cuts and measures raising taxes as well as labor market reforms. What is important to note is that it was agreed that the above amounts would be given in partial payments on pre- specified dates under the condition that the requirements set by the bailout program were being met. This was a factor the caused periodic flare- ups of the crisis, as there was a

[99] Greek Government Debt Crisis. See https://en.wikipedia.org/wiki/Greek_government-debt_crisis (last checked on May 30 2018)
[100] See Robert Z. Aliber and Charles P. Kindleberger, Ibidem, p. 227
[101] See Philip R. Lane, *The European Sovereign Debt Crisis*, 2012, Journal of Economic Perspectives, 26(3): 49- 68 Available at https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.26.3.49 (last checked on May 30 2018)
[102] European Troika. See https://en.wikipedia.org/wiki/European_troika (last checked May 30 2018)

lot of noise around every evaluation about whether Greece had complied or not with the terms of its agreement with Troika.

In July 2011, there was a preliminary agreement for a second bailout for Greece for 109 billion euros, later increased to 130 billion when the agreement was finalized in 2012. These actions intended to reassure markets that the leaders of the Eurozone countries were prepared to do what was necessary in order to exit the crisis and to restore confidence. But what we saw in fact was a dramatic increase that summer in the spreads of Spanish and Italian debt. On August 7th 2011 the ECB stated that it would purchase bonds from those countries in order to maintain stability of their debt. This was a significant action on behalf of the ECB which was set up with a single mandate to maintain inflation rates under control[103]. After this announcement Italy and Spain reacted with austerity policies.

By early 2012, the financial situation was more stable and bond yields had fallen but there was a deep second recession throughout the Eurozone. In Spain and Greece unemployment was dangerously high. In March 2012 Greece went into a technical default[104] when it forced haircuts on some of its bondholders. In July 2012 the ECB president, *Mario Draghi* stated that the central bank would do whatever it took to preserve the euro. This speech and subsequent actions to calm the financial markets did indeed result in a decrease in the spreads of sovereign bonds and a general calming down.

The after effects of the global financial crisis in the Eurozone were so much worse than in the Unites States and the central reason for that was

[103] European Central Bank. See https://en.wikipedia.org/wiki/European_Central_Bank (last check on May 30 2018). Also see https://www.ecb.europa.eu/mopo/intro/html/index.en.html (last checked on May 30 2018)
[104] Technical Default. See https://www.investopedia.com/terms/t/technical-default.asp (last checked on May 30 2018)

because the Eurozone is not an optimal currency area. The Eurozone countries do not have their own monetary policy which leaves them, when faced with a shock like the one in our discussion, with the option of nominal wage and price reductions or deflation (internal price adjustment). But deflation can be extremely painful because people whose wages are falling see their debts as being even greater. This can indeed be seen as a structural weakness of the Eurozone.

Conclusion

By the end of 2009 the United States had managed to prevent a major depression, this will probably remain at the heart of President *Barack Obama*'s legacy. The U.S. was able to come out of the global crisis earlier than most of the other countries caught up in it. In part this was because the initial conditions were different but also because of the greater degree of freedom they had related to other countries. Most importantly though, its quick recovery was due to the fact of *how* it used this freedom. A depression could have been an unimaginable catastrophe in terms of unemployment, foreclosures and poverty. In 2009 the U.S. economy was on a path to lose nine million jobs. The housing market and auto industry were collapsing. The financial system was still fragile and the five bombs, *Fannie*, *Freddie*, *AIG*, *Citi* and *BofA* were all serious threats to explode, but they didn't. And the U.S. economy escaped its death spiral. It started growing again within six months and by end of 2013 GDP was 6% higher than before the crisis in contrast to the Eurozone where it remained below the pre- crisis output levels[105]. Today the financial system is much safer. The financial reforms dramatically improved the safeguards in the system,

[105] See Timothy F. Geithner, Ibidem, p. 493- 495

forcing banks to hold more capital and rely less on short- term funding. But the regulatory system remains fragmented.

I will agree with *Timothy Geithner*, that governments and central banks need emergency authority that they can use on a massive scale when crisis hits. The authority should be reserved for the most dangerous situations, and there should be some uncertainty about its deployment to reduce the risk of moral hazard, but it should come with a lot of discretion and a lot of force. In the case of the Eurozone crisis the complete lack of a lender-of-last resort was probably the largest weakness of the system. When president of the ECB, *Mario Draghi* pledged "*to do whatever it takes to save the euro*", the situation began to turn around. If in 2010, *Jean Claude Trichet*, then president of the ECB, had reassured the markets in a similar manner, events would have unfolded differently especially related to Greece. As stated in the beginning of this paper a crisis is a crisis of confidence. There is no way to prevent manias and no radar warning us when a crisis is looming but it is at our discretion to be prepared and have the tools to confront such events. As the Chinese say "*the more you sweat in peace the less you bleed in war*".

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