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# The Federal Reserve as lender of last resort

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## The Federal Reserve as Lender of Last Resort During the Subprime Crisis – Successful Stabilisation Without Structural Changes

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**Abstract.** This paper studies the actions of the U.S. Federal Reserve Bank (FRB) during the financial crisis from 2007-2012 rating the performance of the Federal Reserve during the crisis. The chosen scoring model approach shows that the average performance of five specific measures taken by the FRB only ranks between fair and good. Comparing Stiglitz (2010) viewpoints with those of the FRB, this paper analyses several policies and events and argues that the resulting decisions were well intentioned but that the outcome was different from expectations because of missing regulations and restrictions. Furthermore, the structure of the FRB is examined and criticized.

**Keywords.** Asset bubbles, Federal Reserve Bank, Scoring model, Financial crisis, Monetary policy, Regimes of growth.

**JEL.** E42, E58, G18, E65.

### 1. Introduction

The subprime crisis that started in 2007 in the United States can be seen as the worst financial crisis since World War II (Dullien, et al., 2011). It is necessary to understand how it developed and if the responses following the outbreak of the crisis were correct. In the first section, the development of bubbles and financial crises in general are discussed. In the second section, the developments which led to the subprime crises are analysed. In the main part of the paper, section three, the responses of the U.S. Federal Reserve Bank (FRB) after the outbreak of the crisis until early 2012 are discussed; especially the first wave of extraordinary policies by the FRB is analysed. The long-term quantitative easing policy and comparisons with other central banks' policies are not explicitly covered in this paper.<sup>1</sup> The last section concludes.

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## 2. Asset Bubbles and Asset Price Volatility

Asset bubbles have shaped the financial landscape for more than 300 years (Kindleberger, 1978). Whereas the bubbles during the 17<sup>th</sup> century were mostly driven by excitement over emerging markets, bubbles during the 18<sup>th</sup> century were driven by infrastructure and land improvements.<sup>2</sup> During the last century, the key drivers have been more of a technological and financial nature, i.e., stocks, high yield bonds, and real estate (Norman & Thiagarajan, 2009). Although the drivers of bubbles have changed over time, most bubbles follow set steps in their lifetime: displacement, boom, euphoria, panic, and intervention. Bubbles are potentially very costly as their bursting leads to an escalation of non-performing loans, a relocation of consumption and investment and the likelihood of long-term economic stagnation (Dodig & Herr, 2015).<sup>3</sup> The burst of bubbles also has social effects as people are affected by unemployment, pushed into precarious conditions, and see their just gained benefits decreasing yet again.

Bubbles vary in many different ways however most still have some common ingredients. Bubbles are characterized by cumulative feedback mechanisms and are combined with unsustainable credit expansion. Feedback mechanisms can have an “objective” character (e.g., increasing asset prices increase the value of collateral stimulates further credit expansion) or a “subjective” character (for example, positive expectations spread to more and more people and become more and more positive). The beginning of a bubble, as well as the end, is usually given by exogenous factors, however, an expansion phase leads to an increasingly fragile situation which sooner or later must come to an end.<sup>4</sup>

In the recent debate, Sullivan (2009) argues that three factors often represent the main ingredients for a bubble: financial innovation, investor emotions, and speculative leverage. Most of the recent bubbles were triggered by innovation in either telecommunication, technological, or financial markets combined with the overconfidence of investors and leverage. Innovations in financial markets, driven by investors seeking to reduce, share, or transfer risk resulted in complex financial structures where the risk is difficult to evaluate. This behaviour is further stimulated by the desire for even higher returns. Innovations become problematic when they fail to deliver what they originally promised and when they multiply risk in the system due to assessment difficulties. Usually, regulation is not ahead of innovation and thus complex innovations made risk management by investors and regulators more challenging.

In line with the argumentation from Sullivan, Guttman (2009) claims that two main factors are common to recent crises and bubbles: low interest rates and financial innovation; furthermore naming speculation as a driving factor for the development of asset bubbles. However, Dellas & Tavlas (2011) argue that the creation of asset bubbles is possible in situations of increased monetary liquidity as this stimulates the demand for assets.

Shiller (2005), though, names 12 main reasons that explain stock market booms in recent years. These reasons vary from a bubble supported by monetary policy, new information technology and the expansion of volume in trade to the decline of inflation and the effects of money illusion. In “The Subprime Solution” (2008), he argues that the most important single factor is the social contagion of boom thinking, comparing social contagion to an epidemic. If certain factors arise that boost an optimistic view of the economy and the removal rate at which people are no longer contagious is significantly lower, then the optimistic view will be widespread through the market and social contagion will replace individual thinking and analysis. This will drive up asset prices and cause an asset price bubble. While not the only explanation of how asset bubbles can arise, the loss of

individual information analysis to group thinking of decreasing quality is significant although typical for human behaviour especially in situations of uncertainty.

The number of recent crises underscores that in an environment of deregulated financial markets asset bubbles are hard to prevent and sometimes to detect. Even if detected, vested interests may prevent a consequent containment of a bubble. The International Monetary Fund counted 124 systemic banking crises within the period 1970 to 2007 (Laeven & Valencia, 2008). If detecting bubbles would be easy, their impact on the economy could have been reduced if not completely prevented. Nevertheless, opinions about the detection of asset bubbles are widely spread; economists who believe in rational expectations and efficient financial markets are blind to financial crises.

Some economists argue that asset bubble identification prior to the burst is impossible. As Alan Greenspan noted in 2002 on the dot-com bubble, “We at the Federal Reserve considered a number of issues related to asset bubbles – that is, surges in prices of assets to unsustainable levels. As events evolved, we recognized that, despite our suspicions, it was very difficult to definitively identify a bubble until after the fact – that is, when it’s bursting confirmed its existence” (Greenspan, 2002).

Other economists propose methods or checklists that should make detection possible before bursting. Siegel (2003) proposes that an asset market bubble exists if the realized return of an asset is more than two standard deviations away from the expected return, taking into account prevailing risk and return conditions. The expected return is defined by the duration or the time-weighted average of all future expected cash flows of that asset. Siegel argues that this definition makes it impossible to judge whether or not there is a bubble as future cash flows are not known.

Following Minsky (1975; 1992) who assumes that during bubbles leverage ratios increase and during busts decrease, Borio & Lowe (2002) propose a pre-crisis indicator called credit gap that helps identifying bubbles. The credit gap is assumed as the “difference between the current ratio of credit to GDP and a slowly changing measure of the trend value of this ratio” (Federal Reserve Bank of San Francisco, 2009b, no page given). A boom or bust is therefore characterized by the event that the ratio of credit to GDP deviates significantly from its trend. The critical point of this theory is the decision of which threshold level to use. Borio and Lowe’s tests have shown that the accuracy of the prediction is dependent on the percentage of threshold used and the chosen time horizon. The best results were accomplished by choosing a time horizon of three years and a threshold of four percent; 79% of the crises could have been predicted and the percentage of false alarms declined to 20%.

We believe that a historical discretionary analysis supported by indicators such as the one developed by Borio & Lowe (2002) is the best method to detect bubbles. Using such an approach it would not have been too difficult to detect a bubble in the USA years before it burst. The unsustainability of subprime-credit expansion also would have not been too difficult to detect. Administrative tools such as curbing credits to the real estate sector, demanding more own capital for real estate investments, increasing reserve requirements for real estate credits, limiting securitisation of real estate credits or taxing speculative gains could have been used to contain the real estate bubble without increasing the interest rate. Greenspan and rating agencies, for example, blindly believed in efficient financial markets or did not want to stop the party and thus closed their eyes to market developments.

### 3. The Development of the Housing Bubble and its Bursting

#### 3.1. *The Housing Bubble 2000 – 2007*

The bursting of the dot-com bubble in 2000 led to a significant decrease in the stock market. Following strong growth in the late 1990s, tech stock prices fell up to 75% until October 2002. This led in the US to a recession in March 2001. To fight this recession, Alan Greenspan, Chairman of the FRB at that time, lowered the federal funds rate. When President George W. Bush failed to stimulate the economy with tax cuts for the rich, everything was dependent on monetary policy. Therefore, the FRB flooded the market with liquidity in the form of cheap money. Because of all the excess capacity in the economy, the cheap money did not enhance investments in plants and equipment. Instead, consumption goods and real estate were the new focus for spending the money at this time. When the United States invaded Iraq in 2003, oil prices started to increase. Nonetheless, even higher oil prices did not lead to inflationary pressure as wage increases remained low. Due to this development, Greenspan kept the interest rates low and money remained cheap (Stiglitz, 2010). Global liquidity doubled in size; increasing from 36 trillion to 72 trillion dollars between 2000 and 2006 (Davidson & Blumberg, 2008). Thus, Greenspan's announcement that the federal funds rate remained low ruined investment opportunities in Treasury bills and resulted in mortgage-backed securities becoming one of the main providers of a stable investment income with underlying assets as securities for institutional and other investors. Securitization of mortgages has been used since the late 1970s, yet, pooling, slicing and repacking mortgage credits only became popular in the early 2000s. The residential mortgage-backed securities were structured into three tranches. The senior tranche with the lowest interest paid has the lowest risk exposure as investors only would suffer losses when non-performing loans would have eaten up completely the other tranches. For this reason senior tranches were rated with an AAA. As a result even subprime loans could be sold to a wide range of investors. The riskier tranches were sold to hedge funds or other more risk loving investors (e.g., Jacobs, 2009 or Hein et al. 2015). Instead of focusing on the design of mature and transparent financial products, Wall Street was focusing on products that were generating a higher profit in times of cheap money. The main functions of the banking system are providing an efficient payment mechanism with facilitating transactions and transfers, managing and accessing risks, and making cheap and sufficient loans to enterprises. Unfortunately, most financial institutions concentrated on transaction costs and earning fees, creating less transparency to allow rent-seeking and other ways to make money instead of on their core functions.

The income of the poorer half of U.S.-Americans stagnated from the 1980s on, and the solution for many was borrowing to finance their consumption. In the 1990s and 2000s the average savings rate fell to approximately zero. As many rich U.S.-Americans increased their savings, this meant that the lower income population had a negative savings rate and increased debt enhanced by the low interest rates and lax regulation policies. According to Stiglitz (2010), two-thirds to three-quarters of total GDP before the bursting of the bubble in 2007 was housing related, including the construction of new homes, borrowing against them, and then spending the money on something else.

As house prices almost doubled from 2000 to 2006, real estate investments were considered safe investments. Many house owners speculated on rising prices. Expected higher real estate prices and lax regulations reduce the necessary loan down payments (Sagemann & Reese, 2011); The necessary criteria for clients to

get a mortgage loan decreased and more and more people were allowed to borrow money. Risk was put aside as banks thought to sell risky mortgages to the rest of the world. The whole system suffered from deep moral hazard problems and even fraud. The fierce competition on the asset-backed securities market made companies join the wave even though they knew the traded mortgages were bad ones. Rating agencies in charge to evaluate risks of asset-backed securities failed to act in an appropriate way and intensified the problems.

When housing prices started to decline in late summer 2006 due to an increase in supply and decrease in demand, mortgage rates began to climb. People began having problems paying back the higher mortgage rates with their current income and borrowers defaulted on their mortgage payments (Shiller, 2008).<sup>5</sup> The defaulted payments caused severe losses for banks and other investors as the underlying securities were decreasing in value and therefore did not cover the full initial loan sum. Investors thus had to face losses.

The subprime credit crisis first became public when the Hong Kong and Shanghai Banking Corporation Holdings (HSBC) had to announce a write-off of 11 billion USD in mortgage debt investments. When other investors followed, the asset-backed security market collapsed thus beginning a worldwide turmoil in capital markets. Unexpectedly, even money markets between banks broke down as banks did not trust each other due to their off-balance sheet activities and the resulting lack of transparency. Banks, hedge funds, and other financial institutions were forced to recapitalize followed by closed money market funds and the collapse of Bear Stearns, at that time the fifth biggest U.S. investment bank, and Washington Mutual, the largest U.S. savings and loan association. In 2008, Lehman Brothers, the fourth-largest U.S. investment bank, went bankrupt, a symbol of the largest financial market failure in history. Subsequently, many large banks and financial institutions had to ask for financial help from their respective governments and central banks and were consequently partially nationalized.

### *3.2. Major Reasons that led to this Bubble*

The causes of the U.S.-American subprime crisis and the subsequent global financial turmoil are numerous and cannot all be considered in this paper. The focus of this section elucidates some major reasons for not only the creation of the bubble but also the developments once the bubble burst in 2007.

According to Shiller (2008), the overly optimistic view of the real estate market was one major factor during the crisis. In a 2005 survey, a third of all questioned homebuyers in the San Francisco area answered with exaggerated price expectations. The average expected price increase for the next 10 years was about nine percent per year. These expectations were mainly results of increasing house prices in the past and their interpretations. As explained in Section 1, the social contagion created “new era” stories, making everyone believe in its truth because everybody couldn’t be wrong. The price increases supported economic optimism which encouraged spending behaviour. The increased spending endorsed economic growth and created even more optimism. As real estate prices were steadily increasing, people considered housing as a safe investment and started basing their decisions on the actions of others instead of on their own assessments.

This behaviour was encouraged by what Shiller (2008) calls the “real estate myth” - that real estate prices must increase over time as the population and economy are growing and the amount of land available is limited. Therefore, people expected increasing house prices as a result of fundamental developments. Moreover, although the fraction of income spent on housing was stable, the increased income was not invested in more expensive housing but instead in an increasing amount of housing. To live in bigger houses was the main driver of housing demand, not the increasing population. According to the U.S. Census



Bureau, the average floor area of one-family houses increased almost 50%, from 1973 to 2006 while the average household size declined from 3.29 persons in the 1960s to 2.63 in the 1990s e.g., people moved into bigger houses and spread out across more houses thus explaining the increasing amount spent on housing. Government programs such as the Community Reinvestment Act (CRA) boosted housing even more as they encouraged financial institutions to lend to underserved communities and to make housing affordable. The privatized, government-sponsored enterprises Fannie Mae and Freddie Mac contributed to boosting housing consumption as their purpose was to expand the secondary mortgage market by securitizing mortgages thus making it possible for lenders to increase their mortgage-credit volume. Even more important, in the 2000s more and more private institutions entered the mortgage market and securitized especially subprime mortgages (Hellwig, 2008).

A second factor was the monetary policy of the FRB. Since the prevailing view is that low interest rates favour investments and economic development, as previously noted, the interest rates of the FRB remained at a low level while it tried to fight the economic downturns following the burst of the internet bubble and the attacks of 11 September 2001. Alan Greenspan believed that the potential inflation coming from low interest rates would be counterbalanced by innovation and globalization boosting productivity and competition. Greenspan flooded the US economy with cheap money to encourage spending and borrowing in times of financial crises. The FRB was mainly focused on preventing a recession and deflation after the stock market crash and to trigger growth. Market participants were increasingly relying on this behaviour, known as the “Greenspan put” (Sagemann & Reese, 2011). Therefore, the FRB approved the loose lending policies of banks and other financial institutions because they encouraged consumption and were seen as efficient tools to stimulate growth of the US economy in a situation of low investment by firms.

When house prices rose significantly, Ben Bernanke (in Wessel, 2009), the successor of Alan Greenspan, noted that this increase mostly reflected strong economic fundamentals. According to the FRB, asset bubbles would not have an impact on the long-term development of the economy. Nevertheless, the low interest rates implemented by the FRB cannot alone explain the nine-year upward trend of real estate prices. Shiller (2008) claims that after the end of the internet bubble in the 1990s the period of negative real short-term interest rates after the inflation correction was 31 months long. This is just a third of the nineyear price increase and is therefore not enough to justify such a sharp bubble.

Yet another and the most important factor was the deregulation of the financial system. The 1999 repeal of the Glass-Steagall Act played an important role. Norman & Thiagarajan (2009) claim that after the repeal of the Glass-Steagall Act less than 25% of all credits were given via loans by commercial banks. Less regulated non-bank-financial-institutions could offer lower spreads than banks and therefore financial transactions were transferred to the shadow-banking system with financial institutions which were risk-loving, speculative-oriented and followed short-term profit strategies.

Financial innovations with no purpose other than circumventing regulations, avoiding taxes, and creating less transparency added to the crisis. The deregulation made it possible to create complex investment products with increasing risk and information asymmetries. The securitization of mortgages and the selling of tranches led to complex structures that were hard to assess and judge when it came to the actual risk level. The financial markets failed to perform their functions of managing risk, allocating capital and mobilizing savings while offering low transaction costs. “Instead, they had created risk, misallocated capital, and

encouraged excessive indebtedness while imposing high transaction costs.” (Stiglitz, 2010, p. 7) Banks and other institutions not only misjudged the risks involved in their transactions and the accorded rating of their investments, they also misjudged the risk evolving with high leverage. Risky assets only held small risk premiums because financial institutions were speculating that either the Federal Reserve Bank or the U.S. Treasury Department would bail them out in case something happened (which was correct). Wrong incentives and opportunities in an environment of a deregulated financial system made financial managers greedy.

Taking these aspects into account, the 2007 subprime mortgage bubble seems to be a textbook example of an asset price bubble as it included all factors of a typical bubble mentioned above: Mortgage securitization and other new financial products represent innovation. The belief that housing prices would increase continuously and the housing myth represent the social contagion theory as well as the investors’ emotion approach. When Greenspan kept the federal funds rate at a low level, money was cheap and the credit volume was expanding. The increase in liquidity stimulated the demand for debt-securities, stocks and real estate instead of investments in plants and equipment due to the excess capacity of the economy and, compared with financial investment, low expected rates of return. All these factors combined with missing regulation and the reckless behaviour of market participants fuelled the bubble’s development. The whole financial system had become so fragile that problems in a relatively small market segment, the market for subprime loans in the USA, led almost to a meltdown of the world financial system (Hellwig, 2009).<sup>6</sup> All this shows how deep and fundamental were some problems such that the effects of the bursting of the bubble were disastrous.

### **4. Federal Reserve Bank Reactions during the Subprime Crisis**

The objective of the FRB is to “maintain long run growth of monetary and credit aggregates, combined with maximum employment, stable prices, and moderate long term interest rates” (U.S.Code, § 225A). These three goals implicate that the FRB must have an implicit ranking and looks for a compromise between the different goals. In times of turmoil, the FRB usually concentrates only on the stability of the financial system, which is a fourth implicit goal based on the function of a central bank as lender of last resort (Harris, 2008).

The severity of the financial crisis triggered by the problems in the subprime market led to a variety of actions and measures taken by the FRB. As described earlier, the main monetary policy tool of central banks is the setting of a target federal funds rate to influence the economy accordingly. Figure 1 shows the reaction of the FRB before and after the bursting of the housing bubble. After the dot.com bubble, the FRB tried to fight a threatening recession in lowering the rate progressively to 1-2% hoping to encourage spending and investment. After the outbreak of the subprime crisis the FRB acted in a similar way. When the first signs of an economic downturn appeared, the FRB Board of Governors began lowering the federal funds rate; from mid-2007 - 2009 the interest rate dropped from 5.25% to 0 - 0.25%.



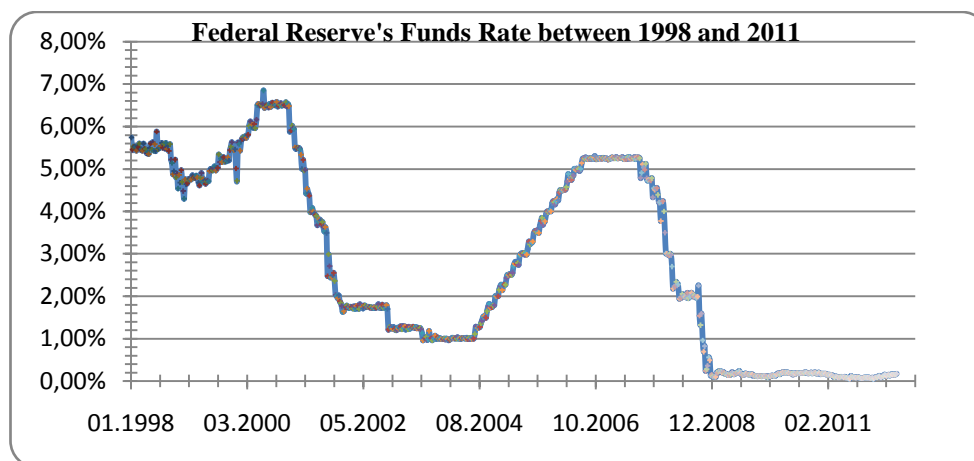


Figure 1. The Federal Reserve's Funds Rate from 1998 to 2011<sup>7</sup>

Interest rate policy was not enough to stabilize the financial system and prevent a slowdown of the economy. The asset price deflation in the real estate and stock market, the breakdown of the market of asset-backed securities and the money market led to severe liquidity and also solvency problems of commercial banks and financial institutions in the shadow financial system. A systemic financial crisis typical after a strong bubble hit a financial system which had become fragile as the result of radical deregulations. The FRB had to take over the function of a lender of last resort in a very comprehensive way. Figure 2 gives an overview over the most important emergency programs following the bursting of the subprime crisis in 2007.

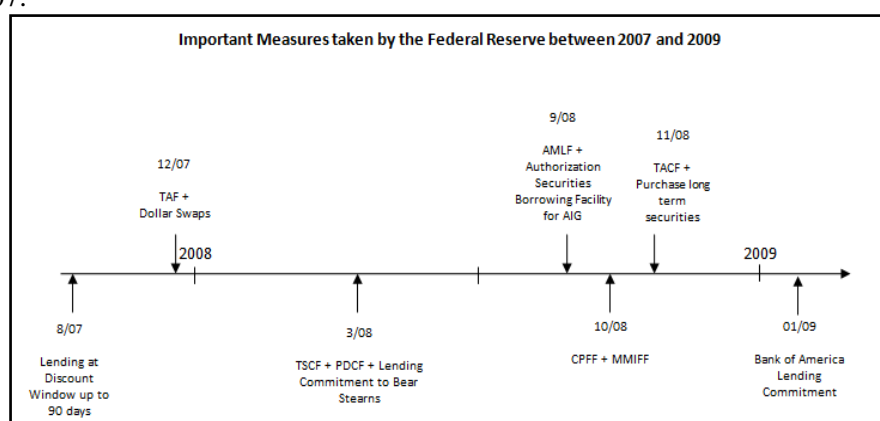


Figure 2. Important Measures taken by the Federal Reserve<sup>8</sup>

The tools used by the FRB comprise the provision of short-term liquidity to depository institutions, other financial institutions, and even companies, representing the central bank's role as lender of last resort. For a brief explanation of the various actions taken by the FRB during this period, please consult Box 1.

#### Box 1. Actions of the FRB

##### *Provision of short-term liquidity to depository institutions, banks and other financial institutions*

When the spread between LIBOR (London InterBank Offered Rate) and Treasury bills was increasing and the commercial paper market between large financial institutions froze at the end of 2007 and beginning of 2008, the FRB responded by creating several programs that reallocated funds to those institutions most affected by the liquidity crisis:

From August 2007, banks were able to borrow from the **discount window** for a period of up to 90 days through the Term Discount Window Facility instead of just overnight (Eisenbeis, 2010).

In December 2007, the FRB instituted the **Term Auction Facility** (TAF) to address disruptions in U.S. interbank lending markets. TAF was auctioning money to any bank in the country not just

primary dealers, in an attempt to reduce the spread between LIBOR and the FED rates. With a lending volume of \$450 billion in 2008, this program was used more often than the normal discount window with a lending volume of \$90 billion (Wessel, 2009).

Also in December 2007, the FRB announced **dollar swaps** with several foreign central banks to flood the market with dollar liquidity to provide the dollar markets abroad with sufficient liquidity. The dollar swap lines included agreements with countries such as Japan, United Kingdom, Canada, Switzerland, Australia, Sweden, Norway and Denmark and the European Central Bank (Federal Reserve Bank Governance, 2012).

In March 2008, the FRB created the **TermSecurities Lending Facility** (TSLF), which enabled primary dealers to borrow U.S. Treasury securities against their hard-to-sell collaterals. The collateral that could be used included mortgage-backed securities and other assets. To be able to do so, the Federal Reserve Board had to invoke section 13(3) of the Federal Reserve Act for the first time during the crisis. The range of assets accepted was broadened when the crisis intensified (Federal Reserve Bank Governance, 2012). With this program, the Fed could take up to \$200 billion of the assets Wall Street could hardly sell and exchange them into treasury securities, trying to prevent an uncontrolled downwards price spiral that would have started if dealers were forced to sell these illiquid assets (Wessel, 2009). Because the securities were lent out overnight and taken back every next morning, the TSLF was off balance sheet and had no influence on the bank reserves in the FRB's balance sheet. Nevertheless, successful bidders could use the provided securities to engage in repurchase agreements and gain overnight liquidity (Federal Reserve Bank of New York, 2009). This allocated liquidity to primary dealers (Eisenbeis, 2010).

In March 2008 as well, the FRB created the **Primary Dealer Credit Facility** (PDCF), a facility that provided primary dealers with collateralized cash loans over night, in case the situation with Bear Stearns would create a liquidity run to other banks. Primary dealers include banks and security broker-dealers (Board of Governors of the Federal Reserve System, 2012). Cash loans were therefore given to investment banks and commercial banks. PDCF was available from March 17, 2008 following the already implemented tri-party repurchase agreements with the primary dealers. Bear Stearns itself was the largest PDCF borrower in the first month (Federal Reserve Bank Governance, 2012).

### **Provision of liquidity to borrowers and investors in key credit markets**

In November 2008, the **Term Asset-Backed Securities Loan Facility** (TALF) was created trying to reopen the securitizations market. TALF opened in March 2009, closing in June 2010, and provided U.S. companies and individuals access to credit in return for securities as collateral. Before the burst of the bubble, many consumer loans such as credit card debt, student loans and auto loans, were turned into securities. When the market for these securities froze in the fall of 2008, no securities could be sold anymore and consequently consumer loans decreased significantly. As this was threatening consumer spending, the FRB was trying to reopen the consumer credit securities market again through offering loans to hedge funds and other investors. The Treasury put in \$20 billion of tax payers' money from the **Troubled Asset Relief Program** (TARP) that would absorb the first losses so that when the FRB put in \$180 billion, the total volume of loans that TALF could offer was \$200 billion. Treasury and FRB agreed that borrowers using TALF would not have to pay back the FRB in the case where the end consumers behind the securities would not pay back their loans; the borrowing institution would then lose the additional collateral posted with the FRB, usually just a minor percentage of the total loan (Wessel, 2009).

In October 2008, the FRB authorized the **Commercial Paper Funding Facility** (CPFF) creating a limited liability company CPFF LLC to buy unsecured and asset backed commercial papers from U.S. issuers. CPFF tried to reduce the reluctance of issuers to engage in longer-term maturities. The CPFF was closed in February 2010 (Board of Governors of the Federal Reserve System, 2011a).

In September 2008, the **Asset-backed Commercial Paper Money Market Mutual Fund Liquidity Facility** (AMLF) was created to provide liquidity to money market mutual funds. The AMLF intended to assist money market funds to be able to meet money market fund redemptions. To make sure that the liquidity provided was used in the intended manner, the FRB established redemption thresholds for money market mutual funds who were only eligible to AMLF loans if they had experienced outflows of at least 5% of net assets in a single day or 10% of net assets within the five prior business days (Board of Governors of the Federal Reserve System, 2011a).

The creation of the **Money Market Investor Funding Facility** (MMIFF) was announced in October 2008. The aim was to finance the purchase of short-term debt from money market mutual funds. As MMIFF expired in October 2009 without having being used, no further explanation for this funding facility is necessary (United States Government Accountability Office, 2011).

### *Purchase of long-term securities*

The Federal Reserve has expended its traditional set of tools by purchasing longer-term securities. In November 2008, the Federal Reserve announced that it would purchase government-sponsored debt and mortgage-backed securities. In March 2009, the amounts were increased to up to \$200 billion in

government-sponsored debt and \$1.23 trillion in mortgage backed securities. The Federal Reserve slowed down the purchases in August and completed the whole program in October 2010.

### *Support for specific institutions*

When **Bear Stearns** informed the FRB on 13 March, 2008 that it would have to file for bankruptcy the next day without financial help due to an increased run on its liquidity, the FRB decided to provide Bear Stearns with a bridge loan in order to gain time for Bear Stearns to find an acquirer who would stand behind its assets when markets reopened to circumvent bankruptcy. Criteria were set for which assets would be in the Federal Reserve's portfolio and J.P. Morgan Chase and Co agreed to cover the first \$1 billion of losses (Wessel, 2009). After several negotiation processes, the special-purpose vehicle *Maiden Lane LLC* was created to buy assets from Bear Stearns, consisting of a senior loan of \$28.82 billion from the FRB of New York and a subordinated loan of \$1.15 billion from J.P. Morgan Chase and Co (Federal Reserve Bank Governance, 2012).

**American International Group Inc. (AIG)** is an US-American multinational insurance corporation that sold among other things insurances against borrowers' defaulting, especially in Europe. After its failure to increase equity to survive, AIG tried to obtain loans. But when AIG's debt was downgraded and its stock price was falling, its business partners stopped trading with AIG and the FRB had to step in to rescue AIG from bankruptcy. When the Federal Reserve restructured AIG's debt in November 2008 the Treasury purchased preferred stock worth of \$40 billion. Furthermore, the Federal Reserve created the special purpose vehicles (SPV) *Maiden Lane II*, replacing the securities borrowing facility, and *Maiden Lane III* to purchase collateralized debt obligations from AIG's counterparties. In September 2010, AIG signed a recapitalization plan with the Treasury, the FRB of New York and the trustees of the AIG Credit Facility Trust concerning the repayment of AIG's obligations. In January 2011, the recapitalization plan was closed as the revolving credit facility was fully repaid and any further lending terminated.

At the end of November 2008, the FRB of New York provided **Citigroup** with a lending commitment together with the Treasury and Federal Deposit Insurance Corporation (FDIC) to prevent the institution from failure. The FRB of New York agreed to lend to Citigroup after Citigroup's losses reached a certain value. When the loss sharing agreement was terminated in December 2009, the FRB of New York never made a loan to Citigroup under this lending facility. Citigroup subsidiaries used other Federal Reserve emergency programs such as TSLF and TAF, using the "ring-fence" assets agreed in the loss sharing agreement as collateral. When the agreement was terminated by Citigroup, the FRB of New York received a \$50 million termination fee.

In January 2009, the Federal Reserve announced jointly with the Treasury and the FDIC that they will provide assistance to **Bank of America** to ensure financial stability. Due to the acquisition of Merrill Lynch and its holding of mortgage backed securities the Bank of America saw its balance sheet threatened. The Treasury and FDIC offered protection against unusual losses from of \$118 billion. In return the Bank of America should have issued preferred shares to both. Furthermore, the Treasury announced investments of \$20 billion from TARP in exchange for preferred stock with a dividend of 8%. But in May 2009, after the results of the Supervisory Capital Assessment Program, the Bank of America announced that it did not want to continue with the announced package of support and paid an exit fee to terminate the term sheet with all three parties. The Federal Reserve received an exit payment of \$57 million (Board of Governors of the Federal Reserve System, 2011c).

When private lending froze, the FRB extended its lending to all kinds of market participants including investment banks, hedge funds and companies. Not only the liquidity in the money market was guaranteed by the FRB, it also tried to keep other credit markets liquid. The FRB also bought large amounts of toxic paper to help clean-up the balance sheets of those financial institutions in difficulty. However, the FRB helped financial institutions in need without making any important demands to stop the excessive risk taking and management strategies of financial institutions which led to the systemic crisis.

Furthermore, Stiglitz (2010) complained about a lack of transparency concerning the actions taken by the FRB, as it was not clear how much of taxpayers' money was put at risk and what the cost would be in the end. Instead of increasing transparency as Bernanke originally had planned when he became Fed chairman in 2006, the secrecy increased and left spectators wondering if the obscured reason was to hide mistakes and other incorrect decisions. There was no debate how to handle insolvent institutions especially in the shadow financial system. It is not obvious whether a central bank should help financial institutions in the shadow financial system and it is even less obvious whether and to which

extent owners and big creditors (bondholders) of insolvent institutions should be saved. At this point the FRB followed a very unclear strategy which in many cases was very much shaped by the interest of Wall Street. In the next section the actions of the FRB are evaluated in more detail.

## 5. An Evaluation of the FRB's Reaction during the Subprime Crisis

To evaluate selected decisions of the Federal Reserve after the burst of the housing bubble starting in 2007, a scoring model approach will be used. The scoring model is based on scores for different criteria that are weighted according to their importance. Through the weighting, the scores for every criterion will form a weighted average that then provides an overall score for a certain project or action. The averages of all decisions or actions that have been analysed form the overall score.

To perform this analysis, four different criteria have been chosen. The first criterion, *effectiveness*, considers the reasoning and justification behind the decision of the Federal Reserve and analyses if the target outcome was achieved or not. It compares the realized effects of an action to the intentions of the Federal Reserve and analyses if the effects were helping to stabilize the financial markets on a short- and long-term basis. The second aspect, *transparency*, measures the communication approach of the Federal Reserve and if their decisions were made transparent to the public and other market participants. Furthermore, it considers the aspect of clear guidelines and tools that made the process of choosing a particular action understandable. Additionally, the scoring model takes into consideration whether there have been *other reaction possibilities* for the FRB (according to their knowledge at the point of time the decision was taken) and if so, whether the chosen decision was the best for the general public, although it is difficult to decide as the outcome of other actions is hard to predict. The fourth criterion analyses the *consistency* of the FRB's actions considering measures taken before and after that specific situation. If it is a measure that was to be expected from previous actions, it is considered to be consistent. If the decision taken contradicts other actions then it is considered as inconsistent or fairly consistent.

Actions or decisions are graded with a scoring system from 1 to 4. Four different grade options seem plausible as they deliver enough room for evaluation. Furthermore, with an even number of grades, neutral grades are avoided. As the decisions involve relatively complex structures which dealt with power limitations and were sometimes taken under time pressure, grades of a more diversified and outspread scoring system would be hard to justify. The scores are translated into the following:

- 1 – bad
- 2 – fair
- 3 – good
- 4 – very good

This classification allows judging the actions of the FRB accordingly, given that bad (1) is the worst grade and very good (4) the best. Fair (2) represents a decision that was either justified and following the right intentions but not satisfying in its results or involving too much risk on the taxpayers' side and creating wrong incentives for market participants. Good (3) represents a decision that followed the right intentions and improved the overall situation but still leaves room for improvement.

As not all criteria are of the same importance, the contribution to the final grade for one decision is adjusted through different weights for the different criteria. The

effectiveness of an action is considered to be the most important criterion of all. That is why its weighting in the final grade is adjusted with a factor of 0.4. The remaining 60% of the grade are split between transparency, consistency, and the possibility of other actions - each with 20%. Three areas of evaluation are chosen. The first area evaluated is the FRB's interest rate policy (Table 1). The second area evaluates measures by the FRB to keep the money market and other credit markets liquid (Table 2). The third area evaluates the bail-out of financial institutions by the FRB (Table 3). In the end, the average of the scores of the different areas is calculated thus grading the overall decision. All areas are weighted equally thereby providing a final grade of the Federal Reserve Bank's decisions and actions.

**Table 1. Decision 1 of FRB: Cuts of the Federal Funds Rate**

Comment	FRB's comment	Score	Justification/Explanation	weight
The FRB cut the interest rate after the outbreak of the crisis quickly and substantially. The time frame in which interest rates were dropping from over 5% to almost 0% was unusually short.	Even though the effectiveness of monetary policy in times of crises is usually hampered, the monetary policy actions of the Federal Reserve nevertheless have worked to improve credit markets and reduce the burden of debtors. The aggressive funds rate cuts brought down interest rates ( <a href="#">Federal Reserve Bank of San Francisco, 2009b</a> ).	4	Expansionary monetary policy in a crisis is like pushing on a string. Still, the decision of the Federal Reserve to lower the interest rate was correct. This policy was needed and was functional to stabilise the financial system and the economy. The effect of lowering the federal funds rate in a financial crisis was not sufficient to overcome the crisis. But it is still something that had to be done.	0.4
Decisions were taken according to the usual procedures.	The interest rate cuts were a decision of the Open Market Committee. After meetings, the outcome was presented to the public. There were at least eight meetings per year; additional meetings were scheduled according to the economic situation.	4	The federal funds rate is one main monetary policy tool of the Federal Reserve. The strategy is decided and voted for in the meetings of the Open Market Committee. The meeting schedules and decisions are accessible for the public. No changes were made in the procedure in comparison to the process before the crisis.	0.2
There was no alternative to cut interest rates	The setting of the federal funds rate and the open market operations are the main monetary policy tools of the Federal Reserve. There was no alternative.	4	As the main policy tool of the Federal Reserve, lowering the federal funds rate was the appropriate reaction. Only when these actions did not show enough results, the Federal Reserve had to follow other tools and actions.	0.2
The policy was consistent with other reactions during crises periods.	The lowering of the federal funds rate followed the usual logic of monetary policy and did not contradict other actions.	4	Lowering the federal funds rate over time to almost zero was hoped to stimulate the markets and reduce all interest rates. This was appropriate and consistent with other measures taken by the Federal Reserve.	0.2
weighted average		4.0		

**Table 2.** *Decision 2 of FRB: Measures to keep money market and other credit markets liquid*

Comment	Fed's comment	Score	Justification/Explanation	weight
Liquidity measures like TAF, TSLF, PDCF, TALF, CPFF, AMLF, MMLFF, etc.	These measures provide needed liquidity in different segments of the credit market.	3	These measures can be seen as part of the FRB's function as lender of last resort which it took over in a comprehensive way. The FRB bought also large amounts of toxic papers. The effectiveness could have been increased had the FRB demanded financial institutions benefitting from the programs to change their business models including securitisation, bonus payments and risk evaluation models.	0.4
The FRB was driven by the systemic financial crises and implemented one special program after the other.	All information needed was and are accessible on the Federal Reserve's website.	3	Everything is accessible except the names of the institutions that were bidding and those who actually received funds through TAF, etc. Overall the implementation of the programs was not fully transparent for all market participants.	0.2
The FRB had no option than to take over the function of a lender of last resort.	The FRB saw no other option to try to keep financial markets liquid and to stabilize the financial system.	3	To provide liquidity and policies to keep markets functioning was needed. There was no alternative. However, help could have been given under the condition that economic behaviour of financial institutions and their business models have to be changed. This would have stabilised the financial system in the long-run.	0.2
To take over the function of lender of last resort in a financial crisis was needed and by its nature has discretionary character.	The programs are part of the function as lender of last resort,	3	The actions were consistent with other actions taking into account the crisis situation. However, there was no element included in the measures to make the financial system more stable in the long-run	0.2
weighted average		3.0		



**Table 3. Decision 3 of FRB: Bailout of financial institutions**

comment	FRB's comment	Score	Justification/Explanation	weight
The FRB massively helped the take-over of Bear Stearns; it let Lehman Brothers fail and saved AIG, it bought toxic papers from many institutions	<p>The provision of funds to Bear Stearns prevented the imminent insolvency of the company and bought time to find a buyer for Bear Stearns. AIG had to be saved to prevent the meltdown of the national and international financial system (<a href="#">Federal Reserve Bank of New York, 2012</a>). "The actions that the Federal Reserve and the Treasury have taken to stabilize systemically critical firms were essential to protect the financial system as a whole, and, in particular, the financial risks inherent in the credits extended by the Federal Reserve were, in my [<i>Ben Bernanke's</i>] view, greatly outweighed by the risks that would have been faced by the financial system and the economy had we not stepped in." (<a href="#">Board of Governors of the Federal Reserve System, 2009</a>)</p> <p>In the case of Lehman Brothers the FRB argued that the failure of Lehman Brothers was clear for so long and markets had enough time to prepare and protect themselves. The Federal Reserve was sure that the failure would not pose any systemic threat. The FRB also argued that there was no clear legal framework for resolving big financial institutions other than banks. Also, according to the Federal Reserve, AIG's core business (insurance) was healthy and could be sold whereas nobody was interested in Lehman Brothers (<a href="#">Wessel, 2009, p.23</a>).</p>	2	<p>There would have been the possibility to let financial institutions in the shadow financial system fail and to build a ring-fence around commercial banks and pension funds. In the case of Bear Stearns and AIG the action of the FRB privileged owner and creditors (bondholders). Also in the case of buying toxic papers from other institutions this would have been possible. The bailouts and the saving of owners and big creditors were not helping building trust in market principles.</p> <p>The FRB's arguments to let Lehman Brothers fail and AIG and Bear Stearns not were not convincing.</p>	0.4
There was no transparency.	The FRB argued that there was no time to follow a procedure following market principles. "Things happened very quickly and left very little time window." ( <a href="#">Bernanke in Wessel, 2009, 159</a> )	1	The FRB's decisions were not transparent, e.g., it is unclear why AIG was saved and not Lehman Brothers. There was no public debate how to handle insolvent institutions. The interests of Wall Streets seemed to have dominated.	0.2
Several options would have been possible.	The breakdown of Bear Stearns might have threatened the whole financial system.	1	<p>There would have been the possibility, as mentioned above, to let financial institutions in the shadow financial system fail and save socially important commercial banks and pension funds.</p> <p>In case the decision was taken to save institutions there would have been the possibility to follow the following procedure: a) shareholder cover all losses, b) if a) is not sufficient debt-for-equity swap for creditors (bondholders,</p>	0.2

			but not small deposit holders), if b) also is not sufficient together with the Treasury the companies could have been nationalised. Clear procedures and options to handle insolvent financial institutions were not discussed. Options were chosen which were in the interest of financial institutions and their owners and big creditors.	
There was no consistency how to handle insolvent financial institutions.	The FRB tried to explain its actions (see the arguments above).	1	There was no constancy. Some institutions were saved, others not.	0.2
weighted average		1.4		

Using the described method, the average grade of all actions analysed is 2.8. This evaluates the performance of the FRB only between fair and good. Looking at the interest rate policy by the FRB after 2007 there is no criticism justified. Interest rates were cut quickly and to almost zero. The different programs to keep financial markets liquid followed the logic of a lender of last resort which has to be followed by a central bank. The problem was not an insufficient liquidity creation; the problem was that the FRB provided liquidity without demanding a change in the functioning of financial markets which created the biggest systemic financial crisis after World War II with enormous costs for the real economy and the social situation of many people. The FRB also did not demand financial institutions to give a certain amount of credit to firms and households or to help poor households which were not able to serve their mortgage obligations. Problematic was the handling of financial institutions in the shadow financial system and the bailouts by the FRB. This policy area was not transparent and not based on market principles (Stiglitz, 2010). Bear Stearns and AIG were saved and Lehman Brothers not. Owners and big creditors to financial institutions benefited at the cost of risk of tax payers.

One reason for the unsatisfying handling of financial institutions in trouble might be the structure of the FRB. In the current election process the directors of the FRB are elected by the banking sector. The FRB in its monetary policy, in its role to supervise financial institutions and especially in its role of lender of last resort can therefore not be seen as truly independent. The question is whether the wrong incentives were driving the decision making of the FRB during the crisis. A central bank should be willing and able to follow actions even though it might implicate smaller profits and bonuses for certain actors or even the breakdown of financial institutions with losses for equity holders and big creditors to banks.

## 5. Conclusion

This paper showed that asset bubble theory is an important field in economic theory as the effects of such bubbles can be disastrous. Missing regulation and reckless behaviour of market participants fuelled the subprime crisis and led to a systemic financial crisis. Even though it is important to improve the handling methods of a bubble, it is even more important to change the underlying conditions so that bubbles cannot arise in the first place. All bubbles have common features but are nevertheless unique in their development and especially outcome. Fighting the symptoms of a bubble is therefore riskier and less reliable than eliminating or at least containing the causes of asset bubbles in general. A major failure of the FRB was to not prevent the subprime bubble or at least to lobby for stricter regulations

which would have been preventative. From this perspective, the FRB was an additional part of the problem rather than an institution helping to create and sustain a sound financial system.

The actions of the FRB after the outbreak of the subprime crisis have provoked many discussions. This is not only due to the fact that the FRB created new tools that haven't been used before but also due to the lack of transparency of many decisions of the FRB that were criticized earlier. Not only that this lack of transparency can destabilise markets even more as market participants act on the basis of unclear information, in the case of the subprime crisis the FRB also gave the impression that it was trying to hide certain facts from the public (as was the case with AIG). This allows the conclusion that the FRB protected the rich and super-rich and bailed out Wall Street, not Main Street and poor over-indebted households. This impression was supported by the actions of the Obama administration which in substance followed the policy of the previous the Bush administration (Stiglitz, 2010).

Furthermore, the rescuing of financial market players during the financial crisis sent wrong incentives to the financial market. These incentives have to be changed. Banks, and especially financial institutions in the shadow financial system, should be allowed to go bankrupt. Institutions should not be too big to fail. If institutions have to be saved, owners and big creditors to these institutions should lose their investment before the government steps in. Nationalisation of institutions leads to the option to privatise nationalised institutions after the end of the crisis without losses.

So while it is important that the engine of the financial markets is running again, it is equally important that procedures are changed. Otherwise, a repetition of the situation is likely. Major reasons for the housing bubble and the resulting financial crisis were the deregulation of the financial system in the decades before which gave room for destabilising financial innovation, moral hazard, risky and speculative behaviour. It is within the FRB's duty to understand, judge, and, if necessary, help to regulate financial markets including financial products and business models in order to ensure well-functioning financial markets. The recent past has shown (as in many cases in the past) that markets do not work efficiently without regulation. The fact that the FRB was almost unprepared, and continued to deny the existence of a bubble even right before the housing bubble burst, introduces the question of whether the FRB is carrying out its mission of oversight of the financial market carefully enough. In general, the FRB underestimated the risk that banks and institutions in the shadow financial system were holding; misjudged the securitization principles and underestimated the incentives for excessive risk taking of bankers. The FRB could have pushed for higher down payments on houses or higher margin requirements for stock trading, limiting and standardizing securitisation and many other regulative policies to cool down the bubble before its burst. During his tenure Greenspan allowed banks to engage in even riskier lending, for example encouraging homebuyers to take variable mortgage loans that could (and did) later explode.

The 2010 Dodd-Frank reform legislation which includes a soft version of the Volcker rule might be a start. Although the question is whether this reform will really help dealing with financial meltdowns without risking taxpayer's money. Credit relationships between commercial banks and shadow financial institutions are still not cut. In addition, financial products, still need to be checked by supervisory institutions before they are allowed to be used. Much remains to be done.

## Notes

<sup>1</sup> See Herr (2014) for other comparisons.

<sup>2</sup> For further information see Barlevy (2007).

<sup>3</sup> In economic history, there is a long list of economists belonging to different paradigms who have analysed bubbles. Among the most famous are K. Wicksell, F. Hayek, I. Fisher, C. Kindleberger, and H. Minsky. For an overview of these paradigms, see Detzer & Herr (2015).

<sup>4</sup> The International Monetary Fund has shown that bubbles usually lead to an output loss after their burst. Laeven & Valencia (2008) report that of 40 crises, the average output loss as a share of GDP was 20.1%. The impact on emerging markets could be far more important than on developed markets. The output loss of Thailand after the systemic banking crisis starting in 1997 was measured at 97.7% showing the possible destructive effect of a bursting bubble very clearly.

<sup>5</sup> Between 2006-2009, the S&P/ Case-Shiller Home Price Index showed a drop of 33 % and the foreclosure rate consequently went up, tripling to almost 3 million per month in 2008 (Sagemann & Reese, 2011).

<sup>6</sup> The savings and loan crisis of the 1980s and the 1990s in the US was quantitatively bigger than the subprime crisis. However, at that time the overall financial system was more stable and the crisis could be contained (Hellwig, 2009).

<sup>7</sup> Source: Federal Reserve's Funds Rate Archive, own graph.

<sup>8</sup> Stiglitz, J. E., (2010). Freefall - America, Free Markets, and the Sinking of the World Economy, page 7.

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