



# A retrospective on the subprime crisis and its aftermath ten years after Lehman's collapse



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## ABSTRACT

This paper reviews the interactions between policymaking, the financial system and the U.S. economy before, during and after the subprime crisis, with particular attention to current controversies about the policy decisions that led to Lehman's downfall and their lessons for the future. The first part of the paper documents and analyzes the interactions between policy, financial markets and the economy during the acute and subsequent moderate phases of the crisis as well as during the later gradual exit from the zero lower bound and the extremely slow reduction in high powered money and bank reserves. The remaining parts develop alternative aspects of the thesis that mutual uncertainties inflicted by financial institutions on policymakers and by the latter on financial markets were at the root of the non-negligible surprises that the crisis inflicted on everybody. In particular, it discusses the political economy of bailout operations, reviews and evaluates recent controversies about the reasons for not rescuing Lehman Brothers, and informally presents the structure and policy lessons from a general equilibrium model of the financial sector highlighting the consequences of policy actions that have raised (Knightian) bailout uncertainty. The last section takes a brief look ahead and discusses some longer term consequences of the crisis.

## 1. Introduction

September 2018 marked the tenth anniversary of Lehman's collapse. Although the crisis already sent tremors through the financial system in 2007, this was the most traumatic single event of the subprime crisis. Relying on the advantage of a ten year perspective, this paper takes a broad look at the evolution of the crisis, the extraordinary policy responses and their consequences, the slow exit from such policies as well as at the long-term consequences of the crisis.

The financial crisis initially ignited fears about a potential replay of the devastations caused by the Great Depression, but the impact was neither as deep nor as persistent. This outcome was made possible by lessons learned from the depression of the 1930s and the audacity to experiment with policy measures that, up to 2007/2008, were considered unconventional. But the crisis produced the deepest post-war recession and took most policymakers and the financial community by surprise. Interestingly, this occurred despite the fact that the actions (and inactions) of financial institutions and policymakers contributed to creating the substantial levels of uncertainty that surprised both of them.

By 2018 the impacts of the crisis on the real economy and on banking credit were gone. Policymakers' reactions during the crisis went through the following phases: Pre-crisis regulatory complacency, vigorous and unconventional deployment of monetary and fiscal measures during the acute phases of the crisis to shore up the financial system, regulatory reform in 2010, extension of large-scale asset purchases over 2010–2014 to revive the real economy, and, since the end of 2015, gradual lifting of the federal fund rate

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that had been maintained at the zero lower bound (ZLB) since the end of 2008.

But other economic and policy consequences of the crisis still persisted in 2018. Some of them were likely to characterize the post-crisis era for a long time to come. Although they rebounded from their depressed crisis levels of 2017, aggregate net new issues of bonds were still far below their pre-crisis levels. As of 2018, the huge levels of high powered money and bank reserves created through large-scale asset purchases (LSAP) were still not far from their 2014 peaks. Various regulatory changes permanently altered the regulatory landscape, LSAP at the ZLB along with forward guidance became standard measures in the toolkit of monetary policy and, ever since October 2008, the Fed has been paying interest on excess reserves. Last but not least, the dilemmas confronting policymakers faced with the need to bail out systemically important financial institutions (SIFI) had not vanished and are likely to occasionally re-emerge in the future.

This paper takes a retrospective bird's eye view on the interactions between policymaking, the financial system and the economy before, during and after the subprime crisis. The first part of the paper documents and analyzes the interactions between policy, financial market and the economy during the first acute and later more moderate phases of the crisis as well as during the gradual exit from ZLB and the much slower reduction in high powered money and bank reserves. The remaining sections develop various aspects of the claim that the surprise elements induced by the crisis were largely due to mutual uncertainties inflicted by financial institutions on policymakers and by the latter on financial markets. In particular, prior to the crisis, regulators and other policymakers failed to recognize the full impact of financial innovations and their own regulatory neglect on the systemic risks associated with the emergence of the subprime bubble. Once the crisis was in full swing, the absence of preannounced transparent bailout policies contributed to raising the level of uncertainty faced by financial institutions, triggering the devastating post-Lehman financial panic.

In spite of a succession of highly criticized previous rescue operations, the Fed and the secretary of the Treasury were faced with the imminent downfall of three colossal SIFIs in early September 2008; Fannie Mae and Freddie Mac, AIG and Lehman Brothers.<sup>1</sup> They chose to rescue the first two and leave Lehman to its fate. The memoirs of the three main framers of the bailouts (Bernanke, 2015; Paulson, 2010; Geithner, 2014) suggest that the latter decision was due to the fact that, in the absence of congressional approval, the Fed had reached the legal limits of its lender of last resort mandate. In contrast, Ball (2018) argues that the Fed had the legal authority to offer emergency lending to Lehman and that Lehman's collateral was no more risky than that of other SIFIs that were rescued.

Against this retrospective disagreement about the motives and reasons for the dramatic policy decisions of September 2008 this paper discusses the political economy of bailout operations in the face of dilemmas not encountered since the Great Depression. It presents, contrasts and evaluates different current views on the important September 2008 policy decisions and suggests an improvement designed to reduce bailout uncertainty if and when financial rescue operations become necessary in the future. Interestingly, a similar policy recommendation is implied by a general equilibrium model of the financial system, whose main assumptions and results are summarized in the paper.

The organization of the paper is as follows. Section 2 presents a bird's eye view of the interactions between policymaking, financial markets and the economy through the various phases of the crisis and its aftermath. The section documents and analyzes the interactions between policy on one hand and credit formation through the banking system and the bond market on the other. Subsection 2.2 discusses the consequences of payment of interest on excess reserves for banking credit and Subsection 2.3 documents the allocation of credit through the bond market. Subsection 2.4 argues that the low levels of inflation prevailing until 2016 were due to the reluctance of banks to lend in spite of their huge reserve levels. Several factors such as an increase in aversion to bailout uncertainty, payment of interest on excess reserves and post-Lehman toughening of regulation fed this reluctance.

Section 3 contains a brief introduction to the mechanisms through which policymakers and financial institutions inflicted elevated levels of uncertainty on each other. The political economy of financial bailout operations during the acute phases of the crisis is discussed in Section 4. Section 5 confronts and evaluates conflicting recent views about the reasons that led to the decision not to bail out Lehman. Using concepts from modern decision theory and psychology, Section 6 informally presents the structure and results of a theoretical model designed to highlight the adverse impact of increasing bailout uncertainty. The main point is that, by raising (Knightian) uncertainty about future bailout policies, the decision not to rescue Lehman triggered the devastating post-Lehman panic. This is followed by a brief summary and a look at the longer term consequences and lessons from the crisis in Section 7.

## 2. A bird's eye view of interactions between policy actions, aggregate credit and the economy before, during and after the crisis

Although the subprime crisis had been building up gradually since summer 2007, LSAP operations (also known as quantitative easing (QE)), started only after the downfall of Lehman and the ensuing panic. Initially, these operations were aimed at meeting the huge increase in demand for liquidity induced by the panic and to provide interim financing for fiscal bailouts of ailing SIFI like Bear-Stearns, AIG and the two giant Government Sponsored Enterprises (GSEs). But after a while the major objective became the stimulation of economic activity in a ZLB environment.<sup>2</sup> After two years of gradual descent, the federal funds rate effectively reached the ZLB at the end of 2008. The Fed responded with large-scale purchases of government and private obligations that dramatically increased the size of its balance sheet. The level of reserves in the banking system and the monetary base increased correspondingly. These large-scale operations were implemented via three waves of massive purchases of government and private obligations by the

<sup>1</sup> The fact that these institutions are arranged by the value of their balance sheets is not accidental, as explained in Section 5.

<sup>2</sup> In the post-Lehman period the rate of unemployment peaked at over 9 percent.

Fed. In retrospect, these three waves of purchases became known as QE1, QE2 and QE3.

Under QE1, which started in September 2008, the Fed purchased about 2 trillion dollars' worth of bank debt, mortgage-backed securities and Treasury notes. In November 2010, the Fed announced a second round of quantitative easing, "QE2", buying 600 billion dollars of Treasury securities by the end of the second quarter of 2011.<sup>3</sup> QE operations drew various criticisms from some politicians and economists. Shortly after the Fed unveiled plans for QE2, four top Republicans in Congress dispatched a letter to its chairman expressing their concern about the continuous use of this unconventional policy instrument. They wrote that the Fed's LSAP could "result in ... hard to control, long term inflation and potentially generate artificial asset bubbles". Being well aware of the importance of monetary policy for US economic activity, Bernanke (2015, p. 493) mentions that this letter came a day after representative Mike Pence of Indiana proposed legislation to remove the Fed's dual mandate, leaving price stability as the only objective of monetary policy. There is little doubt that this proposal was based on a poor understanding of the transmission channels of monetary policy, since both output and inflation gaps were negative at the time, implying that there was no conflict between closing the (negative) output and inflation gaps.

The main objective of QE3 was to reduce the unemployment rate, which remained stubbornly above 7 percent through 2012. Within the framework of QE3 the Fed bought 85 billion worth of bonds each month, starting in December 2012, for about a year. A more elaborate discussion of the interaction between QE and unemployment appears in Subsection 2.3 below. From December 2013 the purchased amount was gradually reduced until its total discontinuation at the end of October 2014. The cumulative impact of the QE programs increased the US monetary base by more than four and a half times (from about 850 billion dollars in August 2008 to a bit over 4 trillion in September 2015).

The Fed's QE operations were aimed at reducing long-term interest rates in a ZLB environment. According to conventional wisdom, during normal times, expansionary monetary policy stimulates the economy by lowering risky long-term rates, which in turn respond to the lowering of short-term policy rates by the CB.<sup>4</sup> But this transmission mechanism no longer operates in the presence of a ZLB. The view underlying unconventional monetary instruments like QE is that in such situations long-term risky rates, which were above the ZLB even during the crisis, can be reduced directly by QE operations and maturity extension programs.

In addition, pre-crisis conventional wisdom was that by raising the stock of reserves in the banking system, such operations induce further lending by banks, which stimulates the economy by raising aggregate demand. However, this view presupposes that the interest paid on bank reserves is lower than the federal funds rate. But starting with the last quarter of 2008 the federal funds rate was actually lower than the interest the Fed paid on reserves. For reasons elaborated below, Selgin (2018) argues that this rate configuration hindered the operation of the conventional transmission mechanism. The next two subsections examine the extent to which QE operations in the post-Lehman era managed to activate the transmission mechanisms described above by taking a look at the evolution of the monetary base, banking reserves and credit, and net new bond issues before and after the crisis.

## 2.1. Policy actions and banking credit

Figs. 1 and 2, respectively, show the evolution of the effective federal fund rate (EFFR), the monetary base and total bank reserves between January 2006 and March 2018. To back up the subsequent discussion, Fig. 1 also shows the evolution of unemployment and inflation. Just over a year prior to the September 2008 Lehman event, the EFFR was over 5 percent and the base was growing at a relatively low and steady rate. Between the initial 2007 appearance of problems in the repo market and the end of 2008 the EFFR gradually decreased to the 0-0.25 range, effectively hitting the ZLB. By contrast, the monetary base continued to increase at its pre-crisis tranquil rate until Lehman's collapse. From that point it increased dramatically through several waves of QE operations. Bank reserves follow a pattern similar to that of the base. A broad comparison of Figs. 1 and 2 suggests that reserves and the monetary base are tightly related. Prior to Lehman's collapse none of them moved by much. After this event, strong upward movements in bank reserves largely mirror similar movements in the monetary base.

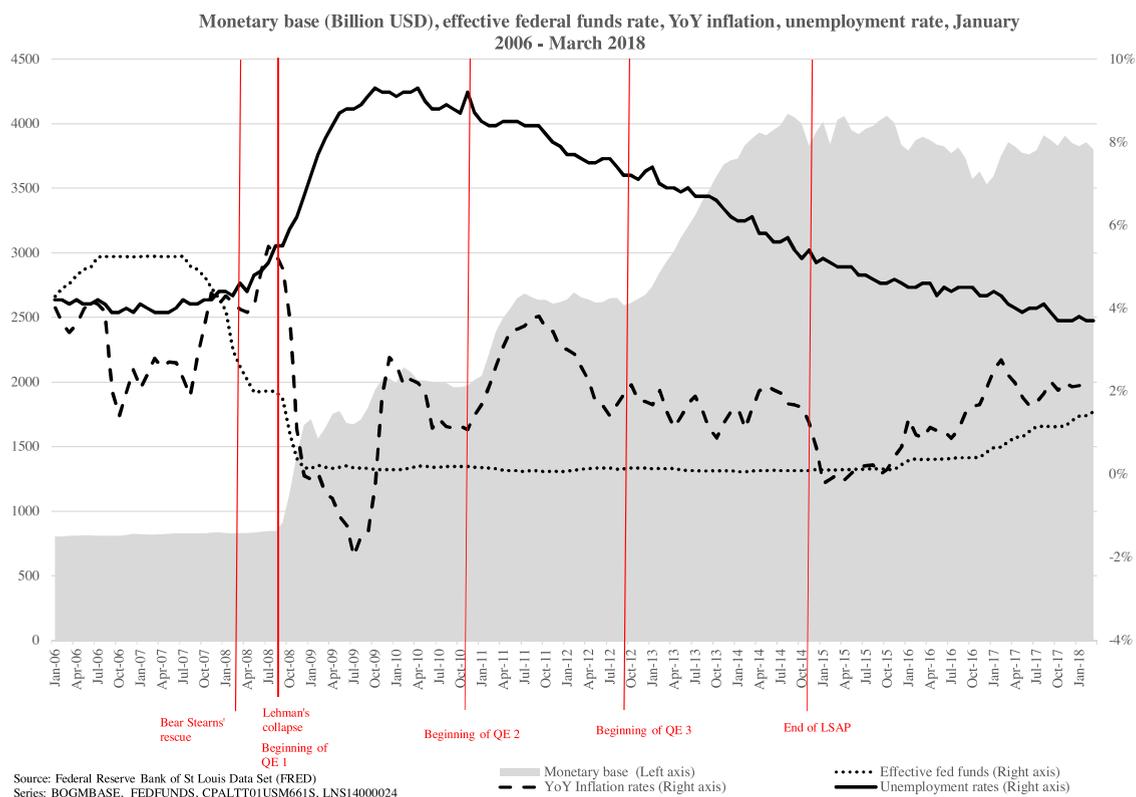
Given the supply of currency in circulation, movements in reserves are directly determined by changes in the monetary base since, by definition, the monetary base is equal to cash plus reserves in the banking system. Due to the fact that the public's desired cash to deposits ratio was relatively stable and that liquid deposits increased substantially less than the monetary base, the close association between bank reserves and the monetary base is not surprising.<sup>5</sup> It implies that the level of banking reserves largely reflects the huge QE operations of the Fed. In particular, between August 2008 and the discontinuation of QE3 (November 2014), banking reserves and the base increased by 2542 and 3086 billion dollars respectively, implying that over eighty percent of the base increase took the form of an increase in reserves and the remainder leaked into cash.

Although LSAP were discontinued at the end of 2014, the Fed's policy rates only started to slowly move up from the ZLB at the end

<sup>3</sup> In September 2011 the Fed unveiled a plan to buy 400 billion dollars of long-term debt and simultaneously sell short-term debt in order to reduce long-term rates. Unlike QE operations this move did not have a first order effect on the total Fed's balance sheet and on the monetary base since it only involved a swap of short- for long-term debt. The Fed referred to this program as a "Maturity Extension Program" and the press as "Operation Twist", since it had some similarities to a Fed program of the same name from 1961 aimed at reducing the slope of the yield curve by simultaneously selling short-term and buying long-term debt.

<sup>4</sup> Work by Gilchrist and Zakrajšek (2012) and Cukierman (2016) suggests that, of all the different types of rates, long-term risky rates are the ones most closely connected to the level of economic activity.

<sup>5</sup> The relative stability of this ratio both before and after the crisis is due to the existence of deposit insurance in conjunction with the fact that, following the onset of the crisis, the ceiling on this insurance was raised (from one hundred thousand dollars per deposit to two hundred and fifty thousand dollars). Further details are in Cukierman (2018).



**Fig. 1.** Monetary base (billion USD), effective federal funds rate, YoY inflation, unemployment rate, January 2006 - March 2018. Series: BOGMBASE, FEDFUNDS, CPALTT01USM661S, LNS14000024. Source: Federal Reserve Bank of St Louis Data Set (FRED).

of 2015, reaching the 1.50–1.75 percent range by April 2018. But the huge stocks of base money and bank reserves created by the three waves of QE went down rather modestly from their peaks (see the 2014–2018 time ranges in Figs. 1 and 2). As of March 2018, the stocks of base money and bank reserves were still at 93 percent and 78 percent of the peak levels reached during the second half of 2014. This reflects a conscious decision by the Fed to wind down the monetary base and the excess reserves accumulated during the crisis by attrition rather than by open market sales.

Fig. 3 shows the evolution of total net new banking credit and net new bond issues between 2000 and 2018. The dark and lightly shaded rectangles refer to net new credit allocated through the banking system and the bond market, respectively.<sup>6</sup> A quick glance at the figure suggests that with the intensification of the crisis the hefty rates of credit expansion through the banking system observed prior to the crisis tapered off following the rescue of Bear-Stearns, dropped into the negative range over 2009 and, excluding 2012, remained anemic through 2013. Banking credit rose back to the 2012 level in 2014, finally reaching pre-crisis levels during 2015 and 2016.

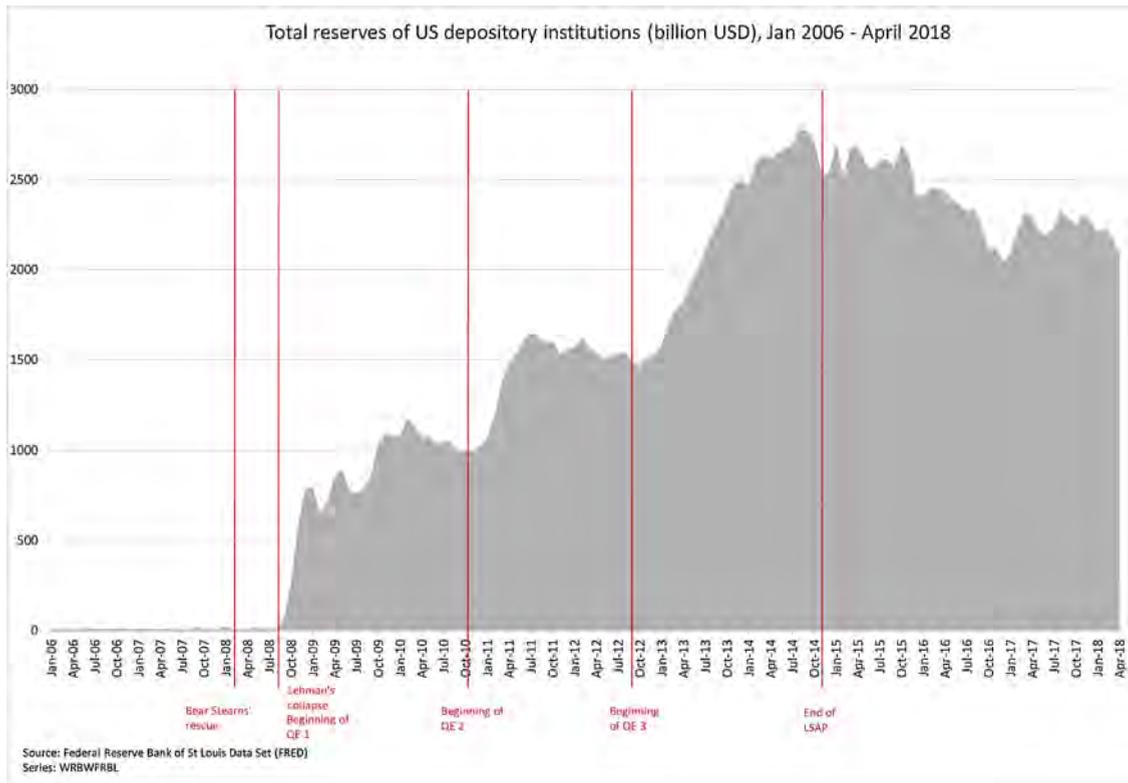
A comparison of the behavior of new banking credit formation in Fig. 3 with the behavior of banking reserves (Fig. 2) in the post-Lehman period suggests that, in spite of a huge Fed-induced expansion of bank reserves, the blow to banking credit from the intensification of the crisis in 2008 persisted for at least five years. Thus, following Lehman's collapse, the part of the transmission mechanism that was supposed to stimulate the growth of banking credit by means of reserve creation was largely non-existent until at least 2014. It is nonetheless possible that in the absence of LSAP banking credit would have shrunk even more after the Lehman event. It is also possible that the QE operations of the Fed until 2014, in particular including the absorption of legacy assets by the Fed, contributed to the revival of banking credit from 2015.

## 2.2. The shift from a corridor to a floor system and its consequences

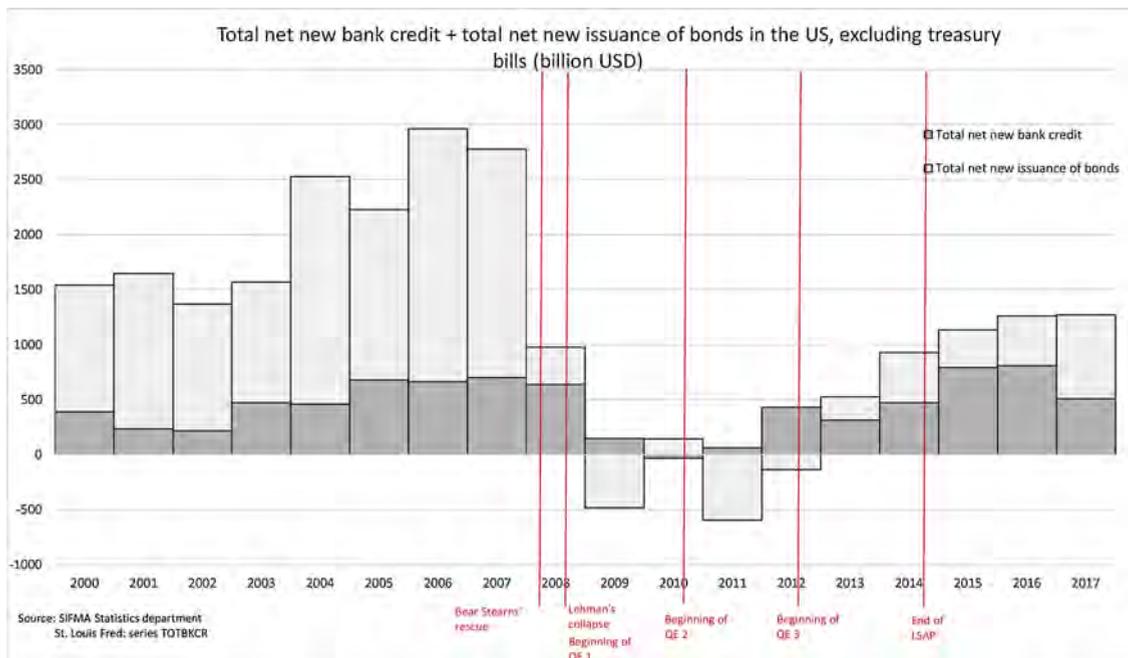
In October 2008, following the passage of the Emergency Economic Stabilization Act, the Fed started paying interest on excess reserves (IOER). This rate, which was initially higher than 1 percent, was quickly lowered to 0.25 percent in December 2008 and remained at this level until December 2015. From that time it increased gradually, reaching 1.75 percent in May 2018.

Importantly, during virtually all of this period the (market-determined) EFFR was lower than the IOER. Selgin (2018) and

<sup>6</sup> Credit formation through the bond market is discussed in the next subsection.



**Fig. 2.** Total reserves of US depository institutions (billion USD), Jan 2006 - April 2018.  
Series: WRBWFRL.  
Source: Federal Reserve Bank of St Louis Data Set (FRED).



**Fig. 3.** Total net new bank credit + total net new issuance of bonds in the US, excluding treasury bills (billion USD).  
St. Louis Fred: series TOTBKCR.  
Source: SIFMA Statistics department.

Dutkowsky and VanHoose (2017) convincingly argue that this transformed the conventional corridor system in which the EFFR was bounded between the discount rate and the IOER into a floor system in which the expansion of bank reserves through open market purchases is substantially less effective in incentivizing banks to increase credit to the economy.

Under the corridor system that was in effect prior to the crisis, banks had an incentive to use excess reserves to increase lending, since the return on credit was sufficiently higher than the (zero) rate on reserves to compensate them for the higher risk involved. But once the IOER became higher than the market-determined EFFR, transforming the corridor into a floor system, the incentive of banks to use the huge excess reserves created by the QE programs for higher credit extension weakened considerably. This was a natural response in view of the fact that the rate they could obtain on excess reserves was higher than a riskier, market-determined, short-term rate. The reaction was reinforced by a general flight to safety in the aftermath of Lehman's collapse and subsequently by a tightening of financial regulations.

Selgin (2018) argues that, at least during the initial stages of the crisis, the Fed did not intend to replace the corridor system with a floor system and was not fully aware of the consequences of this policy change for the effectiveness of conventional open market purchases. The initial motivation, as reflected in the announcements of Fed officials at the time, was to prevent the huge QE operations from reducing the EFFR below the target rate for this variable and cause price increases. With the benefit of hindsight we know that these fears were grossly exaggerated.<sup>7</sup> This supports the view that, in the face of dramatic economic events that induce the introduction of novel policy instruments on a grand scale, even experienced policymakers have to go through painful learning periods.

Flooding the economy with liquidity via QE along with IOER led to a substantial reduction in the volume of transactions in the short-term interbank market, since the Fed policy largely reduced the need of banks to borrow or lend in this market.<sup>8</sup> The reason that this market did not fully vanish is that various government sponsored enterprises (GSEs), including Fannie Mae, Freddy Mac and the Federal Home Loan Banks, keep deposit balances at the Fed but are not eligible for interest on those balances. The GSEs access to the Fed funds market therefore created an arbitrage opportunity Fed officials didn't anticipate, with GSEs lending Fed funds to banks over night, especially to very large U.S. banks and a handful of (mostly European) foreign bank branches, in exchange for a share of the latter's IOER earnings (Selgin, 2018, pp. 18–19). This arbitrage mechanism is also responsible for the fact that the EFFR was uniformly lower than the IOER.

### 2.3. Policy actions and the bond market

A substantial part of credit flows in the US occurs through bond issues in the capital market.<sup>9</sup> This subsection examines the behavior of bond issues through the US bond market prior to, during and after the crisis. The lightly shaded rectangles in Fig. 3 show the yearly volumes of total, net of redemptions, new bond issues excluding treasury bills. The yearly data in the figure highlight the fact that the decrease in net new bond issues since 2008 was dramatic and highly persistent. A central objective of the QE operations was to revive the bond market. Fig. 3 suggests that the results were mixed at best. Since 2008 total net new issues of bonds often dropped into negative territory and, even when they finally picked up during 2016 and 2017, they hardly returned to their customary pre-crisis levels.

The decrease in net new bond issues was not distributed evenly across different categories of bonds. There was a dramatic and sustained decrease in net new issues of mortgage-related and asset-backed bonds. From a peak of over one trillion and a half in 2006, net new issues of those bonds became negative in 2008, remained in negative or negligible territory every single year until 2013, and rose very modestly above zero through 2017. Net new issues of federal agencies' securities and municipal bonds also plunged into negative territory for a good number of years following Lehman's collapse. Fig. 4 shows that the sum total of net new issues of those four categories decreased from over a trillion and a half in 2006 and 2007 to less than half a trillion in 2008. This sum was persistently negative every year between 2009 and 2013, positive but not far from zero during 2014–2016 and modestly higher in 2017. Although they differ in terms of absolute magnitudes, the time paths of each of the components of this sum are qualitatively similar to the behavior of the total, suggesting that the total sum is dominated by movements in mortgage-related and asset-backed bonds.

By contrast, the time path of net new issues of corporate bonds is quite different. Although those issues decreased from about 400 billion in 2007 to less than 200 billion in 2008, they actually increased to roughly 500 and 600 billion over 2009 and 2010, respectively (Fig. 5). Following a deep in 2011, net new issues of corporate bonds rebounded to their pre-crisis levels in every single year during 2012–2017. But, since the increase in net new issues of corporate bonds was substantially smaller than the collapse of mortgage-related and asset-backed bonds, total net new nonfederal bond issues were still in negative territory, as can be seen from Fig. 3. Possible reasons for this contrast are discussed at the end of this subsection.

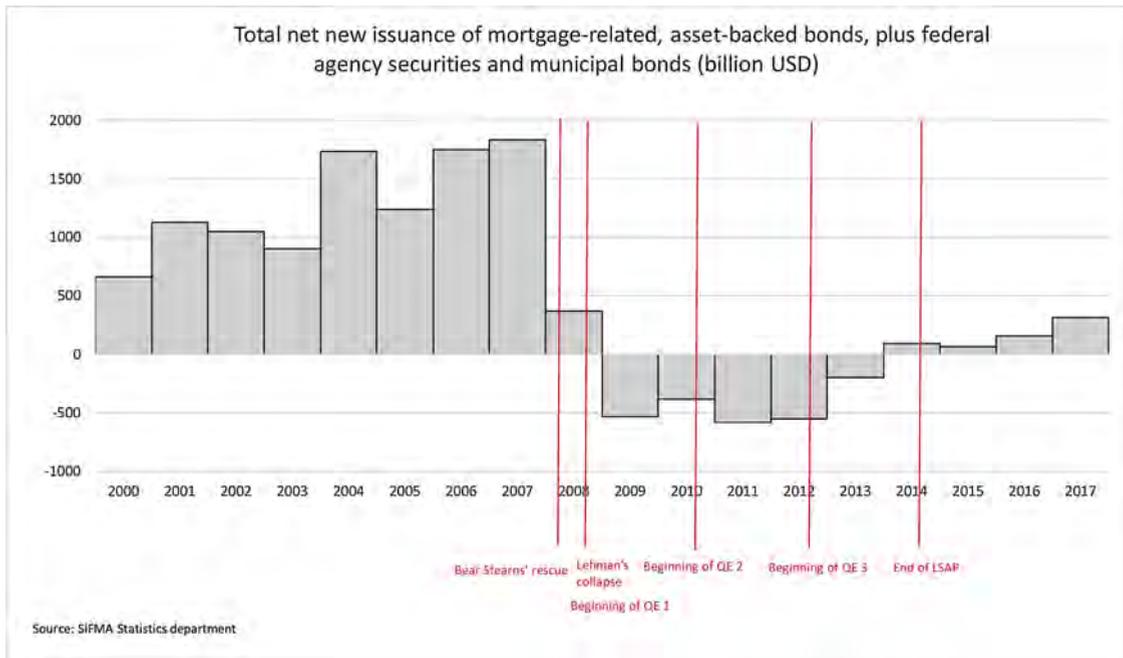
Next, I turn to commercial paper<sup>10</sup> (CP), which is a short-term debt instrument issued by large corporations mainly from the financial sector. At the beginning of 2007, with almost two trillion dollars outstanding, the CP was the largest short-term debt

<sup>7</sup> The experience of the Eurozone and Switzerland with negative policy rates shows that the effective lower bound is lower than zero. The Fed's policy of paying a positive rate on excess reserves probably contributed to raising the lower bound above what it would have been in the absence of this policy.

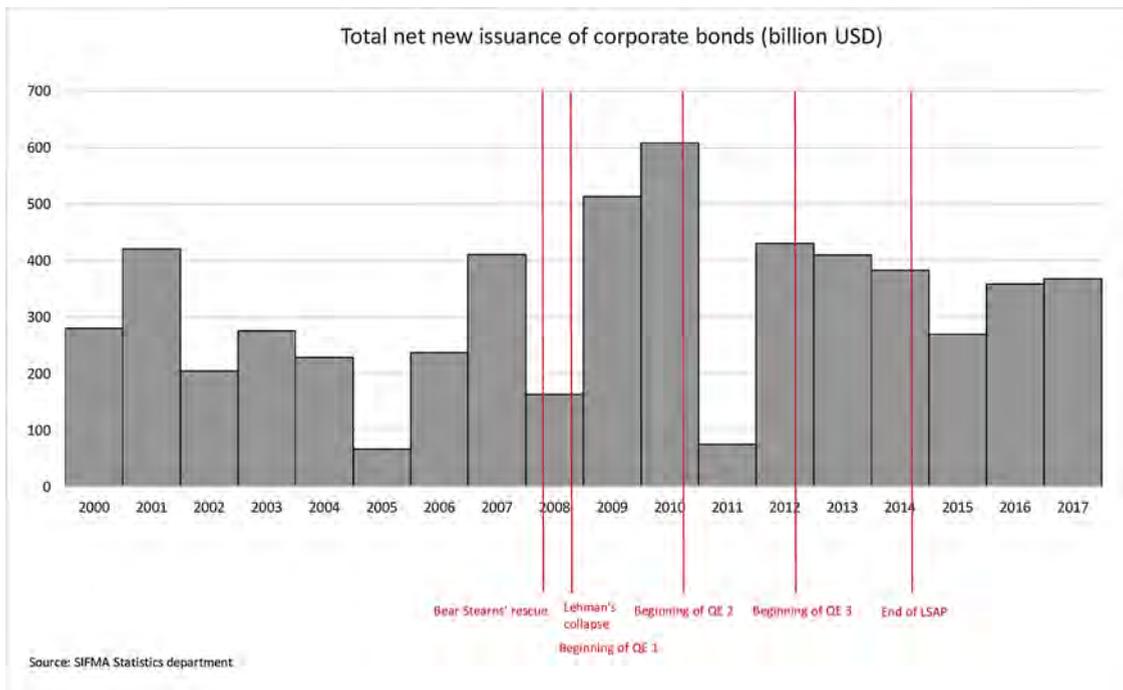
<sup>8</sup> Essentially the Fed became a "lender of first resort", reducing the incentive of banks to monitor each other.

<sup>9</sup> The stock of US private bonds is about three times larger than the stock of banking credit. Further details are in Section 5 of Cukierman (2014).

<sup>10</sup> The discussion of commercial paper draws partially on Kacperczyk and Schnabl (2010).



**Fig. 4.** Total net new issuance of mortgage-related, asset-backed bonds, plus federal agency securities and municipal bonds (billion USD). Source: SIFMA Statistics department.



**Fig. 5.** Total net new issuance of corporate bonds (billion USD). Source: SIFMA Statistics department.

instrument in the US. From the perspective of the issuer one benefit of CP is that they can avoid the costly process involving registration under the Security Act of 1933 provided (i) the maturity of CP is not higher than 270 days. In practice, commercial paper typically has far shorter maturities—between one and 90 days—with an average maturity of about 30 days. (ii) CP must not be targeted towards the general public. Hence, issuers of CP cater to institutional investors, usually offering large denominations of 100 thousands or more. (iii) Issuers of CP are allowed to finance only short-term assets with the proceeds of CP. But a legal exemption

makes it possible to bypass this requirement under some conditions, enabling them to finance long-term assets by continually rolling over CP.

Depending on the issuer there are three kinds of CP: Asset-backed, financial and corporate. The share of asset-backed commercial paper (ABCP) grew substantially during the twenty years preceding the financial crisis. Out of the 1.97 trillion dollars balance of CP outstanding in January 2007, 56.8 percent was ABCP, 34.4 percent was financial CP and 5.7 percent was corporate CP. ABCP are issued by off-balance sheet conduits of large financial institutions, where “off-balance sheet” means that the assets and liabilities of the conduits are not included in the financial institutions’ balance sheets. But the assets of the conduits are under the control of the parent institution in the sense that the conduit is a shell company managed by the parent. By the early 2000s most conduits invested in long-term assets. This maturity mismatch exposed them to roll-over risk.<sup>11</sup> In addition, since they invested a large fraction of their assets in MBS it turned out with the benefit of hindsight that the conduits were also risky because they were investing in assets that were far riskier than believed prior to the subprime crisis. Financial CP is issued directly by the issuing financial institution rather than through a conduit and is unsecured. It is characterized by short maturities and issued mostly by major financial institutions with strong balance sheets. Corporate CP is also unsecured and only large creditworthy firms with strong balance sheets can issue CP.

During the early 2000s, the total outstanding balance of CP fluctuated around 1.4 trillion dollars. Since 2004 this balance underwent a rapid expansion, reaching a peak of about 2.2 trillion dollars by early July 2007, when it experienced an initial collapse. This turnaround was triggered by the filing for bankruptcy of two Bear-Stearns’ hedge funds and the suspension of withdrawals from three of its investment funds by BNP Paribas. Fig. 6 shows the net new issuance of CP by year between 2001 and 2017. The most striking aspects of the figure are the large positive net new issues during 2004–2006 followed by even larger negative net new issues during the subsequent four years. The cumulative impact of those changes reduced the outstanding balance of CP from the July 2007 2.2 trillion dollar peak to about 1 trillion dollars at the end of 2010.

The shrinkage of the CP market occurred mainly in the components that were either directly or indirectly exposed to mortgage-backed securities (MBS). In particular, it included conduits that had used the proceeds of their CP issues to buy long-term MBS or CP that was collateralized by means of MBS. There were two main triggers. The first occurred in summer 2007 and was due to the financial difficulties of the Bear-Stearns hedge funds and the BNP Paribas investment funds described above. The second substantially stronger trigger was the collapse of Lehman Brothers in September 2008. In spite of two years of net new issuance of CP (2012 and 2017, see Fig. 6), the balance of CP was still lower at the end of 2017 than the bottom reached just prior to the beginning of the sustained increase at the beginning of 2004.<sup>12</sup>

A summary overview: The dramatic decrease in mortgage-related and asset-backed bonds was due to the realization by investors in the wake of the crisis that their ability to measure and manage the risks associated with these types of instruments was substantially lower than they had believed prior to the outbreak of the crisis. Since, prior to the crisis, those assets were used as collateral in commercial paper and repo transactions, a substantial part of the evaporation of liquidity was due to the collapse in mortgage-related assets.

The increase in corporate bonds during 2009 and 2010 partially reflects a substitution away from these defunct mortgage instruments into corporate bonds triggered by the perceived increase in the relative riskiness of the former. It also implies that the demand for credit by large corporations with good access to the capital market remained substantial in spite of the recession induced by the subprime crisis. It is likely that the Fed QE operations along with the maturity extension program and forward guidance contributed to this trend. By flooding the long end of the bond market with liquidity and keeping long-term interest rates low, the Fed encouraged corporations with good credit ratings to increase their long-term borrowing.

#### 2.4. Policy actions, unemployment and inflation

Fig. 1 shows the evolution of unemployment and inflation prior to, during and after the crisis. Until 2008 the rate of unemployment fluctuated in a narrow range around 4 percent and inflation was in the vicinity of the 2 percent target with bouts of overshooting. Following the panic triggered by Lehman’s collapse, inflation became negative and unemployment shot up to around 9 percent in 2009. Although unusually expansionary monetary and fiscal policies, aided by targeted bailouts of SIFI institutions, gradually reversed those extreme realizations of unemployment and inflation, the downward trend in unemployment was painfully slow.

An unemployment rate of almost 8 percent during the first half of 2012 triggered the third round of quantitative easing (QE3), which was announced on 13 September 2012. In an 11–1 vote, the Federal Reserve decided to launch a new \$40 billion per month, open-ended bond purchasing program of agency mortgage-backed securities. In December 2012, the FOMC announced an increase in the amount of purchases from \$40 billion to \$85 billion per month. The additional purchases were directed at treasury bills. Unlike the previous two programs, which had preset termination dates, QE3 was open-ended. In its December 2012 press release the FOMC motivated this further expansion of the base and related measures as follows:

“... the Committee decided to keep the target range for the federal funds rate at 0–1/4 percent and currently anticipates that this exceptionally low range for the federal funds rate will be appropriate at least as long as the unemployment rate remains above 6–1/2 percent, inflation between one and two years ahead is projected to be no more than a half percentage point above the

<sup>11</sup> To mitigate this risk, parent companies typically provided credit guarantees to outside investors in the ABCP.

<sup>12</sup> Balances are not shown.

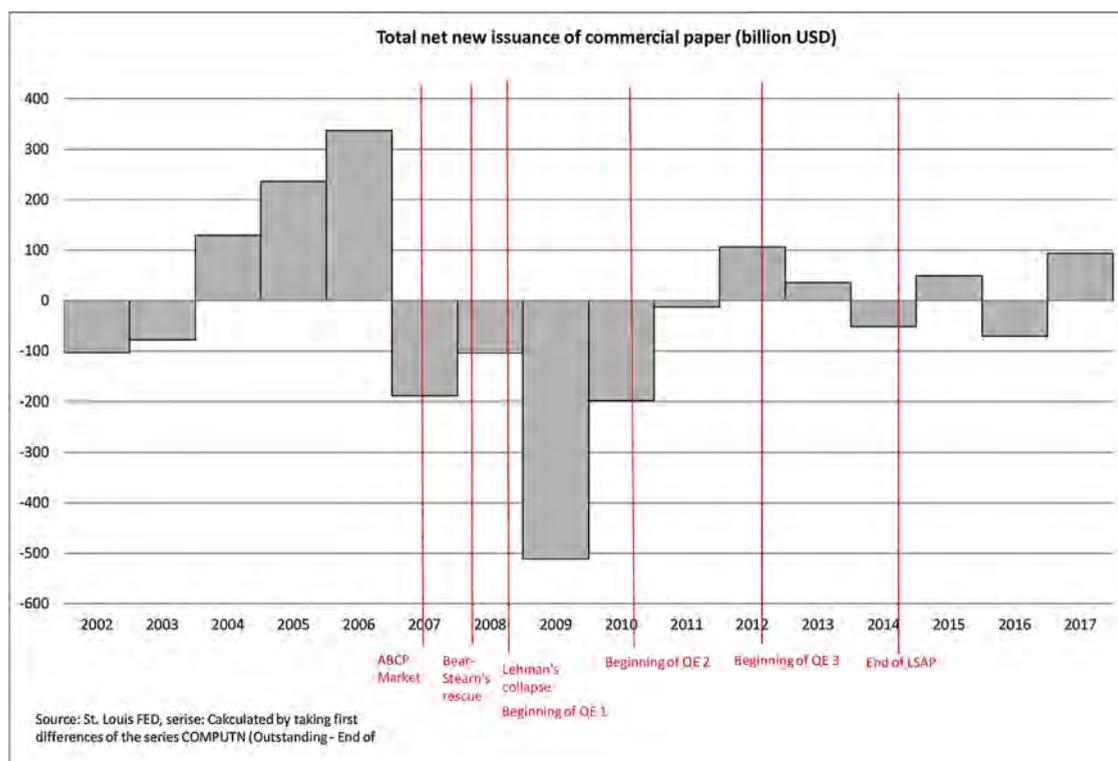


Fig. 6. Total net new issuance of commercial paper (billion USD).

Source: St. Louis FED, serie: Calculated by taking first differences of the series COMPUTN (Outstanding - End of period).

Committee's 2 percent longer-run goal, and longer-term inflation expectations continue to be well anchored. The Committee views these thresholds as consistent with its earlier date-based guidance. In determining how long to maintain a highly accommodative stance of monetary policy, the Committee will also consider other information, including additional measures of labor market conditions, indicators of inflation pressures and inflation expectations, and readings on financial developments.”

From that meeting onwards, the Fed intensified the use of forward guidance as a policy instrument that would complement the LSAP. Importantly, the FOMC stressed that the 6.5 percent unemployment and 2.5 percent inflation mentioned in the press release were thresholds rather than triggers. In other words, the statement implied that the FOMC would have to see the rate of unemployment at or below 6.5 percent before it would even consider raising the policy rate (Bernanke, 2015, p.332). When the LSAP were finally discontinued in October 2014, unemployment was well below 6.5 percent, highlighting the relatively high weight given by the Fed to economic activity.

Following a brief overshooting of the 2 percent inflation target in 2011, inflation missed the target from below for several years, dipped even more during 2015 and 2016, and finally returned to the vicinity of the target in 2017. The evolution of unemployment, inflation and the EFR since 2015 in Fig. 1 nicely illustrates the gradual return of monetary policy to normal inflation targeting in the post-crisis period. In particular, as unemployment and inflation gradually converged toward more acceptable levels, the Fed finally started an exit process by gradually raising the federal fund rate from the end of 2015.

In spite of LSAP during the six years following Lehman's collapse, inflation remained subdued. To believers in some basic version of the quantity theory this might appear surprising at first blush (an example is Issing, 2012). However, if, owing to the slowdown in credit growth since the Lehman event, higher order monetary stocks like M1 and M2 did not keep up with the growth in high powered money, this phenomenon would be more understandable.

Due to the fact that the QE operations involved open market purchases of bonds, a large part of the liquidity injected by the Fed took the form of banking reserves.<sup>13</sup> As shown in the preceding two subsections, in spite of this huge accumulation of reserves, banking credit increased very little during the six years following the Lehman event and net new bond issues remained sluggish through 2017. As a consequence, most of the normal transmission to higher order monetary stocks did not materialize. In spite of a flood of reserves they obtained from the Fed, banks did not expand credit or increased it at much lower rates than prior to the crisis at least until 2013. As a result, only a fraction of the more than fourfold base expansion took the form of increases in higher order monetary stocks. Between August 2008 and June 2016, high powered money (H) increased by 415% while M1 and M2 increased by

<sup>13</sup> By contrast, until 2014 the ECB injected liquidity mainly through self-liquidating repos. The consequences of those different policy procedures for the behavior of banking reserves are explored in Cukierman (2014).

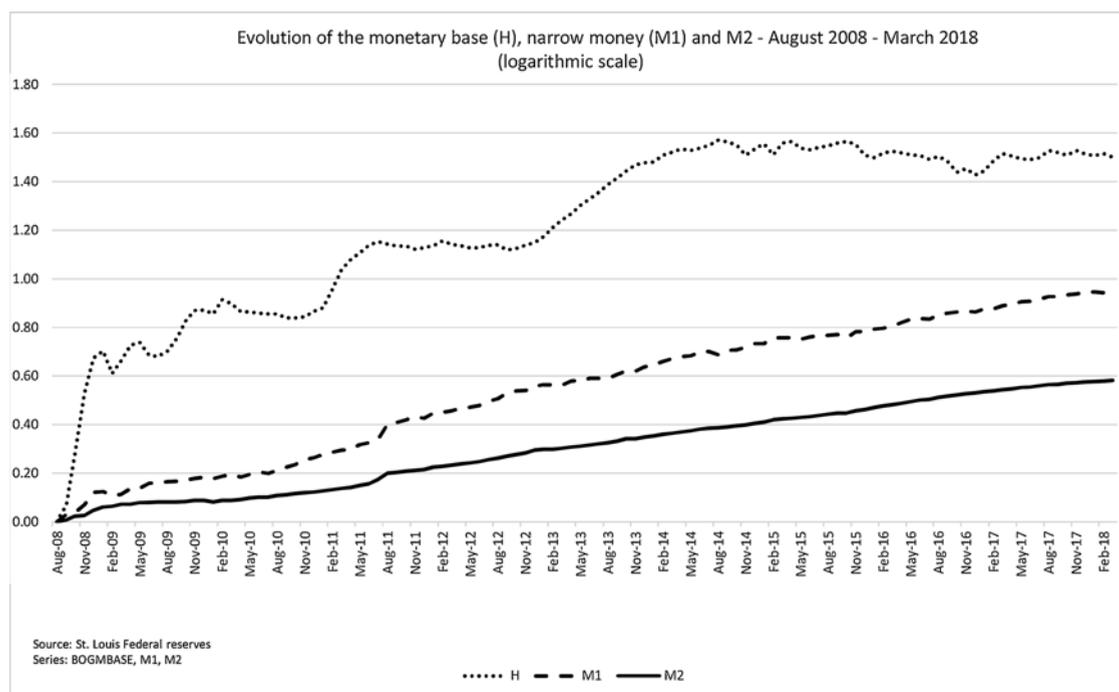


Fig. 7. Evolution of the monetary base (H), narrow money (M1) and M2 - August 2008 - March 2018 (logarithmic scale).

Series: BOGMBASE, M1, M2.

Source: St. Louis Federal reserves.

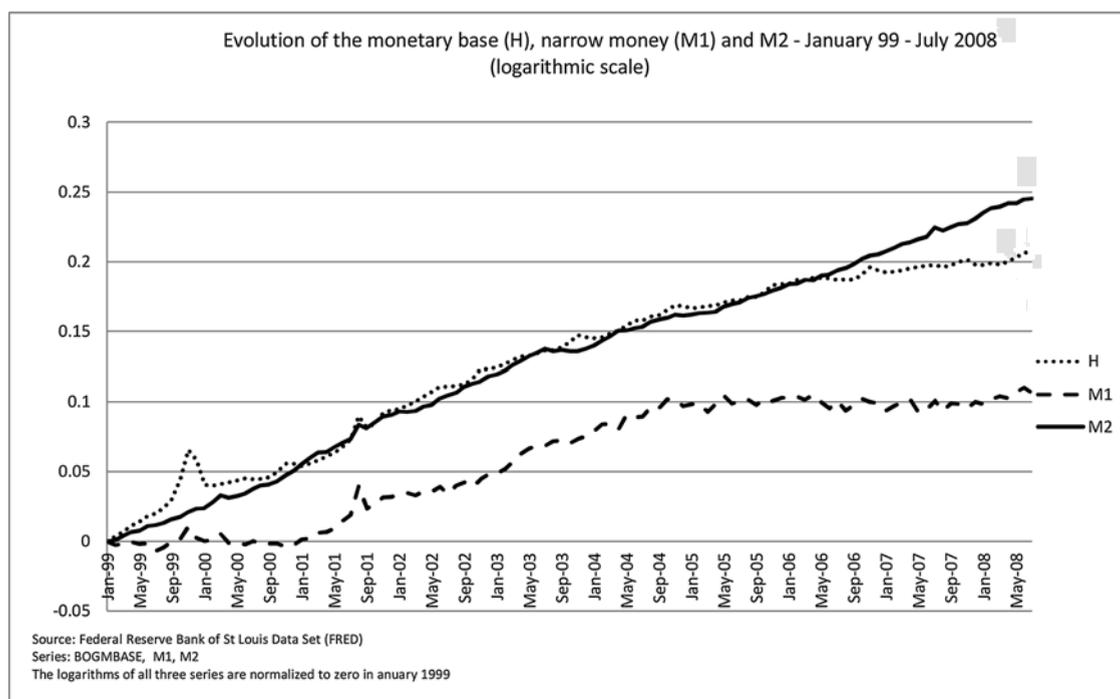
only 216% and 164% respectively.

Fig. 7 shows the evolution of H, M1 and M2 on a logarithmic scale between August 2008 and March 2018. Since the levels of all three stocks are normalized to 1 in August 2008, the three curves in the figure highlight the differences between the cumulative rates of increase of each of the stocks since that date (note that, since the scale is logarithmic, the slope of a curve at each date shows the rate of growth of the stock at that date). The figure dramatizes the fact that, since mid-2008, H expanded much more than either M1 or M2. Interestingly, M1, whose main function is to facilitate transactions, grew more than M2. The relatively slow growth of the latter in comparison to narrow money reflects the public's substitution away from interest-bearing assets into M1 due to the very low level of short-term interest rates since the end of 2008.

The period since the downfall of Lehman is obviously very special. It is therefore useful to compare the relative behavior of the monetary base, M1 and M2, to their behavior during normal times. To provide such a benchmark, Fig. 8 replicates Fig. 7 in the pre-Lehman collapse era (between January 1999 and July 2008). The first obvious (and previously documented) difference between their behavior before and after the Lehman event is that, in the second period, the monetary base expanded at much higher rates than during normal times. But the most striking observation is that, in spite of the huge difference in the rate of growth of the base between the two periods, the rates of growth of M1 and M2 are not too different across the two periods. This observation is consistent with the tameness of inflation during the second period. Also, during the normal period M2 expanded more than either the monetary base or narrow money, and the latter expanded at the lowest rate. This ranking reflects the higher levels of confidence in the financial system and the higher interest rates that prevailed in the benchmark normal period.

The much lower rates of growth of M1 and M2 in comparison to H are obviously related to the arrest in banking credit documented in the first two subsections. As argued in the last part of Subsection 2.2, this was due to a shift from a corridor system to a floor system in conjunction with "flight to safety" considerations in the supply and, possibly to a lesser extent, in the demand for credit as well as to tougher regulation. In addition to that, net new bond issues, an even more important channel of credit flows in the US, shrank dramatically with the onset of the crisis and, as of 2017, did not fully recover (Fig. 3). As a consequence inflation remained subdued.<sup>14</sup>

<sup>14</sup> Relatedly, Cukierman (2017) reports that, in spite of the fact that US base expansion during the six years following Lehman's downfall is similar in magnitude to the base expansion during about half of the post-WWI German hyperinflation, in the latter case inflation was many times higher. A first order reason for this difference is that in the German case base expansion was immediately transformed into higher money supply by a seignorage-hungry government due to insufficient tax revenues.



**Fig. 8.** Evolution of the monetary base (H), narrow money (M1) and M2 - January 99 - July 2008 (logarithmic scale).

Series: BOGMBASE, M1, M2.

The logarithms of all three series are normalized to zero in January 1999.

Source: Federal Reserve Bank of St Louis Data Set (FRED).

### 3. The impact of mutual uncertainty on the interactions between policymaking and the financial sector; an introduction

With the benefit of hindsight there is a wide consensus that an important cause for the subprime crisis was insufficient and fractionalized regulation along with regulatory forbearance (Blinder, 2014). Over the two decades that preceded the crisis, sustained lobbying by banking interests managed to erode some of the legal regulatory safeguards established during the Great Depression and financial innovations aimed at the reduction of financial assets that were subject to regulation exposed the financial system to systemic risks. Although regulators were aware of these processes at the time, they underestimated the severity of their implications for the aggregate financial system and the economy. Only after the first signs of the crisis became apparent with the run on the repo market in 2007 did regulators realize the increase in aggregate financial and real uncertainty induced by those developments.<sup>15</sup>

Difficulties in the evaluation of the value of triple A tranches of MBS along with opaqueness about the exposure of individual financial institutions to subprime securitized assets severely limited liquidity flows between financial institutions.<sup>16</sup> This raised the uncertainty faced by financial institutions. To reduce this uncertainty and calm the fears of the financial sector, the Fed, the Treasury and later on Congress engaged in various rescue operations. During the acute phases of the crisis policymakers were frequently surprised by the intensity of the reactions of financial markets to their rescue decisions. On the other hand, financial market participants gradually became sensitized to political uncertainties about rescue operations. As shown in Section 6 the crest of this uncertainty was largely responsible for the panic that materialized immediately following the decision not to bail out Lehman.

A good measure of the uncertainty perceived by financial operators is the repo haircut index. A repo (short for repurchase agreement) is collateralized borrowing between two parties in which securities of the borrower are sold to the lender against cash. The feature of the repo that distinguishes it from a standard sale of securities is that the borrower commits upfront to repurchase the securities within a pre-specified (usually short) period of time at a pre-specified price. The buyer acts as a short-term lender, the seller acts as a short-term borrower, and the security is the collateral. The repo haircut index is the difference between the market value of the collateral at the time the deal is struck and the amount of cash lent to the seller of the repo. This index is a good measure of the perceived uncertainty faced by lenders because it is directly related to the concerns of lenders about the value of the collateral during the life of the repo.

Fig. 9 shows the evolution of the repo haircut index between January 2007 and January 2009. Until summer 2007 the index is at a normal pre-crisis small level in the figure. As the Paribas problems unfolded in August 2007, the index started to climb, reaching a hefty 10 percent in March 2008 when three of Bear-Stearns' hedge funds ran into financial difficulties. In spite of the Fed's liquidity

<sup>15</sup> An early warning paper by Rajan (2005) was largely ignored at the time.

<sup>16</sup> Gorton (2010) and Gorton and Metrick (2012) present detailed accounts and analyses of the 2007 consequent run on the repo market.

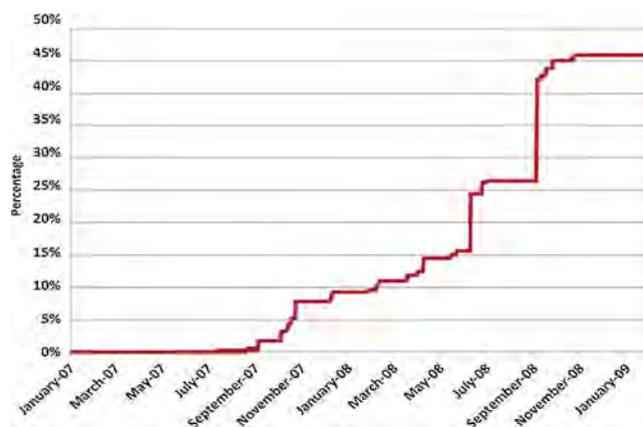


Fig. 9. The repo haircut index.

The repo-haircut index is an equally weighted average haircut of nine categories of asset- and mortgage-backed securities and of collateralized debt obligations used as collateral in the repo market.

Source: Gorton and Metrick (2012), Fig. 4.

injections and other financial rescue operations, subsequent threats to the liquidity (and possibly to the solvency) of other major financial institutions made the index climb further to 25 percent by summer 2008.

The rescue operations undertaken between summer 2007 and summer 2008 solidified the financial community's belief that policymakers will go to great lengths in order to prevent SIFI from failing. Against this background their decision to let Lehman's Brothers fail surprised the financial community and substantially raised uncertainty about future bailout policies. Fig. 9 shows that, immediately following this decision, the repo haircut index shot up from 25 percent to 45 percent, signaling a virtual drying up of all private liquidity sources. Subsequent actions revealed that, in retrospect, the policy establishment regretted this decision. The following subsection discusses the political, institutional and ideological factors that led to this fateful decision.

#### 4. The political economy of US bailouts during the acute phases of the crisis

Although the subprime crisis started in 2007, the main governmental and Fed decisions on rescue operations were made during 2008 in order to avoid or postpone a prospective devastating financial panic. In all cases, the size and interconnectedness of the financial institutions were so large that the failure of at least one of those SIFI might have seriously impeded the functioning of the financial system, the flow of credit and ultimately real economic activity. The major players involved in decision-making on these issues were the Fed, the Secretary of the Treasury, Congress and the President. In all cases the public authorities were caught between the impending need to avoid a financial panic and the longer term moral hazard problems induced by bailouts along with the political blame for using taxpayers' money in order to rescue unpopular financial institutions.

Although it commanded a fair amount of authority to quickly use monetary policy in order to inject liquidity during financial crises, the Fed recognized that the authority for making extraordinarily large bailout decisions is ultimately vested with the democratically elected and slow moving Congress.<sup>17</sup> The relationship between Congress and the Fed is that of a canonical principal agent problem. Congress (the principal) delegates instrument independence to the Fed (the agent), but retains the legislative authority to alter the Fed's degree of independence. When the systemic threats induced by a financial crisis call for substantial bailout operations, the difference between fiscal and monetary policies blurs, ultimately inducing the Fed to seek Congressional approval. This slows down the deployment of rescue operations during crisis times requiring swift policy responses.

The main SIFI institutions that were rescued or seriously considered for rescue were Bear-Stearns in March 2008, the Government Sponsored Enterprises (GSEs) – Fannie Mae and Freddie Mac – at the beginning of September 2008, Lehman Brothers in mid-September and AIG a few days later. The bunching of the last three episodes was forced on policymakers by a swift evaporation of liquidity that had started in the interbank repos market in summer 2007 and intensified during August and September 2008. In terms of total balance sheet assets just prior to being considered for rescue, Bear-Stearns (with about \$400 billion) was the smallest and the GSEs (with about \$ 5 trillion) were the largest. AIG with about one trillion in assets was the next largest followed by Lehman with approximately 600 billion (2008 GDP was about \$14 trillion).<sup>18</sup> All these rescue operations involved consultation and close cooperation between the Treasury, headed by Henry Paulson, and the Fed under the Chairmanship of Ben Bernanke. Although the formal authority for advancing liquidity from the Fed to ailing financial institutions was vested **only with the Fed**, Paulson was involved in decisions about Fed rescue operations for reasons that are discussed in the next section.

<sup>17</sup> Ball (2018) argues that, contrary to statements made by Fed officials, the Fed had the authority to bail out Lehman Brothers. The next section discusses this issue at some length.

<sup>18</sup> During September 2008 the Securities and Exchange Commission (SEC) also facilitated the sale of Washington Mutual to JPMorgan Chase. Subsequently, Wachovia was gradually absorbed by Wells Fargo.

The main public sector player in the March 2008 Bear-Stearns rescue was the Fed, which provided a long-term 30 billion collateralized loan in order to facilitate the takeover of Bear-Stearns by JPMorgan Chase. The latter drove a hard bargain, paying only 10 dollars for a Bear-Stearns share (Bear-Stearns stock in the preceding 52 weeks peaked at 133.2 dollars). The reluctant decision not to rescue Lehman was made jointly by the Treasury and the Fed under the leadership of the former. The reasons for this decision are discussed at length in the next section. In contrast to Bear-Stearns, rescue of the GSEs was implemented by placing them into public conservatorship after approval by Congress. Fannie and Freddie were congressionally chartered companies that relied heavily on implicit government support before the crisis. Between them they owned or guaranteed more than \$5 trillion in residential mortgages and mortgage-backed securities – about half of all in the country. To finance operations, they were among the biggest issuers of debt in the world: a total of about \$1.7 trillion for the pair (Paulson, 2010, p. 3). In spite of the implicit US government guarantee, ownership of the GSEs was private, implying that profits went to shareholders but losses were absorbed by taxpayers. It was clear that the collapse of Fannie and Freddie would be a catastrophe not only for the US and for the credibility of its government but also for the global financial system.<sup>19</sup>

On September 7 2008, a week prior to Lehman's downfall, with the backing of President Bush, Paulson actively sought and received congressional approval for the following plan: Placing Fannie and Freddie in temporary public conservatorship, provision of up to \$100 billion to each company in order to backup any capital shortfall, firing of the two CEOs, establishment of a new secured Treasury lending facility for Fannie and Freddie and establishment of a temporary program to buy mortgage-backed securities to boost the housing market (Paulson, 2010, p.17). Placing the GSEs under conservatorship rather than nationalizing them was motivated by the plan framers' belief that this would be a temporary measure until a longer term reform of the GSE's business model. As of spring 2018, no such reform was implemented, leaving the GSEs in public conservatorship (American Banker, 2018; Frame et al., 2015).

AIG business spanned 130 countries. Its biggest business was selling ordinary life and property insurance, and its US operations were overseen by state insurance regulators rather than the Fed. However, the holding company that tied together AIG's many businesses (including its foreign insurance operations) was not regulated by US authorities. AIG's principal threat to financial stability came from the operations of a subsidiary named AIG Financial Products, whose customers were US and European banks and financial institutions that wanted protection against the possibility of large losses in their holdings of collateralized debt obligations (CDO). In exchange for a regular premium, AIG agreed to make good any losses to those securities exceeding specified amounts. This insurance was offered by means of derivatives called credit default swaps (CDS) (Bernanke, 2015, pp. 272-3). A large part of AIG's losses prior to its bailout was due to its huge, insufficiently hedged, balance of CDS.

Although the ultimate decision on the injection of public funds into AIG was made by Congress, the implementation was mainly done by the fiscal authority under the Troubled Assets Relief Program (TARP) legislation approved by Congress on October 3, 2008. In the panicky conditions prevailing at the time, the Federal Reserve determined that "a disorderly failure of AIG could add to already significant levels of financial market fragility" and stepped in to provide temporary support to the company. Had AIG not been given assistance by the government, bankruptcy seemed a near certainty. The Federal Reserve support was later supplemented and ultimately replaced by assistance from TARP. Ultimately, the Fed and the Treasury committed approximately \$182.3 billion in specific extraordinary assistance for AIG and another \$15.9 billion through a more widely available lending facility. The amount actually disbursed to assist AIG reached a maximum of \$184.6 billion in April 2009. In return, AIG paid interest and dividends on the funding and the Treasury received a 92% ownership share in the company. As of December 14, 2012, the government assistance for AIG ended. All Federal Reserve loans have been repaid, the Treasury has sold all the common equity that resulted from the assistance and the entire package generated an, originally unexpected, small positive pecuniary return (Webel, 2013).

In the midst of the dramatic days between Lehman's bankruptcy and the final approval of the TARP program, Goldman-Sachs and Morgan Stanley changed their legal status from broker dealers and securities holding companies to banking holding companies. This occurred on September 21, 2008. Goldman Sachs executives explained that this change was introduced in order to secure access to Fed funding. However, in practice, Goldman already possessed such access prior to this change. In view of this, Bernanke (2015, p. 310) argues that Goldman executives believed that they could reduce the risk of runs on their short-term funding by simply announcing that, from that point on, they would be overseen by the Fed. This is one example of the importance of legal details for public beliefs and actions.

According to Bagehot's rule (Bagehot, 1873), in order to prevent an impending financial crisis, a CB should provide fully collateralized funds to illiquid financial institutions, provided they are solvent. But it should not lend to insolvent institutions, since these are ultimately going to fail anyway. Lending to such institutions will only transfer their losses to the CB (and ultimately to taxpayers) without changing their long-run fate. Although Bagehot's principle makes good sense, its practical application is complicated by the fact that it is usually hard to know in advance whether illiquidity problems are due to temporary reasons or persistent insolvency problems.<sup>20</sup> Moreover, a self-fulfilling financial panic may transform an initially illiquid but solvent SIFI institution into an insolvent one.

Due to this uncertainty it is not clear that all institutions whose solvency is not a priori clear-cut should not benefit from public

<sup>19</sup> A substantial fraction of Chinese reserves at the time took the form of GSE obligations.

<sup>20</sup> Hogan et al. (2015) argue that the Fed did not really adhere to Bagehot's principle since it discounted low quality assets of institutions that at the time appeared to be insolvent at below market rates and did not preannounce the policy it was going to follow in advance. On the other hand, although it appeared to be ineligible for receipt of emergency liquidity under Bagehot's rule in 2008, AIG repaid the funds it had received from the US government and the Fed by 2012.

funds. But when these doubts reach a certain threshold (and/or the required amount of rescue funds is large) it makes more sense, for democratic accountability and distributional equity reasons, that the required funds are approved by Congress rather than by the CB alone. The policy responses of the main US policymaking players in 2008 appear to broadly conform to this principle. When the amounts involved were not too large and there was reasonable hope of private sector participation in shoring up an ailing SIFI, the handling was left to the Fed (Bear-Stearns). But when the amounts involved and the likelihood of insolvency were sufficiently large, the ailing SIFI institutions obtained funds only after Congressional approval (GSEs and AIG) or were left to their fate (Lehman).

## 5. The recent controversy about the reasons for not rescuing Lehman and its wider implications

Why was Lehman Brothers not rescued? In view of the rescue of Bear-Stearns, the GSE and AIG, this is a natural question to ask. This section confronts the views of the main architects of rescue operations (Bernanke, Paulson, Geithner) with those of Ball (2018), who disputes their claims on this question, and concludes with my own view on the political and social undercurrents that led to this fateful decision.

### 5.1. The conventional view

The conventional view is due to the framers of the rescue operations. Chapter 12 of Bernanke (2015) and chapters 8 through 10 of Paulson (2010) argue that the Fed's chairman, the secretary of the Treasury as well as the professional staffers of the two institutions were aware of the financial havoc that a Lehman bankruptcy would cause and spared no efforts to arrange a deal that would keep it alive. Being aware of this record and their efforts, Lehman's CEO, Dick Fuld, did not abandon hope that the Fed and Treasury would prevent a bankruptcy until just a day before Lehman filed for bankruptcy at 1.15 pm on Monday, September 15, 2008.

In particular, why did the Fed not consider arranging a long-term loan for potential buyers of Lehman, as it had six months earlier for Bear-Stearns? In the case of Bear-Stearns the loan was arranged in order to induce JPMorgan Chase to buy it. Both the Treasury and the Fed had a similar model for Lehman in mind and tried to help Lehman find a buyer. Initially, the Bank of America was interested but, after going over Lehman's books, decided that buying it would be too risky and opted instead for the purchase of Merrill Lynch. Subsequently, Barclays Bank of London became interested and initiated an inspection of Lehman's books. Ultimately the deal with Barclays did not go through, mainly because the head of the British Financial Service (FSA) and the Chancellor of the Exchequer worried that the purchase of Lehman by Barclays would bring Barclays down and force the British government into a dreaded bailout.

In his 2015 memoirs, Bernanke claims that the "hole" in Lehman's capital was larger than that of Bear due to its larger size and lower quality assets. In the absence of any buyer, only an injection of equity capital into Lehman would have prevented a bankruptcy. Although the TARP bill provided substantial funding for such equity injections it was approved by Congress only about three weeks later – at the beginning of October 2008. On top of that, the large injections of public money to rescue Bear and the GSEs triggered waves of criticism by politicians, the general public and even some economists.<sup>21</sup> The Fed's reluctance to lend to Lehman was reinforced by the fact that, unlike in the case of Bear-Stearns, there were several additional SIFI institutions that were on the verge of financial collapse (the most important of those were AIG, Washington Mutual and Merrill Lynch).

In his book, Paulson recalls Barney Frank's (chairman of the House Financial Services Committee between 2007 and 2011) strong opposition to further bailouts. Similarly, Bernanke recounts that, following the Fed's decision to provide funds to facilitate the acquisition of Bear-Stearns by JPMorgan Chase, some of his former academic colleagues criticized this move on the ground that it induced moral hazard. There is little doubt that these criticisms hardened the conviction of Paulson and Bernanke that, in the absence of congressional authority, they should not pursue further rescue operations. Paulson and his team believed that they should publicly emphasize that there could be no government money for a Lehman deal to obtain the best price from a potential private buyer in order to save taxpayers money (Paulson, 2010, p.181). In retrospect, by reducing the motivation of potential buyers to acquire Lehman, this bargaining strategy might have been counterproductive.

### 5.2. Explanations for the decision not to rescue Lehman based on Ball

In a meticulously documented recent book drawing on a variety of sources, Larry Ball (2018) takes issue with the explanations provided by the framers of the 2008 bailout operations for the decision not to rescue Lehman. The first and most important one is that, contrary to assertions made by Fed officials and its chair, the Fed had the authority to lend to Lehman. In particular, the Fed could have used Section 13(3) to lend to Lehman, as it had done in the cases of Bear-Stearns and AIG. The book also disputes the assertion that Lehman did not possess sufficient appropriate collateral on the ground that Lehman's collateral was no more risky than that of other institutions that benefited from Fed lending through the Primary Dealer Credit Facility. Based on documents from a variety of sources, Ball (2018, p.225) argues further that;

"Lehman probably could have survived if the Fed had merely not taken actions to restrict its access to the Primary Dealer Credit Facility on September 14".

<sup>21</sup> Brad DeLong, an economics professor at Berkeley, put it in his blog that "Bernanke and Paulson are both focused like laser beams on not making the same mistakes as were made in 1929.... They want to make their own original mistakes" (Bernanke, 2015, p. 310).

Ball's evidence begs a basic question about the real-time reasons that led the framers of the rescue operations to provide liquidity to other SIFI and not to Lehman. In a captivating summary section on "Explaining the Lehman Decision", Ball provides two answers. First, the 2008 rescue operations produced virulent bipartisan criticism from politicians, economists, the media and the American public. All three rescue framers, including the personally authoritarian Treasury secretary, ultimately felt the weight of these criticisms was too heavy. One of many well-documented quotes supporting this view is from Geithner (2014, p.175), who writes;

"The reaction to Fannie and Freddie quickly made the backlash over Bear look mild, Senator Bunning, who had said the Bear deal's assault on free enterprise made him feel like he lived in France, now said he felt he lived in China. Senator Obama and the Republican presidential nominee, John McCain, both expressed outrage about public rescues of private firms..."

Second, just prior to the decision not to rescue Lehman, the three framers apparently underestimated the severity of the market reaction to this decision. Although the evidence supporting this view is not as abundant as the evidence backing the preceding explanation, it suffices to cast doubt on the post-Lehman claim of the framers that they had anticipated the severity of this reaction but felt there was nothing more they could do. For example, in his memoir, Paulson (2010, p.187) describes a September 12 meeting with Bernanke in which Bernanke says: "*We can only hope that if Lehman goes, the market will have sufficient time to prepare for it*".

### 5.3. An assessment of the conflicting views about the Lehman decision

Although there are non-negligible differences concerning the interpretation of events and motives leading to the decision not to rescue Lehman between the framers of this decision and Ball's (2018) interpretation, the gap is not as wide as may appear at first sight. Most importantly, like Ball, the memoirs of all three framers (Paulson, 2010; Geithner, 2014; Bernanke, 2015) explicitly acknowledge the sustained and widespread criticism their rescue operations encountered as such operations became more important and frequent. Some passages in their memoirs and related sources leave little doubt, in line with what is argued by Ball, that this criticism eventually affected their decisions.

In my view, the main difference between the ex post explanations of the Lehman decision by its framers and by Ball boils down to two main points. First, the framers give the impression that they had no other option, whereas Ball argues that the Fed **could** have lent to Lehman under Section 13(3). Second, contrary to the assertion of the framers, Ball's documentation supports the view that Lehman's collateral was **no more risky** than the collateral accepted by the Fed in some other 2008 rescue operations.

It is hard to argue with the two preceding, well-documented conclusions and useful to be aware of the discrepancy between these and the ex post interpretations of the framers. However, in a broader sense, the ex post interpretation of the reasons given for the Lehman decision by its framers makes sense within the context of the quickly mounting threats to the viability of major SIFIs during the summer of 2008. By August/September 2008 further substantial decreases in the value of financial assets substantially dented the capital cushions of major financial institutions including the GSEs, AIG, Lehman, Washington Mutual and Merrill Lynch.

These developments, which were largely simultaneous and occurred very quickly, put the Treasury, the Fed and ultimately Congress in a virtual state of siege. It forced them to swiftly and simultaneously address burning problems on several fronts, the most sizable of which were the GSEs with 5 trillion and AIG with 1 trillion in assets. Next in line was Lehman Brothers with a balance sheet of "only" 600 billion. There is little doubt that the gigantic size of the GSEs along with the implicit government guarantee of their solvency implied that their problems should be handled by the Treasury secretary and Congress, as indeed turned out to be the case on September 7 (Section 4). Even before the rescue of the GSEs it was probably clear to the three framers that, in view of the (not quite unjustified given real-time information) public criticisms they would not be able to rescue all three institutions without the backing of Congress. Given that one of the institutions had to go, there was some logic in settling on the smallest of the three, that is, on Lehman.

Be that as it may, following the rescue of the GSEs, public outrage at rescue operations went overboard, as suggested by the quote from Geithner's memoir in the previous subsection, making it almost impossible politically to consider a bailout for Lehman just one week later.<sup>22</sup> This is probably one reason for Paulson's pre-Lehman insistence on conditioning public help to both Lehman and AIG on finding a private buyer. A similar motive partially explains the fact that the Fed willingly accepted Paulson's involvement in emergency lending decisions in spite of the fact that only the Fed was endowed with the formal authority to make such decisions. The Fed and its chair clearly sought to broaden the scope of responsibility for the, unprecedented at the time, quasi-fiscal operations that it had initiated.<sup>23</sup>

However, once the scope of the panic triggered by Lehman's downfall started to become apparent on September 16, both Paulson and Bernanke quickly reversed their positions on private participation and directed their joint efforts to convince Congress to pass the TARP package. Although this task was not easy, it would have been inconceivable had not the immediate post-Lehman panic silenced much of the pre-Lehman criticism of rescue operations. A major beneficiary of this development was AIG, which benefitted from liquidity injections of almost 200 billion dollars.

<sup>22</sup> Quoting various sources, Ball (2018, p.212) reports that in a September 11 conference call with Bernanke and Geithner, Paulson said: "*I emphasized that there would be no public assistance for a Lehman bailout*".

<sup>23</sup> Interestingly, the 2010 Dodd-Frank act now requires the formal approval of the Treasury secretary of emergency lending by the Fed under Section 13(3).

#### 5.4. Aftermath, counterfactuals and a policy lesson

Although it realized the gravity of the situation, Congress, which has the ultimate authority to approve sizable bailouts, was not able to move as quickly as the Fed. As a consequence, the TARP legislation, which empowers the US government to purchase legacy assets and equity from financial institutions to strengthen the financial sector, was signed into law only on October 3, 2008.

Notable victims of this state of affairs were Lehman and the world's financial systems. This prompts one to ask the following questions: 1. Had the TARP legislation been in place prior to the emergence of Lehman's problems, would it have been rescued? 2. Had the Fed known in advance the havoc on the financial markets induced by Lehman's collapse, would it have rescued it even in the absence of the TARP legislation?

I believe the answer to the first question is clearly positive, while the answer to the second is less clear-cut for the following reason. Even if the Fed possessed the authority to rescue Lehman at the time, the fact that the next in line for rescue was the almost twice as large AIG pushed the Fed's highly professional but non-elected bureaucracy too far into the fiscal arena.<sup>24</sup> The highly unusual and unexpected event of 2008 along with Section 13(3), which was inherited from the Great Depression, left the determination of how much is "too far" to the Fed and its chair.

An important policy lesson from these dramatic events is that the advanced delegation of bailout authority up to a certain ceiling and subject to appropriate penalties to CEOs of failing SIFI may be desirable. In times of impending panics, the existence of a fiscally preapproved bailout fund that can be quickly deployed has two advantages. First, by reducing the level of bailout uncertainty, it helps mitigate the fears of financial markets. Second, the knowledge that there is ultimate fiscal coverage makes policymakers at the CB more willing to extend interim funds to ailing SIFI institutions. Thus, prior to the existence of the TARP legislation, the Fed decided not to lend any funds to Lehman. But after the legislation passed the Fed did lend substantial amounts to AIG in order to provide temporary liquidity until the more slowly moving TARP funds could be allocated. The knowledge that there is ultimate fiscal backing raised the willingness of the CB to be more lenient in the provision of its swiftly deployable funds.

#### 6. The impact of bailout uncertainty following Lehman's collapse: A theoretical perspective

Lehman's downfall transformed a simmering financial crisis into an open worldwide financial panic. This prompts a question about the mechanism(s) that triggered such a violent reaction from the US financial community. This subsection argues that an important mechanism is the increase in bailout uncertainty triggered by the decision to let Lehman fail against the background of previous numerous bailouts of SIFI.

Using Gilboa and Schmeidler's (1989) multiple priors framework, Cukierman and Izhakian (2015) (CI in the sequel) model the increase in this (Knightian) uncertainty about the probability  $P$  of bailouts as a downward expansion of the set of such prior probabilities.<sup>25</sup> The main idea is illustrated by means of an example in Fig. 10. Prior to the Lehman event, market participants believed that the probability  $P$  had a non-zero mass only in the  $[0.4, 0.6]$  range. After this event the set of multiple priors with positive mass expanded downward to (say) the  $[0.1, 0.6]$  range.<sup>26</sup> More heuristically, market participants became *probabilistically aware* of bailout probabilities in the  $[0.1, 0.4]$  range to which they had attributed zero mass prior to Lehman's downfall. Based on a set of axioms similar to those postulated by Von Neumann-Morgenstern to derive the expected utility theorem, Gilboa and Schmeidler (1989) show that, when faced with multiple priors, rational individuals would choose the best action against the worst possible distribution (the maxmin criterion). Continuing the preceding illustration, this means, within the CI framework, that prior to the Lehman event creditors maximized expected utility as if the bailout probability were 0.4, and after it, as if it were 0.1.

CI explore the implications of such a change within a 3 sector general equilibrium model of the financial system with risk-averse agents and show that it leads to a general contraction of banking credit, a general increase in borrowing rates, and in extreme cases to total credit arrest. The sectors are lenders (pension, mutual and hedge funds), financial intermediaries (banks) and borrowers (firms and households). The broad intuition of this result follows. As lenders become aware of lower bailout probabilities, they increase the proportion of their portfolio in safe government securities at the expense of short-term risky loans to financial intermediaries. The reduction in funds available to intermediaries leads to an increase in interest rates and the restriction of credit to borrowers by the intermediaries.

For the first two years or so following the Lehman event, this mechanism appears to provide a first order explanation for the dramatic post-Lehman decrease in banking credit. But, as can be seen from Fig. 4, the sluggishness in net banking credit expansion lasted at least until 2013. As time went by, the following, persistence creating, mechanisms became more prominent: First was the need of banks to rebuild their equity positions, which had deteriorated during 2007/8. Second, by lowering the values of assets of households and businesses, the crisis reduced the value of acceptable (to banks) collateral assets.

Finally, the toughening of banking regulation through the 2010 Dodd-Frank Act and related channels reduced banks' incentives to expand credit. Important features of this process are: (i) the imposition of higher capital requirements (CAR) and liquidity coverage

<sup>24</sup> Admittedly, the Fed was originally created to act as a lender of last resort (Meltzer, 2003; Bernanke, 2013; Rotemberg, 2013). But the magnitude and fiscal risks of rescuing Lehman were viewed by the Fed's top officials at the time as excessive in the absence of congressional approval.

<sup>25</sup> Knight (1921) and Hansen and Sargent (2008) use the idea of multiple priors to explore the consequences of parameter uncertainty for the behavior of the economy.

<sup>26</sup> The probability masses have been drawn as uniform for simplicity. Any two probability masses over  $P$  such that the minimal value of the post-Lehman support is lower than its counterpart in the pre-Lehman period can be used to convey the general idea of the figure.

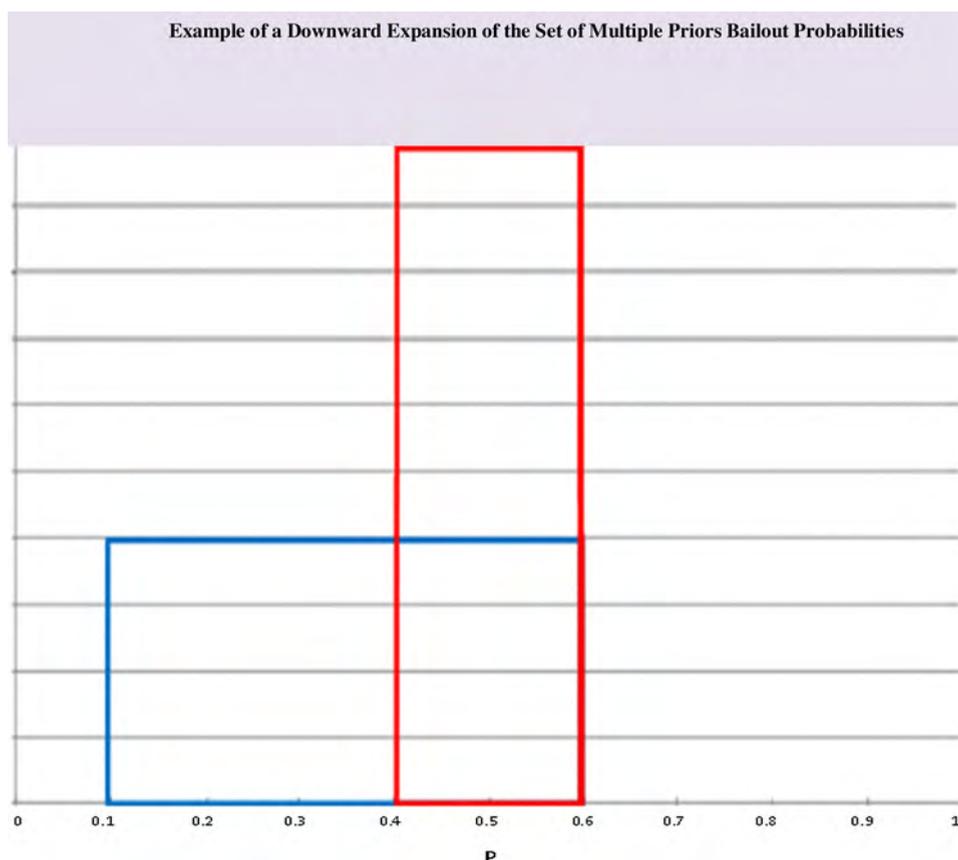


Fig. 10. Example of a downward expansion of the set of multiple priors bailout probabilities.

ratios under Basel III since 2010, (ii) Even higher CAR, to be phased in gradually, for SIFI. Although the increase in CAR on SIFI is being phased in gradually, the advance announcement of such future measures impacted banks' decisions before the actual regulation became effective. The effect of the Basel III net stable funding ratios to be gradually imposed on large banks in the future was similar.<sup>27</sup> Stress tests and the imposition of limits on the ability of banks to move securitized assets off balance sheets also contributed to the credit slowdown.<sup>28</sup> In addition, by starting to pay IOER, the Fed effectively transformed the pre-crisis corridor system into a floor system, substantially weakening the link between excess reserves on one hand and credit cum deposits on the other.<sup>29</sup>

Thus, beyond its immediate impact, the financial crisis induced longer term processes through reduction in the values of assets, tougher regulation and payment of IOER. These processes increased the persistence of the credit slowdown beyond the increased awareness to low bailout probabilities triggered by Lehman's collapse.<sup>30</sup> It is nonetheless likely that this increased awareness left some longer term cautionary memories in the mind of many financial market participants. The panic and trauma that seized financial markets following Lehman's bankruptcy filing is likely to be remembered for a long time. This is reminiscent of post-traumatic stress disorder (PTSD) – well-known in the psychology literature. PTSD is an anxiety disorder that may develop when a person encounters an unexpected extreme traumatic stressor such as war, personal assault, confinement or a severe car accident (Javidi and Yadollahie, 2012).

Fig. 3 shows that, although net new issues of bonds picked up to some extent over 2016 and 2017, they were still substantially below their pre-crisis levels almost ten years after the start of the crisis. This might be due to the memories of the traumatic days following Lehman's collapse.<sup>31</sup> It might also reflect the uncertainty and incompleteness of the post-crisis regulatory reforms.

<sup>27</sup> The net stable funding ratio is defined as the ratio of appropriately weighted long-term (stable) assets of a bank to its long-term (stable) liabilities. Basel III regulations require this ratio to be at least 100%.

<sup>28</sup> Moving assets off balance sheet means that a bank creates a legal entity that is separate from the bank and moves some of its assets and liabilities to the balance sheet of this separate entity. Although the assets and liabilities that have been moved no longer appear on the bank's balance sheet there is still a legal connection between the bank and the subsidiary entity it has created.

<sup>29</sup> The mechanism responsible for this outcome is elaborated in Subsection 2.2. Similarly, Cukierman (2018) documents a roughly fifty percent permanent decrease in the traditional money multiplier.

<sup>30</sup> One day after this collapse, Reserve Primary Fund, the oldest money fund, broke the buck when its shares fell to 97 cents after writing off debt issued by Lehman Brothers.

<sup>31</sup> Interestingly, the PTSD concept has a conceptual counterpart in modern decision theory. The multiple priors framework implies that an

## 7. Brief summary and a look ahead

Although they both contributed to it, the crisis took most policymakers and financial market participants by surprise. With bitter memories from the policy mistakes of the Great Depression, the Fed's chairman and the FOMC initially reacted in line with (a modified) [Bagehot \(1873\)](#) principle that, in such situations, the central bank should act as a lender of last resort.<sup>32</sup> Those policy actions most likely delayed the realization of an open financial crisis from the second half of 2007 to mid-2008. But as suspicions about the solvency of important financial institutions gradually mounted – triggering an increasing string of rescue operations and public criticisms – the Fed and the Treasury reached what they perceived as the politically acceptable and legal limits of what they could do without the approval of Congress. In late summer 2008 Paulson managed to convince Congress to bail out the GSEs. However, this did not suffice because Lehman Brothers, AIG and Merrill-Lynch were already on the verge of collapse at that time. Since it was in somewhat better shape, Merrill was bought by the Bank of America, but no quick buyer could be found for the former substantially larger financial institutions.<sup>33</sup>

At that juncture, there were strong pronouncements from both Congress and academic economists against further bailouts.<sup>34</sup> In the absence of Congressional approval for further bailout money, Lehman was not rescued. Both Bernanke and Paulson report in their memoirs that they had feared a major financial panic would be unleashed by letting a SIFI like Lehman fail. In retrospect it appears that the financial panic following Lehman's bankruptcy filing on September 15, 2008 was stronger than they had expected. [Ball \(2018\)](#) even claims that just prior to letting Lehman sink they had seriously underestimated the impact of this event.<sup>35</sup> Ironically, the violence of the financial disruptions following this event provided Paulson and Bernanke with strong evidence backing their request from Congress for a further large discretionary rescue package. In spite of this, Congress initially rejected their proposal but finally approved an amended version known as TARP on October 3 2008.

The paper argues that, by triggering an increase in both bailout uncertainty and the aversion to this uncertainty, Lehman's bankruptcy transformed a simmering crisis into a major open financial panic. This magnified the credit arrest that had started at the beginning of 2008. If TARP had already existed at the beginning of September 2008, some of its funds could have been used to facilitate a Lehman's take-over by another financial firm. This might have prevented Lehman's downfall, restraining the additional financial market disruptions caused by the post-Lehman panic. One lesson from this episode is that the ability to swiftly commit fiscal funds in major emergency situations may help reduce the likelihood of impending financial panic.

Part of the increase in bailout uncertainty gradually receded after the disbursement of TARP funds to bail out AIG and other financial institutions. However, the increased aversion to this uncertainty most likely persisted for a longer period of time. Highly visible adverse public events, such as Lehman's collapse, are likely to raise uncertainty aversion to those events for a sustained period of time.<sup>36</sup>

Since it is rooted in a basic tradeoff between the short-run financial disruptions caused by letting a SIFI institution fail and long-term moral hazard problems, bailout uncertainty is unlikely to disappear even after substantial regulatory reforms. Differences of opinion about the relative costs of the two "bads" between legislators along with changing circumstances will continue to feed this uncertainty and the aversion to it in the future. For example, in spite of the dramatic disruptions experienced after Lehman's collapse, European governments decided in summer 2011 that in the second Greek bailout holders of Greek bonds should take some losses. This decision led to wider tensions in European bond markets by raising rates on ten year Spanish and Italian sovereign bonds.<sup>37</sup> Clearly, how to best resolve the tension between the prevention of impending financial panics and long-term moral hazard is an open

*(footnote continued)*

expansion of the set of priors can occur either because bailout uncertainty has increased, because individual aversion to this uncertainty has increased, or because of a combination of both factors, implying that attitudes also matter. In particular, suppose two individuals share the same subjective information, i.e., they both believe the same set of bailout probabilities are possible. Then modern decision theory implies that the set of multiple priors of the less uncertainty-averse individual is a subset of the set of multiple priors of the more uncertainty-averse individual (Theorem 17-(ii) in [Ghirardato and Marinacci, 2002](#), and [Klibanoff et al., 2005,p.1872](#)). In terms of the example in [Fig. 10](#), this implies that, even if beliefs about the likelihood of bailout are back at their pre-Lehman level, the downward expansion in the set of bailout priors may persist only because of a persistent increase in aversion to this uncertainty.

<sup>32</sup> As a disciple of [Friedman and Schwartz \(1963\)](#), Bernanke was determined not to repeat the mistakes of the Fed during the Great Depression.

<sup>33</sup> Merrill-Lynch was bought by the Bank of America at the last moment on Sunday Sep 14 about 12 hours before Lehman filed for bankruptcy in the night between Sunday and Monday.

<sup>34</sup> The opposition of the public and major financial newspapers to bailouts due to moral hazard problems is discussed in [Bernanke \(2015, pp. 260/61\)](#). Bernanke (op. cit., pp. 243/4) reports that at the August 2008 Jackson Hole meeting Willem Buiter argued that letting a big financial firm fail would be good for the financial system.

<sup>35</sup> The fact that even ten years after the Lehman event there are still serious disagreements about the reasons for not rescuing Lehman underscores the abnormally high levels of uncertainty and doubts faced by policymakers in September 2008.

<sup>36</sup> An example from a completely different area provides an illustration of this claim. According to the Non-Life Insurance Rating Organization of Japan, the stricken Fukushima prefecture, bearing the brunt of the huge earthquake and tsunami that devastated the region at the beginning of 2011, saw the rates of new earthquake insurance coverage increase almost threefold in the aftermath of the earthquake ([Majirox news, August 24, 2011](#)). Provided this event did not appreciably change the beliefs of individuals about the objective probability distribution of such events this evidence is consistent with the view that, following the trauma caused by the tsunami, the aversion to uncertainty about tsunamis has increased. The analogy to the Lehman event should be self-explanatory.

<sup>37</sup> Empirical evidence in [Mink and de Haan \(2013\)](#) suggests that markets considered news about bailouts to be a signal of European governments' willingness to use public funds to combat the financial crisis.

issue awaiting additional solutions.

Another source of future uncertainties concerns the fate of regulatory reform. The comprehensive 2010 Dodd-Frank Act that was designed to handle previously neglected systemic risks and efficiently dispose of ailing SIFIs is encountering opposition from the financial community as well as the Trump administration.

Following Lehman's demise, the Fed engaged in LSAP. Those operations were initially aimed at shoring up the financial system. After a while, their focus shifted to stimulation of the economy through direct purchases of long-term private and at times risky securities within a ZLB environment.<sup>38</sup> Once the economic recovery gathered sufficient momentum the Fed started to roll back expansionary monetary policies by gradually raising the discount rate, as well as the IOER, since late 2015.

But, as of March 2018, the monetary base was still about four times its pre-crisis level and correspondingly banks' reserves were extremely high. This reflected the Fed's tendency to reduce the base by attrition, implying (May 2018) that the base will continue to be abnormally high for quite a while.<sup>39</sup> As a result, US monetary policy will have to operate in an environment in which reserves do not constitute an effective constraint on banks for the foreseeable future.<sup>40</sup> The root causes of the crisis were sown over at least ten years prior to the crisis due to various reasons including political meddling, financial innovations designed to avoid regulation, regulatory forbearance and excessive credit growth. But once the financial crisis reached an acute stage, the Fed shifted the bulk of its policy instruments away from inflation targeting to financial stability in spite of the fact that over the preceding twenty years inflation targeting became the accepted norm for CB policy. Along with a gradual return to inflation targeting since 2016, this shows that, under good professional management, the CB is able to adjust its procedures in order to deal with the major problem of the day.

The global financial crisis, along with a persistent downward trend in long-term interest rates, alerted monetary policymakers of developed economies to the limitations imposed by the ZLB when excessively low economic activity and inflation required negative policy rates.<sup>41</sup> The current (2018) view among policymakers is that the ZLB is more likely to constrain effective monetary policy in the future than in the past. The ZLB, or the effective lower bound, is grounded in existing monetary institutions and is definitely not god given. It is a consequence of the fact that, when the interest paid on deposits is sufficiently negative, individuals rush to convert deposits into cash. Recent literature proposes a number of alternative devices that would eliminate the ZLB constraint. One that appears attractive and currently the most feasible is to let the rate of exchange between currency and deposits float. As the use of electronic money becomes more widespread, central banks could achieve the same objective by paying or charging the same (negative at times) interest on regular and electronic deposits.<sup>42</sup>

The dilemma raised by the tradeoff between moral hazard and CB emergency lending against poor collateral during financial crises is unlikely to go away in the future. In a recent book, Mervyn King (2016, chapter 7) proposes the following flexibilization of the old 100 percent reserve banking idea for the amelioration of this tradeoff: During non-crisis times, each bank (including shadow banks) would decide how much of its relevant assets it would position for examination by the CB as collateral for possible emergency lending during crisis times. The CB would then determine and commit to the haircut on each type of asset pledged for this purpose by the private bank. Fully liquid assets like reserves at the CB would have a zero haircut, while high haircuts would be applied to illiquid assets such as long-term loans. The effective liquid assets of the private bank would then be calculated as the sum total of assets net of haircuts pledged for that purpose by the private bank.<sup>43</sup> Each bank would eventually be subject to a constraint stipulating that the total of its short-term deposits and other short-term liabilities is bounded from above by total effective liquid assets.

King proposes to phase this proposal in gradually and notes that, given the high level of reserves and the experience accumulated during the crisis, now is a good time for its implementation. The proposal has several advantages. First, subject to the overall constraint that liquid liabilities should not exceed effective liquid assets, it leaves the flexibility to determine the magnitude and structure of the pledged collateral to the individual bank. Second, CB haircuts are determined *ex ante* taking into consideration both normal and crisis times. This, along with the overall constraint, reduces the incentive of banks to finance themselves by short-term liabilities, thereby reducing moral hazard and the odds of a financial crisis. The proposal achieves the same objectives as those of more elaborate schemes such as Basel III and the Dodd-Frank act and is simpler to apply. Finally, it enables the individual bank to determine in advance the amount of effective liquidity it will receive from the CB in case of a crisis rather than wait for the decision of the CB after the realization of a crisis. Although I find the proposal appealing, I would favor an in-depth systematic comparison between other schemes and this proposal prior to its implementation.

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<sup>38</sup> He and Krishnamurthy (2013) find that injections of equity capital by the Fed were particularly effective in stimulating the economy.

<sup>39</sup> In view of the high bank reserves it is likely that the IOER was increased in parallel with the lifting of the discount rate in order to slow down a potential resuscitation of the shrunk money multiplier to avoid an overly quick return of credit expansion and inflation.

<sup>40</sup> Cukierman (2018) documents a large permanent decrease in the conventional money multiplier upon the start of LSAP and argues that this concept is a poor guide for the impact of monetary policy on the economy in the presence of large excess reserves. This finding is consistent with the Fed's switch from a corridor to a floor system since October 2008. As noted by Dutkowsky and VanHoose (2017), this implies that the Fed can unwind its bloated balance sheet without much fear of any substantial effect on bank credit.

<sup>41</sup> Bean et al. (2015) document the downward trend in long-term safe rates.

<sup>42</sup> Detailed proposals appear in Buitier (2010), Goodfriend (2016) and Rogoff (2016).

<sup>43</sup> Obviously the private bank would not be able to use these assets as collateral in other transactions.

provided efficient research assistance.

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## Glossary of Acronyms

ABCP: Asset Backed Commercial Paper  
 AIG: American International Group  
 CAR: Capital Requirement  
 CB: Central Bank  
 CDS: Credit Default Swaps  
 CEO: Chief Executive Officer  
 CP: Commercial Paper  
 EFFF: Effective Federal Fund Rate  
 GSE: Government Sponsored Enterprises  
 IOER: Interest on Excess Reserves  
 LSAP: Large Scale Asset Purchases  
 MBS: Mortgage Backed Securities  
 PTSD: Post Traumatic Stress Disorder  
 QE: Quantitative Easing  
 SIFI: Systemically Important Financial Institutions  
 TARP: Troubled Asset Relief Program  
 ZLB: Zero Lower Bound