



# Monetary policy and institutions before, during, and after the global financial crisis<sup>☆</sup>

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## ABSTRACT

This paper describes the changes that occurred in the conduct and instruments of monetary policy used by major central banks when the crisis hit; discusses the new tradeoffs and controversies engendered by those policy reactions; and speculates about additional likely future changes in monetary policy and institutions. Following a brief account of the evolution of monetary policymaking principles and institutions in the past, the paper deals with the controversial question of how and when to exit a period of large-scale monetary expansion. The paper documents the fact that, in spite of huge monetary injections and historically low interest rates, inflation in the US and in the Eurozone remained subdued, and reports that since the onset of the subprime crisis, there has been a dramatic deceleration in the growth of banking credit in the US. The paper also discusses the tradeoff between the lender-of-last-resort function of the central bank and moral hazard; the consequences of bailout uncertainty for central bank policy; and the particular problems faced by the ECB in the face of a major financial crisis.

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## 1. Introduction

Economic history suggests that conventional wisdom about monetary policy undergoes substantial changes following major events such as financial panics, depressions and wars. Following long periods of stability, a monetary policy consensus builds up and solidifies, only to be shaken when the next major event materializes. The global financial crisis (GFC) is no exception. It has already shaken some of the conventional wisdom about what constitutes good monetary policy, and is likely to lead to further revisions of the consensus that evolved after the great inflation (GI) of the seventies and, more recently, during the great moderation (GM).

This paper describes the changes that occurred in the conduct and instruments of monetary policy by major central banks when the crisis hit; discusses the new tradeoffs and controversies

engendered by those policy reactions; and speculates about additional likely future changes in monetary policy and institutions induced by the crisis. Although the bulk of the paper is descriptive in nature, some of the discussion is prescriptive.

The paper is organized as follows: to provide a broader perspective, Section 2 presents a brief, long-term history of the evolution of monetary policymaking principles and institutions. Section 3 describes the changes in the conduct and instruments of monetary policy during the crisis. Section 4 addresses the controversial question of how and when to exit a period of large-scale monetary expansion deployed to avert an imminent crisis. It documents the fact that, in spite of huge monetary injections and historically low interest rates, inflation in the US and the Eurozone areas remained subdued. This is followed, in Section 5, by a discussion of how the GFC is likely to change monetary policy objectives and instruments, as well as related economic research, in the future. Section 6 reflects on how the crisis might affect future monetary policymaking institutions.

The long simmering subprime crisis in the US degenerated into a full-blown panic in September 2008, when the US government decided not to bail out Lehman Brothers. Similarly, credit default swaps (CDS) on Greek and other weak sovereign European debts shot through the roof whenever political uncertainty concerning governmental bailouts rose. Section 7 discusses the reasons for bailout uncertainty and its consequences for central bank (CB)

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<sup>1</sup> I benefited from the comments of Stanley Fischer and of Charles Goodhart. Omer Snir provided efficient research assistance.

policy. Section 8 focuses on the particular problems of the ECB in the face of a major financial crisis.

## 2. A long-term perspective on the evolution of thought on monetary policy and institutions

In their early years, major central banks were expected to inject liquidity into the financial system when liquidity evaporated during financial panics. Such panics often occurred during short periods immediately preceding the Bank of England (BE) decision to temporarily relax the gold standard, due to wars or gold drains. Thornton (1802) and Bagehot (1873) recommended such a lender-of-last-resort (LLR) policy for the BE, provided the liquidity recipients were basically solvent and their liquidity problems were judged to be temporary. In a similar vein, the Fed was originally created mainly in order to prevent financial panics and the associated violent spikes in interest rates and banking failures.

In the aftermath of the great depression and the ensuing Keynesian revolution, the focus shifted, after WWII, to stabilization of the real economy. The downward sloping Phillips curve initially estimated by Phillips (1958) was taken to represent a stable policy tradeoff between inflation and unemployment – and therefore a menu of possible choices confronting monetary and fiscal policy-makers (Samuelson and Solow, 1960).

The great inflation of the seventies, followed by Volcker's costly disinflation in the US, reoriented the focus toward price stability and the Friedman–Lucas (Friedman, 1968; Lucas, 1973) view that money is neutral in the long run. Inevitably this led to the conclusion that monetary policy should focus mainly or even solely on delivering price stability in the long run.<sup>2</sup> In parallel, the idea that price stability can be assured via central bank independence took hold during the eighties, subsequently leading to worldwide upgrades in the autonomy of central banks during the nineties.<sup>3</sup> By making it more difficult to use fixed exchange-rate pegs to deliver price stability, the gradual removal of capital controls reinforced the view that this stability should be maintained by granting autonomy to the central bank and by directing it to focus mainly on price stability.

Volcker's disinflation was followed, within several years, by a great moderation in the variabilities of both output and inflation. This moderation, which lasted from the end of the eighties till the bursting of the US subprime bubble in 2008, led to the view that, although monetary policy cannot affect real variables in the long run, it could be used in the short and medium terms to stabilize the real business cycle without endangering the long-run stability of prices. This view was operationalized, in many countries, by means of inflation targeting (IT). Taylor (1993) was probably the first to formulate an explicit IT rule in order to describe the actual policy followed by Greenspan.<sup>4</sup> This rule postulated that the short-term interest rate is a linear function of the output and inflation gaps and of the expected rate of inflation.

In a series of publications during the end of the nineties and the first decade of the twenty-first century, New-Keynesians provided general equilibrium micro foundations for IT monetary rules (Clarida et al., 1999; Woodford, 2003 are prominent examples). In this microfounded version of IT, an independent CB picks the short-term interest rate (taking the structure of the economy and

inflationary expectations as given), so as to minimize a weighted linear combination of the social costs of the inflation and output gaps. Here the first gap is the deviation of inflation from a (low) inflation target and the second gap is the deviation of actual from potential output.

Up to the eruption of the US subprime crisis in 2008, conventional wisdom concerning monetary policy was that: 1. The (real) interest rate is the main policy instrument and a sufficient statistic for the stance of monetary policy.<sup>5</sup> 2. The CB should lean against bubbles to the extent that they push actual inflation away from the inflation target. 3. Under IT, financial stability and prudential considerations took a back seat. One institutional manifestation of this approach was the transfer of financial supervision from the Bank of England to a separate agency – the financial services authority (FSA) – during the second half of the nineties. 4. Relatedly, precious little attention was devoted, at least by mainstream academics, to systemic financial risks.

## 3. How did the GFC alter the actual conduct and instruments of monetary policy?

The GFC reminded monetary policymakers that during a financial crisis, the CB – of all public institutions – has a comparative advantage in swiftly preventing the crisis from becoming a generalized panic that would seriously cripple the financial system. The main reason for this comparative advantage is that financial crises are characterized by sudden huge increases in excess demand for liquidity. Due to its monopoly over the creation of high-powered money, the CB is the choice institution for satisfying this craving for liquidity before it destroys or seriously cripples the financial system.

Following the demise of Lehman Brothers in September 2008, this fact was quickly recognized by Federal Reserve Chair Ben Bernanke who, as a scholar, developed the view that a critical factor in the severity and persistence of the great depression was the collapse of the credit mechanism caused by massive banking failures (Bernanke, 1983).<sup>6</sup> The Fed reacted so vigorously that within six months of Lehman's collapse its balance sheet had more than doubled, putting the yearly rate of expansion of its balance sheet over those six months at an all-time record of 420% per year. By comparison, during the previous nine years the average annual rate of expansion of the Fed's balance sheet was a comparatively small 6.25%. Some observers even argue that since the burst of the subprime crisis, the Fed has been acting as market maker of first resort rather than as the classical Thornton–Bagehot LLR (Humphrey, 2010).

This dramatic policy shift was soon to be followed by a number of operational changes in both the implicit and explicit IT procedures followed during the preceding great moderation years. Within less than six months of the Lehman event, the zero bound on the short-term policy rate became effective, forcing the Fed to supplement interest rate policy by means of quantitative easing programs. In parallel, the conduct of expansionary open market operations shifted to longer term maturities and higher risk securities.

Initially European banks were affected by the US subprime crisis mainly through their international financial linkages with the

<sup>2</sup> But this still left the door open for some short-run stabilization of the real economy – particularly so in the face of demand shocks.

<sup>3</sup> A recent survey on the evolution and measurement of CBI appears in Cukierman (2008a).

<sup>4</sup> Henderson and McKibbin (1993) simultaneously formulated such a policy rule for open economies.

<sup>5</sup> In some countries there were experiments with a monetary conditions index as a means of recognizing that the interest rate affects more than output and inflation.

<sup>6</sup> Bernanke took the work of Friedman and Schwartz (1963) as a point of departure, but he stressed credit, rather than money contraction, as the main culprit. Although those two nominal stocks normally move together, this is not necessarily the case during panics and banking failures. Further discussion of the prime importance of credit appears in Sections 3 and 4 below.

US. Some of them had to be rescued, but this was done more by the respective fiscal authorities than by the European Central Bank (ECB). Although the ECB did eventually reduce its policy rate, the reduction path lagged behind that of the Fed and is currently (December 2012) still three quarters of a percent above the zero bound. However, in the wake of the ongoing Greek and other PIIGS countries' sovereign debt problems, the highly conservative ECB inaugurated a long-term refinancing operation (LTRO). This lending facility is aimed at providing substantial long-term (up to three years) credit to banks within the Euro area. Its total size has recently been increased from half a Trillion Euros to one Trillion. From the collapse of Lehman Brothers till May 2011, the ECB balance sheet expanded at the rather modest rate of about 2.46% per annum. The much higher rate of expansion of the Fed's balance sheet over the same period reflects the higher conservativeness of the ECB, as well as the fact that although it had worldwide ramifications, the subprime crisis started in the US.

But following the increases in demand for liquidity induced by the persistence of the sovereign Greek debt crisis, the rate of expansion of the ECB's balance sheet accelerated dramatically. It increased to a whopping 70.88% per annum over the May 2011 to March 2012 period. As a result of this acceleration, the ECB balance sheet roughly doubled between Lehman's collapse and March 2012. Thus, in the face of an acute crisis within its own jurisdiction, even the highly conservative ECB had to react with substantial liquidity injections.

Since September 2008 the risks of inflation in both the US and in Europe appear negligible at first blush and, judging by survey results, inflationary expectations are well anchored. Further details appear in the next section.

Following the crisis, more countries (Japan, Switzerland, Brazil and Israel) periodically intervened in the Forex market in order to moderate excessive appreciations caused by inflows of foreign exchange.

#### 4. How to choose the timing of exit after large liquidity injections by central banks?

The huge liquidity injections performed by the Fed and, more recently, by the ECB, along with persistently low policy rates, raise the risk that when the economies of the US and of the Eurozone finally return to normalcy, inflation will pick up unless most of this liquidity is mopped up. This concern is occasionally voiced by some FOMC members as well as by former monetary policymakers in the Euro area (Issing, 2012 is a prominent example).

Although, ever since Lehman's downfall, inflation and inflationary expectations in both the US and the Euro area have been rather low, the above concern cannot be dismissed easily. Since monetary policy affects inflation with a lag and the liquidity injections have been huge, there is a real risk that the Fed and the ECB will start the tightening cycle too late.<sup>7</sup> On the other hand, starting it too early might kill a budding recovery.

The main problem is that there is little prior experience of the speed with which large economies such as the US and the Euro area return to normalcy following financial crises that were (and still are) met by large liquidity injections along with unusually low

interest rates.<sup>8</sup> The optimal timing for starting a tightening cycle is, therefore, shrouded in a lot of uncertainty. This uncertainty lies at the root of disagreements among policymakers and economists about the correct timing for mopping out liquidity injections.

In what follows I offer some thought about how to proceed in order to find a reasonably good exit time for monetary policy. A first major task involves the identification of changes in the demand for liquidity, since as long as this demand matches the large increase in the supply of liquidity, the risk of inflation is likely to be low.

As a matter of fact, the large initial expansions in the balance sheets of the Fed and of the ECB were largely in response to dramatic increases in the demand for liquidity, mostly by banks. Following the 2008 Lehman episode this increased demand was triggered by the drying out of the US interbank market, due to banks' losses on subprime securities. During the 2011/2012 Eurozone crisis, it was triggered by losses of European banks on Greek and other sovereign debt. Although the origins of the losses were different, the end result in both cases was to generate huge increases in the demand for liquidity by banks, and a parallel reduction in banking credit to potential lenders.

There is little doubt that since September 2008, US monetary policy has been extremely expansionary. This statement also applies (somewhat less dramatically) since the outbreak of the Greek sovereign crisis to the ECB. In what follows I take a look at the rates of expansion in the balance sheets and the policy rates of those two institutions, as well as the actual and expected rates of inflation in the US and in the Eurozone.

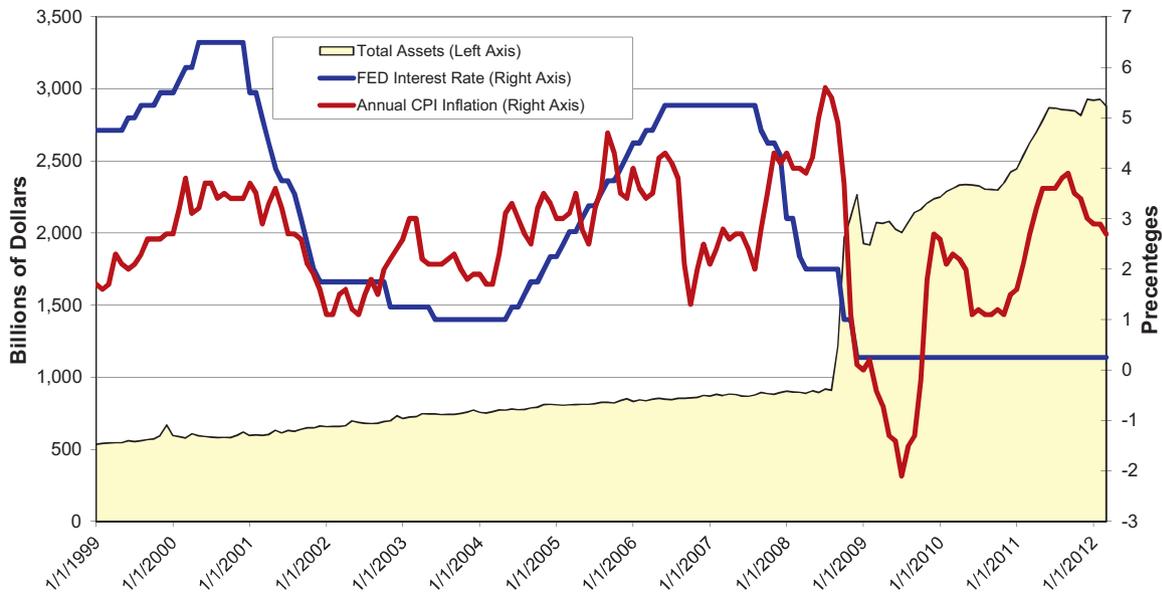
##### 4.1. The Federal Reserve (Fed)

The Fed's policy rate was reduced to nearly zero in early 2009 and has been kept at this level ever since. In addition, several large quantitative easing packages aimed at acquiring longer term assets were deployed, leading roughly to a tripling of the Fed's balance sheet between August 31 2008 and March 31 2012. This is equivalent to a yearly rate of increase of 38% over this period. By comparison, the yearly rate of expansion over the preceding, relatively normal, nine years (January 31, 1999–August 31, 2008) was only 6%. Interestingly, the higher rate experienced since September 2008 was not spread evenly over the second period. It accelerated to a gigantic 420% annual rate of expansion over the seven months immediately following the end of August 2008, dropping back to a yearly (moderately higher) rate of about 11.5% in the remainder of the period. Further details on the Fed's balance sheet, interest rate and US inflation, by sub periods, appear in Fig. 1 and Table 1. The very high rate of expansion during the first short sub-period obviously reflects the Fed's vigorous reaction to the rush to liquidity that seized financial markets following the downfall of Lehman Brothers.

Table 1 also shows the one year and the ten years ahead average inflationary expectations from the Survey of Professional Forecasters (SPF) by sub-periods, along with two measures of the short-term *ex ante* real rate calculated as the difference between the Fed's rate and each of the one-year and ten-year inflationary expectations. Those calculations show that ever since September 2008, the short-term real rate in the US has been negative. However, in spite of that and the huge increases in the Fed's balance sheet, inflation has remained low, and both short- and long-term

<sup>7</sup> A New-Keynesian might argue that if the IT regime in place is credible, the lag between the start of tightening and the impact on inflation should be short, since as soon as the tightening cycle starts, inflationary expectations will adjust downward. However, if it turns out with the benefit of hindsight that tightening started too late, credibility may be damaged and with it the beneficial effect through inflationary expectations.

<sup>8</sup> Economic developments in Japan during the nineties may provide some guidance. However, due to differences in structure and in policies, the lessons from the Japanese experience still leave a large margin of uncertainty.



Source: Bloomberg - Tickers: FARFAST Index, ECCPEMUY Index and FDTR Index respectively

Fig. 1. FED's balance sheet plus interest rate and annual CPI inflation (US).

Table 1

FED's monetary policy (rates of expansion of balance sheet and interest rates), inflation, inflationary expectations and real interest rates (US).

Time period	Rate of growth FED's balance sheet	Mean FED's interest rate	Mean annual CPI inflation	Mean SPF inflation 1 year	Mean SPF inflation 10 year	(FED rate) – (SPF 1 year)	(FED rate) – (SPF 10 year)
January 31 1999 till August 31 2008	6.26	3.47	2.88	2.35	2.48	1.12	0.99
August 31 2008 till March 31 2009	420.21	0.71	1.37	2.06	2.49	-1.34	-1.77
March 31 2009 till March 31 2012	11.58	0.25	1.72	1.81	2.38	-1.56	-2.13
August 31 2008 till March 31 2012	38.01	0.33	1.67	1.85	2.39	-1.52	-2.07

Source: From left to right: First three variables are calculated from data in Bloomberg (Tickers: FARFAST, FDTR, ECCPEMUY). The remaining four variables are based on data from the Federal Reserve Bank of Philadelphia website.

inflationary expectations remained well anchored.<sup>9</sup> The main implication of this brief data excursion is that existing evidence is consistent with the view that in spite of extraordinarily expansionary monetary policies, the risks of inflation in the US are currently minimal.

#### 4.2. The European Central Bank (ECB)

From the eve of the Lehman event to the end of March 2012, the ECB's balance sheet nearly doubled. During the nine years preceding August 31, 2008 its balance sheet had expanded at a yearly average rate of slightly less than 9%. From that date until March 31, 2012 the yearly average rate rose to about 22%, and during the (approximately) seven months following the downfall of Lehman Brothers, it shot up to almost 55%. Thus, although the acceleration in the rate of expansion of the ECB's balance sheet was not as dramatic as that of the Fed's balance sheet, its time path was generally similar except for the following important event: as the Greek sovereign crisis intensified between May 31, 2011 and March 31, 2012, the rate of expansion reached an all-time high of almost 71% per annum.

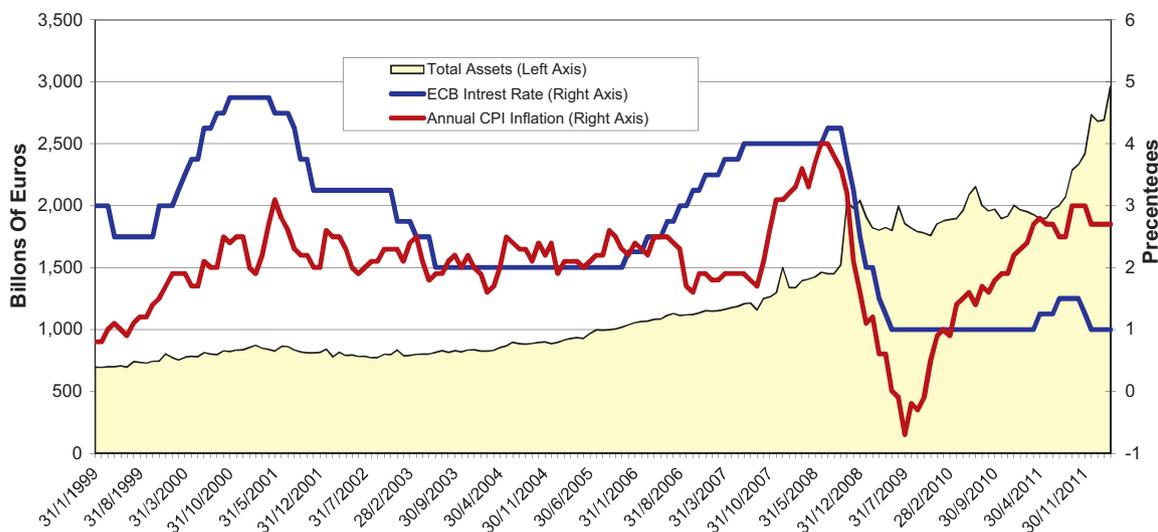
Although it also went down, the ECB interest rate reacted less strongly and later than that of the Fed. It initially hit a minimum of 1% in May 2009 and remained at this level until April 2011, at which

point it was raised above this level till November 2011 – most likely to moderate some acceleration of inflation. But since December 2011 the rate has returned to 1% and recently dropped to 0.75%, in spite of the fact that inflation did not decrease substantially. This is probably due to periodic intensification of the European debt crisis in conjunction with changes in the composition of the ECB Council (see Fig. 2).

In comparison to the Fed, the slower reaction of the ECB is due to the fact that, by design and tradition, it is more conservative than the Fed, in conjunction with the fact that the epicenter of the sub-prime bubble burst occurred in the US rather than in the Eurozone. But when, due to the PIIGS sovereign debt problems, the eye of the financial storm moved to the Eurozone, the rate of expansion in the ECB's balance sheet reached an all-time high. This pattern is reminiscent of the all-time high recorded for the rate of expansion of the Fed's balance sheet in the aftermath of the Lehman event. But the ECB's top rate of balance-sheet expansion was still much lower than the huge acceleration in the Fed's balance sheet following Lehman's collapse.

More detailed information arranged by sub-periods appears in Table 2. Along with indicators for the ease of monetary policy, the table presents Eurozone data on CPI inflation and inflationary expectations for one-year and five-year horizons from surveys of professional forecasters (SPF). The last two columns present two indicators for the real content of the policy rate by subtracting each of the two expectations series from the nominal policy rate. Since March 2009 both of those indicators have been in negative territory. In spite of that and despite the acceleration of inflation since

<sup>9</sup> As a matter of fact, inflation actually decreased in the post-Lehman collapse period.



Source: Bloomberg -Tickers: EBBSTOTA Index, EURR002W Index, ECCPEMUY Index respectively

Fig. 2. ECB's balance sheet plus interest rate and Annual CPI inflation (Eurozone).

Table 2

ECB's monetary policy (rates of expansion of balance sheet and interest rates), inflation, inflationary expectations and real interest rates (Eurozone).

Time period	Rate of growth ECB's balance sheet	Mean ECB's interest rate	Mean annual CPI inflation	Mean SPF inflation 1 year	Mean SPF inflation 5 year	(ECB rate) – (SPF 1 year)	(ECB rate) – (SPF 5 year)
January 31 1999 till August 31 2008	8.77	3.09	2.17	1.82	1.88	1.27	1.21
August 31 2008 till March 31 2009	54.81	2.75	1.91	2.04	1.99	0.71	0.76
March 31 2009 till May 31 2011	2.47	1.03	1.25	1.41	1.93	-0.38	-0.91
May 31 2011 till March 2012	70.84	1.25	2.75	1.79	2.00	-0.54	-0.75
August 31 2008 till March 31 2012	22.13	1.36	1.70	1.60	1.96	-0.24	-0.60

Source: From left to right: First three variables are calculated from data in Bloomberg (Tickers: EBBSTOTA I, EURR002W, ECCPEMUY). The remaining four variables are based on data from the ECB website.

the beginning of 2011, inflationary expectations have been well anchored.

Although Eurozone inflation hit 3% for three months during the second half of 2011, it has since receded to around 2.5%. Thus, despite the historically loose monetary policy, inflation does not appear to be a major concern, particularly in comparison to the risk of Euro area panic due to sovereign debt problems.

#### 4.3. Evidence on banks' behavior and summary reflections on the choice of timing for exit policies

The evidence in the previous two subsections shows that (with some differences in timing and intensity) both the Fed and the ECB reacted to their respective financial crises with historically loose monetary policies. Although it was given a back seat (at least in academic discussions) during the great moderation years, the financial stability motive has become a prime mover of monetary policy decisions since 2008.<sup>10</sup> In the face of large increases in the demand for liquidity on the part of banks, who are the traditional suppliers of liquidity to the economy, both the Fed and the ECB injected large amounts of liquidity, thus reducing interest rates to very low levels.

As long as the demand for liquidity by banks is high, they do not expand credit at high rates; this keeps the risk of inflation at bay. Despite substantial liquidity injections by the Fed and the ECB, the fact that inflation and inflationary expectations did not experience

substantial changes is consistent with the conjecture that, up to now, the bulk of the official liquidity injections have not translated into substantive increases in credit to the economy.

This conjecture is strongly supported by US data. Between January 1947 and August 2008, total US banking credit expanded at an average compound yearly rate of 5.3%. Since Lehman's collapse until April 2012, this rate dropped to a mere 1.8% – one-third of its previous normal long-term rate of growth.<sup>11</sup> Although credit growth picked up to some extent later, it was still only 2.2% during 2011. Fig. 3 illustrates this dramatic change in the behavior of US banking credit prior to and after the downfall of Lehman Brothers. The figure clearly shows that, after increasing rapidly between the early eighties and mid-2008, credit expansion decelerated sharply after September 2008.

An even more dramatic break – before and after September 2008 – can be observed in the behavior of total US bank reserves. Their annual long-term normal rate of increase between January 1999 and August 2008 is about half a percent. After the Lehman event and up to April 2011, this annual rate accelerated to 100%. Fig. 4 shows the rush to reserves of US banks after September 2008. At the end of August 2008, total banking reserves stood at about \$ 46 billion. A year later they were eighteen times larger!!! They did decline moderately during the second half of 2010 and then increased again by about 60% till the end of April 2012. Another way to appreciate the magnitude of the change in the behavior of

<sup>10</sup> An exception to the first statement is chapter 7 of Cukierman (1998).

<sup>11</sup> It even shrank by over 3.5% during 2009.

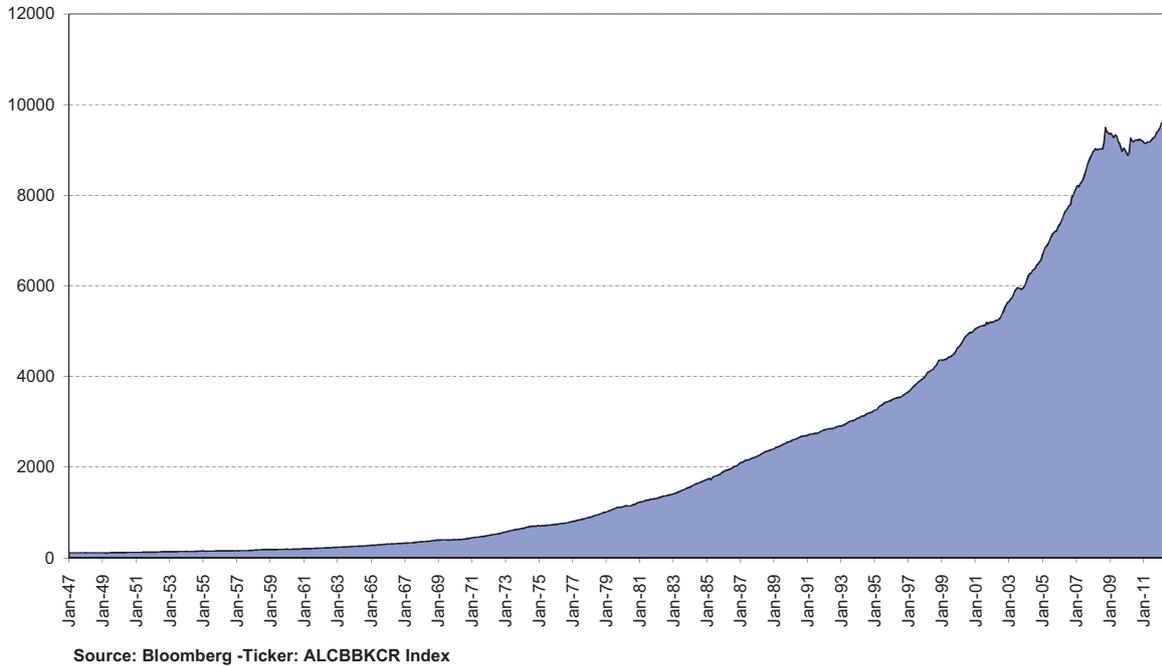


Fig. 3. Total US commercial banks' credit (billions of \$).

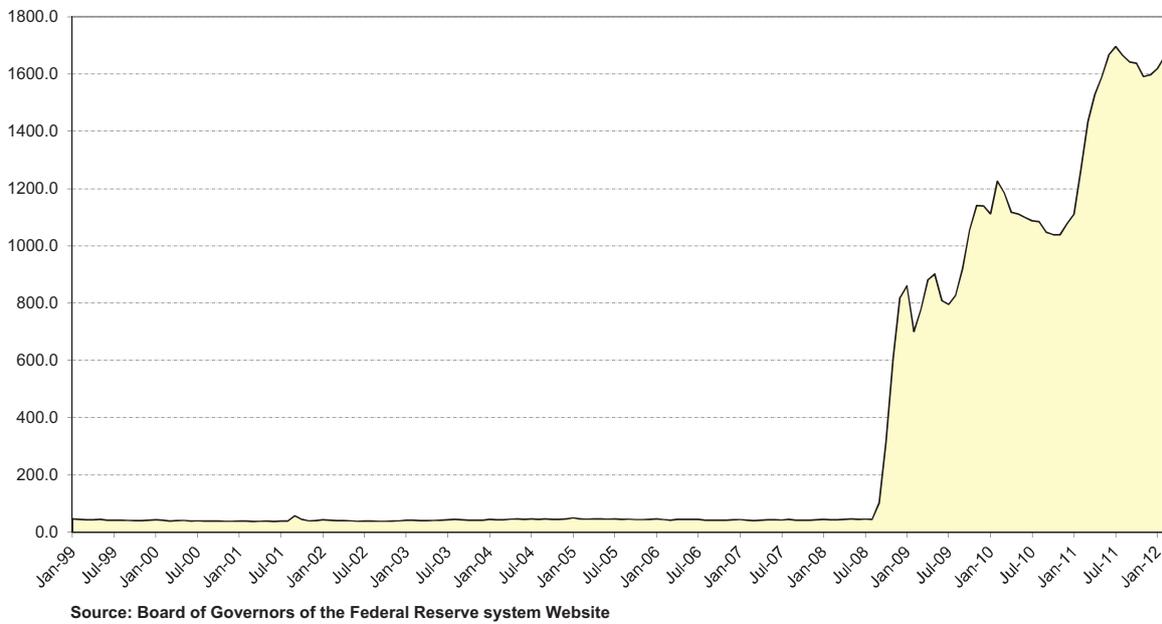


Fig. 4. Total reserves of US depository institutions (billions of \$).

US banks prior to and after the Lehman event is to compare the ratio between their total reserves and their total credit before and after this event. Just one month prior to Lehman's downfall, on August 31 2008, this reserve ratio was slightly more than half a percent. As can be gleaned from Figs. 3 and 4, it shot up dramatically immediately after reaching 12.62% on November 30, 2009.

This behavior on the part of the banks provides an explanation for the fact that, in spite of the huge expansion in the Fed's balance sheet, inflation remained low. As long as the banking system does not translate the huge increases in base money into higher levels of credit to the economy, and keeps most of it in the form of liquid reserves, the risks of inflation are small. This suggests that an important indicator of future inflationary risks is the rate of

expansion in banking credit.<sup>12</sup> In this context another variable that needs to be monitored is credit expansion through the capital market.

The post-Lehman behavior of US banks fits well into the old IS-LM liquidity trap story – in that they are willing to absorb large amounts of liquidity without using them to expand credit and loosen credit constraints on potential borrowers. As in the standard classroom model, this reduces the ability of expansionary

<sup>12</sup> As stressed by Borio and Drehmann (2009), this variable is also a potential leading indicator for the formation of bubbles. This issue is discussed further in the next section.

monetary policy to stimulate economic activity. But by the same token, it also substantially reduces the inflationary risks of this policy.

Like most economic models, the liquidity trap is an abstraction that does not perfectly fit real-world episodes. However, it does capture an important limitation of monetary policy in times of deep financial crises such as the great depression and the recent great recession. An interesting difference in the modus operandi of the (US) liquidity trap between those two episodes is that during the great depression, the liquidity trap mechanism operated to a large extent through cash-hungry runs of individuals on commercial banks. By contrast, due to the existence of deposit insurance during the recent crisis, such runs were largely absent. Instead, the liquidity trap took the form of a “run” of commercial banks for Fed’s reserves, as the interbank market for such reserves dried up due to generalized fears of insolvency.<sup>13</sup>

The preceding discussion suggests that central banks’ research departments may contribute to better monetary policymaking in the future, by examining changes in the quantitative relation between base money and credit to the economy, during and in the aftermath of severe financial shocks. An additional factor that may explain the relative tameness of inflation is that the speed of price adjustment during periods of extended low demand (and inflation) is lower than during periods of higher, more normal, demand. This suggests that another useful avenue for research aimed at improving future monetary policy is to investigate the possibility that the relation between inflation and the output or unemployment gap is weaker during major recessions than during normal times.<sup>14</sup>

## 5. How is the crisis likely to affect conventional wisdom about monetary policy and its interactions with the economy?

This section ventures some predictions about future developments in monetary policy objectives and instruments, as well as in related research about the aggregate economy following the issues raised by the GFC. In the US and the UK the financial stability objective has recently been elevated to a status similar to that of price stability in the charters of central banks. This process is likely to spread to other central banks. In parallel, research on potential conflicts between financial and price stability and on ways to improve on potential tradeoffs between those objectives will intensify.

There already is (and there will be further) recognition that, besides the interest rate, the stance of monetary policy is determined by the volume of high-powered money – which is determined in turn by the volume and type of obligations that the CB is willing to buy from government and the public. This point of view is quickly becoming respectable again, due to the Fed’s quantitative easing programs and the fact that the interest rate in the US is at the zero bound. This revival in the role of nominal stocks is likely to outlive the periods during which the policy rate is stuck at the zero bound.

<sup>13</sup> There were also very large excess bank reserves during the great depression. One of the explanations for the 1937 recession is that the Fed tried to mop up those excess reserves in that year – and discovered that the banks actually wanted to hold excess reserves.

<sup>14</sup> For the US, Cukierman (2008b) argues that the speed of price adjustment was lower during the (stable and low-inflation years) preceding the great inflation of the seventies than during the latter period. In terms of the new Keynesian model, this means that the Calvo parameter went down during the seventies. For Israel, that experienced higher fluctuations in inflation than the US, there is strong empirical evidence that the Calvo parameter is negatively related to inflation (Lach and Tsiddon, 1992).

The term “again” in the previous paragraph is not accidental. Prior to the emergence of the canonical New-Keynesian framework which characterizes the stance of monetary policy by means of the short-term interest rate, the stance of monetary policy was characterized, at least by the Chicago School and their followers, by the quantity of high-powered money or some other nominal stock like M1 or M2.<sup>15</sup> Somewhat ironically, what is currently labeled as “unconventional monetary policy” (Curdia and Woodford, 2009; Gertler and Karadi, 2011) was considered to be largely conventional policy by monetarists just twenty years ago.<sup>16</sup> Like beauty, terminology is in the eye (pen) of the beholder (author). Although this is innocuous, it is useful to keep in mind that nomenclature is subject to vintage effects.

The view that the CB (possibly with other regulators when regulation is spread across several institutions) should develop instruments beyond the short-term interest rate, in order to moderate bubbles in housing and other specific markets, is likely to gain respectability and may even become part of the conventional toolkit at the disposition of macro-prudential policy.<sup>17</sup> Three unsettled questions arise in this context: Why are bubbles bad? How can bubbles be identified *ex ante*? What kind of instruments should be used to lean against a bubble when this is deemed to be desirable?

Most cyclical expansions and some contractions probably have some bubbly elements in them. Current investment, consumption and credit market decisions are made on the basis of expectations about an uncertain future. By inducing individuals and firms to take more leverage in order to consume and invest more, optimism about the future induces them to take actions that at least partially validate this optimism. For exactly identical but symmetrically opposite reasons, pessimism is also at least partially self-fulfilling. In addition, an expansion breeds optimism that reinforces the expansion; a contraction breeds pessimism which reinforces the contraction.

One may therefore argue that, even when driven by overly optimistic expectations, the CB should not attempt to deflate a bubble, since such an action may also kill a healthy expansion in fundamentals. This argument is reinforced by serious limitations on the profession’s ability to identify *ex ante* the “bubbly” component of an expansion.<sup>18</sup> Indeed, if bubbles had never burst there would be no good reason to lean against them. However, bubbles do occasionally burst, and the probability that they do is an increasing function of the degree of over-optimism during their expansionary phases. Furthermore, the more the bubble is allowed to expand, in the sense that prices of assets deviate more from fundamental values, the more serious is the crisis when the bubble ultimately bursts.

<sup>15</sup> Obviously, when the interest rate is non-zero, choice of the interest rate implies a choice of high-powered money and vice versa. But when the interest rate is at the zero bound, high-powered money can be chosen independently of the interest rate, implying that the stance of monetary policy cannot be evaluated only by the interest rate. In particular, during depressions, the nominal rate could be low, but if the monetary base or one of the broader Ms was growing very slowly, monetary policy could still be restrictive rather than expansionary. This is one reason for the monetarist view that high-powered money is a better metric for the stance of monetary policy than the interest rate.

<sup>16</sup> Traditional Keynesians like Tobin and Modigliani believed that the transmission of monetary policy to the economy operates mainly through the interest rate. But they recognized that changes in interest rate policy and in the monetary base are two sides of the same coin.

<sup>17</sup> A perceptive discussion of those difficult issues appears in White (2010).

<sup>18</sup> This is probably the reason for the pre-crisis view, according to which the CB should not lean against a bubble; if worse comes to worst and the bubble does burst – it should “clean” its consequences after the fact. White (2009) takes a strong position against this view.

I believe therefore that *ex ante* interference with an expanding bubble should not be excluded a priori although this does not mean that the CB should lean against all bubbles. In particular, it should lean against those bubbles that are more likely to burst and to cause substantial disruptions in economic activity. This brings us to a modified version of the second question, which is: How to evaluate the likelihood that the bubbly part of an expansion will burst into a costly recession?

Although the economic profession is currently far from possessing a full answer to this important question, recent work by [Jorda et al. \(2012\)](#) on the behavior of the ratio between bank credit and GDP during 200 recessions – and on the preceding expansions in 14 advanced economies going back to 1870 – suggests that a stronger increase in this ratio during the boom tends to lead to a deeper subsequent downturn. [Borio and Drehmann \(2009\)](#) show that, as an empirical matter, financial crises are more likely when the credit-to-GDP ratio is larger. Taken together, those findings imply that some measures of aggregate credit to GDP may be taken as leading indicators both for the likelihood of a crisis and for the seriousness of its recessionary effects.<sup>19</sup>

Interestingly, such credit indicators can also be supported by theoretical considerations backed by a more precise analytical framework. In what follows I briefly sketch the basic intuitive argument. When agents in the economy are more optimistic, they tend to borrow and lend more. This leads to larger levels of credit. At higher levels of credit, both borrowers and lenders are more exposed to negative news. Consequently, when new negative information arrives, the likelihood of a financial crisis is larger when leverage is higher. In addition the recessionary impact of the crisis is stronger when leverage is larger.<sup>20</sup>

I now turn to the question regarding a type of instrument to be used when it is deemed necessary to lean against the formation of a bubble within a bubble-prone sector such as housing. [Taylor \(2009\)](#), among others, has claimed that the Fed has contributed to the housing bubble in the US by keeping the policy rate too low for too long.<sup>21</sup> Although Taylor's diagnosis in this specific case may be partially correct, the instrument of choice for leaning against a housing bubble is not always the interest rate. This is the case, for example, when inflation and general economic activity are low, but due to the abundance of liquidity in the mortgage market, demand for housing is too high. In such a case the CB can use more sector-specific instruments, such as limits on the amount of mortgage credit that banks can extend, or higher capital requirements on mortgages.<sup>22</sup>

More generally, in the presence of conflicts between price and financial stability, additional monetary policy instruments – such as specific banking regulations on shares of credit to different industries, loan to value requirements on mortgage loans, or changes in capital requirements for particular credit categories – can be and are increasingly being used. It is likely that the twin objectives of price and financial stability will lead to an intensification of such trends in the future. Additional instruments, such

as forex market interventions, are increasingly being deployed and are likely to become even more important in the face of short-term large capital flows.

Last but not least, more attention is already being given and will be given to systemic risks. Although the CB is not always the only institution charged with monitoring and leaning against such risks, in most countries it is the natural institution for leading the effort against the buildup of systemic risks.

## 6. The lender of last resort – moral hazard tradeoff, the Dodd–Frank Act and the future of monetary policymaking institutions

There is little doubt that once a financial crisis has been allowed to develop, the CB has to act as a LLR. Obviously this conflicts with the pre-crisis prescriptions of the IT regime and begs the question of how to maintain the benefits of IT while allowing the CB to act as a LLR when the need arises.

One way is to maintain IT during tranquil times, but to temporarily suspend IT and focus on the LLR function during crisis periods. In some cases such a strategy can be justified, even within the IT framework, on the grounds of preventing large negative output gaps that would have materialized had the financial crisis been unattended. The behavior of inflation during the last four years supports the view that, in spite of large liquidity injections, due to collective flight to safety by banks and the public, inflation is not the main risk during financial crises.

On the other hand, although *ex post* the injection of liquidity may be a lesser evil, the knowledge that such a facility is likely to be deployed leads, *ex ante*, to excessive risk taking and credit expansion throughout the financial system. Basically, the advance knowledge that some sort of LLR facility exists creates moral hazard problems and encourages the buildup of bubbles. There is thus a tradeoff between the *desirability* of liquidity injections once a crisis materializes and its *ex ante undesirable* effect on risk taking and bubble formation. I will refer to it in the sequel as the lender of last resort – moral hazard tradeoff (LLR-MHT). This tradeoff is particularly unfavorable in the case of systemically important financial institutions (SIFI), since the likelihood that such institutions will have to be bailed out is higher than that of other financial institutions.

Although the LLR-MHT appears to be an inescapable fact of life, there might be ways to ameliorate it by means of appropriate regulatory legislation. This is the route taken in the US via the Dodd–Frank Act of July 2010 ([Dodd–Frank Act](#)). The Act creates a Financial Stability Oversight Council (FSOC) made up of 10 federal financial regulators, including the Federal Reserve Board, and chaired by the Treasury Secretary. The Council is charged with identifying and responding to emerging risks throughout the financial system. For this purpose the Council is directed and authorized to perform the following functions:<sup>23</sup>

- (i) Make recommendations to the Federal Reserve for increasingly strict rules for capital, leverage, liquidity, risk management and other requirements as companies grow in size and complexity, with significant requirements on companies that pose risks to the financial system.

<sup>19</sup> Be that as it may, it is likely that we will see much more work on early indicators for the detection of bubbles that are likely to burst with high probability.

<sup>20</sup> [Cukierman and Izhakian \(2012\)](#) demonstrate this analytically for the case in which overly optimistic bailout expectations are suddenly revised downward, as was the case when Lehman was not rescued. But the argument is more general. It can be applied to any variable that is relevant for the choice of leverage levels, such as expectations about the rate of growth of the economy, war versus peace or the price of oil.

<sup>21</sup> But see [Bernanke's \(2010\)](#) rebuttal.

<sup>22</sup> To cool off overheating in the housing sector in 2009 and 2010 the Bank of Israel recently imposed ceilings on the volume of nonindexed variable rates mortgages linked to the prime rate.

<sup>23</sup> The Act is quite comprehensive and covers many areas, including consumer protection. The text focuses only on the parts of the Act that are relevant for the LLR-MHT.

- (ii) Authorized to require, with a 2/3 vote and vote of the chair, that a nonbank financial company be regulated by the Federal Reserve if the council believe there would be negative effects on the financial system if the company failed, or if its activities would pose a risk to the financial stability of the US.
- (iii) Able to approve, with a 2/3 vote and vote of the chair, a Federal Reserve decision to require a large, complex company to divest some of its holdings if it poses a grave threat to the financial stability of the United States – but only as a last resort.
- (iv) Establishes a floor for capital that cannot be lower than the standards in effect today, and authorizes the Council to impose a ceiling of 15 to 1 leverage to capital ratio at a company, if necessary, to mitigate a grave threat to the financial system.
- (v) Requires large, complex financial companies to periodically submit plans for their rapid and orderly shutdown, should the company go under – also known as funeral plans or living wills.
- (vi) Creates an orderly liquidation mechanism for the Federal Deposit Insurance Corporation (FDIC) to unwind failing systemically significant financial companies. Shareholders and unsecured creditors bear losses, and management and culpable directors will be removed.
- (vii) Requires that Treasury, FDIC and the Federal Reserve all agree to put a company into the orderly liquidation process to mitigate serious adverse effects on financial stability, with an up-front judicial review.
- (viii) Any emergency lending by the Fed must be approved by the Secretary of the Treasury, and loans cannot be made to insolvent firms.

It can be seen from the list above that the Act tries to mitigate the LLR-MHT by various measures that include capital requirements, authority to break up SIFI in order to reduce the likelihood that they will have to be bailed out, and living wills that would facilitate the liquidation of complex institutions in case of default. Those measures, as well as additional ones (not reported), are meant to assure that in case of insolvency, losses are borne by shareholders and not by taxpayers. The legislation embraces the Thornton–Bagehot principle that emergency liquidity should be provided by the Fed – but only to solvent institutions. Interestingly, such emergency liquidity has to be approved by the Secretary of the Treasury.

The Dodd–Frank Act raises an important general question about the appropriate location of authority concerning emergency lending. It appears that in democratic societies, financial crises that require large liquidity injections cannot be left only to the discretion of the CB. The reason is that as the magnitude of those injections rises, they become more similar to fiscal policy in that they involve a redistribution of wealth, at least potentially.<sup>24</sup> This violates the (implicit) principle that at least in a democratic society, distributional policies should be determined by elected officials rather than by unelected bureaucrats.

It thus appears that during serious financial disruptions, fiscal and monetary policies have to cooperate in spite of the long-term damage this may create for CBI during more tranquil times. A possible way to ameliorate this tradeoff is to distinguish between crisis

and tranquil times. It is likely that this tradeoff – along with the extent to which the Dodd–Frank Act will mitigate it in practice – are issues that will receive substantial further attention in the future.<sup>25</sup>

## 7. Bailout uncertainty and its implications for central bank policy

The financial sector bailouts in the US and Europe have revived the well-known dilemma between restoration of confidence in the face of a panic and the costs of moral hazard. On the one hand, when a panic engulfs financial markets, bailouts appear indispensable in order to restore confidence and prevent further problems within the financial system. On the other, by subsidizing opportunistic behavior at the expense of taxpayers, bailouts encourage excessive risk-taking on the part of financial institutions, borrowers and lenders, and plant the seeds of the next bubble.

This dilemma is one of the important factors underlying uncertainty about governmental bailout policy. Different officials have different views about the relative importance of the immediate costs of letting a systemically important financial institution (SIFI) disappear, versus the longer-term costs associated with an increase in opportunistic behavior due to moral hazard. Since this tradeoff also involves normative considerations, it is normally resolved by elected officials rather than by bureaucrats and is therefore also affected by ideology, political considerations and partisanship.

The buildup of the subprime bubble in the US and its bursting provide an interesting case study. An important reason for the buildup of the real-estate bubble in the US was the implicit bailout guarantee offered to holders of mortgage-backed securities (MBS). The decision not to bail out Lehman led to a revision of beliefs about the likelihood of bailouts, and sensitized financial markets to their relative ignorance about the probability of bailouts triggering a liquidity and ultimately a solvency crisis.

Prior to Lehman's downfall on September 15, 2008, financial markets believed the likelihood that authorities would let the holders of a SIFI debt suffer major losses in case of failure to be low. The implicit governmental guarantees to Fannie Mae and Freddie Mac and the Fed's actions in the Bear–Stearns case in March 2008 reinforced this belief. The (initial) decision to impose losses on Lehman's creditors, followed by the initial Congressional rejection of the TARP package, along with the preceding highly publicized split within Congress about the wisdom of this package, led to an immediate and substantial downward adjustment in bailout beliefs. Although anxieties were reduced to some extent with the passage of an amended TARP package on October 3, 2008, markets suddenly realized that letting the creditors of a failing SIFI institution bear major losses is not a zero probability event. Using Taleb's (2007) metaphor, markets suddenly discovered that a “no bailout” black swan does exist.

Using a modern decision theory concept of Knightian uncertainty, Cukierman and Izhakian (2012) show – within a micro founded general equilibrium model of the financial system – that such a change in beliefs induces a flight to safety, a decline in credit flows, a general increase in rates within financial markets, an increase in banking spreads and, in some cases, complete

<sup>24</sup> This consideration has particular force in view of the fact that, even when the law stipulates that emergency lending is only for illiquid but solvent institutions, it is often impractical to implement this principle due to objective difficulties in distinguishing *ex ante* between illiquid and insolvent institutions.

<sup>25</sup> Some economists are skeptical about the ability of the various regulators involved in it to efficiently implement the numerous pieces of the act. See in particular chapter 7 of Barth et al. (2012).

financial arrest.<sup>26</sup> The last several months following Lehman's collapse exhibited similar features.

An important additional implication of the Cukierman–Izhakian framework is that elevated beliefs about the generosity of bailouts prior to Lehman's collapse intensified the buildup of the subprime bubble by inducing excessive credit expansions within the financial system. When this bubble finally burst, the excessive credit buildup aggravated the dire consequences of the subprime crisis. Thus, *ex ante* irresolute and opaque policies, that induce overly optimistic bailout expectations, aggravate the *ex post* consequences of a downward adjustment in bailout expectations. Recent gyrations between optimism and pessimism regarding the EZ sovereign debt problems are, to a large extent, also due to uncertainty about political decisions regarding bailouts.<sup>27</sup>

### 7.1. Monetary policy and bailout uncertainty

Is there a useful role for the CB in alleviating the problems induced by bailout uncertainty? Since bailout decisions are ultimately in the hands of fiscal authorities, bailout uncertainty and its consequences are, at first blush, outside the control of the CB. But the CB can appease an *ex post* panic that seizes financial markets in the aftermath of a bubble burst by injecting large amounts of liquidity. As we have seen above, such *ex post* policies have been deployed by the Fed and by the ECB.

Beyond such *ex post* “firefighting” measures, the CB can also lean against the *ex ante* excessive buildup of a bubble by maintaining a sufficiently contractionary monetary stance. In particular, during good times, it could diffuse excessive credit buildups caused by overly optimistic bailout expectations, by standing ready to raise the interest rate when those expectations are too high. Such a strategy may create a tradeoff between the traditional inflation targeting (IT) function of the CB and the prevention of excessive credit buildups.

This tradeoff may be improved by using interest rate policy mainly for IT and by developing other more specific instruments to lean against excessive credit expansion. Examples of such instruments include the imposition of ceilings on credit types whose expansion appears to be exaggerated. Other instruments may include a more frequent use of changes in reserve requirements and capital requirements.

The optimal combination of interest rate policy and of those additional instruments to achieve the joint objectives of IT and of leaning against bubble buildups will most likely vary depending on specific economic circumstances. To deploy these additional instruments, the CB needs the authority to regulate the banking system. This consideration provides an important argument for locating banking supervision and regulation within the CB.

## 8. The particular problems of the Eurozone in the face of a financial crisis

In the face of a financial crisis whose magnitude requires the intervention of fiscal authorities, the Eurozone faces several difficulties beyond those experienced in the US during the subprime crisis.

The first and most important is that, unlike in the US, fiscal decisions are decentralized across the sovereign member states within the Eurozone. As a consequence, bailouts have to be negotiated ad hoc by national governments with different constituencies, ideologies and norms. This is not to deny that there are interest divergences across the US states as well. However, there is only one main fiscal authority managed by the Federal government, and ever since the end of the US War of Independence all states in the union accept the primacy of its fiscal decisions.<sup>28</sup> In addition, since the great depression, the Federal government has been using its budget to cross insure states against natural disasters and local recessions. Once in place, this governmental insurance program induces the states to support its continuation willingly.

The second particular problem of the Eurozone is that the charter of the ECB makes it responsible for price stability in the first place, while the responsibility for financial stability resides mainly with the national central banks within the monetary union. The third is that, in the absence of support from other members or from the ECB, some of the sovereign countries within the Euro area are in effect insolvent.

These features create a tradeoff between the main objective of the ECB and the current reality, which is dominated by financial fears fueled by potential sovereign defaults of heavily indebted governments like Greece and Spain. The experience of the last few years has demonstrated that outright sovereign defaults can be achieved or at least postponed by large injections of liquidity from the CB, accompanied by fiscal bailout packages. Due to the structural differences discussed above, Europe is less resolute than the US in deploying such policies.

Nonetheless, in spite of its traditional focus on price stability, the ECB recently demonstrated that when push comes to shove it is willing to inject substantial amounts of liquidity into the economy. A case in point is the Long Term Financing Operation (LTRO) that offered up to one Trillion Euros in three-year loans to Eurozone commercial banks and the more recent Outright Monetary Transactions (OMT) plan for purchasing sovereign debt subject to some conditions.

But continuous liquidity injections have fiscal implications. Bailout operations, whether carried out indirectly through the ECB or by direct agreement of the Eurozone governments, will have to involve the fiscal authorities of the area. Agreement about who will foot the costs of necessary future bailouts is hard to achieve and leads to a protracted political bargaining process. By providing long-term financing to banks, the ECB can prevent the immediate financial panic that would otherwise most probably engulf the Euro area. This can provide some breathing space for the parties involved to hammer out an accepted agreement. In view of the Eurozone fiscal fragmentation, this breathing space is badly needed.

It is most likely that, when hammering out the principles of the Maastricht Treaty, its framers did not envisage that one day the ECB would have to act mainly as a lender of last resort. As a consequence, the ECB is currently torn between its ingrained allegiance to the price stability objective and between the fact that, given current monetary arrangements, it is the only institution that can swiftly supply the large amounts of liquidity needed to

<sup>26</sup> The behavioral paradigm used is Gilboa and Schmeidler's (1989) maximin criterion for decision making under uncertainty. This criterion is consistent with a high degree of uncertainty aversion – which may not be unrealistic following extreme, largely unanticipated events, of the type discussed in the text.

<sup>27</sup> A more detailed discussion appears in the next section.

<sup>28</sup> After this war, the power to levy tariffs was transferred from the states to the Federal government, in return for the latter assuming the heavy debts incurred by the states during the war. In his Nobel lecture, Sargent (2012) recounts that in 1790, “Congress carried out a comprehensive bailout of state governments’ debts, part of a grand bargain that made creditors of the states become advocates of ample federal taxes.”

deflect an impending financial panic. The longer it takes for the different fiscal authorities, the creditors (mainly Eurozone banks) and the heavily indebted governments to hammer out a stable long term fiscal agreement, the more important is the ECB's potential lender-of-last-resort function.

However, there are long-term costs to the excessive application of such policies, since they reduce the incentives for fiscal responsibility of the members' fiscal authorities. In the long run there should be better enforcement of limitations on deficits and debts. The Eurozone fiscal compact is a recent attempt to do exactly that. But it remains to be seen whether the compact will be ratified and implemented. The fact that most of the countries in the Eurozone are currently in recession does not bode well for quick ratification of the compact.

If the Euro project is to survive in the long run, it will ultimately have to move to more centralization of fiscal decisions along with some form of cross-insurance of member states. Under such an arrangement, a nation state within the Eurozone could expect transfers from the rest of the area in the case of adverse shocks, such as a deep recession and/or a shortfall in tax revenues. In return, the individual state would have to abide by Eurozone-wide limitations on its ability to create deficits and accumulate debt. In a nutshell: There would be "no bailouts without fiscal discipline." This obviously requires more economic as well as political centralization, as recently suggested by Chancellor Merkel.

Due to the numerous financial links between government and the banking system on the one hand and the links between the latter and the CB on the other, it is likely that, in parallel, there would also have to be more centralization of authority within the ECB. In particular, the existence of SIFIs at the European level requires at least a Eurozone-wide authority in charge of regulation and supervision of the financial system at the same level. The ECB is the natural institution to perform this function.<sup>29</sup> Even if, due to the large varieties in institutional structures across countries within the area, detailed implementation is left to local regulators and supervisors, the ECB should take the lead in devising and implementing those functions. Due to its monopoly over the creation of liquidity, the ECB is also the natural candidate to act as an LLR in the face of a financial crisis.<sup>30</sup>

*Ex ante* regulation and supervision by the ECB should be aimed at minimizing the likelihood of contagion and the associated financial panics. However, in the (hopefully) few cases in which such panics materialize, the ECB would have to perform the LLR function. This implies that the financial stability objective in the ECB charter should probably be elevated to a status similar to that of the price stability objective.

Some economists worry about potential conflicts between these two objectives (a recent example is *Issing (2012)*). However, the behavior of inflation and of inflationary expectations in the face of persistent expansionary monetary policies in both the US and Europe during the GFC crisis suggests that, luckily, the inflationary cost of LLR operations is small, precisely when such operations are most needed (Section 4). Hence allowing the ECB to adjust its focus between normal versus financial crisis periods may not be as costly as might appear at first sight.

<sup>29</sup> During the final editing of this paper (December 2012) EU Finance Ministers agreed to transfer regulation of Eurozone SIFI to the ECB.

<sup>30</sup> In November 2010, the European Parliament and the Council established the European Banking Authority (EBA) to monitor Europe's biggest banks. In line with this mandate, the EBA conducted stress tests, but failed to predict the June 2012 Spanish debt problems. This is now catalyzing German and French support for transferring this function to the ECB.

## 9. Concluding remarks

Monetary policy principles and monetary policymaking institutions change substantially following major economic upheavals. Thus, the great depression led *inter alia* to deposit insurance and to the Glass–Steagall Act. The great inflation of the seventies was followed by Volcker's stabilization, and the ascendancy of central bank independence. The great moderation spurred inflation targeting, Taylor's rule and the New-Keynesian framework, along with a relative neglect for financial stability issues.

The global financial crisis resurrected concerns about financial stability, and underlined the importance of the central bank's lender-of-last-resort function. It also led to a more intensive use of unconventional monetary policy instruments. The crisis also demonstrated that during financial crises, highly expansionary monetary policies do not necessarily raise inflation.

Section 4 of the paper presents data on total US banking credit and reserves which support the view that this seeming anomaly is due to huge increases in the demand for liquidity and safe assets by the banking system and other financial institutions over the crisis. A corollary to this view is that inflationary risks will reappear only when the rate of increase in credit to the economy picks up. This is consistent with the view that the transmission of monetary policy to the real economy and to inflation is substantially weaker during financial crises than during normal times; or, more generally, that the transmission of monetary policy to inflation depends on the state of the financial system.

The preceding remarks suggest that an important open question for future research is: how does the transmission of monetary policy to private banks' interest rates and the volume of credit they offer, differ between normal times and between periods of banking distress. A related open question concerns the possibility that the speed of price adjustments is lower during deep recession periods than during more normal times.

If, as I believe, future research supports these two hypotheses, the operational policy conclusion may be that during financial crises, inflation targeting should be de-emphasized in favor of the maintenance of liquidity and confidence.

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