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**EURO-AREA AND US BANKS BEHAVIOR,
AND ECB-FED MONETARY POLICIES
DURING THE GLOBAL FINANCIAL CRISIS:
A COMPARISON**

Alex Cukierman

*FINANCIAL ECONOMICS and
INTERNATIONAL MACROECONOMICS*



Centre for Economic Policy Research

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Abstract

This paper compares the behavior of Euro-Area (EA) banks' credit and reserves with those of US banks following respective major crisis triggers (Lehman's collapse in the US and the 2009 admission by Papandreou, that Greece's deficit was substantially higher than previously believed, in the EA). The paper shows that, although the behavior of banks' credit following those widely observed crisis triggers is similar in the EA and in the US, the behavior of their reserves is quite different. In particular, while US banks' reserves have been on an uninterrupted upward trend since Lehman's collapse, those of EA banks fluctuated markedly in both directions. The paper argues that, at the source, this is due to differences in the liquidity injections procedures between the Eurosystem and the Fed. Those different procedures are traced, in turn, to differences in the relative importance of banking credit within the total amount of credit intermediated through banks and bond issues in the EA and the US as well as to the higher institutional aversion of the ECB to inflation relatively to that of the Fed.

JEL Classification: E51, E52, E58 and G1

Keywords: credit, crisis, euro area, monetary policy, reserves and us

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Euro-Area and US Banks Behavior, and ECB-Fed Monetary Policies during the Global Financial Crisis: A Comparison

Alex Cukierman¹

1. Introduction

This paper compares the behavior of Euro-Area (EA) banks with that of US banks during the global financial crisis. In particular it compares the behavior of banking credit and of banks' reserves following major crisis triggers in the US and the EA. Although the downfall of Lehman Brothers constitutes such a trigger for both the US and Europe its impact on the US was stronger than on the EA. The EA was hit only by the blast waves of the Lehman event while the US was at the epicenter of the panic generated by it. An important, internally generated, crisis trigger in the EA was the November 2009 announcement by Greek prime minister George Papandreou that Greece's annual budget deficit will be more than double the previously announced figure. For the US Lehman's downfall obviously constitutes a clear watershed. Since the EA was affected both by this event as well as by Papandreou's announcement the paper examines the behavior of EA bank credit and reserves following each one of those events.

The paper shows that, although the behavior of banks' credit following widely observed crisis triggers is similar in the EA and in the US, the behavior of their reserves is quite different. The paper argues that, at the source, this is due to differences in the liquidity injections procedures between the Eurosystem and the Fed. Those different procedures are traced, in turn, to differences in the relative importance of banking credit within the total amount of credit intermediated through banks and bond issues in the EA and the US as well as to the higher institutional aversion of the ECB to inflation relatively to that of the Fed.

¹ Interdisciplinary Center, Tel-Aviv University and CEPR. I benefitted from very enlightening discussions with Nuno Cassola and Francesco Papadia and from the reactions of Ulrich Bindseil. Nir Pinchasovitch provided efficient research assistance

The paper is organized as follows. Section 2 documents the behavior of banks' credit in the EA and in the US prior to and after the realization of crisis triggers. Section 3 compares the behavior of banks' reserves and of the monetary base during the crisis in the EA and in the US and discusses the reasons for their different behavior. Section 4 argues that differences in monetary policy procedures between the Fed and the Eurosystem underly the different behavior of banks' reserves in the EA and the US. Section 5 documents the relative importance of banking credit in total credit (bank credit plus bond issues) and argues that the traditionally higher weight of bond issues in the US relatively to the EA is an important reason for the difference in policy procedures used by the Fed and the Eurosystem. An additional reason is the relatively stronger focus of the ECB on price stability. Section 6 compares the behavior of total new loan credit and its components (banking credit plus new net bond issues) during the crisis to their behavior during normal times in the EA and in the US. This is followed by concluding remarks.

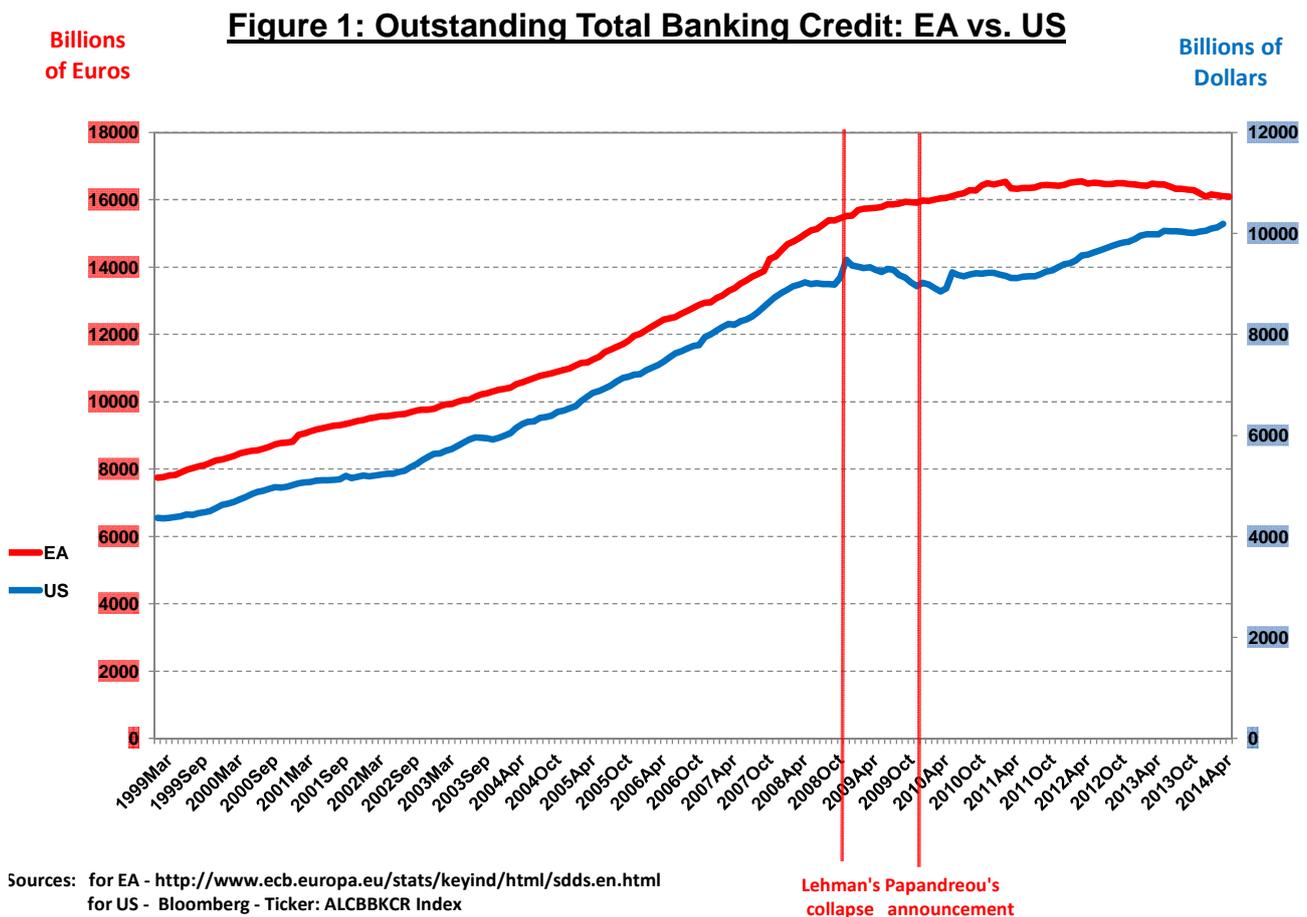
2. Behavior of banking credit during the crisis in the EA and the US: A comparison

Figure 1 and Table 1 show that total banking credit in both the EA and the US expanded at average yearly rates of about seven percent between 1999 and the last quarter of 2007. Since Lehman's collapse till the beginning of 2014 average yearly rates of credit expansion shrank dramatically – to less than one percent in the EA and to 1.3% in the US. The credit shrinkage in the US preceded its counterpart in the EA by one to two years. In particular, between October 2007 and September 2008 average credit growth in the EA actually went up to 7.7% but dropped to 4.2% in the US.

During the year following Lehman's downfall **outstanding** banking credit in the US actually **shrank** by 4.7%. Although it stayed in the positive range the rate of credit growth in the EA during that year dropped to 3.1%. Since Papandreou's dramatic upward revision of the Greek deficit figure in November 2009 till February 2014 the yearly average rate of growth of EA banking credit dropped further to around 0.3% but its US counterpart regained some ground – to 2.9%. Both of those events are marked by vertical red lines in Figure 1. It is also noteworthy that since (roughly) the peak of the sovereign debt crisis in the EA till February 2014 outstanding banking credit went down by almost one

percent per year on average in the EA (first memo item in Table 1).² By contrast the corresponding rate in the US was back up about half of the way to its pre-crisis level – a bit over 3.5%.

Together the figure and the table show that although credit growth in both the EA and the US went down following Lehman's collapse and Papandreou's announcement the impact of the first event was stronger in the US and that of the second was stronger in the EA. Since the first event precedes the second by over a year the brunt of the financial crisis hit the EA later than the US and correspondingly credit recovery in the EA lags behind that of the US. However, in both the EA and the US rates of banking credit growth are still anemic in comparison to their pre-crisis levels: Overall, in the five and a half years since Lehman's collapse the average yearly rates of credit expansion dropped to less than 0.8% and 1.35% in the EA and in the US respectively (second memo item in Table 1).



² CDS rates on Greek government bonds hovered in the vicinity of their all time high of 35% during the end of 2011 and the beginning of 2012 (Figure 7).

Table1: Bankings Credit Growth Prior to and Following the Global Financial Crisis Comparison EA vs. US		
Time Period	Yearly Growth of Total European Banks' Credit	Yearly Growth of Total US Banks' Credit
JAN 1999 - SEP 2007	6.72%	7.83%
OCT 2007 - SEP 2008	7.72%	4.22%
OCT 2008 - SEP 2009	3.14%	-4.74%
OCT 2009 - FEB 2014	0.28%	2.93%
Memo items		
DEC 2011 - FEB 2014	-0.86%	3.56%
OCT 2008 - FEB 2014	0.80%	1.35%
Sources: for EA - http://www.ecb.europa.eu/stats/keyind/html/sdds.en.html for US - Bloomberg - Ticker: ALCBBKCR Index		

3. Behavior of total banks' reserves during the crisis in the EA and in the US: A comparison

Figures 2a and 2b show respectively the evolution of total bank reserves in the EA and in the US prior to and after the realization of crisis triggers. In both cases there initially is an acceleration in the rate of growth of those reserves. However since Lehman's collapse rates of reserve growth are substantially lower and much more variable in the EA than in the US. In particular, since September 2008 bank reserves are on a sustained upward trend in the US while in the EA they fluctuate substantially in both upward and downward directions.

The vertical red lines in Figure 2a depict the beginnings of the main liquidity injections programs of the ECB. The first of those is the Fixed-Rate, Full-Allotment (FRFA) liquidity provision that was introduced in October 2008. In normal times, the Eurosystem assesses the total liquidity need of the banking sector and, in competitive tenders allots this amount. Since these tenders are usually conducted as variable rate tenders banks have to pay the interest that they offer when they make their bids. As a consequence, during periods of high demand for liquidity, as is the case during a financial crisis, the rate paid by banks goes up. Under the FRFA liquidity provision the ECB provides **the full amount of liquidity that banks request at a fixed pre-announced rate** subject to appropriate collateral. The FRFA provision was initially introduced for a fixed period of time and subsequently extended several

times.³ By supplying all the desired liquidity at a fixed rate the FRFA provision neutralizes the increase in rates caused by competitive bidding and allows banks to obtain all the liquidity they desire at a rate that is known in advance. The second liquidity injection program is the Covered Bonds Purchasing Plan (CBPP). It was introduced in June 2009 and stipulated the purchase of 60 Billions worth of Euro denominated covered bonds over a period of one year.⁴ The third liquidity injection program known as the Securities Market Programme (SMP) was introduced in May 2010 and phased out in September 2012. It involved the purchase of mainly sovereign bonds on the secondary markets and was fully sterilized. The total volume of this program peaked at around 210 billion Euros.

In December 2011 and February 2012 the ECB launched two waves of a Long Term Refinancing Operation (LTRO) involving three years loans to banks against appropriate collateral. The total amount allotted amounted to about a Trillion Euros.⁵ The last liquidity injection program (within the time span covered in Figure 2a) known as Outright Monetary Transactions (OMT) was announced in August 2012. Its objective was to buy EA sovereign bonds with maturities of up to three years on secondary markets. As in other bond buying programs the liquidity injections caused by those purchases were fully sterilized.

It is apparent from Figure 2a that upon the inception of a given liquidity injection program total banking reserves at the ECB shoot up and decrease after a while. In the case of bond purchases the increase is due to the fact that sterilization is achieved through an increase in banks deposits at the ECB in conjunction with the fact those deposits constitute banking reserves. Those additional reserves may go into either a “Current Account” that is designed as a repository for required reserves or into a “Deposit Facility” that pays a higher rate and is designed as a repository for excess reserves. By definition total reserves of the banking system equal the sum of those two accounts. Banks are free to determine in which of the two accounts they hold their reserves and obviously have an interest to hold most if not all excess reserves in the Deposit Facility.

In the case of direct liquidity injections to banks under programs such as the LTRO banks with liquidity deficiencies take advantage of the liquidity offered under the program and use it to repay short

³ The information on the various programs in this section is obtained from Voss (2012) and the window on “Key dates of the financial crisis” in the ECB web page.

⁴ A second CBPP for a total of 40 Billion Euros was initiated in October 2011. .

⁵ In July 2014 a new Targeted LTRO was introduced.

term debt to other more financially robust banks. Being flooded with additional liquidity the latter types of banks initially deposit their excess liquidity with the ECB. This process was strongly in evidence during the acute phases of the Euro sovereign debt crisis in which relatively liquid banks in the core countries were unwilling to directly lend to other banks but were willing to do that through the intermediation of the Eurosystem. The upshot is that under both liquidity injections through lending to banks as well as through bond purchases banking reserves at the ECB go up following a liquidity injection program.

This still begs a question about the mechanism underlying the reversals in banking reserves some time after an expansionary monetary action. A possible explanation follows: ECB expansionary actions are often designed in response to tight market conditions during which there is a strong demand for liquidity for precautionary and even panicky reasons. By supplying this demand an appropriately devised liquidity program, alleviates the panic, reduces the precautionary demand for liquidity and encourages banks to convert some of their reserves into riskier but also higher yielding assets.⁶

I turn now to the evolution of banking reserves in the US before and during the financial crisis. Figure 2b shows that prior to Lehman's downfall total reserves of the US banking system were relatively steady at about 50 billions \$. Since that event reserves strongly trend in an upward direction. At the beginning of 2014 they are about 50 times higher than just prior to the collapse of Lehman's brothers. Their level evolved in tandem with the magnitude of the various Quantitative Easing (QE) programs used by the Federal Reserve System to inject liquidity into the economy.⁷ The beginnings of each of the three major QE programs are marked in the figure by vertical red lines.

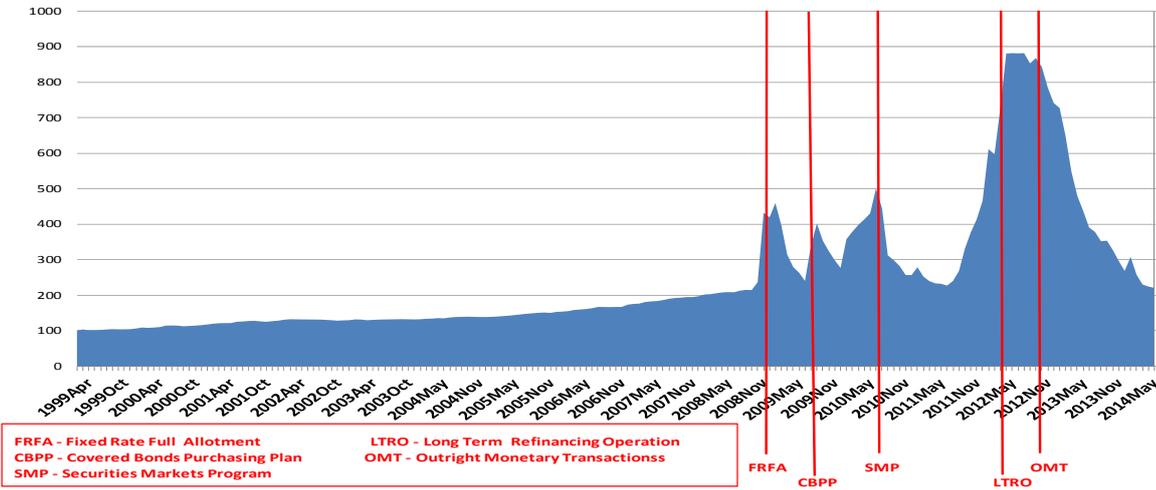
Under QE1 that started in September 2008 the Fed purchased about 2 Trillions dollars worth of bank debt, mortgage-backed securities, and Treasury notes. In November 2010, the Fed announced a second round of quantitative easing "QE2", buying \$600 billion of Treasury securities by the end of the second quarter of 2011. A third round of quantitative easing, "QE3", 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 open-ended purchases from \$40 billion to \$85 billion per

⁶ See also ECB (2014).

⁷ A fuller discussion appears in Cukierman (2014).

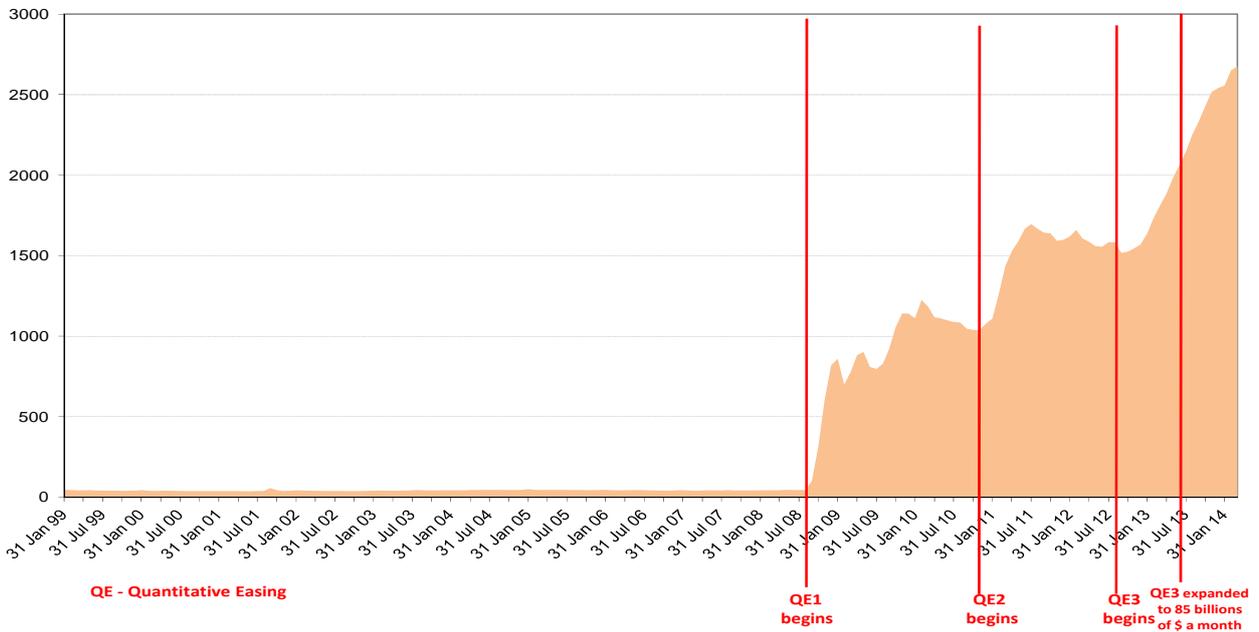
month. During the last few months this amount has gradually been reduced and (as of July 2014) is expected to converge toward zero sometime during the last quarter of 2014.

**Figure 2a: Total Reserves of EA Banking System
(Current Account + Deposit Facility)**
[Billions of Euros]



Source: ECB : <http://sdw.ecb.europa.eu/reports.do?node=100000135>

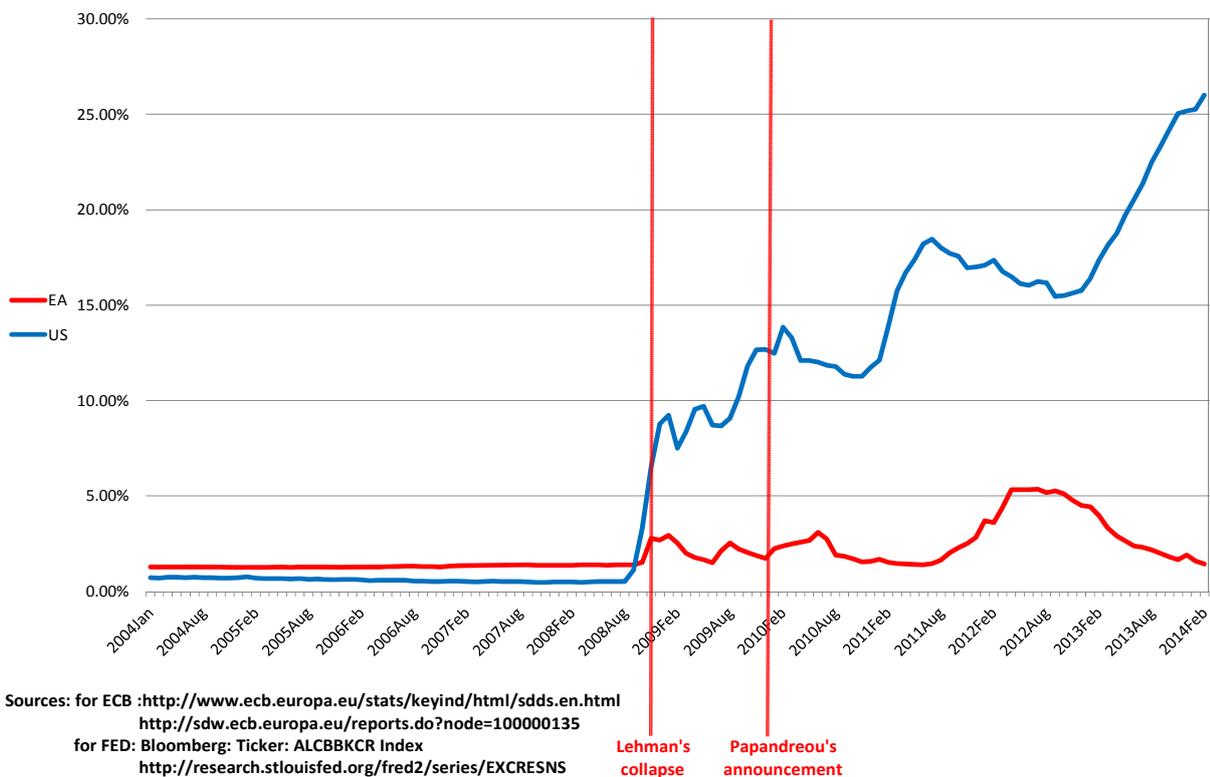
Figure 2b: Total Reserves of US Depository Institutions
[Billions of Dollars]



Source: Federal Reserve Website: <http://research.stlouisfed.org/fred2/series/EXCRSNS>

Figure 3 compares the evolution of the ratio between reserves and total banking credit in the Euro area and in the US. Since Lehman's collapse this "reserve ratio" is substantially lower in the EA than in the US.⁸ Another post Lehman difference is that, while this ratio has been on a strong upward trend in the US, there is no such trend in the EA. This begs a question about the reason for those differences. The following section addresses those issues.

**Figure3: Total Reserves as a Share of Total Banking Credit
in the EA and in the US**



⁸ Note that this concept differs from the conventional reserve ratio that is defined as the ratio between reserves and deposits. Obviously those two concepts are closely related.

4. Differences in liquidity injections procedures between the Eurosystem and the Fed as an explanation for the different behavior of reserves and of the monetary base between the EA and the US.

Since October 2008, the ECB passively supplies banks' liquidity demands at the current policy rate. This is done mainly through repos with fixed redemption periods.⁹ Basically, provided they have appropriate collateral, **banks largely determine the outstanding quantity of repos**. As a consequence the level of reserves in the EA is determined through an interaction between the terms of the repos set by the ECB and the demand for this liquidity by EA banks -- implying that both reserves and the monetary base are determined endogenously by the liquidity demands of the banking system.

By contrast, since the onset of the subprime crisis, liquidity injections in the US mainly take the form of massive purchases of securities including, inter alia, US Treasury securities, Federal Agency debt securities and MBS. As a consequence, the level of reserves and the monetary base since the onset of the crisis are largely determined by the Fed's policy decisions about the volume of open market operations. Due to those procedural differences, the monetary base and reserves in the EA are highly sensitive to short run fluctuations in banks' demand for liquidity while in the US those aggregates mainly reflect the Fed's quantitative easing policy decisions.¹⁰

This explains the fact, documented in Figure 2a, that since the start of the financial crisis EA banking reserves experienced strong fluctuations in **both directions**. By contrast in the US, due to the Fed's determination to flood the economy with liquidity, the monetary base has been on an uninterrupted upward trend since Lehman's collapse.¹¹ This difference in policy procedures explains the fact, documented in Figure 2b, that US banking reserves have been on a persistent **upward trend** since that event. By definition the monetary base is composed of banks' reserves plus currency in circulation implying that any exogenous policy increase in the base must take the form of an increase in either reserves, currency or both of them. Although part of the increase in base money usually leaks into cash the bulk of it takes the form of an increase in reserves.

⁹ Redemptions periods were gradually extended as the EA sovereign debt crisis intensified peaking at three years under the large LTRO program.

¹⁰ A comparison of ECB-Fed policy procedures during normal times appears in Blenck, Hasko, Hilton and Masaki (2001).

¹¹ The dramatic increase in US monetary base since that event is documented in Table 5 of Cukierman (2014).

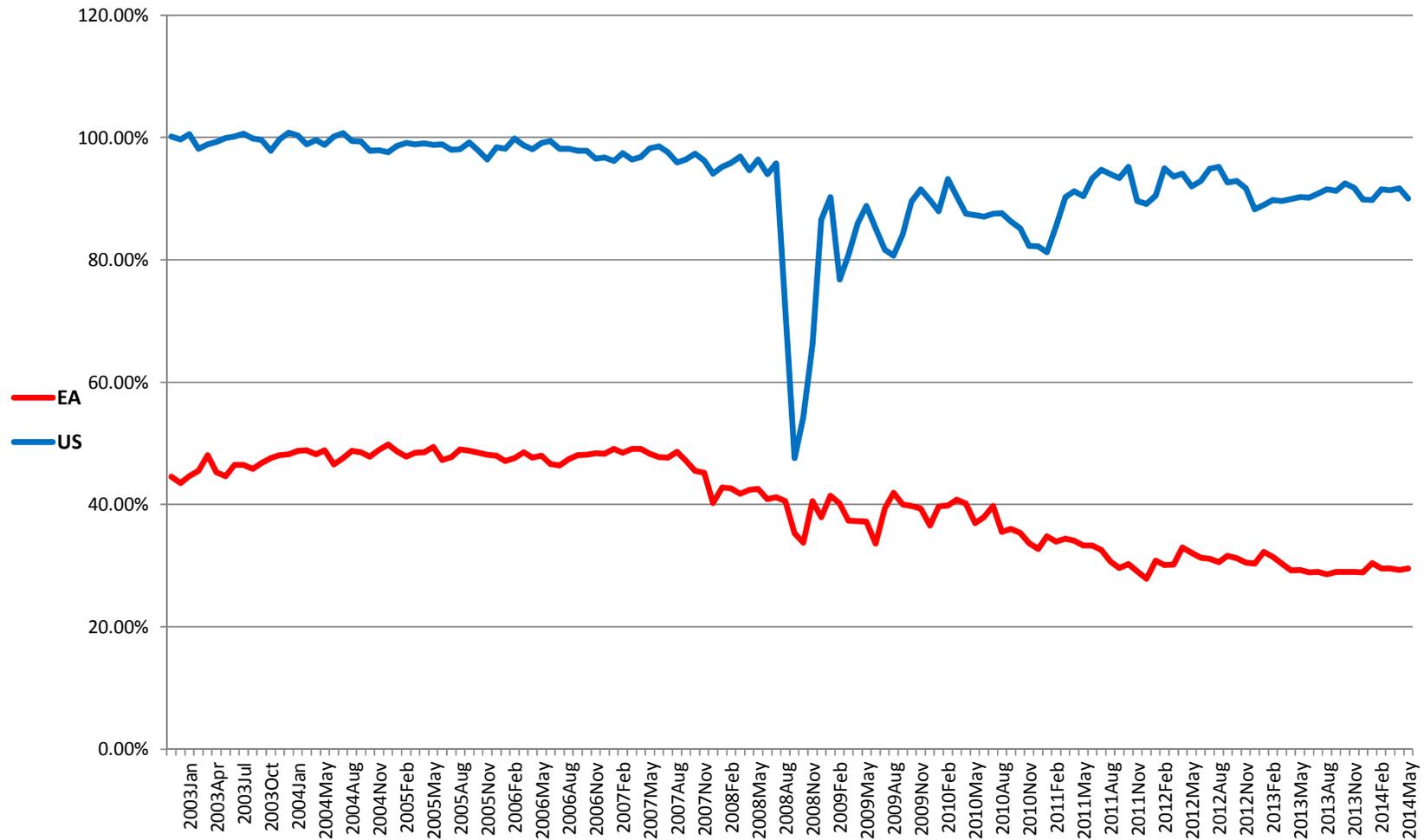
The preceding observations can now be used to explain the fact, documented in Figure 3, that since the Lehman event the ratio of reserves to banking credit has been going up substantially more in the US than in the Euro area. We saw in section 2 that, due to the crisis, banking credit growth went down significantly in both the EA and the US. Hence the growing discrepancy between the EA and the US in this “reserve ratio” mainly reflects the substantially higher rate of growth of high powered money in the US.

The tendency of the Fed to use mainly open market operations (or outright monetary purchases in EA terminology) to inject liquidity and to keep the bonds it purchases on its balance sheet for an open ended time imply that those operations have a strong and sustained impact on the monetary base. The Eurosystem liquidity injection policy differs from the Fed’s operation mode in two respects. First, the cumulative level of its liquidity injections is lower. Secondly, since liquidity injections are done mainly through repos and may be repaid when banks choose to do so, the monetary base is largely determined by banks’ liquidity demands implying that the base goes up and down in line with banks’ liquidity demands.

Figure 4 shows the evolution of the share of the monetary base in the total central bank balance sheet for the Eurosystem and for the Federal Reserve System (Fed) between January 2003 and May 2014. The most striking observation is that the share of the base within the Fed’s balance sheet is roughly two times higher than its counterpart in the Eurosystem. This is mainly due to the fact that, unlike the Fed, the balance sheet of the Eurosystem includes sizable governmental deposits and other autonomous factors.

Beyond this long term structural difference the figure shows that following Lehman’s collapse there initially is a decrease in the share of the base in both the Eurosystem and the Fed. The decrease is particularly dramatic in the case of the Fed. It is largely due to the fact that the immediate response of the Fed to the panic that developed following Lehman’s bankruptcy was to lend to specific institutions and to generally provide loans and repos to the financial system. Since those operations raised the total balance sheet of the central bank but did not affect the base the share of the latter went down. As can be seen from the figure, in the case of the Fed the share decrease was quickly reversed mostly by replacing loans and repos with outright purchases of securities. By contrast, in the case of the Eurosystem there is a mild but longer term downward trend in the share of the monetary base.

**Figure 4: Monetary Base as a Share of Total Central Banks' Assets -
Comparison of ECB and FED**



Sources: for ECB - <http://sdw.ecb.europa.eu/reports.do?node=100000141>
for FED - <http://research.stlouisfed.org/fred2/series/WALCL#>

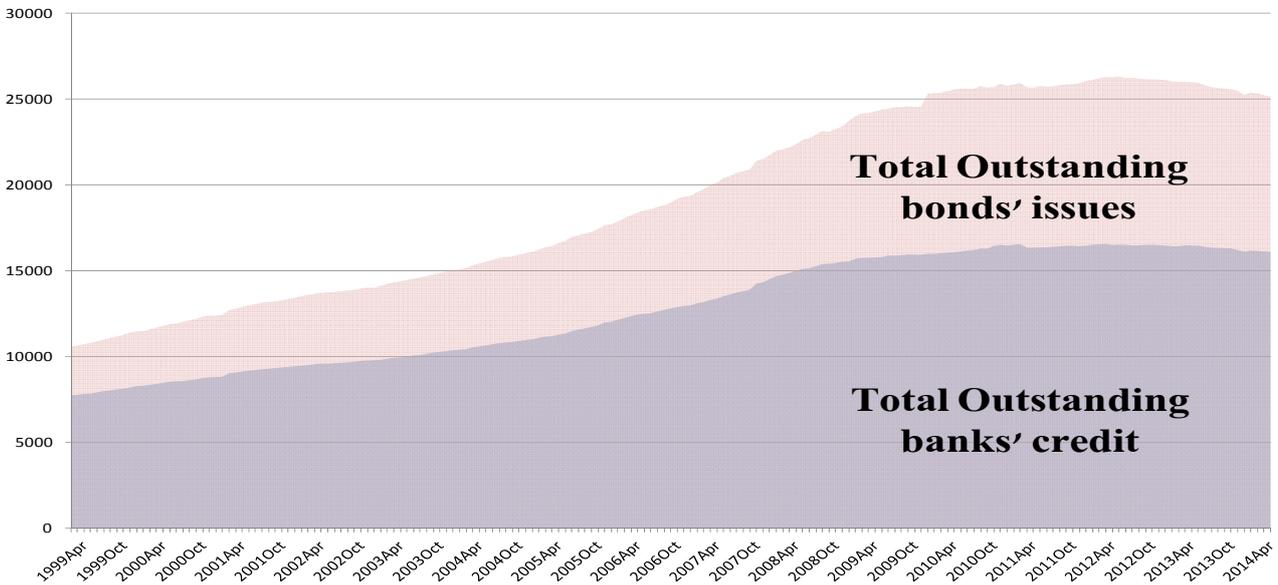
5. Structural reasons for differences in policy procedures between the Eurosystem and the Fed

The difference in policy procedures discussed in the previous section is due to two main reasons. The first is the substantially higher share of banking credit within total credit in the EA. The second is the relatively higher conservativeness of the ECB in comparison to its US counterpart. This section provides some documentation of those differences and discusses their role in shaping the different choices of policies and of policy procedures by the ECB and the Fed in general as well as during the crisis.

The share of banking credit in total credit (outstanding banks' credit plus outstanding bonds issued) is substantially higher in the EA than in the US. In particular, since the beginning of the twenty first century, the average share of banks' credit within total outstanding credit has been **over two thirds in the EA and only about a quarter in the US**. Figures 5 and 6 illustrate this dramatic long run structural difference. This difference mainly reflects the fact that the bond market is substantially wider and deeper in the US than in the Euro area.

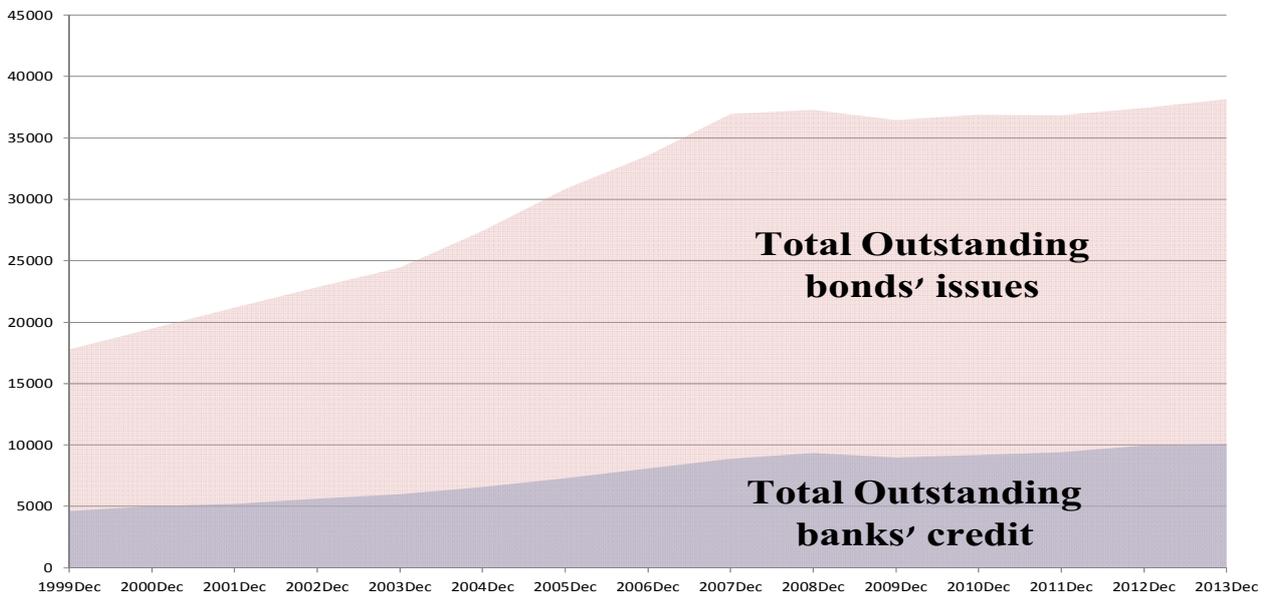
An important consequence of this difference is that (as far as financial stability is concerned) the prime concern of the ECB is about liquidity deficiencies within the banking system while the prime concern of the Fed is about scarcity of liquidity in the bond market. This difference in relative concerns about the two segments of the total credit market dictate different choices of policy procedures. Since it is mainly interested in maintaining sufficient liquidity within the banking system the ECB operates mainly by offering various types of loan facilities and repos to the banking system. By contrast since the Fed is concerned in first place by lack of liquidity in the bond market its prime instrument for liquidity injections are open market operations or outright bond purchases. In a recent blog Papadia (2014) argues that the relative narrowness of EA bond markets implies that, if the ECB decides to engage in sizable quantitative easing operations similar to those of the Fed, it would have to buy mainly sovereign bonds and bank loans.

Figure 5a: Total Outstanding Banks' Credit + Outstanding Bonds' Issues - EURO AREA (Billions of Euros)



Source: <http://www.ecb.europa.eu/stats/keyind/html/sdds.en.html>
<http://sdw.ecb.europa.eu/browse.do?node=2018781>

Figure 5b: Total Outstanding Banks' Credit + Outstanding Bonds' Issues - US (Billions of \$)



Source: Bloomberg ALCBBKCR Index
 Securities Industry and Financial Markets Association (SIFMA)

A second structural difference between the ECB and the Fed is that the former is more conservative in the sense that its charter elevates the price stability objective above all other objectives. By contrast the Fed's charter puts price stability and high levels of employment and economic activity on equal footings. Fearing the potential inflationary consequences of such actions the ECB is more reluctant to engage in large scale outright monetary purchases on a sizable scale in comparison to the Fed. One consequence of this stronger inflation aversion of the ECB is that it waits longer before implementing substantial liquidity injections and, as was the case during the crisis, maintains them at levels that are lower in comparison to their US counterparts. Another consequence is that during stress times the ECB prefers to directly supply self liquidating collateralized emergency liquidity to banks rather than to engage in longer term open market purchases as indeed is the case in the EA.

6. The behavior of total new credit flows in the EA and in the US prior to and during the financial crisis

The difference in the relative importance of banking credit between the EA and the US raises interesting questions about the comparative flows of those two sources of credit during the financial crisis. Sample relevant questions are: Did the crisis differentially affect those two sources of credit to the same extent? Are there any differences in this respect between the EA and the US?

To obtain some feel about those issues Figures 6a and 6b show the evolution of total net new credit as well as its two components; net new banking credit (calculated as the first difference of total outstanding banks' credit) and net new bond issues (calculated as the first difference of the outstanding stock of bonds) in the EA and the US between 2000 and 2013. In both the EA and the US there is a vigorous expansion in total credit up to and including 2007 followed by a dramatic total credit arrest in the US during 2008 and 2009. There is some moderation in the flow of total new credit during those years also in the EA. But a total credit arrest, similar to that experienced in the US during 2008 and 2009, materializes only from 2011 and on. In particular the flow of total new US credit is negative over 2008 and 2009. A similar phenomenon occurs in the EA during 2011-2014.

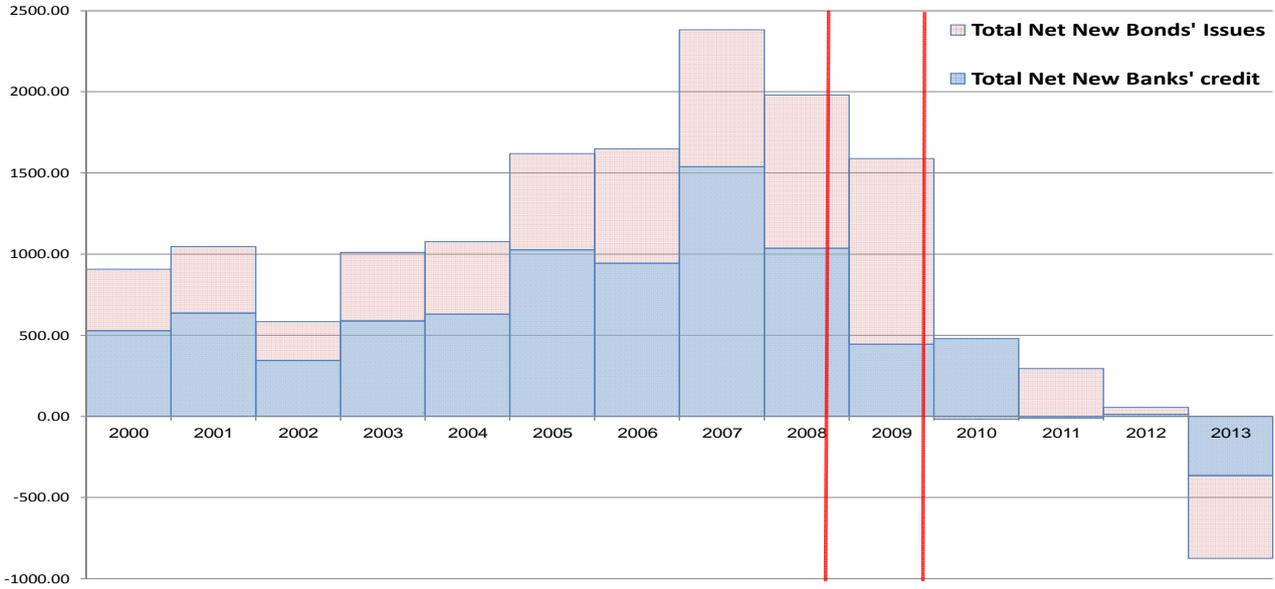
This is consistent with the view that, in spite of the high degree of integration of international capital markets, the total flow of credit is substantially more sensitive to domestically triggered financial crises than to crises that erupt abroad. Thus, the total flow of net new credit in the US becomes negative in the year of Lehman's collapse and the immediately following year. A similar phenomenon starts in

the EA over the three years during and immediately following 2011. The relevant trigger in this case appears to be the peak of the sovereign debt crisis. Judging by the levels of yields on sovereign bonds the peak of the sovereign debt crisis in the EA occurs between the end of 2011 and the beginning of 2012.

What happens to the relative volumes of banking versus bond credit flows in the EA and in the US following the brunt of the crisis in comparison to normal times? Taking the period 2000-2007 as representative of normal times the share of new banking credit in total new credit is almost 61% in the EA and 22% in the US. The corresponding figures for the 2008-2013 period are 45% for the EA and 100% for the US implying that the share of new banking credit in the EA is lower in comparison to preceding normal years. By contrast, in the US, the share of banking credit during the crisis is substantially higher than during the preceding normal period.

Since the peak of the crisis in the EA occurred almost three years after the crisis peak in the US one could reasonably hold the view that the acute crisis period in the EA started only in 2011. Taking the 2011-2013 period as representative of crisis time for the EA it is found that the share of banking credit actually went up (from 61% during normal times) to almost 68%. The upshot is that, provided the timing difference between the peaks of the crisis in the EA and the US is taken into consideration, the share of banking credit went up during (the respective) crisis times in both the EA and the US.

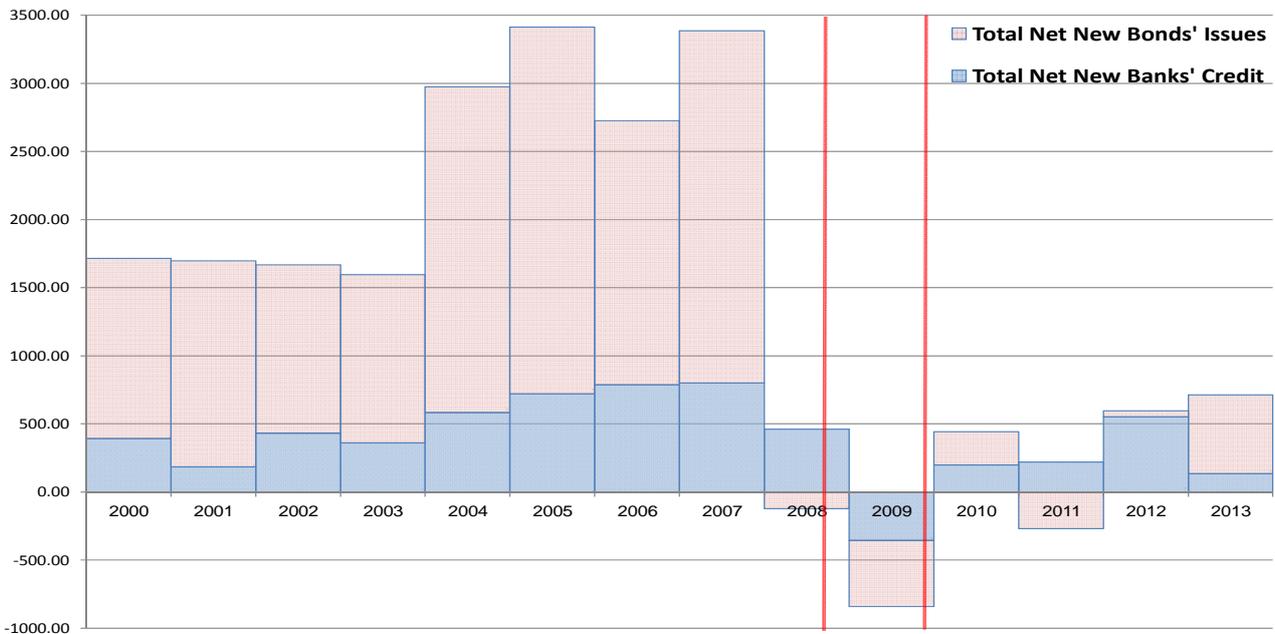
Figure 6a: Total Net New Banks' Credit + Bonds' Issues - EA
(Billions of Euros)



Source: <http://www.ecb.europa.eu/stats/keyind/html/sdds.en.html>
<http://sdw.ecb.europa.eu/browse.do?node=2018781>

Lehman's collapse
Papandreou's announcement

Figure 6b: Total Net New Banks' Credit + Bonds' Issues - US
(Billions of \$)



Source: Bloomberg ALCBBKCR Index
Securities Industry and Financial Markets Association (SIFMA)

Lehman's collapse
Papandreou's announcement

7. Concluding remarks and further thoughts

This paper documents the behavior of banking credit and of banking reserves in the Euro Area (EA) during the global financial crisis and compares it to the behavior of those variables in the US. In both the EA and the US rates of growth of banking credit go down sharply and even become negative at the peaks of their respective crises. But the timings of those peaks differ.

In the US the peak of the financial crisis starts already in 2008 and reaches a resounding crescendo following Lehman's insolvency along with the decision not to bail it out. In the EA it builds up more slowly starting with Papandreou's admission, at the end of 2009, that Greek sovereign debt is actually more than double its previously published magnitude. Judging by sovereign CDS rates, the peak of the panic in the EA occurs over the end of 2011 and the beginning of 2012. This peak is followed by a total arrest in banking credit growth as well as in net new bond issues. In 2012 there is practically no new credit and in 2013 the rates of growth of both banking as well as of capital market credit are negative (Figure 6a). A similar phenomenon occurs in the US during 2009 (Figure 6b).

Although the average level of EA banking reserves during the crisis is higher than prior to it this is overshadowed by wide fluctuations in their levels in both directions. By contrast, in the US since Lehman's collapse, banking reserves have been on an uninterrupted upward trend. The paper argues that this is due to different policy procedures between the ECB and the Fed. Most of the ECB liquidity injections during the crisis were done by passively supplying banks' liquidity demands at fixed rates. As a consequence reserves went up and down with banks' liquidity demands. Since those demands fluctuated quite substantially during the crisis, so did reserves and the closely related monetary base.

By contrast most liquidity injections in the US took the form of sustained securities purchases on the open market creating a strong upward, policy induced, trend in the monetary base. Although some of this increase probably leaked into cash the bulk of it took the form of passive increases in banking reserves. As a consequence banking reserves in the US in March 2014 were **about 50 times larger** than they were just prior to Lehman's collapse (Figure 2a). A notable consequence of this difference in liquidity injection procedures is that banks' reserves on deposit with the central bank are more closely related to the banks' aggregate demand for liquidity in the EA than in the US.¹²

¹² A detailed account of monetary policy operations during crisis times appears in Part II of Bindseil (2014).

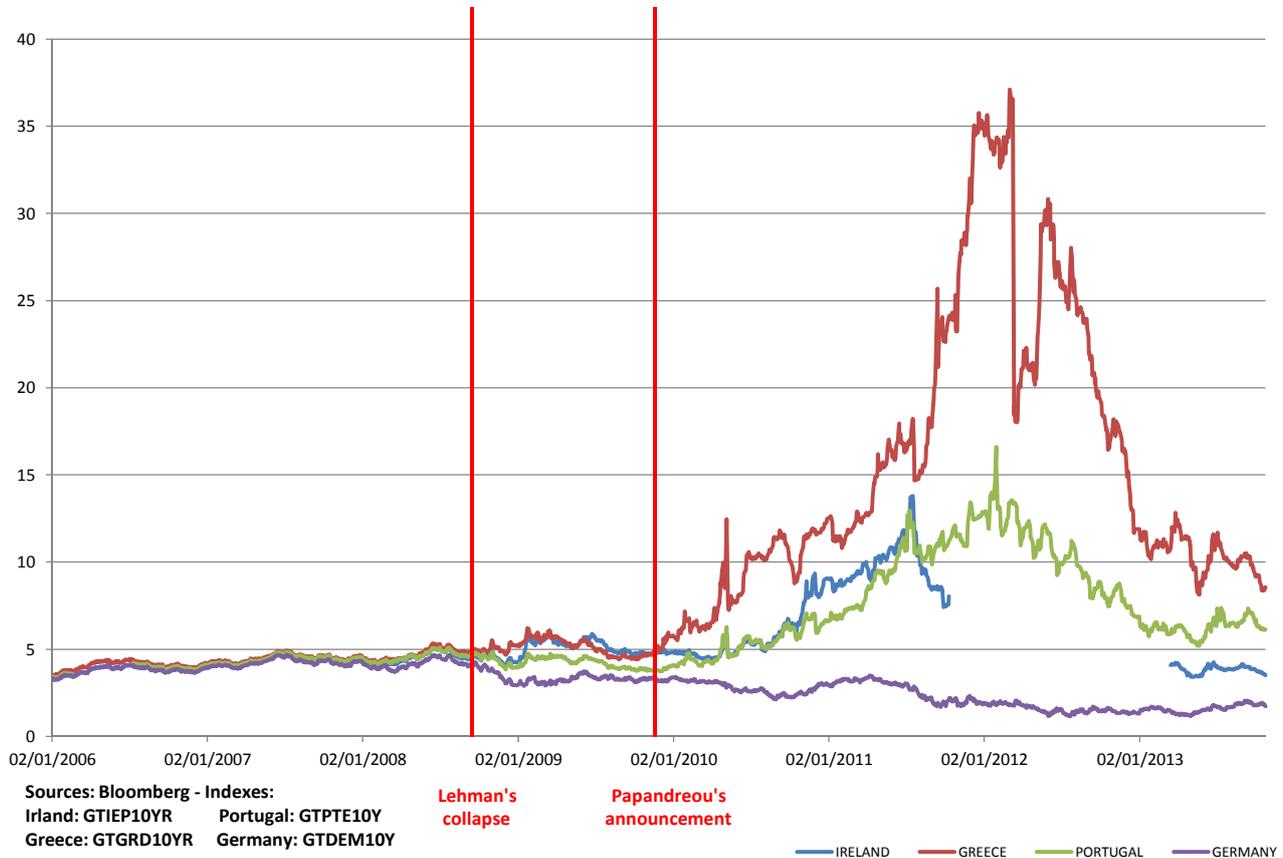
The paper traces the difference in liquidity injection procedures between the ECB and the Fed to two factors: One is the predominance of banking credit in the EA versus the predominance of credit flows through bond issues in the US. The other is the higher conservativeness of the ECB relatively to that of the Fed. Both sources of credit dry out in both the EA and the US and even become negative at the respective peaks of their crises. Judging by the periods of either negligible or negative total new credit the peak of the crisis in the US occurs over 2008-2009 while the peak of the crisis in the EA occurs over 2011-2013.

In spite of the huge expansion of the base in the US total credit growth in this country remains anemic since the Lehman event (Figure 6b). Using a multiple priors framework of the type suggested by Gilboa and Schmeidler (1989) Cukierman and Izhakian (2014) argue that the persistence of credit arrest in the US is largely due to a persistent increase in aversion to bailout uncertainty after the decision not to bailout Lehman Brothers. Following this decision financial markets participants became aware of the fact that low bailout probability distributions to which they had assigned zero mass prior to that event are possible. Cukierman (2014) refers to this phenomenon as **an increase in probabilistic awareness to low bailout probability distributions** and suggests that it is the modern decision theory counterpart of a Post Traumatic Stress Disorder (PTSD) in psychology.¹³ Although they need not result in deep psychological disorders, dramatic economic events such as Lehman's collapse in the US or (as detailed below) Papandreou's announcement are likely to permanently alter individuals probabilistic beliefs in a pessimistic direction.

Although financial markets participants in the EA were affected by the shock waves of Lehman's collapse the major traumatic event of the European crisis was the realization that default probabilities on sovereign bonds of different governments may differ substantially. But this realization dawned on EA financial markets somewhat more gradually than the increase in probabilistic awareness of low bailout probabilities in the US.

¹³ A PTSD is an anxiety disorder that may develop if a person encounters an unexpected extreme traumatic stressor such as war, personal assault, confinement or a severe car accident (Javidi and Yadollahie (2012)).

Figure 7: Yields on Irish, Greek, Portuguese and German 10 Years Sovereign Bonds ; 2006 -2013



This is illustrated in Figure 7 that shows the behavior of Irish, Greek, Portuguese and German sovereign bonds between 2006 and 2013. Between 2006 and the Lehman event the sovereign yields on those bonds are practically indistinguishable supporting the view that financial markets viewed those bonds as equally risky. Following Lehman's demise some moderate spreads emerge. But those spreads widen substantially only after Papandreou's November 2009 announcement about the true size of the Greek deficit as well as subsequent adverse pieces of information about Irish and Portuguese sovereign debt. The upshot is that, following public events like Papandreou's announcement, EA financial market participants became aware of default probability distributions on sovereign bonds to which they previously had assigned a negligible or even zero mass.

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