Kristóf Lehmann, Róbert Mátrai and György Pulai: Measures taken by the Federal Reserve System and the European Central Bank during the crisis*

The instruments applied by the ECB and the Fed[1] during the crisis were based on similar principles, but as the ECB and the Fed function in different financial intermediary systems, they relied on different tools to respond to different types of challenges. Both institutions increased liquidity substantially and deployed instruments with the aim of alleviating tensions in certain market segments. The ECB faced a somewhat more complex problem, due to the combination of banking system difficulties and uncertainties surrounding fiscal sustainability. The central bank(s) of the euro area attempted to ensure the funding of banks by providing longer-term loans unrestrictedly; securities purchases had smaller limit amounts and were, for the most part, intended to mitigate disturbances in certain market segments and lower excessive yields. The Fed tried to address the root problem of the crisis, the mortgage market. With its asset purchases, it attempted to lower long-term yields and mitigate the disturbances in the market of mortgage-backed securities; in addition, it introduced several targeted loan instruments. According to empirical analyses, the unconventional instruments the two central banks deployed successfully mitigated market tensions, expanded market liquidity and lowered yields. Typically, the studies concluded that the programmes improved the situation of the real economy and that the recession would have been deeper and unemployment higher without them.

INTRODUCTION

In the financial crisis which started in 2007, the central banks of developed countries were unable to use traditional monetary policy instruments to efficiently address the substantial downturn in the performance of the real economy and the strains in the functioning of the financial intermediary system and money markets, and consequently they supplemented their instruments by using unconventional measures.

Unconventional instruments were primarily applied in two cases and for two purposes. First, when the central bank base rate dropped to zero or close to zero, but monetary policy decision-makers wished to ease monetary conditions further. With the use of unconventional policies, long-term yields can be reduced further via non-traditional communications (a persistent verbal commitment to low base rate levels) and the purchase of longer-term financial market instruments. The use of unconventional instruments may be also warranted when a certain market segment becomes dysfunctional (for instance, the swap market freezes up), due to an acute money market disturbance or panicky atmosphere, or when the central bank considers the risk premium emerging – or persistently prevailing – in the given market segment to be excessively high. Central bank intervention, in this particular case, is aimed at alleviating tensions, tempering excessive risk avoidance and reducing yields and premia in the specific market to a reasonable level. In turbulent cases, the mere announcement of the measure went a long way towards easing the tensions. During the crisis, nearly all central banks carried out general liquidity-providing operations in an attempt to mitigate the disturbances in the financial intermediary system through banking system liquidity and hence, facilitate banks' lending activity and asset purchases. In this context, against collateral, central banks provided loans to banks in large volumes and not necessarily for the usual maturities. To address money market disturbances, some central banks in developed countries purchased higher-risk money market instruments as well, whereby they incorporated unhedged (or partly hedged) instruments

* The views expressed in this article are those of the author(s) and do not necessarily reflect the offical view ot the Magyar Nemzeti Bank.

[1] For the rest of our paper, the Federal Reserve System will be mentioned informally as the Fed, and the European Central Bank together with the Eurosystem – the latter comprising the ECB and the national central banks of the euro-area Member States – will be referred to as the ECB.

in their portfolio. The purchase of risky assets results in a deterioration of the central bank's portfolio as well, which could pose a significant risk from the perspective of the central bank profit and loss account. Central banks moderate the risk by purchasing risky assets typically in cases where, due to the market disturbance, the price of such assets are presumed to be lower than would be justified by the economic fundamentals, or when they sign an advance guarantee agreement with the state securing the payment of losses from the budget.

Based on Krekó et al. (2012),[2] using the quantitative easing programmes of the Fed and the liquidity providing operations of the ECB, we present in this paper the most important unconventional instruments applied by the central banks of developed countries, and the impact of such measures on economic growth, inflation, lending activity and the liquidity of various money and capital markets. The financial intermediary system of the euro area and that of the USA are very different;[3] moreover, in contrast to the federal budget of the USA, fiscal policy is a national competence in the euro area. Consequently, the crisis generated different problems, to which the central banks responded with different monetary policy measures.

EUROPEAN CENTRAL BANK

Changing the standard instruments

With the deepening of the crisis following the collapse of Lehman Brothers in September 2008, lack of trust among banks increased and the ECB was confronted with the drying-up of interbank markets and a rise in interbank yields. In this environment, demand for central bank liquidity increased significantly. The ECB adapted to this situation by fine-tuning its instruments.

As a first step, on 8 October 2008 the Governing Council decided on the unlimited availability of the one-week MRO tenders[4] at the key interest rate. These measures made the necessary liquidity available for credit institutions, thereby contributing to stabilisation of the banking system. In parallel with this, the width of the interest rate corridor was reduced from 200 basis points to 100 basis points, with the intention of preventing market O/N rates from departing from the policy rate.

As a result of the measures, in the initial period recourse to the MRO tenders and the size of the deposit facility increased by around EUR 150 billion and more than EUR 200 billion, respectively. At the same time, the average turnover of the overnight unsecured interbank market declined by nearly 40 per cent, and the EONIA (euro overnight index average) approached the bottom of the interest rate corridor. Perceiving this, the ECB widened the interest rate corridor to 200 basis points again in January 2009 which, however, did not result in a significant increase in overnight interbank turnover, and the EONIA also remained at the bottom of the widened interest rate corridor.

On 15 October 2008, the ECB widened the range of acceptable securities (collateral) and reduced the credit rating threshold from 'A minus' to 'BBB minus' (with the exception of ABSs[5]). At the same time, the decision was also taken on the full allotment – at fixed interest rates – of the three-month loan tenders (LTROs),[6] which had already been applied prior to the crisis as well, with the six-month operations introduced in April 2008 and one-month ones applied from September 2008. The ECB announced on 7 May 2009 that it would hold one-year LTRO tenders on three occasions between June 2009 and December 2009. The first two tenders were allocated at the MRO rate, thus fixing the one-year point of the yield curve, whereas the last one was allocated at the average MRO rate of the period. On 6 October 2011, the ECB announced that it would hold one-year LTRO tenders on 26 October and 21 December, again with full allotment. In December, in parallel with the announcement of several liquidity providing instruments, the maturity of the LTRO tender of 21 December was adjusted to 3 years and another 3-year LTRO tender was announced on 29 February 2012.

The ECB's primary goal with these 3-year LTROs was to alleviate the negative impact of sovereign risks on the banking system and to avoid a collapse in lending. According to the ECB's preliminary survey, banks were to use one third of the total liquidity provided during the first LTRO for

[2] The study, which was written in April 2012, has since been supplemented in this tender documentation by the description of more recent measures and the use of newer impact studies.

[3] It is an important difference that capital markets have a larger weight in the financial system of the USA from the standpoint of corporate financing, while the banking system plays a more significant role in financing in the European financial system. Consequently, in the capital position of banks the share price of large US listed companies plays a crucial role.

[4] MRO (Main Refinancing Operation): the ECB's main refinancing operation, in which the ECB provides liquidity in the form of a repo transaction to credit institutions of the euro area with a weekly frequency, usually with a one-week maturity.

[5] ABS: asset-backed securities.

[6] LTRO: longer-term refinancing operation, based on the pattern of the ECB's MRO instrument.

lending (with the remaining amount to be spent on refinancing and asset purchases). Instead, banks spent the entire EUR 500 billion facility on refinancing (swapping their funds originating from the interbank market) and government bond purchases.[7] Meanwhile, the LTRO tender successfully alleviated the turmoil in the interbank market, but it was only possible to temporarily reduce the government bond yields of periphery countries.

Complemented with the covered bond purchase programme described in the next chapter and the FX swap tenders, the ECB called the above measures 'enhanced credit support'. The ECB's balance sheet increased considerably as a result of the programme, and the amount of liquidity available for euro-area credit institutions grew during this period, when the drying-up of interbank markets jeopardised the stability of the banking system.

The liquidity providing instruments of the ECB addressed the financial disturbances efficiently and improved the situation of the real economy. Lenza et al. (2010) and Fahr et al. (2010) evaluated the liquidity providing instruments of the ECB in a such way that, based on various assumptions, they set up an alternative scenario without unconventional instruments. In their simulation, Lenza et al. (2010) first tried to determine the decline caused in the spread of the interbank rate at various maturities.[8] Subsequently, they captured the impact of the decline in premium caused by the measures using simulations conducted with a B-VAR model estimated for the pre-crisis period. It was found that the instruments of the ECB played a significant role in the stabilisation of the economy in the period after the Lehman Brothers' bankruptcy: as a result of the programme, private sector credit growth was around 1.5 percentage points higher and unemployment was 0.5 percentage points lower than in the scenario without the measures. Fahr et al. (2010) determined the alternative scenario using a DSGE model that contained the banking system as well. They found that without the instruments the euro area would have been characterised by GDP growth more than one percentage point lower and deflation until 2010 H1.

Covered bond purchase programme

At its meeting on 7 May 2009, the Governing Council of the ECB decreased the key policy rate to 1 per cent. At the same meeting, it decided to launch the covered bond purchase programme (CBPP). The CBPP focused on an identifiable market, the market of covered bonds,[9] which – in the opinion of the Governing Council – was more seriously affected by the crisis than other segments of the securities market (Trichet, 2009). The objectives of the programme were to mitigate strains in the covered bond market, reduce risk premia, increase liquidity and hence, encourage primary issuances. In a targeted manner, the ECB wished to support a revival in market transactions and the improvement of the liquidity of the CB market by purchases in the primary and secondary markets. In addition, the ECB intended to ease the financing conditions of credit institutions and corporations, and wanted to encourage credit institutions to maintain – and possibly expand – their lending activity, while also reducing money market yields.

Between July 2009 and June 2010, the ECB purchased covered bonds (CB) under the CBPP with a total value of EUR 60 billion; since it did not sterilise the bonds, the instrument increased the euro liquidity of the banking system directly as well. In this programme, the ECB primarily focused on the longer end of the yield curve. The maturities of the securities purchased mainly varied between 3 and 7 years, with an average of 4.12 years. Covered bond purchases under the CBPP did not result in any major distortion in the market structure; the ECB obtained a mere 5 per cent share of total holdings and a 10 per cent share of jumbo issues.

CB spreads started to tighten immediately as a result of the announcement of the programme, issuing activity increased, and the liquidity of the market approached pre-crisis levels. By the end of 2011, however, spreads had returned to the levels observed before the announcement of the programme for the most part, although issuing activity continued to be strong. The instrument was largely ineffective in addressing the tensions emerging in the covered bond market because the turmoil was fuelled by banks' exposure to periphery government bonds.

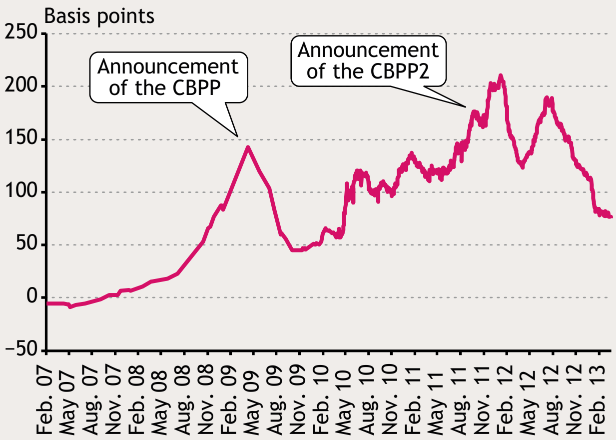
Based on research by Beirne et al. (2011), the ECB's first covered bond purchase programme can be considered successful. The yield spread of covered bonds declined, money market yields dropped, and there was an upturn in bond markets across all maturity horizons. The average decline in yields in the covered bond market was around 12 basis points. The programme successfully stimulated the issuance of covered bonds in the primary market, thereby

[7] Moutot (2012).

[8] For instance, without the intervention the EURIBOR-OIS spread would have stayed at the October 2008 level for a protracted period of time.

[9] One great advantage of covered bonds is that in the case of non-performance the cover is behind the bond, therefore, they are far less risky than packaged or repackaged US debt securities. Therefore, during the crisis it was an important objective to enable this market to expand in Europe.

Chart 1
Premia on 3-5-year euro covered bonds compared to government security yields



Source: UBS Delta.

improving banks' financing conditions and boosting bank lending. The main deficiency of the covered bond purchase is that no feed-through effect evolved, i.e. it did not have a perceptible effect in the market of normal bonds. Another important experience was that in euro-area countries struggling with the sustainability of government debt, the programme failed to improve yields in the covered bond market and was thus completely ineffective.

On 6 October 2011, the ECB announced the launch of CBPP2, within the framework of which the ECB planned to purchase covered bonds at a value of EUR 40 billion between November 2011 and October 2012, with objectives[10] and conditions similar to those of the first programme. The direct impact of the programme on the bond markets is difficult to estimate. In contrast to the first programme in 2009–2010, at this time there was no immediate and lasting decline in the premium following announcement of the programme. The premium on covered bonds only began to decline more significantly at the end of 2011 and the beginning of 2012, which may have already reflected the effect of the three-year LTRO tenders. Nonetheless, the decline in the premium proved to be temporary, and by June 2012 spreads had returned to the levels prevailing before the announcement of the programme. Owing to increased market demand and a weaker-than-expected willingness to issue, the ECB's covered bond purchases during the programme amounted to only EUR 16 billion, i.e. 40 per cent of the anticipated amount.

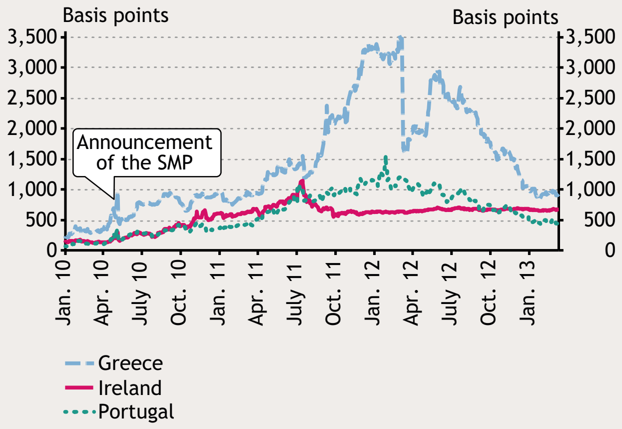
Securities Markets Programme (SMP)

On 10 May 2010, the ECB announced its Securities Markets Programme (SMP), following a significant increase (around one and a half times at the ten-year maturity) in the premia of longer-term government bonds in euro-area periphery countries during the first week of May 2010. Officially, the programme was aimed at addressing the inadequate functioning of securities markets and restoring the monetary transmission mechanism without changing the elements of the standard instruments. The ECB offset the liquidity providing impact of the SMP with one-week deposit tenders.

Right after the announcement on 10 May 2010, spreads declined considerably. On the very next day, however, they already started to increase again, and in a matter of a few months they exceeded the level observed before the May announcement. Until closure of the programme in September 2012, the ECB purchased more than EUR 200 billion worth of securities, primarily consisting of the government papers and other bonds of periphery countries. Over the short term, the programme had a significant positive impact on the government bond yields of periphery countries, but it failed to effectively reduce their long-term yields.

Comprehensive evaluations of the Securities Markets Programme of the ECB are few and far between. According to Fahr et al. (2010), the programme was temporarily

Chart 2
Yield spreads of 10-year Greek, Irish and Portuguese government bonds compared to their German counterparts



Source: Bloomberg.

[10] The primary objectives of the CBPP2 programme were to improve the financing position of credit institutions and corporations and to boost lending.

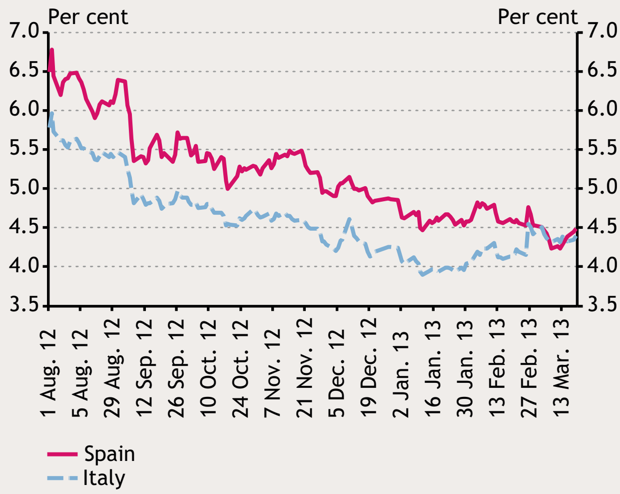
successful in mitigating risks and contagion. However, the recent developments and fluctuations in the yields of the government bond markets of periphery countries suggest that, in the case of periphery countries, the securities purchase programmes were only suitable 'to buy time'. In order to restore market confidence, all governments concerned had to produce a programme that was considered sustainable over the longer term. Although government bond purchases by the central bank led to some improvement, on their own, they were unable to restore market confidence in the periphery countries of the euro area.

Outright Monetary Transactions (OMT)

In 2012 handling the debt crisis remained the main priority for the ECB. As regards the euro area, certain countries saw the emergence of record low sovereign premia, while other countries – particularly in South Europe -recorded unprecedented high levels. The ECB is working to correct the unreasonably high periphery yields and restore the impaired monetary transmission channel with the OMT instrument announced on 2 August 2012 and launched in September 2012, concurrently with the termination of the SMP. Under the OMT scheme, the ECB may contribute to alleviating tensions in the government securities market and easing transmission difficulties by purchasing shorter-term (less than 3-year) government papers.

For the time being, outright monetary transactions should be considered as a verbal intervention only, as none of the countries with high yields can currently meet the conditions required for the use of the instrument. From the perspective of the ECB, this situation is particularly hard to resolve as the ECB is not authorised to prescribe the improvement of fiscal conditions. The ECB attempted to circumvent this problem by setting forth the requirement of participating in the EFSF/ESM programme[11] for the use of the OMT instrument, which also includes fiscal consolidation. Another condition is the country's presence on the primary bond market (government bond issuance). Amid some fluctuations, short-term and medium-term government bond yields and sovereign CDS spreads of periphery countries decreased significantly after the announcement in August. Besides easing the financing position of the countries concerned, this improves banks' balance sheets and capital adequacy as well, which, in turn, may contribute indirectly to the recovery of corporate lending; however, lending data reported so far do not support this assumption.

Chart 3
Changes in Spanish and Italian government bond yields
(iBoxx indices)



Source: UBS Delta.

Comprehensive evaluation of the ECB programmes

The estimates regarding the effectiveness of the ECB's unconventional instruments *(enhanced credit support)*, most of which were prepared by the ECB, basically came to the conclusion that the unconventional instruments influenced the functioning of financial markets and the performance of the economy considerably and positively: although they were unable to prevent the steep downturn, without the programme GDP decline would have been much greater and unemployment much higher.

Giannone et al. (2011) evaluated the effectiveness of all unconventional instruments. The essence of their method is that they used a VAR model estimated for the pre-crisis period to run simulations regarding the crisis period to examine whether any material change can be perceived in the transmission of monetary policy. There was no significant difference between the developments in actual macro variables and the simulated ones that presume pre-crisis transmission. In the authors' assessment, this proves that the programme of the ECB was efficient in the maintenance of transmission, thus unconventional instruments contributed to the fact that a collapse similar to the Great Depression could be avoided.

[11] The EFSF (European Financial Stability Facility) and the ESM (European Stability Mechanism) are crisis funds designed to resolve payment and refinancing difficulties and preserve financial stability in Europe.

FEDERAL RESERVE

Programmes during the crisis

Owing to housing market disturbances, the crisis began in the United States as early as 2007. In the first phase of the crisis, it was the market of financial instruments linked to mortgage loans that was primarily impaired. Through the banking system, this market segment spread to the entire financial system in 2008 and developed into a full-fledged global crisis.

In its management of the financial crisis, the Fed strived to mitigate the severe turmoil in the financial system and the economic downturn partly attributable to it not only with conventional monetary policy instruments,[12] but also with the use of several unconventional tools.

The unconventional instruments applied by the Fed had two fundamental goals: first, they were intended to provide short-term liquidity/loans in order to reduce systemic risks and facilitate lending; second, to ease monetary policy conditions further with a key policy rate close to zero *(zero lower bound, ZLB).*

Looking at the chronology, between August (after the subprime mortgage crisis) and November 2007, basically it was only already existing instruments that were transformed. Between December 2007 and August 2008, the set of liquidity providing instruments were expanded, but still taking account of the central bank's balance sheet with restrictions and sterilising operations. From September 2008, loan instruments were used more flexibly and asset purchase programmes were introduced, supplemented by a longer-term commitment to a low policy rate after reaching the zero interest rate level (December 2008). (The latter contributes to subduing medium-term yields through the expectations channel without open market intervention). Of the instruments applied, below we present only those of greater significance.

TAF (Term Auction Facility) was a programme temporarily applied by the Fed and introduced even before the Lehman Brothers' bankruptcy with the intention to maintain short-term financing and liquidity. In the case of the TAF programme, 28- and 84-day loans were disbursed (against collateral) to depository institutions, provided that they had adequate financial conditions. The Fed launched the TAF programme in December 2007 to handle mortgage market turbulences, and the last auction was organised in March 2010. From March 2008 when Bear Stearns, an investment bank, was struggling with serious financing difficulties and was bought up by JP Morgan, the Fed introduced a permanent lending facility for the most important financial institutions as a supplement to the TAF programme. They also strived to improve the same participants' liquidity by allowing them to exchange their asset-backed securities included in their respective balance sheets as collateral for more liquid government securities with the Fed.

The Fed announced the ***TALF (Term Asset-Backed Securities Loan Facility)*** programme on 25 November 2008, to support the further the issuance of asset-backed securities. Originally, the New York Fed announced the programme with a volume of USD 200 billion.[13] The point in the functional mechanism is that the TALF financed, without right of recourse, investors who purchased AAA, i.e. the highest-rated, covered securities. The Fed provided three arguments to justify the necessity of the programme:

- Following the Lehman bankruptcy, the issuance of asset-backed securities (ABSs) (created by securitisation) fell sharply, before stopping altogether from October.
- Premia of AAA-rated asset-backed securities already on the market reached heights that were even more extreme than historical fluctuations.
- The ABS market plays a prominent role in the financing of small and medium-sized enterprises, as well as consumer loans; therefore, the functional disorder of the market affected the overall economic activity of the USA.

The amount was not directly received by consumers or the SME sector, but by the issuers of ABS bonds. The Fed did not purchase the ABSs, only accepted them as collateral for the sake of further lending. All in all, the Fed lent a mere USD 48 billion to banks and various investment funds through the TALF as the state of the targeted markets improved significantly as a result of the announcement.[14]

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[12] In the case of the conventional policies an attempt is made to improve financing conditions by extending the maturity of the policy rate and of traditional short-term financing (Lenza et al., 2010).

[13] The US Treasury supported the TALF with funds amounting to USD 20 billion, of which a total of USD 200 billion could have been disbursed through the leverage.

[14] It should be noted that the programme was reinforced by the measures announced by the US Treasury as well. One such treasury programme was the PPIP (Public-Private Investment Programme), which bought up the problematic assets of distressed companies dealing with mortgage market financing. A similar one is the TARP (Troubled Asset Relief Programme) introduced after the Lehman bankruptcy in October 2008; its objective was to buy up bad assets of the financial sector (by the Treasury).

The third relevant instrument applied by the Fed was the ***CPFF programme (Commercial Paper Funding Facility)*** aimed at the purchase of short-term corporate debt securities. For this purpose, the Bank set up a fund, which was announced on 7 October 2008 and started its operation as early as 27 October. While the Fed purchased three-month corporate paper directly from issuers under the programme, its primary objective was to stimulate issuances and purchases in the market of longer-term corporate paper. The idea was that the *backstop* created by the instrument would ease anxieties about issuers' inability to obtain the funds necessary to repay their maturing securities through the issuance of further CPs, and thus demand for longer-term securities as well as issuances could pick up again. The programme was necessitated by the fact that following the Lehman bankruptcy, investors invested in funds containing government securities, instead of funds where the weight of the private sector was higher. All of this resulted in such serious turbulence in the market that only overnight financing functioned, and the issuance of longer-term corporate securities stopped due to a lack of demand. Accordingly, the objective of the Fed was to restore confidence and functioning in the CP market with a maturity of up to one year. Up to end-2008, issuers used the financing facilities of the fund at a value of USD 333 billion. The CPFF functioned until 1 February 2010.

The Fed launched its ***AMLF (Asset Backed Commercial Paper Money Market Mutual Fund Liquidity Facility)*** on 22 September 2008. Under the programme, all financial institutions that were handling deposits could take out a loan. They were allowed to spend the loan to purchase good-quality, short-term asset-backed commercial papers (ABCP). On the one hand, the programme was aimed at stabilising the corporate bond market; on the other hand, it strived to restore the demand of institutions dealing in asset-backed securities, in order to prevent the market from collapsing.

Finally, ***large-scale asset purchases (LSAP,*** often called as 'QE', standing for quantitative easing) represented the last and largest volume instruments introduced by the Fed to improve the credit markets in the first round; this instrument was first announced on 25 November 2008. Within the programme, between December 2008 and March 2010 the Fed purchased – mostly mortgage-backed – agency securities (issued by two large financial corporations refinancing mortgage loans) with a value of around USD 1,400 billion and government bonds amounting to USD 300 billion. Even after the launch of asset purchases carried out through balance sheet expansion, the Fed called its programme 'credit easing' to distinguish it from the quantitative easing aimed at accelerating monetary growth previously used in Japan, as the central bank wanted to put emphasis primarily on the composition of the instruments purchased by it. In other words, the purchases were intended to reduce the risk premia emerging in the market of the targeted segments and to tackle liquidity troubles, thereby improving the borrowing conditions of the private sector. While QE1 increased inflation expectations, it reduced the volatility of the expectations, and lowered the risk premium on long-term securities by around 100 basis points.[15] According to Bernanke (2009), the unconventional tools of the Fed were not only required because of the ZLB,[16] but also because of the dysfunctioning of certain credit markets.

Since the weaker-than-expected economic outlook justified further monetary easing, ***another round of large-scale asset purchases (LSAP)*** was carried out involving government papers for the most part, aimed at the reduction of long-term government paper yields. The second programme is called QE2 in the literature and by financial players alike. Under the QE2 programme, government securities worth USD 600 billion were purchased between November 2010 and June 2011, while the proceeds from previously purchased, maturing mortgage bonds were spent on purchasing long-term government papers as well, thereby maintaining the level of the central bank's balance sheet. QE2 reduced long-term government yields by 18 basis points.[17] During the simulations performed in relation to the impact assessment of the QE2 programme, Chen et al. (2012) found that the programme may increase GDP growth by 0.13 per cent, and influence GDP levels persistently. Based on their estimate, the inflationary effect of QE2 is almost negligible as the programme may increase inflation by 0.03 percentage points. Chung et al. (2011) attribute a stronger effect to the programme. According to their estimates, without the programme, the downturn in GDP would have been 1 percentage point greater, the unemployment rate 0.5 percentage point higher, and inflation 0.3 percentage point lower.

The next asset purchase programme of the Fed was the ***MEP (Maturity Extension Program,*** often mentioned as 'Operation Twist'). In essence, replacing its holdings of

[15] Krishnamurthy and Jorgensen (2011).

[16] Zero Lower Bound: the close-to-zero level of central bank base rate, a state where changes to the short-term interest rate do not allow further monetary easing due to the low level of the key interest rate.

[17] Krishnamurthy and Jorgensen (2011).

short-term papers (with a term of up to 3 years), the central bank purchases papers with long maturities (6–30 years), thus putting downward pressure on long-term yields similarly as it does with unsterilised asset purchases, but without an increase in the central bank's balance sheet. The Fed started to replace the papers in September 2011. Originally, it planned to swap bonds worth USD 400 billion in total until June 2012; however, the programme was subsequently extended. In relation to the MEP programme it should be noted that the nominal value of the short-term bonds sold and the long-term bonds purchased is practically identical (and thus the central bank balance sheet does not increase); however, the interest rate risk integrated into the balance sheet increases substantially. The result on the side of market players is the reverse: the average maturity of government papers held by the market was reduced by the programme as the volume of long-term papers available in the market decreased. This may have played a significant role in the decline in long-term yields.

The Fed announced its ***next large-scale asset purchase programme (LSAP, 'QE3')*** in September 2012. The asset purchase supplements the unconventional instruments already in use and extended until the end of the year (reinvestment of the principal repayments of the MEP and agency papers[18]). Under QE3 the value of the mortgage-backed securities (MBS) purchased reached USD 40 billion per month. Thus, with the new asset purchase programme, the holdings of longer-term bonds in the Fed's portfolio are expected to increase by USD 85 billion each month.[19] With the programme the Fed wishes to lower long-term yields and boost the mortgage bond market, which will eventually lead to the easing of credit conditions. Over the longer term, this may contribute to the recovery of the housing market and hence, support growth and reduce unemployment without allowing inflation to exceed the target. The instrument is open-ended, i.e. its application has no time limitation and since the amount is unrestricted as well, this tool can be adjusted flexibly in the future.

Evaluation of the programmes

In connection with the comprehensive evaluation of the programmes of the Fed, Gagnon et al. 2010) emphasised their success in the reduction in the term premium (by 30–100 basis points on average) and long-term interest rates. The study considered the mortgage market crisis management as the most effective one, as the targeted instruments here were able to prevent the complete collapse of the market. In addition, the analysis points out that the harmonised programmes triggered a notable positive effect in the market of both government bonds and corporate bonds.

It can be concluded in general that the asset purchase programmes of the Fed boosted market liquidity, reduced spreads and increased securities issues. In several cases the announcement mitigated market tensions and panic in and of their own right, and asset purchases resulted in a further decline in yields down the road. Communication was very important in terms of effectiveness, as the announcement effect influenced market expectations almost immediately. Further effects of the programmes depended on the nature of the specific market segments, risk aversion and the magnitude (or possible expansion) of the programme. Several studies attempted to provide quantitative estimates of the effects of the LSAP programmes. Overall, based on the findings of the studies, the programmes had a significant positive effect on financial markets. According to the evaluation of the programmes, strong consensus evolved in the literature about the first phase of the Fed's LSAP (Large Scale Asset Purchase) Programme, which reduced the yields on 10-year treasury bills and corporate bonds with a good credit rating by some 50 basis points.[20] Due to the short period of time elapsed, the effects of QE3 cannot be quantified; the announcement in itself did not generate a significant decrease either in government paper yields or mortgage market yields. The Fed, however, expects that the stimulating effect on the economy will emerge over a longer horizon, through a decline in mortgage loan interest rates.

As regards macroeconomic effects, the conclusions of the studies are very diverse. At the same time, the studies point out that without the programmes the fall in GDP would have been much more significant. Baumeister and Benati (2010) estimate 4 percentage point lower real GDP growth both in the USA and in the United Kingdom in the first quarter of 2009 if there were no asset purchase programmes. Analysing the programmes of the Fed, Chung et al. (2011) came to the conclusion that term premia declined by 50 basis points on average and by a further 20 basis points as a result of the QE1 and QE2 programmes, respectively. Regarding the impact on economic growth they came to the conclusion that without the QE1 programme the US GDP would be 2 percentage points lower until 2012, and it would have declined by a further 1 percentage point without the QE2 programme.

[18] During the reinvestment, the Fed spends the principal repayments of the securities concerned on the purchase of additional mortgage-backed securities (MBS).

[19] At its meeting on 20 March 2013, the Federal Open Market Committee (FOMC) decided to continue the programme.

[20] Adrian et al. (2010), Agarwal et al. (2010), Gagnon et al. (2010), and Joyce et al. (2011).

SUMMARY

In response to the housing market disturbances in the United States, the Fed began to change its monetary policy instruments as early as 2007, although between August and November 2007 it reacted to the unfavourable market developments by merely transforming its already existing instruments. Liquidity providing instruments were expanded from December 2007 and, after September 2008, besides a gradual lowering of the key policy rate – which practically dropped to zero by December 2008[21] – the Fed began to use credit instruments more flexibly and introduced its asset purchase programmes.

The frictions, which primarily affected the housing markets in the United States, spilled over to Europe at a slow pace. Compared to the Fed, the ECB was slower to respond to the emerging crisis; it was only after the bankruptcy of Lehman Brothers in September 2008 that the ECB reacted, from October 2008, by gradually lowering the key policy rate prevailing in the euro area on the one hand, and by changing its monetary policy instruments on the other hand. Initially, the ECB's actions were also limited to 'fine-tuning' its standard instruments; i.e. it contributed to the stabilisation of the banking system by the provision of adequate liquidity through changing the conditions of the MRO tenders, easing the eligibility criteria of securities to be used as collateral, and applying more widely – and increasing the maturity of – the LTRO tenders that had already been used before the crisis.

In addition to general liquidity providing measures, both the Fed and the ECB applied asset purchase programmes during the crisis, the interim objective of which was the mitigation and elimination of the disturbances of key money markets. Ultimately, the programmes were intended to restore the liquidity of markets, reduce high risk premia and, through the restoration of the efficiency of interest rate transmission, facilitate the private sector's access to loans, boost the economy, reduce unemployment and lower the risk of deflation.

Again, the Fed was quicker to introduce asset purchase programmes than the ECB. Under the CPFF programme, it commenced the purchase of short-term CPs as early as 27 October 2008, and started to buy longer-term mortgage-backed agency papers and government securities in the framework of the LSAP programme (also known as 'QE') from December 2008. This was followed by the launch of QE2 in November 2010, which was aimed at lowering the yields on long-term government bonds by the purchase of longer-term government papers. In September 2011 the MEP programme (commonly called 'Operation Twist') was introduced, in the context of which the Fed reduced the level of the term premium prevailing in the market by replacing its short-term government papers with long-term ones. Finally, the Fed launched QE3 in September 2012, which is intended to boost the mortgage market of the United States by the purchase of MBSs.

By contrast, the ECB only launched its first asset purchase programme, the CBPP, in July 2009, the objective of which was to ease the financing conditions of credit institutions and businesses by intervention in the covered bond market. This was followed by the SMP programme in May 2010, aimed at the restoration of dysfunctional security markets primarily by the purchase of government papers and other bonds of periphery countries. The OMT programme, which was launched parallel to the conclusion of the SMP in September 2012, was intended to improve the efficiency of the transmission mechanism by promoting the purchase of shorter-term (up to 3-year) securities.

Table 1
Real economy impact of the liquidity providing measures of the Fed and the ECB

	GDP	Unemployment	Inflation	Study
Fed QE1	Output would have been 2 percentage points lower until 2012.	Without the programme, it would have been 1 percentage point higher until 2012.	It would have been 0.7 percentage point lower until 2011.	Chung et al. (2011)
Fed QE2	Without the programme the fall in GDP would have been 1 percentage point higher.	It reduced the unemployment rate by 0.5 percentage point.	It would have been 0.3 percentage point lower in 2011.	Chung et al. (2011)
Liquidity provision by the ECB	Output would have been 1 percentage point lower until H1 2010.	It reduced the unemployment rate by 0.5 percentage point.	Without the programme, deflation would have emerged.	Fahr et al. (2010) and Lenza et al. (2010).

Source: the authors.

[21] Lowering of the policy rate began as early as September 2007.

In addition to the specific measures, during the crisis both central banks placed special emphasis on central bank communication, i.e. the application of verbal intervention. One example is the long-term commitment to low policy rates after the reduction of the rate to a level close to zero. This can loosen monetary conditions through the reduction of longer-term yields. For the time being, the OMT programme launched by the ECB in September 2012 can only be considered a verbal intervention as well, since no Member State can meet the criteria for taking advantage of it. Meanwhile, it can efficiently communicate the ECB's commitment to assist the periphery countries.

In evaluating the programmes of the Fed and the ECB, we can conclude that the instruments applied had a positive impact on the functioning of financial markets and on economic performance, and furthermore they also proved efficient in maintaining the transmission mechanism. While the instruments applied were unable to prevent the downturn, without the programmes the decline in GDP would have been steeper and the unemployment rate would have been considerably higher.

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