The ECB unconventional monetary policies: have they lowered market borrowing costs for banks and governments?*

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Abstract

This paper is the first one to evaluate the impact of all ECB unconventional monetary policies implemented between 2007 and 2012 on bank and government borrowing costs. We employ event-based regressions to measure the effect of each policy. The borrowing conditions for banks are represented by money market spreads and covered bond spreads while the sovereign bond spreads reflect government borrowing costs. The results show that sovereign bond purchasing programs (SMP, OMT) proved to be the most effective in lowering longer-term borrowing costs for both banks and governments with the largest impact in periphery euro-area countries. The strong impact in the euro-area periphery suggests that the central bank intervention in sovereign market is particularly effective when the sovereign risk is important. Furthermore, both covered bond purchase programs and 3-year loans to banks reduced bank refinancing costs.

Keywords: Unconventional monetary policy; sovereign bond spreads; covered bond spreads; money market spreads.

JEL codes: E43; E44; E52; E58.

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1 Introduction

Since August 2007 severe financial market disruptions impaired traditional monetary transmission channels in the euro area. First, the 2007-2009 crisis increased uncertainty concerning the banks' balance-sheet health and paralyzed interbank lending. Second, the euro-area sovereign debt crisis led to the fragmentation of the single financial market and resulted in important differences in credit conditions across the member countries. The European Central Bank (ECB) faced a difficult task of restoring monetary transmission and maintaining price stability in these exceptional circumstances. However, the traditional monetary tool - the ECB main refinancing rate - did not affect other interest rates to the extent it used to before the crisis and the euro-area monetary authority had to design and implement unconventional monetary policies to attain its objectives.

The ECB operational framework was, on the one hand, modern and flexible enough to adjust promptly to new circumstances, especially with regard to liquidity provision to banks. On the other hand, the euro-area construction limited the ECB's field of action. More particularly, sovereign debt purchases were strongly opposed by some member countries and the Federal Reserve-style quantitative easing was difficult to implement. Despite sometimes strong criticism, the ECB gradually introduced important unconventional measures: unlimited liquidity provision in euro and some foreign currencies, lengthening of the maturities of the loans, wider range of collateral accepted and outright purchases of private and government assets. This new policy toolkit was designed to "enhance the flow of credit above and beyond what could be achieved through policy interest rate reductions alone".[1]

The objective of this paper is to provide empirical evidence on the impact of the ECB non-standard measures on the market borrowing costs for banks and governments. This question is motivated by the importance of banks in financing of the euro-area economy and by the crucial role that long-term government refinancing plays in the

[1] Trichet (2009).

ongoing euro-area crisis. There is a rapidly growing literature about the effectiveness of alternative monetary policies in the U.S. and the U.K. but the empirical evidence about the effects of non-orthodox measures in the euro area is still relatively scarce.[2] The impact on macroeconomic variables was studied by Peersman (2011) and Gambacorta et al. (2012) who showed that the ECB unconventional monetary policies increased output and inflation. Beirne et al. (2011) evaluated via an event study the impact of the first covered bond purchasing program and found that it was effective in lowering covered bond spreads. The impact of the ECB unconventional policies on money market spreads is much less clear and the existing studies are skeptical about the effectiveness of exceptional liquidity measures in increasing interbank lending (Brunetti et al. 2011, Angelini et al. 2011).

To our best knowledge this study is the first one to evaluate the effectiveness of all ECB unconventional monetary policies implemented between 2007 and 2012 on bank and government borrowing costs. Specifically, we employ event-based regressions to measure the impact of the ECB announcements on money market spreads, covered bond spreads and sovereign bond spreads in the euro-area. Our methodology allows for the simultaneous evaluation and comparison of the effects of the non-orthodox measures. First, we make a timeline of unconventional monetary policy announcements and classify them into six main categories: 1) fixed-rate full-allotment procedure (FRFA), 2) three-year refinancing operations (3y LTRO), 3) collateral easing and 4) covered bond purchase programmes (CBPP1 and CBPP2), 5) long-term sovereign bond purchases (Securities Markets Programme, SMP) and 6) short-term sovereign bond purchases (Outright Monetary Transactions, OMT). We also consider conventional interest rate policy and less important liquidity measures to ensure that the effect of main unconventional policies is not due to other announcements, sometimes made on the same day. Given the exceptional circumstances during the sovereign debt crisis we also take into account the European Financial Stability Facility / European Stability Mecha-

[2]For the United States see for instance Hamilton and Wu (2012), Krishnamurthy and Vissing-Jorgensen (2011), Szczerbowicz (2011) or Taylor and Williams (2009), for the United Kingdom Joyce et al. (2011).

nism announcements and add a sovereign crisis dummy for the peaks of the crisis. In order to put the ECB measures into perspective, we also include quantitative easing announcements in the U.S. and the U.K.

The results show that only the most spectacular ECB unconventional monetary policies, namely sovereign bond purchase programs (SMP and OMT), covered bond purchase programs (CBPP 1 and 2) and 3-year refinancing operations (3y LTRO) diminished significantly borrowing costs for the euro-area banks and governments. Long-term sovereign bond purchases (SMP) proved to be the most effective in lowering sovereign spreads and their effects range from 35 basis points (Italy) to 476 basis points (Greece). As a comparison, we show that the U.S. and U.K. sovereign spreads also fell following the sovereign bond purchases announced by the Fed and the Bank of England but the magnitude of the effect was much smaller: respectively 5 and 9 basis points. The strong impact in the periphery euro-area countries suggests that the central bank intervention in sovereign market is particularly effective when the sovereign risk is important. The SMP was also the most effective in improving longer-term bank refinancing conditions as it reduced to the greatest extent covered bond spreads in all euro-area countries. The second bond purchasing program, OMT, had a similar impact on borrowing conditions as SMP: it diminished, albeit to smaller extent, sovereign spreads and covered bond spreads, especially in the periphery euro-area countries. As far as covered bond purchase programs are concerned, they reduced the spreads in all markets studied: covered bond spreads, sovereign bond spreads and to some extent the money market spreads. Finally, among the exceptional liquidity provisions, the 3-year refinancing operations (3y LTRO) were the only measure that succeeded in reducing bank refinancing costs and their impact was particularly strong in money market.

The reminder of this paper is organized as follows. The ECB unconventional monetary policy announcements, their objectives and theoretical basis for their effectiveness are described in section 2. Methodology and data are presented in section 3. In section 4 we estimate the impact of the ECB announcements on money market, covered bond and sovereign bond spreads. Section 5 concludes.

2 Unconventional monetary policies implemented by the ECB

The ECB unconventional monetary policies implemented by the ECB can be regrouped into three categories: 2.1) exceptional liquidity measures, 2.2) purchases of assets and 2.3) collateral easing. In this section we present these measures, their theoretical foundations and the objectives they were meant to attain.

2.1 Liquidity provisions

At the beginning of the subprime crisis the ECB reacted very promptly to the tensions on the interbank market. The operational framework of the ECB was already quite flexible compared to other central banks: the ECB accepted a wide range of collateral and provided liquidity to large number of counterparties. However, the regular liquidity tools failed to calm down unprecedented interbank tensions due to global economic crisis and the euro-area sovereign debt crisis (Figure 1). Therefore, the ECB implemented several additional liquidity measures that we define here as unconventional since they go beyond the regular framework of the open market operations.[3]

The main objective of exceptional liquidity provisions was to restore the smooth functioning of interbank markets as this aspect was crucial for extending credit to firms and households.[4] The ECB made clear all along the crisis that monetary policy stance and liquidity programs were two different things, and the latter were merely supposed to normalize euro money markets and improve the monetary transmission.

The exceptional liquidity measures may be effective in stabilizing interbank market

[3]The regular open market operations at the ECB include: 1) Main refinancing operations (MRO) with a frequency and maturity of one week; 2) Longer-term refinancing operations (LTRO) with a monthly frequency and a maturity of three months; 3) Fine-tuning operations designed to smooth the effects on interest rates caused by unexpected liquidity fluctuations; 4) Structural operations carried out by the Eurosystem through reverse transactions, outright transactions and issuance of debt certificates.

[4]Draghi (2008): "Restoring the smooth functioning of the interbank markets globally and within the euro area is a precondition to ensure the stability of credit flows to households and firms, thereby minimizing the real impact of the financial turmoil".

for several reasons. The liquidity shortage has a negative impact on financial institution lending capabilities and may result in credit crunch. Liquidity-constrained banks excessively hoard liquidity for precautionary reasons and proceed to fire sales of assets affecting negatively their prices. The ECB unconventional measures by ensuring funding liquidity diminish these adverse effects. They also reduce the banks' uncertainty with respect to funding liquidity of other market participants and therefore diminish counterparty risk premiums.

Furthermore, the excess liquidity provisions can affect the economy via portfolio rebalancing effect (Meltzer, 1995; Tobin, 1982) when money and other financial assets are not perfect substitutes. Market participants faced with increased money supply want to trade money for non-money assets which increases prices of non-monetary assets and reduces their yields. The ECB excess liquidity might have encouraged banks to purchase sovereign and corporate bonds as they would realize interest-rate gains with these transactions. The imperfect substitutability of assets, in general equilibrium framework, can in particular be linked to a difference in liquidity between money and other assets. Increase in money supply could reduce the liquidity premium and hence reduce long-term interest rates (Andres et al., 2004) and stimulate investment (Kiyotaki and Moore, 2012).

However, the ECB unlimited liquidity provision can also have perverse effects on the money market. It might contribute to "crowding out" of private liquidity and the effective substitution of the ECB for the interbank market trades. The important functions of interbank transactions such as information aggregation, price discovery and peer monitoring are reduced if unlimited liquidity is available from the central bank. The central bank interventions can therefore create greater uncertainty in the interbank market rather than enhancing liquidity as intended (see empirical study of Brunetti et al., 2011). Indeed, Heider et al. (2009) theoretical model shows that in case of high counterparty risk and informational asymmetry, the central bank liquidity injections result in liquidity hoarding and finally contribute to the greater distress of the money markets.

In this paper, we measure the impact of the strongest ECB liquidity innovations: announcements of the fixed-rate full-allotment procedure (FRFA) and the 3-year refinancing operations (3y LTRO). However, since 2007 the ECB has implemented other exceptional liquidity measures: gradual lengthening of LTRO maturity up to 1 year and refinancing operations in foreign currencies. We take into account these innovations even though they are closer to conventional liquidity provisions. In fact, some of these liquidity announcements were made on the same day as the important measures that we focus on and we want to separate their effects.

2.1.1 Fixed-rate full-allotment (FRFA)

The fixed-rate procedure with full allotment (FRFA) was an important part of the ECB's non-standard toolbox. Traditionally, the open market operations were conducted through variable-rate tenders. Under the new procedure, the banks could satisfy all their liquidity needs at the interest rate specified in advance (the interest rate on the main refinancing operation). By ensuring banks' continued access to liquidity the ECB intended to offset liquidity risk in the market. The fixed-rate tenders for the main refinancing operations (MROs), without full allotment, existed in the beginning of the Eurosystem (01/1999 - 06/2000) but were quickly abandoned as the banks were overbidding. When the subprime crisis started, the ECB conducted two fine tuning operations (FTOs) as a fixed-rate tenders with full allotment but it is only after the Lehman Brothers collapsed that it introduced the fixed-rate full-allotment procedure for all open market operations and for the foreign liquidity swaps (Table 1). First, late on October 8, 2008, the ECB announced that all weekly MROs would be carried out through a fixed-rate tender procedure with full allotment rather than through a variable rate tender format used before. On October 13, 2008 it decided to provide unlimited dollar funding in coordinated action with the Fed. Two days later, on October 15, 2008 the ECB decided to conduct its longer-term refinancing operations (LTROs) on a FRFA basis as well. The ECB decided to return to variable-rate tender procedure in the regular 3-month LTROs in March 2010. However, the Greek debt crisis forced it to

resume a FRFA procedure in the regular LTROs in May 2010.

2.1.2 Three-year refinancing operations (3-year LTRO)

On December 8, 2011, the ECB took an unprecedented measure to conduct two three-year refinancing operations (3y LTRO) with full allotment, with the interest rate fixed at the average rate of the MROs over the life of the operation. The first 3y LTRO was offered on December 21, 2011 and the second on February 29, 2012. The banks borrowed more than €1 trillion which covered their immediate funding needs and prevent them from selling assets and cutting some types of lending. The announcement of the 3y LTRO is incomparable to other liquidity measures and created a real surprise on the markets as they extend the central bank intermediation from money markets to capital markets. Taking into consideration the special character of this measure and the surprise it created we separate this announcement from the other liquidity measures.

2.1.3 Longer maturities of the refinancing operations in euros

Soon after the beginning of the subprime crisis, the ECB increased the liquidity provisions through the longer-term refinancing operations (LTROs). The LTROs are liquidity-providing reverse transactions that are regularly conducted with a monthly frequency and a maturity of three months. The ECB does not usually fix the rate of these operations but let the banks participating in auction define it in a variable-rate tender. The LTROs dates are known in advance as the ECB announces them in an indicative calendar. However, during the crisis the ECB announced supplementary LTROs and some of them were of maturity exceeding three months. In this paper, we consider the announcements of liquidity provisions at maturities longer than three months as unconventional in line with Trichet (2009)'s classification (for the dates and description of the announcements see Table 2).[5]

[5] As a robustness check, we add to this category all supplementary liquidity measures which are even closer to regular liquidity operations: supplementary 3-month LTROs announcements and special-term refinancing operations (1 month) but it does not change significantly the results.

The ECB first lengthened the maturity of the supplementary LTROs to six months after the Bear Sterns collapsed in March 2008, to encourage banks in the euro area to lend to one another for longer periods. The 6-month operations were seen as significant because it was the first time the central bank has departed from its standard three-month funding operations. The maturity of loans was further extended to one year in May 2009. As the economy was recovering, the supplementary liquidity measures were to be wound up. However, the outburst of the Greek debt crisis in spring 2010 forced the ECB to resume the supplementary LTROs and to increase again their maturity to ensure that commercial banks get the crucial funding. Indeed, the money markets started to freeze again as the exposure to risky sovereign debt made banks wary of lending to one another.

2.1.4 Liquidity in foreign currencies

Along with the liquidity provisions in euro, the ECB furnished to banks liquidity in foreign currencies thanks to the currency swaps established with other central banks. Within these agreements, reversible in a later date, the ECB exchanged euros against dollars, the Swiss franc and the British pounds and used the foreign currency to lend to euro-area financial institutions. The foreign currency swaps, just as supplementary euro liquidity provisions, were implemented in both subprime and sovereign debt crisis (See Table 3).

When the subprime crisis started and a chain of defaults occurred on the U.S. subprime mortgage markets, the euro-area banks had difficulties to renew their funding in U.S. dollars. In December 2007 the ECB announced the foreign currency swaps with the Fed to help money markets function more smoothly. The terms and amounts of the swaps were regularly expanded and since October 2008 the liquidity in dollars was distributed to banks on FRFA basis. Progressively, the ECB concluded swap arrangements also with the Swiss National Bank (SNB) to provide the Swiss franc to euro-area financial institutions.

The ECB closed the swap lines with the Fed on February 1, 2010 but was obliged to

resume them in May 2010. At the onset of the European crisis, foreign lenders retreated out as they feared that the euro-area financial institutions were holding too much of bad sovereign debt and may be insolvent. As the crisis worsened, the arrangements were subsequently extended. In addition to swap lines with the Fed and the SNB, the arrangements were also made with the Bank of England (BOE) in December 2010 in order to provide liquidity in sterling to Irish banks and limit the problems faced by the Irish banking system.

2.2 Purchases of assets

In a period of financial distress, the central bank can modify the composition of its assets by purchasing the securities that suffer from temporary liquidity problems or are undervalued by financial markets. This policy is sometimes called "credit easing". The purchases can be sterilized by disposal of the other central bank assets ("pure credit easing") or be a part of the central bank balance-sheet expansion ("quantitative easing").

The effectiveness of credit easing is based on the "portfolio rebalancing effect": when the assets are not perfect substitutes, reducing the quantity of selected assets available for private investors increases their prices and diminishes yields by suppressing the risk premia (Bernanke, 2010). The portfolio rebalancing effect is controversial from a theoretical point of view. A representative-agent model of Eggertsson and Woodford (2003) predicts no effect for such operations on price level or output. However, this result holds only under following assumptions: (1) all investors can purchase and sell unlimited quantities of these assets, and (2) the assets being bought and sold are valued only for their pecuniary returns. The first assumption is likely not to hold during crisis as there exist binding constraints on participation in some markets. One example of general equilibrium analysis in which these constraints exist and credit easing affects asset prices is Cùrdia and Woodford (2011). As for the second assumption, Krishnamurthy and Vissing-Jorgensen (2011) show that US government debt for example possesses non-pecuniary qualities that are valued by the financial sector above their

pure pecuniary returns given that Treasuries are often required as collateral in repo transactions.[6]

Furthermore, replacing a representative agent with no preference between markets and assets by heterogeneous agents can also provide rationale for central bank asset purchasing. In the preferred-habitats model of Vayanos and Vila (2009) the interest rates of all maturities are determined through the interaction between risk-averse arbitrageurs and investor clienteles with preferences for specific maturities. In this framework, the central bank purchases of long-term Treasuries can lower the long-term yields because they create a "scarcity effect" that arbitrageurs cannot eliminate. Moreover, the purchases can be effective as they shorten the average maturity of government debt and therefore the duration risk held by arbitrageurs.

In this paper we investigate the effects of the ECB purchases of covered bonds and euro-area sovereign debt. These assets are more risky that government bonds considered in Vayanos and Vila (2009) and the duration risk is not the only one that the central bank takes on its balance sheet. By purchasing above mentioned assets the ECB also accepts the liquidity and default risk that private investors do not want to hold and replaces it with riskfree reserves. Private investors can ask for smaller liquidity compensation when buying covered or sovereign bonds knowing that they would be able to sell the asset easily to the ECB.

Moreover, the sovereign debt crisis in Europe increased the default risk in the sovereign bond markets. Market participants started to price in a high probability of sovereign default and even the high probability that some member states would exit the euro area. Such projections cut off these countries' access to market refinancing or made it extremely costly leading to "self-fulfilling" prophecy and potentially to the outcome that investors were concerned about: default or euro area exit. By purchasing government bonds, and indirectly securing the sovereign debt, the ECB intended to prevent this "bad equilibrium" outcome.

[6]It should be noted however, that government bond purchases by central banks diminish the availability of these desirable assets and can be welfare reducing.

There exists another transmission channel of central bank asset purchases which instead of reducing risk premia has an impact on private sector's expectations of the future monetary policy ("signaling effect"). Accumulation of risky assets on central bank balance sheet associated with important balance sheet expansion can be understood by financial markets as a signal that the monetary easing will continue longer than previously expected. Indeed, raising interest rates in these circumstances would expose the central bank to capital losses on the assets it holds. In this paper however, we focus on the ECB impact on risk premia rather than on agents expectations of future monetary policy given that the ECB objective was to restore homogeneous credit conditions throughout the euro area, but not necessarily to ease credit conditions in aggregate (Coeuré, 2012). Increased risk premia (spreads) on certain markets in the euro area were the reflection of these divergent credit conditions.

2.2.1 Sovereign bond purchases (SMP and OMT)

The Greek sovereign debt in Spring 2010 triggered a fire selling of some euro-area government bonds. The ECB launched on May 9, 2010 the Securities Market Programme (SMP) as a part of European Union efforts to stabilize the euro.[7] The program was designed to purchase sovereign bonds and therefore to "ensure depth and liquidity in those market segments which are dysfunctional".[8] This was the first time the ECB and its constituent central banks bought public debt and the SMP was from the start a source of division within the ECB. The critics said that the ECB was overstepping its mandate by buying public debt in secondary markets and that the bond purchases would increase the inflationary pressures as well as undermine the ECB credibility. However, the ECB insisted that the SMP was temporary and merely aimed at improving the transmission of the monetary policy. In order to distinguish the SMP from the U.S.-style quantitative easing and to ensure that the monetary policy stance is not affected, the ECB decided to sterilize these purchases via specific operations designed to re-absorb the

[7] On the same day the EFSF was established.

[8] "ECB decides on measures to address severe tensions in financial markets", ECB Press Release, 10 May 2010.

injected liquidity.[9] Another notable difference with the Fed sovereign bond purchases, is that the ECB gave no details on how much it could spend or how long it intended the program to last. It did not deliver precise quantities of bonds bought from specific countries neither. The purchases stopped unofficially in January 2011 but the intensity of euro crisis and the risk of contagion to Italy and Spain made the ECB resume the program. After an emergency meeting on Sunday August 7, 2011 the ECB announced they would actively purchase euro-area debt. Since the start of the program, the ECB bought a total 219.5 billion euros of euro area government bonds (see Figure 2).

The euro-area debt crisis continued in the beginning of 2012 as the critical financial standing of Spanish banks was revealed. The concerns about their solvency and *in fine* solvency of the Spanish government made the sovereign yields in the euro-area periphery increase rapidly as market participants were pricing in the possibility of some countries leaving the monetary union. As a response, the ECB President Mario Draghi announced in July 2012 that the central bank would do "whatever it takes to save euro".[10] On September 6, 2012, the ECB announced the sovereign bond purchasing program: Outright Monetary Transactions (OMT) and at the same time officially terminated SMP. The objective of the new program, just as the objective of SMP, was to repair monetary policy transmission mechanism and restore homogeneous credit conditions throughout the euro area. More precisely, the purchases of the euro-area periphery sovereign debt was intended to reduce the risk premia related to fears of the reversibility of the euro. Despite the shared objective, OMT was different to SMP in several aspects. First, the maximum maturity was set to 3 years whereas SMP concerned the longer-term bonds. Second, there was a conditionality attached to participating in OMT: the ECB would only purchase sovereign debt of a given country if its government complies with a full or precautionary macroeconomic adjustment program set by the European Financial Stability Facility (EFSF) or the European Stability Mechanism (ESM). Third, the ECB decided to forgo its seniority status with respect to private creditors. Finally, once the

[9]The sterilization of SMP operations is questionable however, given that the banks had unlimited access to the central bank liquidity and the ECB had no longer control over the monetary base.

[10]Draghi (2012).

country meets the access conditions, the ECB would intervene without limits whereas SMP was always presented as "temporary" and "limited" which was hardly reassuring for investors.[11] OMT was intended as pure "credit easing" meaning that the purchases of bonds would just change the assets composition of the central banks but not increase the overall monetary base.[12]

2.2.2 Covered bond purchases (CBPP1 and CBPP2)

Covered bonds are securities issued by credit institutions to assure their medium and long-term refinancing. They are collateralized by a dedicated pool of loans, typically mortgage loans and public-sector loans, which comply with a minimum legal standard and remain on the lender's balance sheet. This high quality collateral allows banks issuing covered bonds with higher credit rating than their own rating. They are seen as safer than other bank bonds, because they give investors a claim on the credit institution itself and on the the cover pool of collateral as well. This "dual recourse" feature of covered bonds make them also more attractive and more liquid than the ABS market. Unlike in the standard securitization process, the issuer of covered bonds keeps the ownership of the pooled mortgages and loans and ensures that they are at all times sufficient to satisfy the claims of bondholders.

A relatively low risk and the return higher than government bonds makes the covered bonds highly attractive in the eyes of investors. At the end of 2007 it was the most important privately issued bond segment in Europe's capital markets (ECB, 2008). The relative safety of covered bonds contributed to their resilience to the financial turmoil that started in August 2007. However, after the Lehman Brothers collapsed in September 2008, this market dried up as investors turned to government bonds and other less risky assets. To prevent the credit crunch, the ECB announced on May

[11] Introductory statement to the ECB press conference, November 3, 2011 available at: http://www.ecb.int/press/pressconf/2011/html/is111103.en.html

[12] As in the case of SMP, the sterilization operations seem mostly symbolic as the fixed-rate full-allotment procedure in all main refinancing operations leaves the control of monetary base in hands of banks participating in these operations.

7, 2009 that it would purchase €60 billion of euro-denominated covered bonds issued in the euro area. This decision was surprising for the markets which were expecting the rate cut and the lengthening of the lending program but not direct purchases of the private debt, which was perceived as a change in strategy.[13] The objective of the Covered Bond Purchase Programme (CBPP) as stated in the decision of the ECB of July 2, 2009 (ECB/2009/16) were the following: (a) promoting the ongoing decline in money market term rates; (b) easing funding conditions for credit institutions and enterprises; (c) encouraging credit institutions to maintain and expand their lending to clients; and (d) improving market liquidity in important segments of the private debt securities market. All along the implementation of the CBPP, the ECB officials claimed that the covered bond purchases were not quantitative easing but a part of "enhanced credit support" operations. In other words, the ECB wanted to revive an illiquid market but did not intend to create money to buy covered bonds. The ECB thought that these operations would be naturally sterilized as the euro-area banks would demand less liquidity from the ECB's refinancing operations.

In the end of June 2010 the ECB stopped the covered bond purchasing but as the sovereign crisis deepened in autumn 2011 it proceeded to further measures supporting the covered bond markets. On October 6, 2011 it announced the second covered bond purchase programme (CBPP2) of €40bn in favor of euro-denominated covered bonds in both primary and secondary markets (see Figure 3 for the amounts purchased in CBPP 1 and 2).

2.3 Collateral easing

Since the creation of the euro area the ECB had a collateral framework that was much less restrictive than the Fed and the Bank of England. Therefore, the loosening of the collateral rules was not as significant as it was in the U.S at the beginning of the crisis. For instance, the commercial paper was eligible as collateral at the ECB while the Fed

[13] "Trichet Drags ECB Into New Era Over Weber's Bond Objections", May 7, 2009, Bloomberg.

had to implement a specific lending facility in order to purchase it (Commercial Paper Funding Facility). However, after the Lehman Brothers collapse, the ECB significantly loosened its collateral rules (see Table 4). On October 15, 2008 it decided to accept as eligible collateral debt instruments issued by credit institutions, traded on the accepted non-regulated markets (bank certificate of deposit among others). While easing the collateral rules, the ECB sought to limit its exposure to risky assets by applying haircuts on the accepted securities. At the end of 2008 it started preparing the ground to unwind emergency collateral measures and raised the requirements concerning the asset-backed securities (ABS). However, in Spring 2010 the sovereign debt crisis began and the ECB was obliged to ease further its collateral rules. In particular, it took several measures to ensure that the Greek banks would still be able to use Greek government bonds as a guarantee to obtain central bank funds. As the sovereign debt crisis spread to other euro-area countries in 2011, the ECB took the same decisions in favor of Irish and Portuguese government bonds. Moreover, in December 2011 the ECB decided to further reduce some ABS ratings thresholds and to accept loans to small and medium-sized enterprises for the first time. In February 2012, another important innovation was announced: each national central bank would accept divergent types of collateral to accommodate the peculiarities of their country banking industries.

Loosening of the collateral requirements can affect bank and government borrowing costs in two ways. First of all, it increases the volume of collateral that can be used as a guarantee in refinancing operations and therefore reinforces the liquidity provision channels (see subsection 2.1). Furthermore, accepting lower-graded assets as a collateral can contribute to lowering their interest rates in the same way as the asset purchases do (see subsection 2.2).

3 Methodology

The objective of this paper is to assess the effectiveness of all ECB unconventional monetary policies in reducing the market borrowing costs for banks and governments

between 2007 and 2012. We apply event-based regression methodology in order to measure the impact of each non-standard measure on the euro-area money market, covered bond markets and sovereign bond markets. Event-based regression allows testing the impact of an economic event on financial market data. In modern financial markets, as these of the euro area, the effect of the event should be reflected in asset prices over a short period of time.

We rely on dummy variables to discriminate between days when announcements were made or not. Based on the ECB press releases we create a database of unconventional monetary policy news. The announcements are classified into following categories (described in section 2):

- Exceptional liquidity provisions
  - Fixed-rate full-allotment procedure (FRFA)
  - Three-year refinancing operations (3y LTRO)
  - Longer-term refinancing operations of maturity greater than 3 months
  - Liquidity in foreign currencies
- Collateral easing
- Covered bond purchase programs (CBPP1 and CBPP2)
- Longer-term sovereign bond purchase program (SMP)
- Short-term sovereign bond purchase program (OMT)

The advantage of the event-based regression with respect to standard event study methodology is that there is no need to make an assumption as for which announcement (event) was the most important on a specific day. It seems particularly important during the crisis when there were several policy actions announced on the same day. On May 7, 2009 for instance, the ECB introduced the covered bond purchase program and one-year longer-term refinancing operations. On December 8, 2011, the three-year

refinancing operations were announced along with significant collateral rules easing. Moreover, other then monetary news could also affect the market borrowing costs. When these events coincide with monetary policy announcements it is necessary to include them into regression in order to distinguish the effects. We use Factiva press database to check if there were other major events that might have influenced our variables of interest, i.e. interest rate spreads.[14] The most striking example of simultaneous announcements is the weekend of 8-9 May 2010 when several monetary measures were decided and in particular the SMP was created. In parallel, the euro-area politicians founded the European Financial Stability Fund (EFSF). Even though both SMP and EFSF were intended to purchase sovereign debt it is useful to separate the effects of the two measures as they are conducted by different institutions. To assure a correct specification of our event-based regression model we include announcement concerning the EFSF and the European Stability Mechanism developments as well as the dummy for the sovereign debt crisis. The crisis dummy is equal to 1 during the periods when the concerns about solvency of the periphery euro-area countries were the highest.[15]

The ECB conventional monetary policy is also taken into account as the updates about the future ECB interest rates decisions are immediately priced into market interest rates. These surprises may be important if they are announced on the same day as unconventional monetary measures. First, we account for the unanticipated ECB interest rates decisions identified based on Reuters poll and Bloomberg surveys. Second, we include the surprises about the "path" of the ECB interest rates that are defined as the surprise information of the interest rates hikes (cuts) in the following month. We rely on articles in Factiva to determine the surprises in the ECB interest rates "path".[16]

[14]Factiva is an information and research tool owned by Dow Jones & Company. It offers online articles from both licensed and free sources (Wall Street Journal, Reuters, Financial Times among others).

[15]We define the crisis dummy according to Google Trends which show how often a particular search-term ("euro-area sovereign debt crisis" in our case) is entered relative to the total search-volume across various regions of the world. The results were cross-checked with main sovereign debt crisis events reported by Reuters, The Wall Street Journal and The Daily Telegraph in their crisis timelines.

[16]For instance: 1) "No change in interest rates now, hike possible in September", Agence Europe, August 3, 2007: "On Thursday 2 August, the European Central Bank (ECB) decided to keep the euroarea interest rates unchanged. (...) The ECB made a surprise move, however, by holding a press

Given that we investigate the responses of interest rates longer than three month, both current interest rates surprise as well as the surprises about the future interest rates changes matter for this study.

We use daily data from July 2, 2007 until September 27, 2012 with the exception of Italian and Portuguese covered bond series available respectively from January 2, 2009 and October 31, 2008.

4 Results

4.1 Money market

Since August 2007 the uncertainty concerning the health of banks' balance sheet was unusually high and financial institutions were reluctant to lend to each other. They were hoarding liquidity for their own unexpected liquidity needs but also out of concern about the counterparty financial soundness. As a result, the spreads between unsecured and secured rates increased to previously unseen levels (Figure 1). The interbank lending is a key element of the successful monetary transmission and the ECB was determined to support money market activity. The exceptional liquidity measures, relaxed collateral rules and covered bond purchase programs were particularly aimed at restoring the interbank lending.

To test the impact of all announcements on the money market spreads we estimate the following regression:

$$\Delta S_t^M = \alpha + \sum_{i=1}^{I} \beta_i NC_{i,t} + \varphi_1 F_t + \varphi_2 C_t + \gamma x_t + \sum_{n=1}^{N} \psi_n \Delta S_{t-n}^M + \sum_{l=1}^{7} \psi_l D_{l,t} + \epsilon_t$$

conference after the meeting to explain its short-term plans. (...) it organized a press conference to prepare the financial markets for an expected tightening of the monetary belt in September." 2) "Bunds lower as markets digest ECB rate shock", Reuters News, March 3, 2011: "Yields pushed sharply higher and the curve flattened on Thursday after the European Central Bank stunned markets by indicating it could raise interest rates as soon as next month."

where $NC_{i,t}$ are dummies for unconventional monetary policy announcements discussed in section 2; F_t is a dummy for EFSF/ESM announcements; C_t is a dummy for sovereign debt crisis; x_t is a dummy for the ECB policy rate/policy path surprise; ΔS^M_{t-n} are lagged values of dependent variable included to correct for the auto-correlations of the residuals (number of lags $n = 3$); $D_{l,t}$ are dummies for the day of the week (Monday, Tuesday...) and ϵ_t is a stochastic error term.

The dependent variableΔS^M_t is a 2-day change in 3-month money market spreads. We use four alternative measures of money market distress reflecting the difference between unsecured and secured (or riskfree) three-month lending rates: i) Euribor - OIS[17], ii) Euribor - Repo[18], iii) Euribor - Germany Treasury bill and iv) certificate of deposit (CD) - OIS[19]. Among these measures, the Euribor-OIS is the most commonly cited barometer of the situation on the interbank market.

There is a timing issue related to the Euribor-OIS spread. Euribor rate is published at 11:00 a.m. Brussels (10:00 GMT) time while the OIS rate is taken from the Datastream and the last update is from 19:15 GMT. Therefore, many announcements on a given day are not taken into account by Euribor rate. In order to ensure that the markets had the possibility to react to all announcements we consider 2-day event window for all measures.

Another issue is related to the recent revelations about Libor and Euribor manipulation by one of the contributing banks. However, there are two particular features of Euribor rate that make it less sensitive to manipulation than Libor. First, 43 banks contribute to Euribor as opposed to 15 in the Euro Libor panel, which reduces the weight of the eventual misreporting contributor. Second, Euribor is an average lending

[17]The Euro Interbank Offered Rate (Euribor) is an average interbank borrowing rate published daily at 11:00 a.m. (Brussels time) by the European Banking Federation (EBF). The overnight-indexed swap (OIS) rate represents market expectations of the monetary policy rate over the future months. There is no exchange of principal and only the net difference in interest rates is paid at maturity, so there is very little default risk in the OIS market.

[18]Repo is the rate at which, at 11.00 a.m. Brussels time, one bank offers, in the euro-area and worldwide, funds in euro to another bank if in exchange the former receives from the latter the best collateral within the most actively traded European repo market.

[19]Certificate of deposit is a debt instrument issued by banks and other financial institutions.

rate while Libor is an average borrowing rate. During crisis, the contributing banks are more inclined to diminish the latter as high borrowing rates send the negative signal about their financial standing.

Table 5 reports the estimation results. The money market spreads react relatively little to monetary policy announcements. However, following the 3-year LTRO announcement all spreads diminish significantly. The Euribor-OIS spread is reduced by 24 basis points while Euribor-Repo and Euribor-German Treasury bill by respectively 20 and 6 basis points. The coefficient is not reported for the CD-OIS spread as there was no quotation for 3-month certificate of deposit on the day of the announcement.[20] Similarly, the spreads go down on the days of the 3-year LTRO operations. The effect is smaller than the announcement effect for the Euribor spreads (3-6 basis points) but reaches 13 basis points for the CD-OIS spread. Surprisingly, lengthening the LTRO to six months and one year did not have the same effect which confirms that 3-year operations were indeed exceptional measure and incomparable by its scope to other liquidity facilities.[21] The fact that other longer-maturity LTROs did not diminish spreads can be due to several reasons. First, by furnishing unlimited liquidity provisions to banks the ECB substituted itself for the interbank market and might have caused a "crowding out" effect as also shown in Brunetti et al. (2011). As there is unlimited liquidity available at the central bank there is no need to borrow it from the interbank market. Second, the liquidity risk was not the most important determinant of the spreads (Angelini et al. (2011)) and therefore liquidity measures were not able to affect them. In that case, only more risk-taking by the ECB (purchasing of assets, 3y LTRO for instance) would lower the spreads.

Covered bond purchases indeed diminished the spreads but the significance of the results is smaller. The effects range from 15 to 37 basis points but only the impact for

[20] We use Reuters time series for the 3-month certificate of deposit and German Treasury bill. The Euribor, Repo and OIS rates come from Datastream.

[21] In order to verify the robustness of this result we included intro regression other supplementary liquidity announcements: supplementary LTROs of 3 month and Special-Term LTROs of about 1 month. We also included different types of open market operations (regular LTROs, MROs, fine tuning) and none of these reduced the money markets spreads.

the CD-OIS spread is significant at 5%.[22] On the other hand, sovereign bond purchases (SMP and OMT) did not have significant impact on money market spreads.

4.2 Covered bond market

Another source of bank refinancing, yet at longer term, is covered bond market. The ECB unconventional measures, and the covered bond purchase programs in particular, were designed to reduce the cost of longer-term bank borrowing. In order to measure the impact of these measures we estimate the following regression:

$$\Delta S_t^C = \alpha + \sum_{i=1}^{I} \beta_i NC_{i,t} + \varphi_1 F_t + \varphi_2 C_t + \gamma x_t + \sum_{n=1}^{N} \psi_n \Delta S_{t-n}^C + \sum_{l=1}^{7} \psi_l D_{l,t} + \epsilon_t$$

where $NC_{i,t}$ are dummies for unconventional monetary policy announcements; F_t is a dummy for EFSF/ESM announcements; C_t is a dummy for sovereign debt crisis; x_t is a dummy for the ECB policy rate/policy path surprise; ΔS_{t-n}^C are lagged values of dependent variable included to eliminate the auto-correlations of the residuals for all series with the exception of the UK data where the residual were not autocorrelated (number of lags $n = 1$); $D_{l,t}$ are dummies for the day of the week (Monday, Tuesday...) and ϵ_t is a stochastic error term.

ΔS_t^C is a 1-day change in covered bond spread in the euro area and in its member countries, in particular Germany, France, Italy, Ireland, Portugal and Spain.[23] The UK covered bond rates are also considered in order to compare a response of non euro-area rates to the ECB policies. All covered bond rates are synthetic benchmark provided by Iboxx and available from Datastream. These benchmark rates cover all bond maturities exceeding one year and are comparable among countries. The composed-maturity bonds indexes seem appropriate as the ECB bought covered bonds of different maturities.[24]

[22] Result are significant at 10% for Euribor-Repo and Euribor-German bill spreads.

[23] Datastream does not provide the Iboxx covered bond rates for Greece.

[24] CBPP 1: 3-10 years, with strong focus on maturities up to 7 years; CBPP 2: Up to 10.5 years residual maturity, according to ECB website.

The spread is calculated with respect to corresponding all-maturities German sovereign bond, also provided by Iboxx (Datastream). The UK covered bond spread takes as a reference all-maturities UK sovereign bond yield.

Table 6 presents the estimation results for the euro-area, France, Germany and the UK while Table 7 the results for Ireland, Italy, Portugal and Spain. At the euro-area level, the policies that diminished the covered bond spread the most were long-term sovereign bond purchases, SMP (20 bp), followed by covered bond purchases[25] (6 bp), short-term sovereign bond purchases, OMT (5 bp) and 3y LTRO announcement (3 bp). The positive news concerning the EFSF/ESM also diminished spreads (4 bp) while sovereign crisis dummy increased it (1 bp).

Breaking up the results by country allows seeing the differentiated impact of the ECB measures on the spreads. The SMP had by far the strongest effect on all euro-area countries studied but the spread reduction was the most important for Portugal (164 bp) and Ireland (49 bp) and the least for Germany and France (respectively 12 and 8 bp). The biggest impact for the periphery euro area countries suggests that the covered bonds from these countries benefited from the "spill-over effect" from the sovereign bond yields reduction (see next subsection) which are often used as a benchmark for other longer-term rates.[26] More importantly however, longer-term sovereign bond purchases diminished sovereign default risk in these countries which had positive impact on business climate and the credit standing of its financial institutions who held important amount of sovereign debt. The reduction of covered bond spreads after the announcements of European stability facilities (EFSF/ESM) confirms that this market was sensible to measures reducing the sovereign default probability. Furthermore, the announcement of the short-term government bonds purchase program (OMT) also diminished covered bond spreads in all euro-area countries studied but the magnitude of the effect was smaller, ranging from 46 bp for Portugal to 3 bp for France.

[25] We tested CBPP 1 and CBPP 2 separately and they both have similar impact on covered bond spreads.

[26] Covered bonds are highly correlated with government bonds (correlation of 91% between July 2006 and March 2010 as reported by ECBC (2010)).

As far as covered bond purchase programs are concerned (CBPP 1 and 2), they were significant only for Italy (16 bp), Germany (10 bp), Spain (10 bp) and France (4 bp). These results are not surprising given that according to ECBC (2010) the biggest amounts of the CBPP 1 were allocated to the central banks of Germany, France, Italy, Spain and Netherlands. Furthermore, Italy and Finland were the main beneficiaries when the ratio of purchased amounts to the size of the outstanding covered bonds eligible under the CBPP 1 is taken into account.

The impact of 3-year LTRO also differs for each country and was significant for Ireland (6bp) and France (4bp). The overall impact for the euro area is significant (3 bp). 3y LTRO reduced longer-term bank funding constraints and therefore diminished their liquidity and credit risk pulling the yield on their debt down.

As expected, the reaction of the UK covered bonds are quite different to euro-area covered bonds. The sovereign crisis dummy enters in the UK covered bond spread with negative sign which means that the sovereign-debt crisis in euro area redirected investors to UK covered bonds ("flight to quality" effect). Furthermore, the UK covered spreads did not react to ECB measures that were significant for the euro-area spreads: sovereign and covered bond purchases, and 3y LTRO.[27]

4.3 Sovereign bond market

Since the beginning of the euro-area debt crisis the spreads between the euro-area periphery sovereign yields and German sovereign yields increased dramatically. We measure the impact of the ECB unconventional measures and in particular of government bonds purchasing programs (SMP and OMT) on the euro-area long-term sovereign spreads. We compare these effects to the impact of sovereign bond purchases by the Fed and the Bank of England on the US and the UK sovereign spreads. To this end,

[27]The response of the UK spread is only indicative and is reported to show the contrast in the UK rates responses compared to the euro area. For more formal analysis of the UK spread we would need to make sure that the important UK announcements (for example Bank of England monetary surprises) do not coincide with the ECB announcements but this analysis is beyond the scope of our study.

we estimate the following equation:

$$\Delta S_t^S = \alpha + \sum_{i=1}^{I} \beta_i NC_{i,t} + \sum_{j=1}^{2} \delta_j Q_{j,t} + \varphi_1 F_t + \varphi_2 C_t + \gamma x_t + \sum_{n=1}^{N} \psi_n \Delta S_{t-n}^S + \sum_{l=1}^{7} \psi_l D_{l,t} + \epsilon_t$$

where $NC_{i,t}$ are dummies for unconventional monetary policy announcements; $Q_{j,t}$ are dummies for the sovereign bond purchase announcements by the Fed (δ_1) and the Bank of England (δ_2); F_t is a dummy for EFSF/ESM announcements; C_t is a dummy for sovereign debt crisis; x is a dummy for the ECB policy rate/policy path surprise; ΔS_{t-n}^S are lagged values of dependent variable included to eliminate the auto-correlations of the residuals for all series with the exception of the UK data where the residuals were not auto-correlated (number of lags for the euro-area series $n = 1$, U.S. series $n = 2$,); $D_{l,t}$ are dummies for the day of the week (Monday, Tuesday...) and ϵ_t is a stochastic error term.

Dependent variable ΔS_t^S is a 1-day change in 10-year sovereign bond spread. The spread is calculated as a difference between the 10-year sovereign bond yield of the euro-area member country (France, Greece, Ireland, Italy, Portugal and Spain) and the 10-year German sovereign bond yield. The spreads for the Germany, the UK and the US are defined as 10-year sovereign bond yield and the 10-year interest rate swap.

Table 8 presents the results for the euro area, Greece, Italy, Ireland, Portugal and Spain, while the Table 9 the results for Germany, France, the UK and the US. The most striking result in the euro area is the impact of the ECB longer-term sovereign bond purchasing program (SMP) which reduced the spreads by 17 bp. This confirms the economic intuition that increasing the demand for these assets would reduce their risk premium as predicted by Vayanos and Vila (2009). The effect is particularly strong for the countries where the risk attained the highest levels: Greece (476 bp), Ireland (117 bp) and Portugal (205 bp). Italy and Spain acknowledge the reduction of respectively 35

and 44 basis points while French and German spreads do not react. The SMP program was announced without any precision about the amounts nor about the regularity of the purchases. The market participant discovered every Monday the quantities of bonds that the ECB purchased. The analysts say that the ECB purchased mostly Greek, Irish and Portuguese bonds which is reflected in regression results.[28]

The SMP was never officially stopped but there was however one more important date, August 7, 2011, as the crisis was about to spread to Italy and Spain. On that day the ECB confirmed its willingness to purchase actively the euro-area sovereign bonds. This announcement was preceded by a positive appreciation of the Italian and Spanish austerity program execution and was unambiguously understood as a promise to buy Italian and Spanish government bonds. We take this announcement into account and report the results in Table 10. The overall SMP effect for the euro-area increased: 23 bp reduction in the benchmark euro spread but the effect is significant only for Italy and Spain (respectively 65 and 84 basis points).

The second sovereign bond purchasing program, OMT, had similar but smaller impact on benchmark euro area sovereign spreads (13 bp). The program was announced in a view of helping Spain and the Spanish spreads reacted the most to that measure (56 bp). The impact for Italian and Portuguese spreads was also significant at 5% (respectively 28 and 43 bp) but for Irish spreads only at 10% (27 bp) and not significant for Greek spreads. Again, the French and German spreads did not react to the announcement. The particular features of OMT might have contributed to smaller response of Greek and Irish bonds. Indeed, when we take into account the speech of Mario Draghi on July 26, 2012, in which he promised to "do whatever it takes to save euro", the response of Greek rates was significant and high: 38 bp (Table 11). The 26-July announcement triggered expectations of targeting a specific level of long-term sovereign spreads that were further dismissed in the final version of the program. The smaller OMT impact could be also linked to the maturity of bonds purchased, smaller than

[28]Reuters, August 1, 2011, "ECB keeps bond-buying programme dormant", article available at http://www.reuters.com/article/2011/08/01/ecb-bonds-idUSEAP50O13520110801.

three years, whereas SMP concerned longer-term bonds. Finally, the smaller impact of subsequent asset purchasing programs seems to be a general response of financial markets, also valid for asset purchases in the U.S. and in the U.K. where the first programs had far greater impact on sovereign bonds and on corporate bond yields than the later programs Meaning and Zhu (2011).

As a comparison, we show that the U.S. and U.K. sovereign spreads also fell following the sovereign bond purchases announced by the Fed and the Bank of England but the magnitude of the effect was much smaller: respectively 5 and 9 basis points.[29] The strong impact in the euro area suggests that the central bank intervention in sovereign market is particularly effective when the sovereign risk is important. The fall of the sovereign bond spreads following the EFSF/ESM announcements (13 bp) confirms that measures aimed at sovereign default risk reduction were effective in diminishing government borrowing costs in the euro area.

Covered bond purchase programs were another measure that reduced the sovereign spreads (7bp). The puzzling result however, is the reaction of the sovereign spreads following the important 3y LTRO announcement. The spreads rise especially in the Southern European countries. The reaction of sovereign spreads to 3y LTRO announcement is opposite to interbank market and covered bond market reactions which were significant and in line with expectations. This result shows that 3y LTRO improved significantly market borrowing costs for the euro-area banks but not governments. Given that 3y loans were granted to banks this comes as no surprise. However, the 3y LTRO announcement significantly *increased* the government borrowing costs. This reaction suggests that there was another "news" in the ECB announcement. Indeed, articles in the press confirm that market participants were expecting the ECB to reactivate its sovereign bond purchase program and they were disappointed as it did not happen.[30] Therefore, the increase in sovereign spreads reflect mostly the market beliefs

[29] We study the impact of the sovereign spreads and not the sovereign yields which is why our results are smaller than the overall yield reduction found by other studies (see Hamilton and Wu (2012), Szczerbowicz (2011) for instance).

[30] 1) "US Stocks Fall As ECB Disappoints On Bond Buying", December 8, 2011, Wall Street Journal;

that stronger measure, sovereign bond buying, would be needed to solve the euro area crisis. The reaction of the sovereign spreads to 3y LTRO seems to confirm that sovereign bond markets in euro area were mostly driven by the market perception of the sovereign default risk and hence the measures that diminished sovereign risk were the most successful in reducing government borrowing costs.

5 Conclusion

The empirical evidence from the event-based regressions shows that that only the most spectacular ECB unconventional monetary policies, namely sovereign bond purchases (SMP and OMT), covered bond purchases (CBPP 1 and 2) and 3-year refinancing operations (3y LTRO), diminished significantly borrowing costs for banks and government. Money market spreads were most relieved after the 3-year loans were distributed to banks (3y LTRO) and after the ECB started buying longer-term bank debt (CBPP 1 and 2) but remained unaffected by smaller liquidity measures which suggests that credit risk was the banks' principal concern.

The covered bond markets reacted the most to long-term sovereign bond purchasing program (SMP) but also to short-term sovereign bond purchasing program (OMT), covered bond purchases (CBPP 1 and 2) and the 3-year LTRO. Covered bonds, as a source of banks long-term refinancing, were reactive to measures addressed to banks (CBPP, 3y LTRO). However, the strong reaction to sovereign bond purchases suggests that this measure had an impact on broader class of long-term assets as it diminished the risk of sovereign default.

Finally, both OMT and SMP had important impact on the cost of government borrowing in countries directly threatened by loosing access to financial markets: the effects range from 35 basis points (Italy) to 476 basis points (Greece). As a comparison, we show that the U.S. and U.K. sovereign spreads also fell following the sovereign bond purchases announced by the Fed and the Bank of England but the magnitude of the

2) "ECB dampens bond-buying hopes", December 8, 2011, Reuters.

effect was much smaller: respectively 5 and 9 basis points. The strong impact in the euro area suggests that the central bank intervention in sovereign market is particularly effective when the sovereign risk is important.

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6 Annexes

A1. Figures

Figure 1: Money market spread and ECB LTROs

Figure 2: Sovereign Spreads and ECB Sovereign Bond Purchases

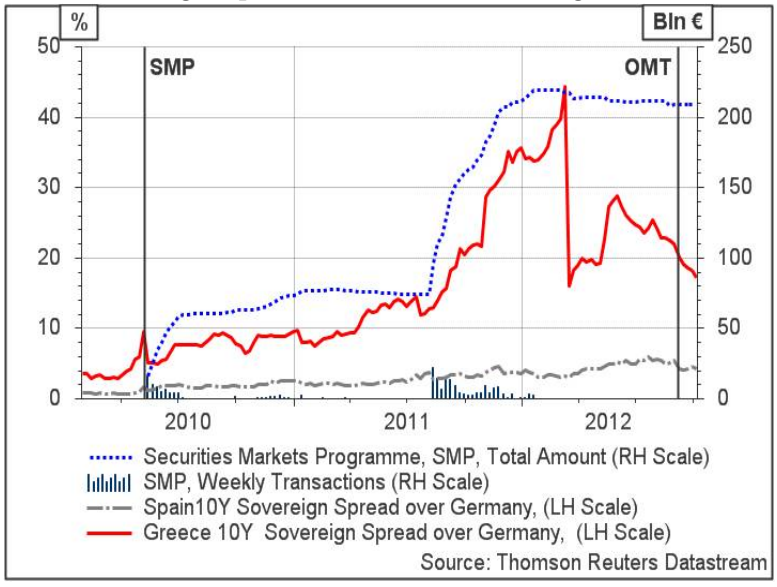
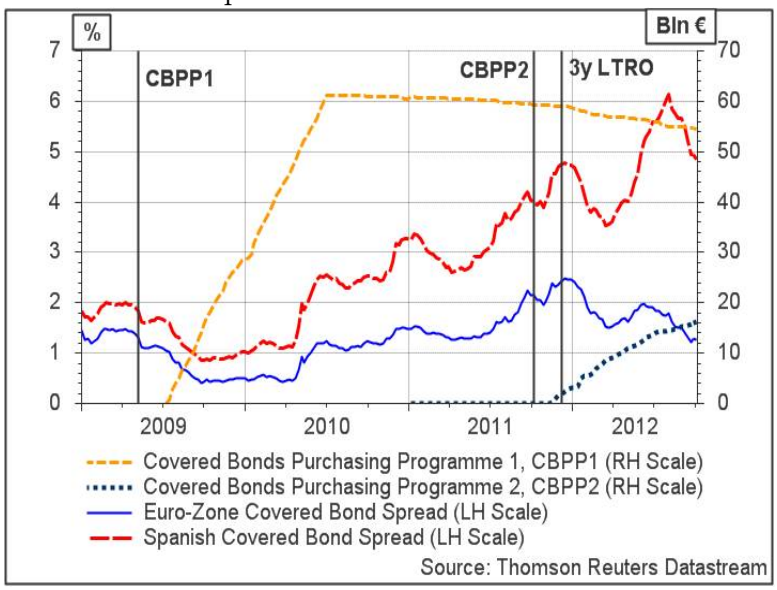


Figure 3: Covered Bond Spreads and ECB Covered Bond Purchases 1 and 2



A2. Tables

Table 1: Fixed-Rate Full-Allotment (FRFA)

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Date	Description of the ECB announcement
08/10/2008	FRFA procedure in the main refinancing operations (MROs) (announced late in the evening and taken into account by markets on 09/10/2008).
13/10/2008	Liquidity in U.S. dollars (currency swaps with the Fed) provided at FRFA procedure.
15/10/2008	FRFA procedure in all longer-term refinancing operations (LTROs).
10/05/2010	Reactivation of FRFA procedure in regular longer-term refinancing operations (LTROs) (the ECB decided to return to variable-rate tender procedures in the regular LTROs on 04/03/2012).

Table 2: Longer-term refinancing operations of maturity above 3 months

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Date	Description of the ECB announcement
28/03/2008	2 supplementary 6-month LTROs (€50 bn)
04/09/2008	Supplementary 6-month LTRO (€25 bn)
07/10/2008	Increase in allotment amount of 6-month LTRO (from €25 to €50bn)
15/10/2008	5 supplementary 6-month LTROs (FRFA procedure)
05/03/2009	ECB will continue with the current frequency and maturity profile of supplementary LTROs for as long as needed, and in any case beyond the end of 2009.
07/05/2009	3 supplementary 1-year LTROs (FRFA)
10/05/2010	Supplementary 6-month LTRO (FRFA)
04/08/2011	Supplementary 6-month LTRO (FRFA)
06/10/2011	Supplementary 12-month and 13-month LTRO (FRFA)

Table 3: Foreign currency arrangements

Date	Currency	Description of the ECB announcement
12/12/2007	USD	Swaps with the Federal Reserve. US dollar liquidity-providing operations up to $20 billion, for a maturity of: 28 and 35 days.
11/03/2008	USD	Swaps with the Federal Reserve increased by $10 billion (up to $30 billion). The ECB commits to provide the USD liquidity for as long as needed.
02/05/2008	USD	Swaps with the Federal Reserve increased by $20 billion (up to $50 billion) and extended to Jan 30, 2009.
30/07/2008	USD	Swaps with the Federal Reserve increased by $5 billion (up to $55 billion). 84-day auction introduced.
18/09/2008	USD	Swaps with Fed expanded to $110 billion.
26/09/2008	USD	Swaps with Fed expanded to $120 billion. 1-week auction introduced.
29/09/2008	USD	Swaps with Fed expanded to $240 billion and extended through April 30, 2009.
13/10/2008	USD	US dollar liquidity-providing at fixed-rate full-allotment basis.
15/10/2008	USD CHF	USD liquidity also through EUR/USD foreign exchange swaps (in parallel with existing tenders against ECB-eligible collateral). Swaps lines with SNB to provide Swiss Francs in euro area.
03/02/2009	USD	Swap lines between the Federal Reserve and ECB extended to October 30, 2009.
25/06/2009	USD CHF	Swap lines between the Fed and ECB extended until February 1, 2010. 1-week Swiss franc liquidity-providing swap operations extended until at least 31 October 2009.
10/05/2010	USD	Reactivation of the swap lines with the Federal Reserve (USD liquidity-providing operations at terms of 7 and 84 days as fixed rate tenders with full allotment).
17/12/2010	GBP	ECB and BOE announce liquidity swap facility: GBP liquidity-providing operations up to £10 billion.
21/12/2010	USD	Swap line between the Federal Reserve and ECB extended to August 1, 2011.
29/06/2011	USD	Swap line between the Federal Reserve and ECB extended to August 1, 2012.
25/08/2011	GBP	Swap line between the BOE and ECB extended to September 28, 2012.
15/09/2011	USD	Fed and ECB decide to conduct 3 USD liquidity-providing operations with a maturity of approx. 3 months covering the end of the year.
30/11/2011	JPY GBP CHF CAD USD	Establishment of a temporary network of reciprocal swap lines with other central banks to provide liquidity operations, should they be needed, in Japanese yen, sterling, Swiss francs and Canadian dollars. ECB reduced the charge for the USD liquidity (-50bp) and extended the size and timing of the swap lines.

Table 4: Collateral easing

Date	Description of the ECB announcement
15/10/2008	ECB expands accepted collateral (until the end of 2009): debt in non-euro currencies; euro-denominated syndicated credit governed by UK law; some debt instruments of credit instruments traded on non-regulated markets (for ex. CDs); some subordinated debt instruments.
07/05/2009	Prolongation until the end of 2010 of the temporary expansion of the list of eligible assets, announced on 15 October 2008.
22/03/2010	Jean Claude Trichet signals the possibility to ease collateral rules if Greek bonds not eligible.
08/04/2010	The ECB reveals its revamped collateral scheme that allows banks to pledge as collateral lower-rated investment-grade debt (also sovereign Greek bonds); certain exceptional collateral no longer accepted from Jan. 1, 2011.
03/05/2010	ECB announces the suspension of the rating threshold for debt instruments of the Greek government
31/03/2011	ECB announces the suspension of the rating threshold for debt instruments of the Irish government
07/07/2011	ECB announces change in eligibility of debt instruments issued or guaranteed by the Portuguese government
21/09/2011	ECB increases the pool of assets it accepts as collateral against loans from Jan1, 2012, accept for ex instruments issued by credit institutions and traded on non-regulated markets but tighten its rules on banks using their own unsecured bonds as collateral
08/12/2011	ECB reduces the rating threshold for some ABS and allowing national central banks to accept credit claims (for ex. bank loans) as collateral.
09/02/2012	ECB relaxes collateral rules; Collateral regulations for ECB loans vary by country (following 8/12/11 that allows additional performing credit claims as collateral)
08/03/2012	ECB reactivates eligibility of Greek bonds as collateral
22/06/2012	ECB reduces the rating threshold and amends the eligibility requirements for certain ABSs
06/09/2012	ECB announces the suspension of the rating threshold for debt instruments of countries that are eligible for OMT or are under an EU-IMF program and comply with the attached conditionality as assessed by the ECB

Table 5: Money Market Spreads

MONEY MARKET SPREADS = 3M unsecured - 3M "safe" rate

3-month	Euribor--OIS	Euribor-Repo	Euribor-German	CD-OIS
Sovereign crisis dummy	0.00	0.00	0.00	0.00
	[0.39]	[0.30]	[0.55]	[0.32]
EFSF/ESM	0.02	0.02*	0.02	-0.01
	[0.27]	[0.09]	[0.64]	[0.86]
ECB policy rates surprises	0.13*	0.04	-0.08	0.13
	[0.08]	[0.80]	[0.38]	[0.34]
Covered Bonds P.P. 1 and 2	-0.21	-0.37*	-0.17*	-0.15**
	[0.11]	[0.10]	[0.07]	[0.03]
Securities Markets Prog.(SMP)	0.19	-0.02	-0.36*	0.01
	[0.45]	[0.93]	[0.05]	[0.96]
Outright Monetary Trans.(OMT)	-0.04	-0.06*	-0.01	
	[0.15]	[0.08]	[0.63]	
Collateral easing	0.02	0.04	0.00	0.03
	[0.42]	[0.24]	[0.97]	[0.35]
3Y LTRO annoucement	-0.24***	-0.20***	-0.06**	
	[0.00]	[0.00]	[0.03]	
3Y LTRO operations	-0.06**	-0.06**	-0.03***	-0.13***
	[0.02]	[0.05]	[0.01]	[0.00]
Fixed-rate full-allotment	-0.38	-0.19	0.15	-0.10
	[0.19]	[0.51]	[0.42]	[0.54]
Longer maturity LTRO	0.13	0.21	0.12	0.10
	[0.31]	[0.12]	[0.22]	[0.12]
Swaps agreements	0.01	0.01	0.04	0.04
	[0.79]	[0.89]	[0.32]	[0.28]
Observations	1,365	1,365	1,278	1,187
R-squared	0.49	0.61	0.33	0.23

*** p<0.01, ** p<0.05, * p<0.1 Robust pval in brackets; Long-run coefficients; Lags of dependent variables, constant and day dummies not reported.

Table 6: Covered bonds: Euro area, Germany, France, UK

COVERED BOND SPREAD = Covered bond rate - German (UK) sovereign bond rate

	Euro area	France	Germany	(UK)
Sovereign crisis dummy	0.01***	0.01***	0.00**	-0.01***
	[0.00]	[0.00]	[0.02]	[0.01]
EFSF/ESM	-0.04***	-0.02***	-0.03***	-0.00
	[0.00]	[0.00]	[0.00]	[0.99]
ECB policy rates surprises	-0.02	-0.02	0.01	-0.02
	[0.48]	[0.40]	[0.58]	[0.25]
Covered Bonds P.P. 1 and 2	-0.06***	-0.04***	-0.08***	0.04
	[0.00]	[0.00]	[0.01]	[0.30]
Securities Markets Prog.(SMP)	-0.20***	-0.08***	-0.12***	0.08
	[0.00]	[0.00]	[0.00]	[0.22]
Outright Monetary Trans.(OMT)	-0.05***	-0.03***	-0.04***	0.09*
	[0.00]	[0.00]	[0.00]	[0.09]
Collateral easing	-0.01	-0.01	-0.01	0.00
	[0.18]	[0.36]	[0.22]	[0.92]
3Y LTRO annoucement	-0.03***	-0.04***	-0.01*	0.10*
	[0.00]	[0.00]	[0.07]	[0.06]
3Y LTRO operations	-0.01	-0.01	-0.01	0.03
	[0.34]	[0.20]	[0.76]	[0.33]
Fixed-rate full-allotment	-0.04	-0.04	-0.03	-0.12***
	[0.13]	[0.23]	[0.41]	[0.00]
Longer maturity LTRO	0.02	0.01	0.04	0.06***
	[0.14]	[0.41]	[0.15]	[0.01]
Swaps agreements	-0.00	0.00	-0.01	-0.02
	[0.83]	[0.60]	[0.12]	[0.15]
Observations	1,368	1,368	1,368	1,369
R-squared	0.13	0.08	0.07	0.04

*** p<0.01, ** p<0.05, * p<0.1 Robust pval in brackets; Long-run coefficients;
Lags of dependent variables, constant and day dummies not reported.

Table 7: Covered bonds: Ireland, Italy, Portugal, Spain

COVERED BOND SPREAD = Covered bond rate - German sovereign bond rate

	Euro area	Ireland	Italy	Portugal	Spain
Sovereign crisis dummy	0.01***	0.01***	0.02***	0.04***	0.02***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
EFSF/ESM	-0.04***	-0.06***	-0.06***	-0.12*	-0.08***
	[0.00]	[0.00]	[0.00]	[0.07]	[0.00]
ECB policy rates surprises	-0.02	-0.01	0.02	-0.01	-0.04
	[0.48]	[0.57]	[0.19]	[0.91]	[0.18]
Covered Bonds P.P. 1 and 2	-0.06***	-0.02	-0.16**	-0.08	-0.07***
	[0.00]	[0.82]	[0.02]	[0.48]	[0.00]
Securities Markets Prog.(SMP)	-0.20***	-0.49***	-0.38***	-1.64***	-0.35***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Outright Monetary Trans.(OMT)	-0.05***	-0.12***	-0.08***	-0.46***	-0.10***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Collateral easing	-0.01	0.02	-0.03	-0.04	-0.02*
	[0.18]	[0.50]	[0.10]	[0.35]	[0.06]
3Y LTRO annoucement	-0.03***	-0.06**	-0.01	0.07	-0.01
	[0.00]	[0.02]	[0.60]	[0.58]	[0.20]
3Y LTRO operations	-0.01	-0.01	-0.04	0.00	-0.01
	[0.34]	[0.69]	[0.16]	[0.98]	[0.31]
Fixed-rate full-allotment	-0.04	-0.07			-0.06**
	[0.13]	[0.15]			[0.05]
Longer maturity LTRO	0.02	0.05	0.08	0.01	0.01
	[0.14]	[0.23]	[0.26]	[0.92]	[0.22]
Swaps agreements	-0.00	0.01	-0.01	-0.01	-0.00
	[0.83]	[0.26]	[0.45]	[0.88]	[0.81]
Observations	1,368	1,368	973	1,018	1,368
R-squared	0.13	0.13	0.17	0.27	0.20

*** p<0.01, ** p<0.05, * p<0.1 Robust pval in brackets; Long-run coefficients;
Lags of dependent variables, constant and day dummies not reported.

Table 8: Sovereign bond spreads: Greece, Ireland, Italy and Spain

SOVEREIGN SPREAD = 10Y Country government bond - 10Y German gov. bond

	Euro area	Greece	Ireland	Italy	Portugal	Spain
Sovereign crisis dummy	0.01**	0.13***	0.02**	0.02**	0.02	0.02**
	[0.04]	[0.00]	[0.01]	[0.05]	[0.20]	[0.02]
ECB policy rates surprises	-0.01	-0.36	-0.02	-0.03	-0.02	-0.06
	[0.15]	[0.30]	[0.74]	[0.19]	[0.83]	[0.20]
EFSF/ESM	-0.13***	-0.24*	-0.52***	-0.28**	-0.46***	-0.43***
	[0.00]	[0.09]	[0.00]	[0.01]	[0.00]	[0.00]
Covered Bonds P.P. 1 and 2	-0.07***	-0.36**	-0.07	-0.21***	-0.07	-0.11
	[0.01]	[0.03]	[0.59]	[0.00]	[0.72]	[0.27]
SMP	-0.17***	-4.76***	-1.17***	-0.35***	-2.05***	-0.44***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
OMT	-0.13***	-0.17	-0.27*	-0.28***	-0.43**	-0.56***
	[0.00]	[0.40]	[0.07]	[0.00]	[0.05]	[0.00]
Collateral easing	-0.02*	0.22	0.03	-0.03	-0.11*	-0.04
	[0.08]	[0.24]	[0.56]	[0.23]	[0.10]	[0.29]
3Y LTRO annoucement	0.20***	1.00***	0.02	0.51***	0.19	0.37***
	[0.00]	[0.00]	[0.87]	[0.00]	[0.38]	[0.00]
3Y LTRO operations	-0.00	-0.03	0.02	-0.01	0.38**	0.05
	[0.95]	[0.84]	[0.82]	[0.94]	[0.01]	[0.52]
Fixed-rate full-allotment	-0.01	-0.02	-0.00	-0.04	-0.01	-0.02
	[0.16]	[0.91]	[0.96]	[0.10]	[0.93]	[0.78]
Longer maturity LTRO	0.01	0.05	-0.07	0.05	-0.01	0.00
	[0.30]	[0.51]	[0.28]	[0.23]	[0.95]	[0.95]
Swaps agreements	-0.01	-0.11	0.02	-0.01	-0.04	-0.01
	[0.52]	[0.42]	[0.60]	[0.70]	[0.43]	[0.74]
Treasuries purchases (US)	0.01	-0.02	0.03	0.01	-0.00	0.03
	[0.34]	[0.71]	[0.56]	[0.67]	[0.95]	[0.44]
Gilt purchases (UK)	0.01	0.03	0.04	0.02	0.05	-0.00
	[0.49]	[0.42]	[0.60]	[0.57]	[0.66]	[0.97]
Observations	1,368	1,368	1,368	1,368	1,368	1,368
R-squared	0.13	0.04	0.19	0.10	0.19	0.17

*** p<0.01, ** p<0.05, * p<0.1 Robust pval in brackets; Long-run coefficients;
Lags of dependent variables, constant and day dummies not reported.

Table 9: Sovereign bond spreads: Germany, France, the UK and the US

SOVEREIGN SPREAD = 10Y Government bond - 10Y Riskfree rate

	Euro area	Germany	France	UK	US
Sovereign crisis dummy	0.01**	-0.00	0.00	-0.00	-0.00
	[0.04]	[0.51]	[0.13]	[0.34]	[0.33]
ECB policy rates surprises	-0.01	0.01	-0.01	0.04	-0.01
	[0.15]	[0.26]	[0.60]	[0.39]	[0.19]
EFSF/ESM	-0.13***	0.02	-0.07***	0.00	-0.00
	[0.00]	[0.11]	[0.00]	[0.61]	[0.93]
Covered Bonds P.P. 1 and 2	-0.07***	-0.00	-0.02	0.06	0.02
	[0.01]	[0.93]	[0.54]	[0.13]	[0.45]
SMP	-0.17***	-0.01	-0.04	-0.01	0.04
	[0.00]	[0.78]	[0.39]	[0.69]	[0.28]
OMT	-0.13***	0.01	-0.05	-0.00	-0.00
	[0.00]	[0.72]	[0.17]	[0.89]	[0.93]
Collateral easing	-0.02*	-0.01	-0.02	-0.01**	-0.01
	[0.08]	[0.25]	[0.14]	[0.04]	[0.50]
3Y LTRO annoucement	0.20***	0.07***	0.20***	-0.00	0.01
	[0.00]	[0.01]	[0.00]	[0.96]	[0.80]
3Y LTRO operations	-0.00	0.00	-0.03	0.01*	0.01
	[0.95]	[0.95]	[0.24]	[0.05]	[0.76]
Fixed-rate full-allotment	-0.01	0.02	-0.01	0.03	-0.02
	[0.16]	[0.27]	[0.70]	[0.43]	[0.15]
Longer maturity LTRO	0.01	0.02	0.01	-0.02	0.00
	[0.30]	[0.11]	[0.62]	[0.20]	[0.72]
Swaps agreements	-0.01	0.00	-0.01	0.01	-0.00
	[0.52]	[0.64]	[0.42]	[0.14]	[0.91]
Treasuries purchases (US)	0.01	0.00	0.01	-0.00	-0.05***
	[0.34]	[0.67]	[0.42]	[0.84]	[0.00]
Gilt purchases (UK)	0.01	0.00	0.01	-0.09**	-0.02
	[0.49]	[0.76]	[0.49]	[0.01]	[0.16]
Observations	1,368	1,368	1,368	1,369	1,367
R-squared	0.13	0.08	0.06	0.06	0.25

*** p<0.01, ** p<0.05, * p<0.1 Robust pval in brackets; Long-run coefficients; Lags of dependent variables, constant and day dummies not reported.

Table 10: Sovereign bond spreads: Greece, Ireland, Italy and Spain (SMP 2nd announcement)

SOVEREIGN BOND SPREAD = 10Y Country gov. bond - 10Y German gov. bond

	Euro area	Greece	Ireland	Italy	Portugal	Spain
Sovereign crisis dummy	0.01**	0.12***	0.02*	0.02**	0.01	0.02**
	[0.05]	[0.00]	[0.09]	[0.05]	[0.40]	[0.01]
ECB policy rates surprises	-0.01	-0.36	-0.02	-0.03	-0.02	-0.06
	[0.15]	[0.30]	[0.62]	[0.19]	[0.66]	[0.19]
EFSF/ESM	-0.12***	-0.83*	-0.68***	-0.23**	-0.69***	-0.35***
	[0.00]	[0.07]	[0.01]	[0.04]	[0.00]	[0.00]
Covered Bonds P.P. 1 and 2	-0.07***	-0.22	-0.04	-0.22***	-0.02	-0.13
	[0.01]	[0.33]	[0.75]	[0.00]	[0.84]	[0.19]
SMP	-0.23***	-1.65	-0.31	-0.65***	-0.77	-0.84***
	[0.00]	[0.21]	[0.41]	[0.00]	[0.15]	[0.00]
OMT	-0.13***	-0.25	-0.29***	-0.27***	-0.46***	-0.55***
	[0.00]	[0.22]	[0.00]	[0.00]	[0.00]	[0.00]
Collateral easing	-0.02*	0.29	0.05	-0.04	-0.08	-0.05
	[0.06]	[0.12]	[0.35]	[0.15]	[0.37]	[0.17]
3Y LTRO annoucement	0.20***	0.93***	0.00	0.52***	0.16*	0.38***
	[0.00]	[0.00]	[0.95]	[0.00]	[0.08]	[0.00]
3Y LTRO operations	-0.00	-0.03	0.02	-0.01	0.38	0.05
	[0.95]	[0.84]	[0.85]	[0.93]	[0.12]	[0.51]
Fixed-rate full-allotment	-0.00	-0.53	-0.15	0.01	-0.22	0.05
	[0.78]	[0.22]	[0.22]	[0.87]	[0.18]	[0.48]
Longer maturity LTRO	0.02	-0.18	-0.13*	0.07*	-0.10	0.03
	[0.16]	[0.34]	[0.08]	[0.10]	[0.18]	[0.49]
Swaps agreements	-0.01	-0.15	0.01	-0.00	-0.06	-0.01
	[0.55]	[0.30]	[0.82]	[0.82]	[0.23]	[0.84]
Treasuries purchases (US)	0.01	-0.02	0.03	0.01	-0.01	0.03
	[0.34]	[0.66]	[0.59]	[0.68]	[0.88]	[0.42]
Gilt purchases (UK)	0.01	0.08	0.05	0.02	0.07	-0.01
	[0.55]	[0.21]	[0.18]	[0.68]	[0.20]	[0.87]
Observations	1,368	1,368	1,368	1,368	1,368	1,368
R-squared	0.15	0.03	0.17	0.14	0.17	0.22

*** p<0.01, ** p<0.05, * p<0.1 Robust pval in brackets; Long-run coefficients;
Lags of dependent variables, constant and day dummies not reported.

Table 11: Sovereign bond spreads: Greece, Ireland, Italy and Spain (OMT 2nd announcement)

SOVEREIGN SPREAD = 10Y Country Government bond - 10Y German gov. bond

	Euro area	Greece	Ireland	Italy	Portugal	Spain
Sovereign crisis dummy	0.01*	0.13***	0.02**	0.01*	0.02	0.02**
	[0.05]	[0.00]	[0.01]	[0.06]	[0.20]	[0.02]
ECB policy rates surprises	-0.01	-0.36	-0.02	-0.03	-0.02	-0.06
	[0.15]	[0.30]	[0.74]	[0.18]	[0.83]	[0.20]
EFSF/ESM	-0.13***	-0.24*	-0.52***	-0.28**	-0.46***	-0.42***
	[0.00]	[0.09]	[0.00]	[0.01]	[0.00]	[0.00]
Covered Bonds P.P. 1 and 2	-0.07***	-0.37**	-0.07	-0.21***	-0.07	-0.11
	[0.00]	[0.03]	[0.61]	[0.00]	[0.73]	[0.27]
SMP	-0.16***	-4.75***	-1.17***	-0.34***	-2.06***	-0.44***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
OMT	-0.17***	-0.38**	-0.18*	-0.39***	-0.37**	-0.57***
	[0.00]	[0.02]	[0.08]	[0.00]	[0.02]	[0.00]
Collateral easing	-0.01	0.23	0.02	-0.02	-0.12*	-0.04
	[0.16]	[0.18]	[0.68]	[0.42]	[0.07]	[0.27]
3Y LTRO annoucement	0.20***	0.98***	0.03	0.50***	0.20	0.37***
	[0.00]	[0.00]	[0.83]	[0.00]	[0.36]	[0.00]
3Y LTRO operations	-0.00	-0.03	0.02	-0.01	0.38**	0.05
	[0.95]	[0.85]	[0.82]	[0.93]	[0.01]	[0.52]
Fixed-rate full-allotment	-0.01	-0.02	-0.00	-0.04*	-0.01	-0.02
	[0.12]	[0.88]	[0.98]	[0.08]	[0.94]	[0.78]
Longer maturity LTRO	0.01	0.04	-0.07	0.04	-0.00	0.00
	[0.33]	[0.54]	[0.29]	[0.25]	[0.96]	[0.97]
Swaps agreements	-0.01	-0.12	0.02	-0.01	-0.04	-0.01
	[0.50]	[0.41]	[0.60]	[0.67]	[0.43]	[0.72]
Treasuries purchases (US)	0.01	-0.02	0.03	0.01	-0.00	0.03
	[0.34]	[0.71]	[0.56]	[0.67]	[0.95]	[0.43]
Gilt purchases (UK)	0.01	0.03	0.04	0.02	0.05	-0.00
	[0.52]	[0.43]	[0.61]	[0.60]	[0.67]	[0.95]
Observations	1,368	1,368	1,368	1,368	1,368	1,368
R-squared	0.14	0.04	0.19	0.12	0.19	0.19

*** p<0.01, ** p<0.05, * p<0.1 Robust pval in brackets; Long-run coefficients;
Lags of dependent variables, constant and day dummies not reported.