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THE IMPACT OF UNCONVENTIONAL MONETARY POLICY ON THE ITALIAN ECONOMY DURING THE SOVEREIGN DEBT CRISIS

by Marco Casiraghi*, Eugenio Gaiotti*, Lisa Rodano* and Alessandro Secchi*

Abstract

We assess the impact on the Italian economy of the main unconventional monetary policies adopted by the ECB in 2011-2012 (SMP, 3-year LTROs and OMTs) by following a two-step approach. We evaluate their effects on money market interest rates, government bond yields and credit availability and then map them onto macroeconomic implications using the Bank of Italy quarterly model of the Italian economy. We find that the SMP and the OMTs have been effective in counteracting increases in government bond yields and that the LTROs have had a beneficial impact on credit supply and money market conditions. From a macroeconomic perspective, we find that the unconventional policies have had a large positive effect on the Italian economy, mainly through the credit channel, with a cumulative impact on GDP growth of 2.7 percentage points over the period 2012-2013. To conclude, while the policies did not prevent the Italian economy from falling into recession, they did avoid a more intense credit crunch and a larger output fall than those actually observed.

JEL Classification: E52, E58, E44.

Keywords: monetary policy, unconventional monetary measures.

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1. Introduction

In recent years many central banks have implemented unconventional monetary measures to counteract the economic effects of the global financial crisis. However, both the instruments used and the problems that they were intended to address have differed significantly. The debate on the effectiveness of the measures is still open.

In this paper we assess the impact on the Italian economy of the main non-standard measures adopted by the European Central Bank (ECB) during the most acute phase of the sovereign debt crisis. The focus on a single country allows us to obtain only a partial assessment of the ECB's measures, which were directed to the entire euro area, but our results provide new insights into the effectiveness of unconventional monetary policies aimed at offsetting the impact on the real economy of financial market disruptions and impediments to the monetary transmission mechanism. From this perspective, our paper contributes significantly to the literature on non-standard monetary measures, which has focused mainly on their ability to stimulate the economy when short-term interest rates are at the zero lower bound.

During the summer of 2011 sovereign debt market tensions resurfaced in some euro-area countries. The strains affected Italy directly and were rapidly transmitted to the banking sector and other segments of the domestic financial market. Corporate bond yields and money market spreads soared, interbank loans dried up, and stock indexes plummeted. The effects were amplified both by the abrupt interruption of capital flows among euro-area countries and by the sudden funding freeze faced by banks on international markets. The adverse impact on the cost and availability of credit to the private sector led to a sizeable drop in aggregate demand.¹ In the summer of 2012 fears of a possible break-up of the euro area aggravated financial tensions and further increased the cross-country disparities in monetary conditions.

In response the ECB took several unconventional measures. It reactivated the Securities Markets Programme (SMP) and extended it to Italian and Spanish government bonds in August 2011, it granted three-year loans to banks (3-year Longer-Term Refinancing Operations, LTROs) in December 2011 and in February 2012, and it announced the Outright Monetary Transactions (OMTs) in September. These instruments were designed to support market segments that were

¹ According to estimates by Albertazzi et al. (2012), in Italy the increase in the cost of lending to firms due to the movements in sovereign spreads reached 2 percentage points at the end of 2011. Aggregate and cross-country evidence of the effects of the sovereign debt crisis on euro-area economies is provided by Neri and Ropele (2013).

dysfunctional, foster bank liquidity, avert a credit crunch and dispel the fears of a euro-area break-up.

We assess the impact of these unconventional monetary policies on the Italian economy using a two-step approach. First, we use measure-specific econometric methodologies to address the issue of heterogeneity across the policy instruments adopted. In detail, we use an event-study methodology to estimate the impact of the 3-year LTROs on money market interest rates and that of the OMTs on government bond yields. As for the influence of the SMP on government bond yields and of the 3-year LTROs on credit availability, we run several types of regression. In the second step, we map the estimated effects on money market interest rates, bond yields and credit availability onto their macroeconomic implications using the Bank of Italy's quarterly model of the Italian economy (BIQM). This model provides sound estimates of the impact of the unconventional measures on the main Italian macroeconomic variables and also allows us to identify the transmission channels for each measure and isolate the specific contribution of changes in interest rates and in credit availability.

Our results suggest that the SMP, the 3-year LTROs and the OMTs have been effective in offsetting undue increases in government bond yields and easing money markets tensions, with a positive and significant impact on credit supply. Transmitted mainly through the credit channel, the policy measures induced a cumulative output growth response equal to 2.7 percentage points in 2012-2013. In considering these findings, one should bear in mind that a full counterfactual scenario is beyond the scope of this paper. The ECB's unconventional policies may have avoided a generalised collapse of financial and credit markets, which cannot be studied using the standard econometric tools insofar as the effects would have been very large and highly non-linear. Nevertheless, our analysis provides an estimate that may be interpreted as a lower bound of the overall macroeconomic impact of the unconventional monetary policy measures considered.

The paper contributes to the literature in a number of ways. First, we study the most acute phase of the sovereign debt crisis, which has not yet been covered by research on the macroeconomic effects of the ECB's unconventional measures. Second, the results for the so-called "peripheral" countries are almost non-existent, as to date the literature has focused on the euro area as a whole. Yet it is precisely those countries that have been affected most severely by the market disruptions, and they accordingly constitute the most suitable gauge for assessing the effectiveness of the measures. Third, our estimation strategy overcomes one crucial weakness of the existing

literature, mainly based on VAR models, on the impact of non-standard policy measures, namely the use of very rough proxies for ECB interventions (e.g. the change in the size of the Eurosystem balance sheet), which fail to capture the peculiarities of the different instruments.² On the contrary, our two-step approach combines state-of-the-art estimation methodologies to evaluate the specific effects of each measure on financial markets and credit availability with a rigorous and consistent mapping of these effects to their macroeconomic consequences, through the BIQM. Finally, the flexibility of the BIQM allows us to take fully into account the impact of the sovereign debt crisis on the monetary transmission mechanism. In particular, we take into consideration that the financial tensions impaired the standard transmission channels and activated new ones that do not normally play a significant role.

The remainder of this paper is organized as follows. Section 2 reviews the evidence on the effects of the unconventional measures adopted by the ECB during the financial and the sovereign debt crisis. Section 3 describes the main channels of monetary transmission included in the structure of the BIQM and discusses how they have been affected by the sovereign debt crisis and the ECB's measures adopted in 2011-2012. Section 4 presents the estimates of the effects of the SMP, the two 3-year LTROs and the OMTs on market yields and on credit supply in Italy based on regression analyses and on high-frequency event studies. In Section 5 we assess the overall effects of the measures on the main Italian macroeconomic variables using the BIQM and, in particular by simulating the response of the economy to a set of shocks on interest rates and credit availability of the same magnitude as those estimated in Section 4. Section 6 concludes.

2. A survey of the existing evidence on the effectiveness of the ECB's unconventional policy measures

The empirical literature on the effectiveness of unconventional monetary policy is growing rapidly. A large part of the most recent analyses seeks to gauge the macroeconomic impact of large-scale asset purchases designed to provide additional monetary stimulus when short-term rates are at the zero lower bound.³ The general finding is that the purchases did in fact sustain the economy, but there is still considerable uncertainty about the effective magnitude of their contribution. However,

² On the other hand, analyses that assess the effects of specific measures are unsuited for evaluation of the overall macroeconomic impact by construction.

³ Surveys of the evidence on the macroeconomic impact of these measures are provided by Cecioni et al. (2011), Santor and Suchanek (2013) and IMF (2013). These surveys also report some evidence on the effectiveness of the measures adopted in the early stages of the financial crisis and after the bankruptcy of Lehman in contrasting illiquidity and financial markets' freezes.

the evidence on the macroeconomic effects of the non-standard measures to counter impediments to the policy transmission process, like those adopted by the ECB during the most acute phase of the sovereign crisis, is still very scanty.⁴

This leaves open the question of whether unconventional monetary policy also has positive macroeconomic effects when it is addressed to specific market failures, which could arise because of a crisis of confidence or worst-case expectations in a situation of multiple equilibria (Meier, 2009; Stone et al., 2011; Kozicki et al., 2011). From a theoretical perspective, this hypothesis is supported by the analysis of Curdia and Woodford (2011), who find that targeted asset purchases by the central bank can be effective if the financial markets are sufficiently disrupted and are likely to be ineffective otherwise (see also Gertler and Karadi, 2011). Similarly, the consensus among European monetary policymakers is that monetary policy can do much, although it cannot overcome the crisis by itself (Visco, 2013).

According to an opposite view, monetary interventions are less effective in presence of extremely tight credit (Kozicki et al., 2011) and increasing the liquidity supply may not produce more lending when banks are under stress or the value of collateral is too low (Stiglitz, 2012). Weidmann (2012) argues that both liquidity provision and outright monetary operations may be ineffective in the euro area because they fail to get at the causes of the crisis of confidence, namely the need for structural adjustments in banking and in public finances.

Papers that provide evidence on the effectiveness of specific unconventional measures adopted by the ECB in response to the sovereign debt crisis are scarce. The empirical analysis on the impact of the SMP asset purchases is summarized by Manganelli (2012), who reports the results of three papers. The first is De Pooter et al. (2012), who use an asset pricing model to determine the liquidity premium implicit in sovereign bond prices and regress this premium on weekly SMP purchases. They find that each percentage point of outstanding bonds purchased lowered the liquidity premia by around 20 basis points on impact and 5 basis points in the long-run. The second, Eser and Schwaab (2012), estimates that for large countries like Italy a total purchase of €50 billion resulted in a persistent cumulative reduction of around 90 basis points in government bond yields. The analysis uses a panel of daily data for bond yields and SMP interventions and addresses the problem of endogeneity by controlling for the effect on yields of unobserved news flows via a

⁴ Some evidence on the financial market effects of the unconventional measures adopted by the ECB before the start of the sovereign debt crisis is presented in Cecioni et al. (2011) and in ECB (2011). Eser et al. (2012) provide a detailed description of the non-standard measures implemented by the ECB since 2009.

factor modelling methodology. Finally, Ghysels et al. (2012) regress yield changes on SMP interventions at high frequencies (15 minutes) to overcome the endogeneity problem that arises with daily data. They find that a €100 million intervention has an immediate impact on bond yields of between 0.1 and 25 basis points, depending on the size of the market. Furthermore, their empirical investigation reveals that SMP purchases also reduced the volatility of targeted bond yields.

A more recent work, Eser and Schwaab (2013), using daily data on five euro-area countries, finds that on average €1 billion of purchases lowered 5-year Italian government bond yields by between 1 and 2 basis points on impact. To investigate persistence, the authors use a dynamic specification that allows for the possibility of lagged effects on yields from contemporaneous purchases. The estimated long-run effect for Italy is equal to 1.9 basis points per €1 billion. Overall the literature suggests that the SMP has been effective in contrasting increases in bond yields and that the quantitative impact of asset purchases in the euro area has been greater than in the US or the UK.⁵ This evidence supports the hypothesis that unconventional monetary policy is more effective when it addresses specific market failures.

The impact of the SMP, the 3-year LTROs and the OMTs on both liquidity and credit risks in the interbank market is analysed by Dubecq et al. (2013), who use a quadratic term structure model of the Euribor-OIS spreads. Liquidity risk reflects banks preference for a portfolio of cash and easy-to-liquidate swap contracts over interbank loans, enabling them to cope with potential future liquidity needs; credit risk corresponds to the premium required by the lender to compensate for borrower default risk. Their results suggest that the SMP had no effect on interbank premia, whereas the announcement of 3-year LTROs progressively reduced liquidity premia by around 50 basis points; according to their estimates the OMTs also helped ease liquidity risk.

As for the overall macroeconomic impact of the ECB measures, all the contributions focus on the period between the Lehman Brothers bankruptcy and the summer of 2011. Accordingly, none of them bear on the effectiveness of any of the unconventional measures we study, except for Darracq-Paries and De Santis (2013), who analyse the macroeconomic impact of the two 3-year LTROs. On the assumption that the effect of that measure coincides with the credit supply shocks indicated in the responses to the euro-area Bank Lending Surveys, the authors estimate a panel-

⁵ As a reference, the range of estimates suggests that quantitative easing in the US had a permanent impact on 10-year government bond yields of between 22 and 40 basis points per \$100 billion purchased, while the program in the UK lowered yields on 10-year Gilts by between 25 and 50 basis points per £100 billion purchased.

VAR for eight euro-area countries and conclude that the LTROs lifted the prospects for real GDP, with the peak of the effect between 0.7 and 1.0 percentage points by mid-2013.

Some works have assumed that the macroeconomic impact of unconventional measures can be measured simply by assessing their effects on specific segments of the financial market. For instance, Lenza et al. (2010) assume that the main effect of the non-standard measures adopted by the ECB after the collapse of Lehman Brothers in the autumn of 2008 was to reduce the spread between unsecured and secured money market rates. Comparing VAR-based forecasts of the main euro-area macroeconomic variables conditional on the observed path of money market spreads and those based on a no-policy scenario, they conclude that credit dynamics would have been much more depressed without the ECB intervention, and industrial output growth and inflation would have been 3 and 0.5 percentage points lower, respectively, in 2010.

Giannone et al. (2011) compare the actual dynamics of euro-area monetary and credit variables over the period from late 2008 to early 2010 with those simulated from a Bayesian VAR, estimated on pre-crisis data. They find that the prediction errors for some variables are not statistically significant and interpret this as evidence of the success of the unconventional measures in offsetting the shocks related to the financial crisis. Other macroeconomic variables behave more erratically, however, implying some limits to the ECB's ability to resolve the underlying structural problems in the financial sector.

Some of the other papers based on VAR models use proxies for the ECB measures that fail to capture the peculiar nature of each instrument. Peersman (2011), investigating the period 1999-2009, takes changes in the size and composition of the Eurosystem balance sheet as a gauge of the ECB's effort to expand bank credit. Defining an "unconventional monetary policy shock" as an innovation to bank credit induced by monetary policy actions that are orthogonal to changes in the policy rate, he estimates that the effects of such shocks on output and inflation are similar to those of conventional monetary policy, although the impact on prices is weaker and less persistent. Gambacorta et al. (2012), who estimate a panel structural VAR with monthly data from eight advanced economies from January 2008 to June 2011, use a similar approach to quantify the unconventional measures and get similar results. Giannone et al. (2012) look directly at the evolution of the aggregates immediately affected by non-standard measures (in particular banks' balance sheets) and construct a gauge of the policy shock constituted by the ECB's increasing role

as a financial intermediary.⁶ They find that unconventional monetary policy increased industrial production by 2 per cent and lowered the unemployment rate by 0.6 percentage points two years after the failure of Lehman Brothers. Finally, Ciccarelli et al. (2013) suggest that the ECB unconventional measures partly mitigated the disruption of the credit channel in the distressed countries.

Methodologically, the paper most closely related to ours is that of Locarno and Secchi (2009), but these authors do not cover the period following the outbreak of the sovereign debt crisis. Their results suggest that the abundant provision of liquidity in the euro area after the bankruptcy of Lehman Brothers narrowed the spread between unsecured and secured interbank rates and reduced short-term lending rates in Italy. The authors measure the impact of this interest rate change on output growth using the Bank of Italy quarterly model and conclude that the non-standard policies of the ECB prevented a further cumulative decline up to almost 2 per cent in Italian output over the period 2009-2011. However, the study does not consider the impact of credit rationing during the crisis.

Overall, to the best of our knowledge, there is no country-level evidence on the macroeconomic effects of the wide range of unconventional measures adopted by the ECB during the most acute phase of the sovereign debt crisis.

3. The unconventional monetary measures of the ECB and the channels of monetary transmission in the Bank of Italy's quarterly model

In order to estimate the macroeconomic impact of the ECB unconventional measures, we use the Bank of Italy quarterly model of the Italian economy.⁷ This strategy seems the most appropriate because the BIQM includes several channels that allow taking precisely into account how the ECB unconventional measures affected the Italian economy, as well as the way in which the sovereign debt crisis impaired the monetary transmission mechanism. These channels are summarised in Figure 1.

⁶ This approach extends that of Giannone et al. (2011), which relies on the evolution of interest rate spreads as a proxy of the effects of the unconventional measures.

⁷ The BIQM is used to provide short- and medium-term projections, for policy evaluation exercises, for counterfactual analyses and for the coordination of economic analysis within the Research Area of the Bank of Italy. Like most traditional macroeconomic models, it is Keynesian in the short run and akin to the Solow model of exogenous growth in the long run. It contains some 800 equations, nearly 100 of which are stochastic. See Buseti et al. (2005).

In the monetary transmission mechanism as captured in the BIQM, changes in the key ECB rates are transmitted to the term structure of interest rates. The BIQM measures this effect through variations in the 1-year T-bill rate (BOTs) and the long-term yield on Treasury bonds (BTPs), which correspond to short-term and long-term rates. Changes in the term structure affect bank lending rates, which in turn directly influence investment in construction, through different mortgage rates, and inventories accumulation. Moreover, bank lending rates and long-term interest rates affect the cost of capital, which, together with the real long-term rates, has an impact on firms' and households' intertemporal investment and consumption decisions.⁸

The sovereign debt crisis significantly altered the monetary transmission mechanism, impeding the standard channels and activating new ones. There were three main effects. First, the spread between the yield on 10-year BTPs and the corresponding risk-free rate increased dramatically starting in summer 2011, breaking the usual relationship between the ECB-driven short-term interest rates and long-term rates (Fig. 2).⁹

Second, the surge in credit and liquidity risk, which was associated with growing national segmentation of interbank markets, resulted in an unprecedented rise in risk premia on money market interest rates in some euro-area countries. Italian banks had to pay a large premium on their secured as well as their unsecured borrowing (Fig. 3, top panels and bottom left panel). The increase in secured money market rates also reflected the lower collateral value of Italian sovereigns. On top of these country-specific shocks, in late 2011 tensions hit the whole area-wide interbank market, with a sharp rise in the spread between interest rates on unsecured 3-month interbank loans (Euribor) and the risk-free rate of that maturity (Overnight Indexed Swaps, OIS; Fig. 3, bottom right panel).

Third, the increase in sovereign yields and the tensions in the interbank market affected not only the cost but also the availability of funding for Italian banks. There ensued an unprecedented increase in quantitative constraints on the availability of credit to the private sector, exacerbating the disparity of monetary conditions between Italy and the countries less affected by the crisis. The index of credit supply restriction derived from the responses of Italian banks to the Bank Lending Survey peaked at end-2011 (Fig. 5).

⁸ Overall, through these channels a decrease of 50 basis points of both the short- and long-term rates normally increases the GDP level by around 0.35 per cent after two years.

⁹ The widening of Italian sovereign spreads reflected both a “wake-up call” form of contagion, implying increased sensitivity to domestic fundamentals (Giordano et al., 2013), and the upsurge in the perceived risk of a euro area break-up (Di Cesare et al., 2012).

As we argued above, the BIQM can take full account of the changes to the monetary transmission mechanism since summer 2011. We can consider the impact of the tensions in the government bond market on bank lending rates. Specifically, in the BIQM 90 per cent of a change in government bond yields is transmitted to lending rates within six quarters, a feature that is broadly confirmed by recent studies on the pass-through of interest rates during the sovereign debt crisis.¹⁰ Furthermore we take into account how higher money market rates have affected both short- and long-term rates and, in turn, aggregate demand. Finally, whereas in the BIQM quantitative constraints to credit availability are not a relevant channel of transmission in normal times, recent research suggests that when they are binding they may have a significant and non-linear impact on investment.¹¹ We estimate and include these effects in the BIQM using the approach developed by Rodano (2011).

To estimate the impact of the sovereign debt crisis, we run simulations based on the BIQM; they confirm that disruptions in the monetary transmission mechanism played a major role in pushing the Italian economy into recession. Higher interest rates and tighter credit constraints cut about 1 percentage point from the growth rate in 2012, about one third of the unexpected economic slowdown that year.¹² Simulations also suggest that the effects would have been even larger if interest rates and credit constraints had not partially receded from their end-2011 peaks.¹³ Our goal is to quantify the contributions of the unconventional measures adopted by the ECB after the sovereign debt crisis had hit Italy.

The ECB has taken unconventional monetary measures since 2007 in the form of ample liquidity, fixed-rate full-allotment refinancing operations, currency swaps and purchases of uncovered bonds. Some of these instruments have been enhanced and others introduced since mid-2011. Their main features are reported in Table 1. The Securities Markets Programme (SMP) was set up in May 2010 and enhanced in August 2011, when purchases were re-activated and extended to Italian and Spanish government securities. Over the life of the programme, a face value of around

¹⁰ If anything, the results of Albertazzi et al. (2012) suggest that the lending rate impact of movements in sovereign yields tends to be slightly greater during periods of financial turmoil.

¹¹ The evidence provided in Gaiotti (2013), based on firm-level data, confirms that in recessions an increase in credit constraints has large effects on investment.

¹² Banca d'Italia (2013). The decomposition is derived by comparing a simulation of the model where the exogenous variables are set at the profiles expected in the summer 2011 projection exercise, i.e. before the sovereign debt crisis accelerated, with a simulation using their realized values.

¹³ In addition, deterioration in credit and monetary conditions could be further amplified by an adverse feedback loop, indicated with a dotted line in Figure 1 (lower GDP and higher interest rates increase the volume of bad loans which, in turn, affects banks' profits and the supply of credit). However, this channel is not envisaged in the standard version of the BIQM in the simulations reported in this paper.

€100 billion in Italian sovereign bonds was purchased.¹⁴ In December 2011 the ECB announced two longer-term refinancing operations (LTROs) with an extended maturity of 3 years, tendered at a fixed rate tender with full allotment. At the same time collateral eligibility criteria were substantially broadened to ensure that banks had enough borrowing capacity to satisfy their current and future liquidity needs.¹⁵ Italian banks borrowed a total of close to €250 billion. Finally, in an interview given at the end of July 2012, President Draghi announced that the ECB would “do whatever it takes” to defend the euro. In the next two months, the ECB announced the guidelines and the operational details of a program of Outright Monetary Transactions (OMTs), i.e. secondary market purchases of government bonds with a maturity between one and three years, with no ex ante volume limit.¹⁶ To date the OMTs have not been activated for any country.

The channels through which the several ECB unconventional measures were intended to counteract the effects of the sovereign debt crisis and restore proper monetary transmission are also shown in Figure 1. The SMP was designed to counter undue yield volatility and ensure depth and liquidity in dysfunctional government bond market segments. In the BIQM, the consequent reduction in risk premia corresponds to lower short- and long-term yields on public securities.¹⁷ Note that these operations had no impact on money market interest rates because the effects on liquidity were sterilised. The LTROs, instead, were intended to improve banks’ liquidity conditions in order to defuse the threat of an impending funding crisis and avert a credit crunch. In the BIQM, the measure eases credit availability conditions, which has a direct effect on investment, and decreases interbank market spreads, which affects the interest rate term structure. And as the effects of the LTROs on excess liquidity were not sterilized, an additional effect could be a lower euro-area overnight rate, but this effect seems likely to be minor. The purpose of the OMTs is to eliminate “tail risks” and preclude destructive scenarios in a context of multiple equilibria. Although most of its effect is likely to be felt on the shorter part of the yield curve where the OMTs would operate, long-term rates might also fall due the attenuation of the perceived redenomination risk.

¹⁴ As announced by the ECB on 10 May 2010, the Eurosystem conducts specific operations in order to absorb the liquidity injected through the SMP and ensure that the monetary policy stance is not affected by this purchase programme.

¹⁵ The availability of collateral was significantly reduced in some banking systems by increased borrowing, the fall in collateral asset prices and more frequent margin calls.

¹⁶ OMTs will be considered by the ECB if deemed necessary from a monetary policy perspective. They may be carried out only for the securities of countries that request an EFSF or ESM financial assistance programme and that comply with its conditions. For the purchases under the OMT, the Eurosystem will not have preferred creditor status. As with the Securities Markets Programme the liquidity created with the OMT will be sterilized.

¹⁷ At the end of 2012 the average maturity of Italian sovereign securities in the SMP portfolio was 4.5 years.

4. Approach and results

The methodology is in two stages. The first, which departs from past research, uses specific estimation approaches to gauge the impact of each of the ECB’s unconventional measures on financial market conditions and the availability of credit. In particular, we estimate two regressions, based on detailed data on the purchases of Italian sovereign bonds under the SMP and on the reaction of individual banks’ credit conditions to 3-year LTROs. We also perform high-frequency event studies on the effects on short- and long-term interest rates of the announcements related to LTROs and OMTs. In the second stage, we map the estimated effects onto their macroeconomic implications for Italy using the Bank of Italy quarterly model of the Italian economy (BIQM).

4.1. SMP interventions

To evaluate the impact of the SMP on Italian government bond yields, we regress daily changes in bond yields on SMP purchases and a series of additional variables that control for other factors that affected yields.¹⁸ The inclusion of these extra variables is particularly important owing to endogeneity. In fact, yields and bond purchases under the SMP reacted to a partially overlapping set of factors, such as changes in market confidence and in risk appetite for Italian government bonds. Since valid instruments are not readily available, we include suitable control covariates that can proxy for the factors affecting yields.¹⁹ The econometric specification can be written as:

$$(1) \quad \Delta r_t = f(SMP_purchases_t, \Delta r_{t-1}, \Delta X_t)$$

where Δr_t is the daily change in the yield on Italian sovereign bonds at either 2-year or 10-year maturity; $SMP_purchases$ is the daily volume of purchases of Italian securities, in billions of euro; ΔX_t is a vector of covariates that control for other factors affecting Italian yields, which serves as a benchmark, i.e. the yield that would have obtained in absence of interventions, given actual economic and financial developments. In particular, these controls include a measure of the “risk-free” interest rate (interest rate swaps, IRS), which is intended to capture the dynamic of the economic outlook and the expected course of policy rates. In addition to IRS, we take a series of other variables, which proxy for the severity of tensions in financial markets and in particular the Italian government bond market (CDS spreads on Italian bonds, stock market indices, volatility

¹⁸The section updates the results presented in Secchi (2012).

¹⁹An analogous approach is adopted by Eser and Schwaab (2013).

indexes, capital outflows measured via Italian Target2 flows, the slope of the yield curve and the spread between the IRS and the yield on German Bunds). As a robustness control, we include the *SMP_purchase_dummy*.²⁰ This variable captures the average impact of unobservable factors (say, a change in confidence) that affected both yield dynamics and SMP interventions and, by their very nature, cannot be controlled by the other variables in the regression. Therefore, this dummy makes an additional contribution to addressing the endogeneity bias.

The estimates of equation (1), reported in Table 3, show a substantial effect of purchases of Italian securities on daily yield movements: €1 billion in bond purchases lower both the 2- and the 10-year yields by between 2 and 5 basis points. Most of the control variables have the expected sign and in many cases are highly significant.²¹ The results of the regressions are robust to the inclusion of the *SMP_purchase_dummy* (columns 3 and 4). Its positive coefficient may indicate the presence of unobservable financial strains on the days when the Eurosystem decided to intervene in the Italian government bond market.

The results are also robust to a range of controls and specifications. The estimates do not change if we remove the variables that do not affect yields in a statistically significant way. More importantly, the results are not sensitive to variations in the sample period, such as restricting it to the dates on which the SMP intervened in the Italian government bond market or considering only the period up to late February 2012 when the SMP made its last purchases; nor are they sensitive to the inclusion of extra covariates (e.g. a Monday dummy to control for recurrent patterns of financial market performance).

Overall, the magnitude of the effects is broadly consistent with the range of currently available estimates of the effectiveness of the SMP. According to our most conservative estimates, the total impact comes to around 200 basis points for both 2- and 10-year BTP yields, since the overall purchases of Italian securities over the whole life of the SMP amounted to slightly more than €100 billion. As a comparison, Eser and Schwaab (2013) conclude SMP permanently reduced Italian yields by about 190 basis points. The estimates obtained by De Pooter et al. (2012) are smaller (approximately 0.5 basis points for each €1 billion of purchases), but this measure is likely to be biased downward because the authors do not control for endogeneity.

²⁰ This dummy variable is equal to 1 in those days in which the SMP purchased Italian government bonds (0 otherwise).

²¹ As expected, increases in IRS and sovereign CDS spreads increase BTP yields, while higher stock market returns and a steeper yield curve (which are inverse measures of financial market tensions) decrease BTP yields.

Our estimates are larger than those commonly found in the literature on central bank purchases of government bonds in the US and the UK.²² This difference is consistent with the view that non-standard measures are more effective when they are designed to rectify a particular impairment in financial markets than when they are intended to provide additional stimulus at the zero lower bound.

In any case, the worsening of sovereign spreads was not interrupted; they continued to widen throughout the second half of 2011, peaking in November. This can be explained by the simultaneous, continuous deterioration in the fundamental determinants of sovereign yields, which suffered from uncertainty on the prospects for the Italian economy and domestic economic policies, as well as from doubts on European policies. In our specification these underlying factors are represented by the evolution of sovereign CDS spreads, stock market indices and measures of market dysfunctions, like the slope of the BTP yield curve and the spread between interest rate swaps and yields on German Bunds. In short, if SMP asset purchases had been held to zero, the yields on Italian government bonds would have been much higher than those actually observed. The predicted values of the 2- and 10-year BTP yields obtained using equation (1) and the actual evolution of their determinants, while keeping SMP purchases at zero, are shown in Figure 4.

4.2. The 3-year LTROs and credit supply

The effects of the 3-year longer term refinancing operations are estimated by two different approaches. First we use event studies, discussed in the next section, to evaluate the impact on Italian interbank interest rate spreads. Second, we exploit the determinants of the Bank Lending Survey (BLS) index of credit supply to estimate the effect on credit availability. These effects are both “direct”, in that the LTROs relaxed banks’ liquidity constraints, and “indirect” because they also eased individual banks’ access to the interbank market and lowered their funding costs. To this end, we take advantage of the possibility to merge bank-specific BLS answers with bank-level information on impaired loans and interbank market rates.

In our empirical approach, the BLS index of credit supply has a crucial role. In this respect we borrow from some existing literature (Darracq-Paries and De Santis, 2013 and Ciccarelli et al., 2013) that exploits the information in the BLS to achieve identification, but we also go one step further to directly estimate the effects of the LTROs on credit availability conditions.

²² See note 6.

We construct an unbalanced panel at quarterly frequency that includes all eleven Italian banks that have ever participated in the BLS. The dependent variable is the degree of tightening of credit supply conditions, as reported by each bank in the BLS. This variable consists of a qualitative index that admits five ordered answers, namely “tightened considerably”, “tightened somewhat”, “basically unchanged”, “eased somewhat”, and “eased considerably”. Following the literature, we assign values 1, 0.5, 0, -0.5, -1, respectively, to those responses. We complement this qualitative information with bank-specific liquidity measures, represented by the rates paid on the interbank market, and with their credit risk, proxied by the flow of new impaired loans. We also consider aggregate information on interbank market tensions and economic prospects, such as the Euribor-Eonia swap spread, the spread between Italian and German government bond yields and the Purchasing Managers’ index (PMI).

To assess the impact of the 3-year LTROs on credit availability, we estimate several different regression equations linking the bank-level BLS index with the aforementioned set of aggregate and individual variables, which control for the main factors influencing credit supply conditions. We include an LTRO dummy to capture the “direct” impact of the measure on credit availability. Our baseline specification is:

$$(2) \quad BLS_{i,t} = f(BLS_{i,t-1}, LTRO_dummy_t, Euribor_spread_t, overnight_spread_{i,t}, BTP_spread_t, \Delta impaired_loans_{i,t}, y_t, \Delta y_t)$$

where i denotes the bank, t indicates the quarter, BLS is the quarterly BLS supply index, $LTRO_dummy$ takes value 1 in 2012:q1, $Euribor_spread$ is the difference between the 3-month Euribor and the corresponding Eonia swap, $overnight_spread$ is the difference between the overnight rate paid on the Italian interbank market and the Eonia, BTP_spread is the spread between the 10-year Italian government bond yield and the corresponding German rate, $\Delta impaired_loans$ is the ratio of the flow of new impaired loans in the previous 4 quarters to total loans, and y and Δy correspond to the PMI index and its quarter-on-quarter growth.

We use a fixed-effect estimator that controls for unobserved bank-level effects. The baseline estimation results are reported in the first two columns of Table 4.²³ The LTRO dummy has a

²³ It has been shown that in panels with a limited number of periods a fixed-effect estimator may result in downward-biased estimates, but we consider the time dimension of our panel (36 quarters) to be long enough.

significant “direct” impact on credit supply conditions, reducing the BLS index by around 0.2. Credit conditions respond significantly to changes in the availability of liquidity, tightening when the aggregate or the bank-specific interbank rate increases. The coefficients on the Euribor spread and the individual overnight spread are positive and significant. The BLS index is persistent over time, as shown by the lagged dependent variable’s coefficient, which is around 0.4. Credit conditions also depend on the economic outlook, given that the coefficient on the quarterly growth of the PMI index is significant. By contrast, changes in impaired loans do not appear to be significant.

Columns (3) to (6) in Table 4 present a series of robustness tests. Column (3) shows that our estimate of the “direct” impact of the LTROs is robust to the inclusion of dummies for the Lehman Brothers failure (2008:q3) and the Italian sovereign crisis (2011:q4).²⁴ The results presented in column (4) assess the persistence of the “direct” effect of the LTROs on credit conditions by including an additional LTRO dummy that takes value 1 from 2012:q2 to 2012:q4 and 0 in the rest of the time sample: the “direct” effect of LTROs on credit conditions observed for the first quarter of 2012 turns statistically insignificant in the rest of the year. One possible explanation is that the injection of liquidity by the ECB counteracted the adverse effects of the strong capital outflows in that period on Italian banks’ lending capacity.

One further econometric issue is the way in which we mapped the answers to the BLS survey onto numerical values. In order to control for bias, we consider two additional econometric specifications, whose outcomes are presented in columns (5) and (6) of Table 4. In detail, column (5) presents the results of an ordered probit estimation, which is the most appropriate approach for ordered qualitative dependent variables.²⁵ Although the ordered probit and fixed-effects linear regression estimates are not directly comparable as regards the size of the coefficients, the results are substantially equivalent both in terms of the statistical significance and signs of the coefficients, as well as in their economic implications.²⁶ And column (6) shows that the estimates do not change even when a very few extreme answers to the BLS (7 observations) are excluded so as to have a

²⁴ The inclusion of the Lehman and the Italian sovereign crisis dummies reduces the impact of the interbank spreads. This result is hardly surprising, as the two events are very important for measuring the spreads’ effect on credit conditions. Further regressions, not presented here, show that as theory suggests the Lehman event is more important for the assessment of the impact of Euribor-OIS spreads on credit conditions and the Italian sovereign debt crisis is essential in gauging the effect of the bank-level Italian overnight spread.

²⁵ This regression, however, does not control for the impact of the lagged qualitative dependent variable and for bank-level fixed effects. To the best of our knowledge standard estimation strategies for fixed effects dynamic ordered probit are still unavailable.

²⁶ The economic implications are not shown here, but they can be derived by considering the change in marginal probabilities and the quantitative metrics used for the BLS supply index.

binary dependent variable and thus largely circumvent the problems connected with the ordinal nature of the BLS index.

All in all, the magnitude of the correlation coefficients indicates that the LTROs had a “direct” impact on credit supply and that interbank market spreads are an important determinant of lending conditions. The next section addresses the thesis that the operations may have helped to normalise interbank market conditions and thus had a more persistent “indirect” effect through lower spreads.

4.3. Event study – LTROs

In order to estimate the impact of the 3-year LTROs on financial market yields, we use a high-frequency event study methodology, measuring and evaluating the statistical significance of the effects of an announcement on a financial asset based on yield changes in small temporal windows surrounding the event.²⁷

We identify three major events: the announcement of the 3-year LTROs and the first and second settlements. For each we focus on the change in selected interest rates in the two days around the event and test the null hypothesis of no effect to determine whether the change is statistically significant. In particular, we consider two sets of interest rates. The first includes interbank interest rates, namely the spread between the overnight rate on the Italian interbank market (e-MID, “mercato interbancario dei depositi”) and the Eonia, and the spread between the yield on 3-month interbank loans collateralised by Italian sovereign securities and the average yield on those backed by French and German sovereigns. The second set includes yields on the sovereign bonds, namely medium- and long-term yields on Italian securities (secondary market Treasury bond yield at the 2-year and 10-year maturity). We also analyse the changes in the spread between those bond yields and the corresponding spread vis-à-vis the interest rate swap with the same maturity, which can be interpreted as a proxy for variations in risk and liquidity premia.

Table 5 reports the results. All in all, they indicate that the LTROs affected money market rates very substantially. The initial announcement of the LTROs on December 8 was not followed by any significant yield changes, but both the first and the second auctions were followed by

²⁷ Event studies have been used widely to measure the impact of the unconventional measures adopted by the major central banks (see, for example, Gagnon et al., 2011 and Swanson, 2011).

statistically and economically significant reductions in all market spreads.²⁸ As a reference, the last two rows of the table report the cumulative change in each interest rate over the three events considered and over the entire period between the announcement of LTROs and the settlement of the second operation. These figures confirm that the changes that took place around the event dates were persistent, since they are close to the total change over the period considered. The interest rates paid by Italian banks on the interbank market dropped by 70 to 100 basis points.

Although the direct effects of the LTROs on long-term sovereign yields also played a prominent role in the public discussion, our event studies do not find any immediate reaction of government bond yields to the announcements. Nor can the gradual but significant fall in Italian long-term yields in the three months following the LTROs be easily be attributed to the monetary operations alone, because the financial markets were also affected by other news.²⁹

The overall effect of the LTROs on credit supply conditions implied by both our regression analysis and our event study can be estimated by combining the two sets of results. Figure 5 reports the outcome of a dynamic simulation of equation (2) assuming no LTROs. That is, *LTRO_dummy* is set to 0 and it is assumed that each bank faced an overnight rate 90 basis points higher beginning in 2012:q1, consistently with the result of the first event study. The Euribor spread is held constant at the level reached in the most acute phase of the sovereign crisis, which corresponds to a maximum of 60 basis points more at the end of 2012.³⁰ In this simulation the response of the BLS index is equal to 0.4 and basically constant over time, mainly reflecting the permanent decrease in the interbank market rates paid by Italian banks.

4.4. Event study – OMTs

We perform a second event study to determine the effect of the ECB's Outright Monetary Transactions on interest rates. In this case, we consider three events: the speech by President Draghi on 26 July 2012 announcing that the ECB would do "whatever it takes" to contrast yield movements due to redenomination risk and the ECB Governing Council meetings of 2 August and 6 September 2012, first making public the broad guidelines of the OMTs and then communicating

²⁸ If anything, the effect of the announcement on the overnight rate and on 10-year yields had the wrong sign. An interpretation is that the market was disappointed by the announcement, because it was expecting an enhancement of the SMP.

²⁹ The decrease of the yields on Italian sovereign bonds started in the second half of January 2012, after a series of successful auctions on the primary market for Italian securities.

³⁰ Our assessment of the impact of the 3-year LTROs on Euribor-OIS spreads is in line with the results of Dubecq et al. (2013) summarized in Section 2.

the complete operational details for the operations. For each event, we consider the same set of money market rates and of sovereign yields as in the previous section.

The results, shown in Table 6, are broadly symmetrical to those set out in the previous section. The estimates suggest that the impact of the OMTs on money market rates was negligible but that on sovereign yields was sizeable and almost entirely frontloaded. A large and significant decrease in all the yields took place around Draghi's speech (Table 6, first row). The effect was concentrated on the shorter end of the curve, where yields decreased by more than 100 basis points, but it also affected the longer end. After the August meeting of the Governing Council, long-term rates did not move but shorter rates fell further (Table 6, second row). This result is likely to be a consequence of the announcement that interventions were to be concentrated on the short segment. Long-term rates fell again around the Council's September meeting (Table 6, third row). The last two rows of the table suggest that most of the movements in government bond yields and risk premia around event dates were persistent.

5. Macroeconomic assessment

Using the Bank of Italy's quarterly econometric model, we combine all the estimates obtained in the previous section to assess the effect that the three unconventional policy measures considered had on the main Italian macroeconomic variables. Note that our purpose is not to construct a complete counterfactual macroeconomic scenario, which cannot be done by standard econometric methodologies in view of the powerful non-linear dynamics that would have marked the economic variables in an extreme scenario of complete market collapse, which the ECB's measures may well have averted. On the contrary, to evaluate the economic effects of the unconventional measures we consider an alternative scenario in which the financial tensions remain around the levels observed at the worst of the sovereign crisis. Our results can be interpreted, in a word, as a lower bound of the impact of the unconventional policies.

In order to derive the macroeconomic impact, we need to construct the time series of the overall effect of the unconventional measures on interbank rates and on the yields on 1- and 10-year Treasury securities and the index of credit conditions, over the period 2012-2013. We then impose these profiles on the BIQM, as if they were exogenous, and run a simulation under this alternative

scenario.³¹ By comparing these results with the baseline scenario of actual data for 2012 and projections for 2013 we derive a measure of the responses of the main Italian macroeconomic variables to the unconventional monetary measures.

The alternative scenario is set out in Table 7. The Italian overnight unsecured rate and the 3-month collateralized rate are 70 and 90 basis points higher, respectively, from the first quarter of 2012 on. Government bond yields are also higher: the 1-year and 10-year yields are 120 basis points higher in third quarter 2011 and 200 points higher starting the next quarter, due to the impact of SMP. The OMTs lowered the short-term and the long-term rates on sovereign bonds by an additional 180 and 95 basis points in the fourth quarter of 2012.³² Finally, we consider a permanent upward shift of 0.4 for the BLS credit supply index, starting from the first quarter of 2012.

The main results are shown in Figure 6, which reports the responses of output, investment, consumption, employment, credit supply, loan rates, prices, the government budget deficit and banks' new non-performing loans to the unconventional monetary measures. For each variable, the blue line shows the percent deviation from the alternative scenario over the period 2011-2013.³³ Separately, the figure also reports a red line that corresponds to the percent deviation due to the interest rate component of the unconventional instruments.³⁴ Therefore, the distance between the blue and the red lines represents the portion of the effect on each variable that is due to the improved credit availability.

Four considerations stand out.

First, the effects of the unconventional measures on the real economy are certainly substantial. At the end of 2013, GDP is higher by almost 3 per cent. Most of the positive impact results from an increase in investment, which is 21 per cent higher, due to its great sensitivity to credit conditions. Consumption reacts comparatively less, being about 2.5 per cent higher at the end of 2013. The more subdued response of consumption to changes in interest rates and credit availability reflects, among other factors, the relatively low indebtedness of Italian households. Moreover, a relatively large share of household wealth consisted in housing and is thus associated

³¹ The four variables considered as exogenous in the simulation are indicated with an * in Figure 1. For the purposes of the simulations, feedbacks from the macroeconomy to these variables (normally not included in the BIQM) are not contemplated, although they may be considered in further developments of this research.

³² They also have some impact in the third quarter of 2012. 1-year yields are 120 and 10-year yields 50 basis points higher.

³³ The responses of interest rates, the deficit-to-GDP ratio and the ratio of bad loans are in terms of absolute differences.

³⁴ This is calculated as the response obtained keeping credit availability in line with actual data.

with a low propensity to consume out of capital gains. Overall, the effect on the labour market is substantial, with employment almost 1.5 per cent higher at the end of the simulation horizon. Given these results, it is clear that while they were unable to prevent recession, the unconventional measures avoided a much deeper depression for the Italian economy. The average yearly effect of the unconventional policy measures, summarized in Table 8, indicate that the Italian GDP growth rate would have been lower by 1.1 percentage points in 2012 and 1.6 points in 2013.³⁵

Second, the cost and quantity of bank loans respond strongly, indicating the relevance of the credit channel. Lending rates are almost 2.5 percentage points lower at the end of 2013, while lending to firms is 8 per cent higher, due to the loosening of credit constraints and the decrease in rates. Once again, the credit responses indicate that the unconventional operations may have averted an even worse situation. Although bank lending continued to decrease in Italy in 2012, the direct effect on supply conditions measured by the BLS and the transmission of lower sovereign yields to bank lending rates via the interest rate structure greatly attenuated the decline in lending to firms, both in 2012 and in 2013 (Fig. 7).³⁶ The former effect is consistent with recent work by Del Giovane et al. (2013) who find, using microdata on bank loans and information from the BLS survey, that the tightening of credit conditions triggered by the sovereign debt crisis sharply restricted credit growth. The latter is consistent with the findings of Albertazzi et al. (2012) that sovereign spreads were largely transmitted to bank lending rates.

Third, the improvement in credit availability is an important channel for the transmission of unconventional measures to the economy. As is shown by the red lines in Figure 6, the loosening of constraints on credit availability accounts for two thirds of the GDP response at the end of 2012 and almost half at the end of 2013. For investment in machinery, the contribution is greater still. The effects of lower interest rates build up more slowly, but they are economically significant at the end of the simulation horizon.

Fourth, unconventional operations also had major effects on important variables that are not usually considered in discussing monetary policy outcomes. For instance, the ratio of the government budget deficit to GDP ratio decreases by 1.6 percentage points at the end of the simulation horizon and the improvement is due not only to the effect of lower yields on interest outlays but also to higher growth. The flow of new impaired bank loans, as a ratio to outstanding

³⁵ In 2012 the Italian GDP shrank by 2.4 per cent. Most projections for 2013 are for a further decline of between 1.3 and 1.9 per cent.

³⁶ Lending to Italian firms fell by 2.0 per cent year-on-year in 2012.

credit, also decreases substantially, a decline estimated at almost 0.4 percentage points at the end of 2013. The amelioration in credit quality reflects the effect of lower interest rates and higher growth on firms' profits and cash flow.

6. Conclusions

In order to estimate the impact of the non-standard measures adopted by the ECB in 2011 and 2012 (SMP, 3-year LTROs, OMTs) on the Italian economy, we first adopted specific estimation approaches to measure the impact on money market interest rates, government bond yields and credit availability and then mapped the estimated effects onto their macroeconomic implications, taking advantage of the Bank of Italy quarterly model of the Italian economy.

The first conclusion is that the SMP has been effective in contrasting undue increases in government bond yields. This conclusion is based on a set of regressions linking daily changes in bond yields with SMP purchases and a series of control variables. The estimates indicate that the effect of the SMP on Italian government bond yields is around 2 basis points per billion euros purchased.

Second, the LTROs had a significant impact on credit supply, mainly through a sizeable reduction in money market spreads, associated with the revival of the interbank market. Although bank lending continued to decrease in Italy in 2012, this result suggests that the unconventional operations may have avoided a much more severe credit restriction and helped to counteract the decline in lending to firms both in 2012 and 2013.

Third, the announcement and the design of the OMTs had very large frontloaded effects on the sovereign bond market. Yields on Italian government bonds decreased sharply after President Draghi's speech at the end of July 2012, and the improvement was reinforced by the ECB Governing Council announcements in early August and September.

From a macroeconomic perspective, our simulations indicate that the unconventional measures have had a powerful effect on the Italian economy through several channels. Based on the standard elasticities included in the BIQM, the cumulative GDP growth response comes to 2.7 percentage points over the period 2012-2013. One of the main channels of transmission is the improvement in credit availability, in particular through its impact on investment.

The simulations also show that the set of unconventional operations had a favourable effect on relevant macroeconomic variables that are usually not emphasised in discussions on the effectiveness of monetary policy. We find that the deficit-GDP ratio improves greatly thanks to the combination of lower interest expenses and higher growth. The flow of new impaired bank loans decreases, as lower interest rates and higher growth support businesses' profits and cash flow. There accordingly appears to be good reason to believe that the unconventional policies helped avoid a further worsening of the adverse spiral between sovereigns, banks and growth.

All in all, while the Securities Markets Programme, the 3-year Longer-Term Refinancing Operations and the Outright Monetary Transactions did not prevent the Italian economy from falling into recession, they did keep it out of a much deeper depression. Even so, interest rates did not completely regain their pre-crisis levels, credit conditions remained relatively tight, and business lending continued to contract, although less sharply than would otherwise have been the case. These findings support the thesis that some of the underlying causes of the sovereign debt crisis could not be addressed and solved by monetary policy alone. Nevertheless, our results provide powerful evidence for the argument that the unconventional monetary measures supported economic activity by avoiding a further downward spiral of the crisis of confidence and a much more severe credit crunch.

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TABLES

Table 1 – The ECB’s three main unconventional operations in 2011-2012

	Description of the measure	Date announced	Date implemented	Objective	Details	Amounts: euro area and Italy
Securities Markets Programme	Outright transactions in the secondary euro-area public and private debt securities markets.	On 10 May 2010, the central banks of the Eurosystem started purchasing securities. On 8 August 2011 the program was enhanced, announcing that "the ECB will actively implement its Securities Markets Programme".	Active from May 2010 (on Italian securities, from August 8, 2011) to February 2012. Formally terminated in September 2012.	To ensure depth and liquidity in those market segments that were dysfunctional, to restore an appropriate monetary policy transmission mechanism and effective conduct of monetary policy	The impact of interventions is sterilised so as to ensure that the monetary policy stance is not affected.	Holdings of euro area securities on December 2012 (nominal amount): 218 bn.; holdings of Italian securities on December 2012 (nominal amount): 102,8 bn.
3-year Long Term Refinancing Operations	Two longer-term refinancing operations with maturity of 36 months.	8 December 2011	First auction: 21 December 2011, settlement 22. Second auction: 29 February 2012, settlement 1 March.	To avert a credit crunch, addressing the risk of a funding and liquidity crisis for the banking system	Collateral eligibility was broadened. The operations were conducted as fixed rate tender procedures with full allotment. The rate in these operations is fixed at the average rate of the main refinancing operations over the life of the respective operation. Banks are endowed with the option of early repay 3-year LTROs after one year.	Total gross borrowing by euro area banks: 1020 bn.; total gross borrowing by Banca d'Italia counterparts: 255 bn.
Outright Monetary Transactions	Outright transactions in secondary sovereign bond markets	First announced by Draghi's speech, 26 July 2012; guidelines announced on 2 August 2012; details announced on 6 September 2012	No member state has yet applied	To serve as a backstop to contrast "tail risks" on the sovereign debt market due to fears of a euro area break-up and a return to national currencies ("redenomination risk").	No ex-ante quantitative limits. Programme conditionality a necessary prerequisite (a member state must be under an EFSF/ESM programme). Interventions focused on sovereign bonds with a maturity of between one and three years. ECB accepts the same treatment (pari passu) as other creditors. Full sterilization of liquidity created is planned.	n.a

Sources: ECB and Bank of Italy.

Table 2 – Determinants of the 2012 recession in Italy according to the Bank of Italy quarterly model
(percentage points)

	2012
GDP growth in a scenario of no sovereign debt crisis (1)	1.1
<i>Determinants of the revisions:</i>	
Sovereign interest rates and spreads	-0.4
Firms' difficulties in obtaining credit	-0.6
Budgetary measures	-1.1
Slowdown of the world economy	-0.7
Uncertainty and confidence	-0.6
Residual component	-0.1
Actual GDP growth	-2.4

Source: BIQM simulation, updated from Banca d'Italia (2013). (1) Published growth projection in July 2011.

Table 3 – Effects of SMP on Italian government bond yields
(OLS regressions, daily data)

Dependent variable, yield change on:	BTP 2-year	BTP 10-year	BTP 2-year	BTP 10-year
	(1)	(2)	(3)	(4)
SMP purchases (bn. euros)	-0.02** (0.01)	-0.02* (0.01)	-0.05*** (0.01)	-0.05*** (0.02)
SMP intervention dummy (1)			0.07*** (0.02)	0.07*** (0.02)
lagged Δ yield	-0.02 (0.04)	0.04 (0.05)	-0.03 (0.04)	0.03 (0.05)
Δ IRS 2y (10y)	0.56*** (0.20)	0.11 (0.16)	0.52** (0.19)	0.09 (0.16)
Δ CDS sov. 2y (10y), Italy	0.29*** (0.05)	0.29*** (0.06)	0.29*** (0.05)	0.29*** (0.06)
$\Delta\%$ stock market index (banks), Italy	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)
Δ volatility bund (options)	-0.02 (0.02)	-0.03 (0.03)	-0.02 (0.02)	-0.03 (0.02)
Δ target balance, Italy	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Δ slope BTP term structure	-1.14*** (0.08)	-0.15** (0.07)	-1.13*** (0.08)	-0.14* (0.07)
Δ spread IRS - Bund 10y	-0.18 (0.23)	-0.17 (0.23)	-0.19 (0.22)	-0.18 (0.22)
Constant	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	-0.01 (0.01)
Excluding 8 Aug. 2011	yes	yes	yes	yes
Sample start	Aug.11	Aug.11	Aug.11	Aug.11
Sample end	Sept.12	Sept.12	Sept.12	Sept.12
Nobs	283	283	283	283
R2	0.80	0.44	0.81	0.46

Notes: Standard errors in parentheses; ***, **, * denote statistical significance at the 1%, 5%, 10% level; Dependent variable: daily change in yields on government bonds, percentage points; (1) Dummy is equal to 1 in case of SMP intervention; 0 otherwise.

Table 4 – Effects of LTROs on credit availability
(quarterly data)

Dependent variable	BLS _{i,t} , bank-level degree of tightening of credit conditions (a)					
	(1)	(2)	(3)	(4)	(5)	(6)
lagged BLS _{i,t}	0.37*** (0.08)	0.37*** (0.09)	0.37*** (0.08)	0.37*** (0.08)		0.32*** (0.10)
Dummy LTRO _t (2012:1q)	-0.15** (0.06)	-0.18*** (0.04)	-0.16** (0.04)	-0.18*** (0.04)	-0.58*** (0.20)	-0.15*** (0.04)
Dummy LTRO _t (2012:2q - 2012:4q)				-0.04 (0.07)		
Euribor-OIS spread _t	0.15*** (0.05)	0.13** (0.05)	0.08 (0.05)	0.13** (0.05)	0.82*** (0.30)	0.15*** (0.05)
Overnight (e-Mid) - Eonia spread _{i,t}	0.28** (0.11)	0.24*** (0.08)	0.11 (0.16)	0.25*** (0.09)	0.98*** (0.33)	0.20* (0.10)
BTP-Bund 10 - year spread _t	-0.01 (0.02)					
Δ banks' impaired loans _{i,t} (1q-lead)	0.06 (0.04)	0.04 (0.03)	0.05* (0.03)	0.05 (0.03)	0.37** (0.18)	0.01 (0.03)
PMI _t	0.00 (0.01)					
Δ% PMI _t (q-on-q)	-0.74** (0.28)	-0.66** (0.27)	-0.70** (0.27)	-0.71** (0.04)	-5.19*** (2.14)	-0.59*** (0.19)
Dummy Lehman _t (2008:3q)			0.26*** (0.03)			
Dummy Sov. crisis _t (2011:4q)			0.16* (0.06)			
Estimation procedure	OLS (a)	OLS (a)	OLS (a)	OLS (a)	ordered probit	OLS (a; b)
Including banks' fixed-effects	yes	yes	yes	yes	no	yes
Sample start	2003:q1	2003:q1	2003:q1	2003:q1	2003:q1	2003:q1
Sample end	2012:q4	2012:q4	2012:q4	2012:q4	2012:q4	2012:q4
Nobs	275	275	275	275	285	264
Number of banks	11	11	11	11	11	11
R2	0.39	0.39	0.42	0.39	0.13	0.39

Notes: Standard errors in parentheses, clustered by date; ***, **, * denote statistical significance at the 1%, 5%, 10% level. (a) In OLS regressions the dependent variable is an index taking values based on each bank's answers on credit conditions: "eased considerably" (-1), "eased somewhat" (-0.5), "basically unchanged" (0.0), "tightened somewhat" (0.5), and "tightened considerably" (1.0). (b) Regression based on a slightly restricted sample that includes only "no change" and "tightened somewhat" answers.

Table 5 – Effects of LTROs announcements on Italian interest rates (1)
(basis points)

Event	Money market interest rates		Sovereign bond yields			
	Spread Italian overnight (2)	Spread Italian collat. 3-month (3)	2-year BTPs	10-year BTPs	Spread 2-year BTPs over IRS	Spread 10-year BTPs over IRS
Announcement LTROs (8 Dec. 2011)	23**	-2	31	37**	29	41*
Settlement 1 st LTRO (22 Dec. 2011)	-76***	-63***	1	19	3	21
Settlement 2 nd LTRO (1 Mar. 2012)	-37***	-5	-39	-28	-33	-27
<i>Memo</i>						
Cumulated change over the above events	-90	-70	-8	28	0	35
Cumulated change over the period (7 Dec. 2011 - 2 Mar. 2012)	-103	-99	-391	-108	-356	-64

Notes: (1) Cumulative two-day change around the announcement. (2) Spread between the overnight interest rates on e-MID and EONIA; overnight interest rate on e-MID computed as a weighted average (by volume of transactions) of the interest rates observed in the small-size and large-size segments of the market. (3) Spreads between the Italian collateralized 3-month interest rates and the average collateralized 3-month interest rates observed in France and in Germany. ***, **, * denote statistical significance at the 1%, 5%, 10% level; statistical significance is not provided for cumulative changes.

Table 6 – Effects of OMT announcements on Italian interest rates (1)
(basis points)

Event	Money market interest rates		Sovereign bond yields			
	Spread Italian overnight (2)	Spread Italian collat. 3-month (3)	2-year BTPs	10-year BTPs	Spread 2-year BTPs over IRS	Spread 10-year BTPs over IRS
Draghi's London speech (26 Jul. 2012)	-2	-1	-116***	-49***	-112***	-62***
ECB Governing Council (2 Aug. 2012)	2	-2	-64**	12	-67**	6
ECB Governing Council (6 Sep. 2012)	-3	-1	-21	-46**	-23	-55**
<i>Memo</i>						
Cumulative change over the above events	-3	-3	-201	-83	-202	-112
Cumulative change over the period (25 Jul. 2012 - 7 Sep. 2012)	-5	4	-270	-139	-255	-145

Notes: (1) Cumulative two-day change around the announcement. (2) Spread between the overnight interest rates on e-MID and the EONIA; overnight interest rate on e-MID computed as a weighted average (by volume of transactions) of the interest rates observed in the small-size and large-size segments of the market. (3) Spreads between the Italian collateralized 3-month interest rates and the average collateralized 3-month interest rates observed in France and in Germany. ***, **, * denote statistical significance at the 1%, 5%, 10% level; statistical significance is not provided for cumulative changes.

Table 7 Summing-up of the main results

	Approach	Main findings	Overall estimated effects
SMP	Time-series regressions	Interventions by the Eurosystem significantly affect the level of Italian government bond yields	<u>10-year and 2-year BTP:</u> cumulative decrease by about 200 b.p. starting from 2011:q3.
	Time-series regressions	The Italian BLS credit supply index was significantly affected by the LTROs (both directly and through reduction of premia in interbank market)	<u>BLS supply index:</u> permanent decrease by about 0.4 beginning in 2012:q1.
3-year LTROs	Event study	When the LTROs were implemented, premia on the Italian interbank market fell (while bond yield did not react).	<u>Premia on Italian interbank market:</u> permanent decrease by 70-100 b.p. starting from 2012:q1.
	Event study	At dates of OMTs announcements, premia on Italian medium and long-term BTPs fell (while interbank interest rates did not react)	<u>10-year BTP yields:</u> cumulative decrease by 95 b.p. starting from 2012:q3. <u>2-year BTP yields:</u> cumulative decrease by 180 b.p. starting from 2012:q3.

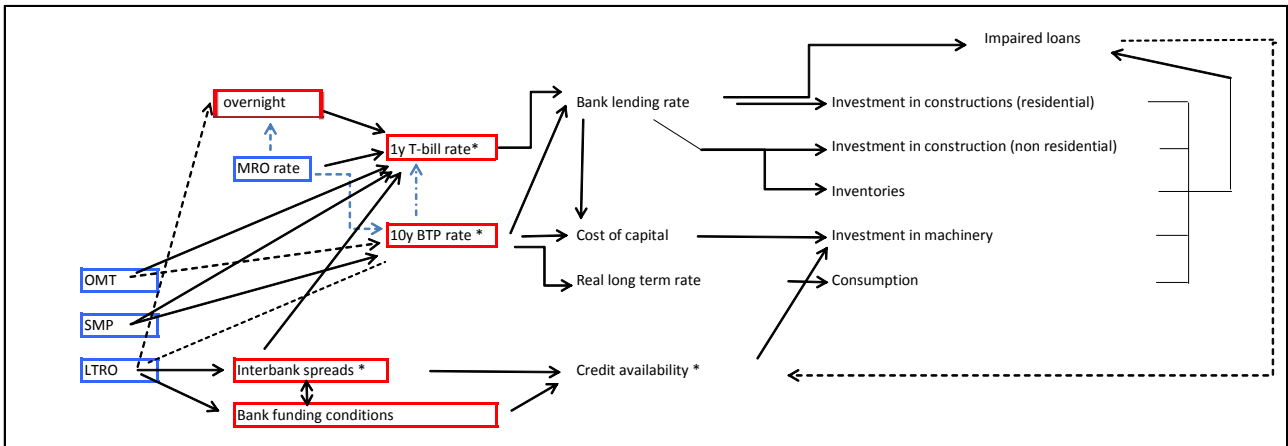
Table 8 – Macroeconomic effects of the unconventional shocks
(growth rates, differences with respect to baseline; percentage points)

	Total		Via interest rates		Via credit availability	
	2012	2013	2012	2013	2012	2013
GDP	1.1	1.6	0.4	1.1	0.7	0.6
Exports	0.1	0.0	0.0	0.0	0.1	0.0
Imports	2.6	3.1	0.5	1.8	2.2	1.6
Household consumption	0.7	1.2	0.6	1.0	0.1	0.2
Investment	5.4	10.3	0.1	4.3	5.4	6.5
- in machinery	12.5	21.7	0.0	6.3	12.7	16.5
- in construction	0.4	3.8	0.3	3.0	0.1	0.8
- residential	0.4	3.7	0.4	3.3	0.0	0.4
Lending to firms	1.4	4.0	0.6	2.3	1.0	1.8
Consumer credit	0.8	3.0	0.8	2.9	0.0	0.2
Mortgages	1.5	6.5	1.4	6.1	0.0	0.4
	0.0	0.3	0.0	0.1	0.0	0.2
Consumption deflator	0.0	0.2	0.0	0.1	0.0	0.1
Unemployment rate	-0.2	-1.5	-0.2	-0.9	0.0	-0.5
Government deficit (%GDP)	-1.1	-1.6	-0.4	-1.1	-0.7	-0.6

Source: Bank of Italy quarterly model simulation. *Notes:* The effects via interest rates and credit availability may not add up to the total effect reported in the table due to rounding and non-linearities in the BIQM.

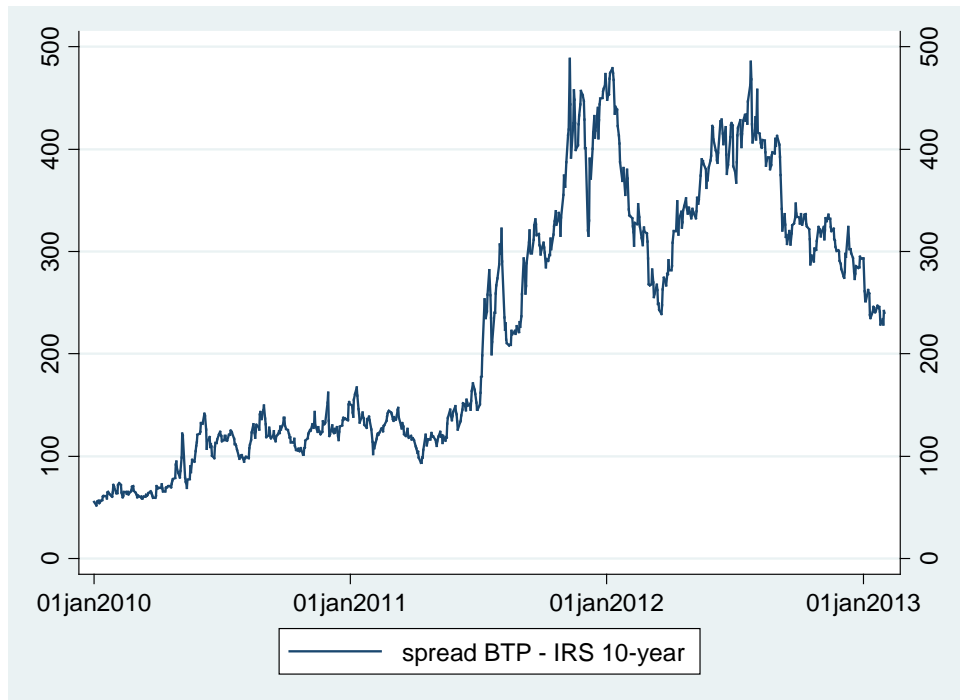
FIGURES

Figure 1 – Monetary transmission in the Bank of Italy quarterly model and unconventional operations



Notes: policy tools are reported in blue boxes and variables directly affected by the sovereign debt crisis in red boxes.

Figure 2 – Evolution of risk premia on Italian 10-year sovereign bonds
(basis points)



Source: Bloomberg. Notes: Spread between the yield on 10-year BTPs and the corresponding Interest Rate Swap (IRS).

Figure 3 – Evolution of risk premia on the interbank markets

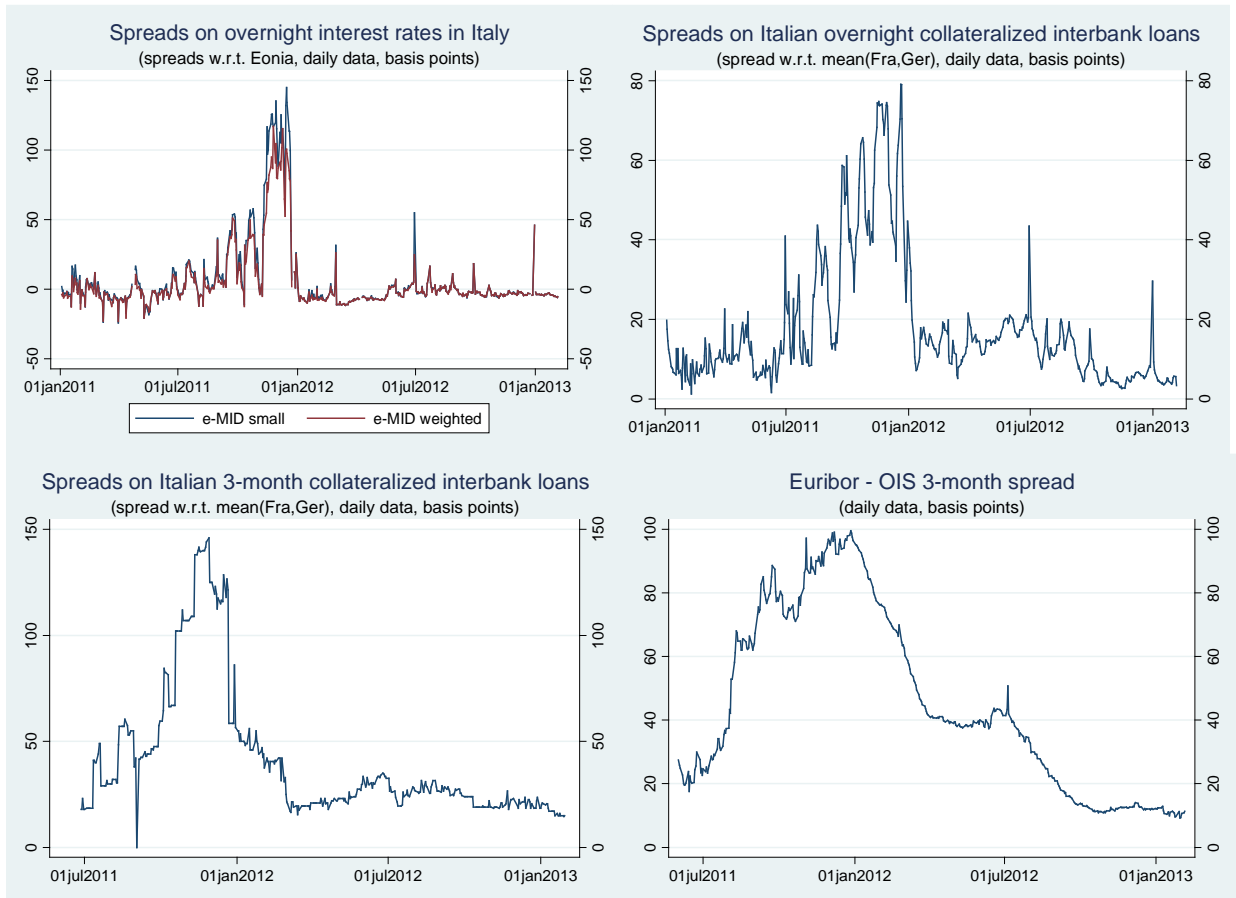
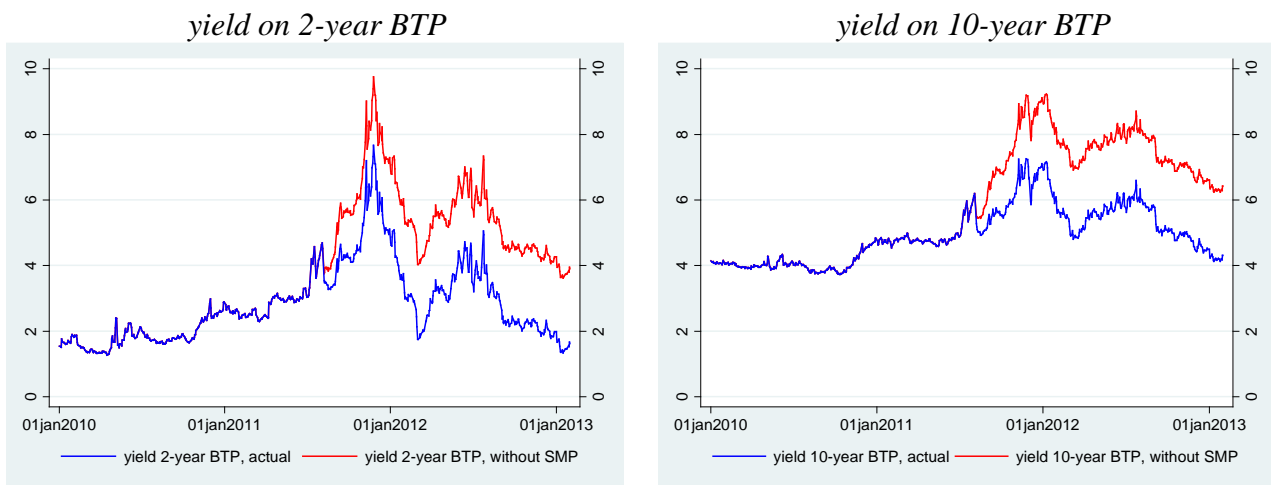
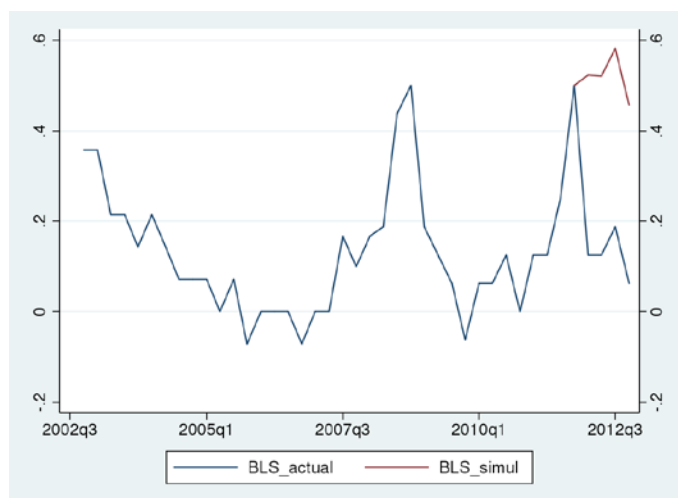


Figure 4 – Yields on Italian BTP: actual and simulated dynamics
(daily data, percentage points)



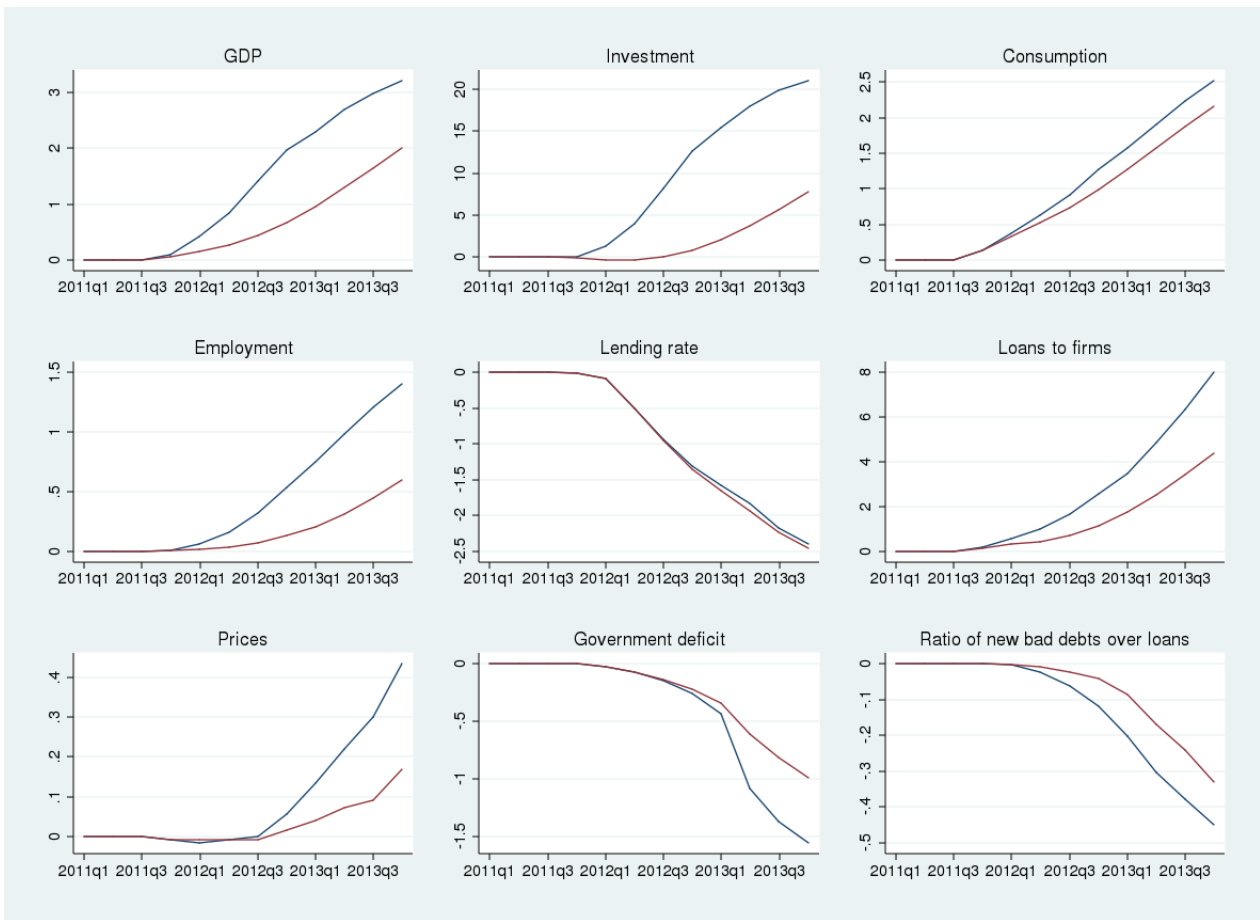
Notes: Simulations based on the assumption of no SMP interventions and an impact of SMP interventions equal to 2 basis points per billion euros of purchases.

Figure 5 – BLS index of credit conditions: actual and simulated dynamics
(quarterly data, index)



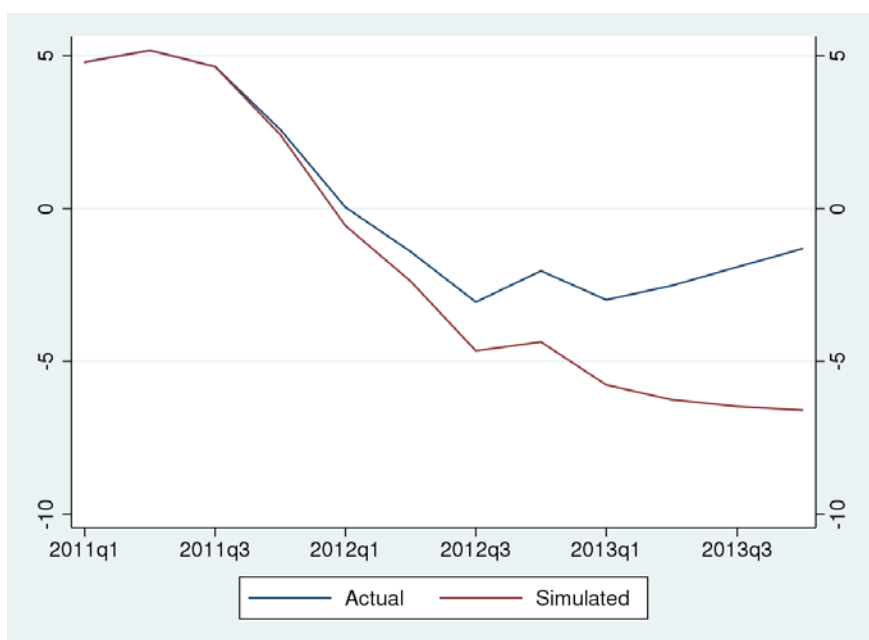
Notes: Simulations based on the estimates presented in Table 4, assuming that 3-year LTROs have neither a “direct” nor an “indirect” effect on credit conditions (see Section 4.2). The BLS survey admits five ordered answers, namely “tightened considerably”, “tightened somewhat”, “basically unchanged”, “eased somewhat”, and “eased considerably”. The index presented in the figure is constructed as the simple mean of the responses provided by the banks after assigning values 1, 0.5, 0, -0.5, -1, respectively, to the possible responses.

Figure 6 – Response of selected variables to the unconventional monetary measures



Notes: Blue line: total response. Red line: response via lower interest rates. The difference between the two lines represents the response via improvement in credit availability.

Figure 7 – Lending to firms: actual and simulated dynamics
(12-month percent growth)



Notes: The simulated profile posits the absence of unconventional policy measures. The actual dynamics is constructed based on observed values until 2013:q1 and on the projected profile presented in Banca d'Italia, *Financial Stability Report*, November 2012, for the two following quarters.