Freie Universität Berlin

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Discussion Paper

Economics

2016/7

Soft Budget Constraints, European Central Banking and the Financial Crisis[1]

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Abstract: During the European financial crisis, the European Central Bank implemented a series of unconventional monetary policy measures. We argue that these unconventional monetary policy measures created soft budget constraints for the Eurozone countries by lowering their bond yield spreads. This hypothesis is tested using pooled OLS estimations and two different datasets: monetary policy event dummies and the purchase volumes of the Securities Markets Programme (SMP). We find significantly negative effects on bond yield spreads for both datasets, leading us to accept the hypothesis. The results are confirmed by robustness checks that directly estimate the effect of unconventional monetary policy on central government debt.

Keywords: soft budget constraints, bond yield spreads, monetary policy events, Securities Markets Programme, European Central Bank

JEL Codes : F34, F37, F42, P17, P51

I. Introduction

The European sovereign debt crisis has led to a major debate on the limits and boundaries of European integration. From the very beginning, the European Central Bank has been playing a central role in combating the crisis. When its standard monetary policies were exhausted, it turned to non-standard (unconventional) monetary policy measures. In this paper, we argue that the European Central Bank (ECB) softened the budget constraints of Eurozone governments by lowering their sovereign bond yield spreads. In an effort to combat the crisis, the ECB reduced its key interest rates to levels never seen before and altered the maturity as well as tender and allotment procedures of standard measures such as the main refinancing operations (MROs) and longer-term refinancing operations (LTROs). Moreover, it introduced several asset purchase programs. One of the most important was the Securities Markets Programme (SMP), which directly targeted sovereign bonds. These policy measures serve as the independent variables in our estimations.

Given the Europeanization of monetary policies, Eurozone members have lost the option of monetary state financing and depend exclusively on financial markets to borrow. As a result, bond

[1] This paper should not be reported as representing the views of the German Federal Ministry of Finance (BMF). The views expressed are those of the authors and do not necessarily reflect those of the BMF. We are grateful to Barry Eichengreen for insightful comments and suggestions. Thanks are due to Maria Polugodina and Julia Zimmermann for exemplary research assistance. Any remaining errors are ours.

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yield spreads can become a binding constraint for incurring more debt when their levels surpass a certain threshold. The ECB can soften this constraint by keeping spreads low.

We discuss the literature on soft budget constraints (SBCs) and on the European financial crisis and examine the effect of the ECB's rescue policies on the sovereign debt levels of Eurozone governments. According to Kornai (1979, 1986), a soft budget constraint is present when a supporting organization (S-organization) is ready to rescue an entity with a budget constraint (BC-organization). So far, there has been a limited number of papers focusing on SBCs in currency unions. There are also conflicting views as to what effect currency unions have on the softness of budget constraints. Jahjah (2000) argues that a currency union can help harden the budget constraints, but, if member countries are fiscally weak and the central bank is not perfectly credible, rules and sanctions are needed to ensure fiscal discipline. Baskaran and Hessami (2013) suggest that Eurozone members nurtured bailout expectations after joining the currency union because they assumed other member countries could not afford their default for either political reasons or the fear of contagion. They show that after the Stability and Growth Pact (SGP) was violated with impunity by France and Germany, other Eurozone members returned to their traditionally high debt levels thinking they would be bailed out if their debt became unsustainable.

In this paper, we empirically test whether the ECB (as the S-organization) softened the budget constraints of Eurozone governments (as the BC-organizations) during the European financial crisis. To test this hypothesis, we estimate the effect of the unconventional monetary policies on bond yield spreads of Eurozone members. We find that these policies indeed significantly lowered spreads, which is also confirmed by robustness checks directly estimating the effect of unconventional monetary policy on central government debt levels.

The remainder of this paper is organized as follows: section 2 provides a literature discussion tracing the evolution of the US financial crisis from the credit and housing bubbles to its spillover to Europe, the development of the European sovereign debt crisis, and the monetary policy responses of the ECB. Furthermore, the theory of SBCs and its empirical applications are discussed. Section 3 presents the datasets used in our estimations. The empirical strategy is described in section 4. Section 5 provides estimation results and robustness checks. Section 6 concludes.

II. Literature

As has been the case with many financial crises, the US subprime crisis in 2007-08 was "preceded by financial liberalization", but its idiosyncratic aspect was the prominent role of the shadow banking system (Reinhart and Rogoff, 2008: 342). Several international and US government decisions made subprime mortgage supply and demand increase substantially, which changed the business model of banks and drove them, in turn, to lobby for further regulatory changes favoring their new model (Blundell-Wignall et al., 2008). The regulatory and supervisory deficiencies resulted in the increased importance and prevalence of shadow banking (Financial Crisis Inquiry Commission, 2011), higher leverage ratios, and the emergence of extremely sophisticated securitization (Acharya et al., 2009). The view that loose monetary policy was an important cause of the housing boom is based on the observation that interest rates were very low in the early 2000s (Taylor, 2008, 2014; White, 2009).

An alternative explanation is the prevalence of global imbalances and their associated capital flows—also known as the global savings glut hypothesis (Bernanke, 2005). It describes the phenomenon of capital flows from developing and transition economies in Asia and Eastern Europe to the advanced economies (North America, Western Europe, Australia) that brought about too low risk premiums and false expectations regarding long-term volatility (Acharya et al., 2009). This hypothesis is tested empirically by Merrouche and Nier (2010), who find that capital inflows had a sizeable and statistically strong effect on financial sector imbalances in OECD countries between 1999 and 2007. Moreover, Merrouche and Nier find no significant effect of monetary policy on financial sector imbalances. Similarly, Bernanke (2010) finds a significant relationship between capital inflows and house price appreciation which explained about one third of house price growth.

When the subprime crisis in the United States developed into a full-fledged financial crisis, it also spread to countries exposed to US securities markets (Dakic, 2014). In Europe, the major banks not only held a large number of asset-backed securities in the US market, but were also dependent on the US dollar supply. As a result, the crisis spilled over to Europe with about the same magnitude (Lane, 2012).[3] This spillover was exacerbated by the fact that several peripheral EU countries suffered from credit booms and housing bubbles of their own, with the most pronounced booms in Greece, Ireland,

[3] For a comprehensive, detailed day-to-day chronology of what happened during the European sovereign debt crisis, see Bundesministerium der Finanzen (2015).

and Spain (Darvas, 2012; Lane, 2012; Taylor, 2014).[4] These twin booms turned into a crisis and, hence, huge capital outflows, liquidity shortages, and increasing loan losses for European banks. The combination of domestic contraction in the real economy and financial markets as well as distress in international capital markets created a European banking crisis and set the grounds for sovereign debt crises (ECB, 2012a; Lane, 2012).

The incentives toward high debt levels prior to the crisis were mainly induced by three parameters. First, in early 2000s, the financial markets assumed the full real convergence of the Eurozone to the German economy and priced their sovereign bonds on the same level (Arghyrou and Kontonikas, 2010: 3). As Mody and Sandri (2012) point out, the homogeneity of sovereign bond yield spreads was already questionable at that time and unrealistic after 2008. Hence, southern European countries enjoyed excessively low interest rates and could borrow as cheaply as never before, which they also did extensively (Arestis and Sawyer, 2011; Lane, 2012). Second, the elimination of national currencies gave national fiscal policies a higher significance as an instrument for countercyclical macroeconomic policies (Lane, 2012). Third, the two pillars of the European treaties with respect to over-borrowing by member-states, the Stability and Growth Pact (SGP) and the "no bailout"-clause, proved to be insufficient. By 2011 about half of the original EU member states exceeded the 3 percent limit for government deficits at least once (Arestis and Sawyer, 2011).

In response to the European sovereign debt crisis, the ECB introduced a variety of standard and non-standard (unconventional) monetary policy measures.[5] The ECB conducts monetary policy using three standard instruments: standing facilities, open market operations, and the minimum reserve system (Pattipeilohy et al., 2013). During the crisis, it reduced interest rates to unprecedentedly low levels (ibid.). Furthermore, in the first phase of the crisis, it primarily changed the composition of its balance sheet (qualitative easing), whereas in the second phase it also strongly expanded it (quantitative easing) (Lenza, et al., 2010). The great majority of non-standard ECB measures used were directed at banks because of their high importance in credit creation, particularly of private credit (European Central Bank, 2011a; Lenza, et al., 2010).

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[4] Note that some authors argue the responsibility for the credit and housing boom should not be solely attributed to the peripheral countries' governments, as it was the northern European countries "whose financial institutions did much of the relevant lending" (Hall, 2012: 357).

[5] Other European institutions were equally active; EU authorities along with member states established several rescue funds (the European Financial Stability Facility, the European Financial Stability Mechanism, and the European Stability Mechanism) and improved the monitoring capacity of the EU over national budgets (Kilponen, et al., 2015). Further, Eurozone member states conducted large-scale policy interventions to rescue their domestic banking systems.

The first period, between August 2007 and the failure of Lehman Brothers in September 2008, was characterized by increased demand for liquidity. Thus, the ECB adopted primarily three non-standard measures: de facto unlimited overnight liquidity, temporary swap lines, and supplementary LRTOs with prolonged maturities (Ibid.). The period after the failure of Lehman Brothers in mid-September 2008 was characterized by panic in financial markets and rocketing interest rate spreads (Lenza et al., 2010). One of the main problems was that the solvency of many financial institutions became questionable, which endangered the stability of the financial sector as a whole (ibid.). Furthermore, the rise in money market spreads could lead to deleveraging by credit institutions and, thus, to negative spillovers to the real economy (European Central Bank, 2011a). In October 2008, the ECB implemented the Enhanced Credit Support program in order to help the banks manage their illiquid assets through increased central bank intermediation (European Central Bank, 2011a; Lenza et al., 2010). A key element of that program was a line of outright purchases, the Covered Bond Purchase Programme (CBPP). The CBPP was from the outset limited with respect to its duration and the volume of bonds that could be bought (European Central Bank, 2009).[6]

When bond yields of peripheral Eurozone members rose dramatically, the ECB adopted the Securities Markets Programme (SMP) (European Central Bank, 2011a). Purchases were limited to secondary markets and fully sterilized (ibid.). This program ended with the announcement of Outright Monetary Transactions (OMT) (European Central Bank, 2015a). During its duration, sovereign bonds of Ireland, Greece, Spain, Italy, and Portugal were bought with the total nominal volume of holdings at the end of 2012 amounting to 218bn € (European Central Bank, 2013). Despite severe doubts whether these programs were permitted by the European treaties, the prevailing opinion is that the ECB acted within the limits of its mandate (Sester, 2012).

Furthermore, in June 2014, the ECB announced a series of non-standard targeted longer-term refinancing operations (TLTROs) to support bank lending to the non-financial private sector in the EU (European Central Bank, 2015b). It also expanded its outright purchases under the expanded Asset Purchase Programme (APP) (European Central Bank, 2015a). This program comprises the CBPP3, the Asset-backed Securities Purchase Programme (ABSPP), and the Public Sector Purchase Programme (PSPP) (ibid.).[7] These liquidity measures, introduced by the ECB from late 2008 onwards, have had a

[6] The CBPP has actually seen two more rounds, named CBPP2 and CBPP3, respectively. The CBPP2 was active from November 2011 to 31 December 2012 and allowed the purchase of a maximum of 40bn € of covered bonds (European Central Bank, 2011b). The CBPP3 has been active since 20 October 2014 with holdings as of September 2015 in the amount of 121bn € (European Central Bank, 2015a).

[7] Until 31 October 2015, cumulative purchases had reached an amount of €396bn under the PSPP alone.

strong effect on short-term interest rates and thus helped sustain the functioning of the financial market and restore the confidence of its participants.[8]

In this paper, we argue that the non-standard monetary policy of the ECB unintendedly created soft budget constraints (SBCs) for the Eurozone economies. The concept of SBCs was first formulated by Kornai (1979) in a paper analyzing the origins of chronic shortages in socialist economies. In his definition, a budget constraint becomes soft if it is negotiable such that a firm consistently spends more than it receives through sales and credit. Under SBCs, unprofitability does not lead to the bankruptcy of the firm, because the state insures its survival with constantly renegotiated credit (Kornai, 1979). Kornai (1986) soon broadened the context of the soft budget constraint and demonstrated that not only state-owned firms in socialist economies, but also privately owned firms in capitalist economies are provided with SBCs by their governments.

The seminal paper by Dewatripont and Maskin (1995) defines the provision of soft budget constraints as a dynamic commitment problem in which an S-organization cannot credibly commit itself to not extending credit to a BC-organization. In central planning, SBCs either decrease firms' sensitivity to prices, which then leads to shortages, or they suppress incentives to screen out poor projects, which hinders productive innovation. In transition economies, the persistence of SBCs instigated privatization of banks or institutional changes in the direction of decentralization and increased competition among regional governments (Qian and Roland, 1998). When banks function as BC-organizations and the government or the central bank is the S-organization, SBCs can arise either because of the role of private banking in credit provision or for political reasons such as keeping unprofitable firms afloat to support employment (Kornai et al., 2003).

Djankov and Murrell (2002) offer a comprehensive review on the prevalence of SBCs in the context of restructuring enterprises in transition economies. Berglof and Roland (1998) and Mitchell (2000) review several sources of SBCs as well as appropriate mechanisms for hardening them in commercial banking. Nonprofit organizations such as schools, universities, and hospitals also face SBCs; most of the SBC studies here focus on the health sector (Babczuk and Kachniarz, 2012; Crivelli et al., 2010). Grigoriadis (2011) introduces the concept of SBCs in explaining the effectiveness of EU development aid in Russia, Ukraine, and Central Asia during transition (1991-2007). Sinelnikov-Murylev et al. (2006) conduct an extensive review of decentralization policies in the United States, Canada, Germany, Norway, China, Brazil, Argentina, Hungary, and Ukraine and conclude that SBCs

[8] On the effectiveness of ECB non-standard monetary policy, see Altavilla et al. (2014), Pattipeilohy et al. (2013), Kilponen et al. (2015), Eser and Schwaab (2015), and De Pooter et al (2015).

are an inherent problem of every decentralized fiscal system. Similar findings are derived by Pettersson-Lidbom (2010) for Sweden and by Baskaran (2012) for Germany.

Furthermore, SBCs are relevant for monetary policy and currency unions. It is not new for national governments to ask for financial support from the international community. In the past, the IMF has usually taken on the role of international crisis manager and lender of last resort (Fischer, 1999). National governments in currency unions, in particular, lack the policy instrument of currency devaluation and hence they have to turn to the central bank or other member states for potential bailouts. So far, there have only been very few studies explicitly dealing with SBCs in currency unions, where member states are BC-organizations and the central bank is the S-organization. Our paper intends to fill that gap.

The absence of an autonomous monetary policy, which is an inherent component of a currency union, makes national governments dependent on financial markets for their borrowing activities. In this respect, their sovereign bond yields become critical because if they are too high, they incur more debt. Therefore, a key method for the ECB to soften the budget constraints of member states without explicitly violating the prohibition of monetary state financing is to keep sovereign bond yields lower than their expected value.

III. Data

The ECB non-standard monetary policy measures are the independent variables for our paper. There are two ways to quantify monetary policy measures. First, when monetary policies embody unique actions that can be pinpointed to specific dates, they can be regarded as singular *events*, such as the reduction of an interest rate to a new level or the start of an asset-buying program. These measures can be modelled as event dummy variables. Second, policy measures can be represented by stock or flow values, such as the volume of purchases under an asset-buying program. To account for both types of data, two different datasets are created for the benchmark estimations: one containing monetary policy events in the form of dummy variables and the other the volume of sovereign bond purchases under the SMP.

The event dummies dataset is in daily frequency and covers the timespan from 1 January 2007 to 31 December 2013, roughly the period of the unconventional monetary policy interventions.[9] Because SMP purchase volumes are only available on a weekly frequency, their dataset is also weekly. It covers

[9] The sample ends on 31 December 2013 due to data availability, despite ongoing policy interventions.

the time period corresponding to the lifespan of the SMP (May 2010-September 2012). Ideally, the estimation sample would include all Eurozone economies, but this is constrained by data availability. Thus, the dataset includes Greece, Ireland, Italy, Portugal, and Spain, which compose the group of crisis countries, and Austria, Belgium, Finland, France, Germany, and the Netherlands, which are the non-crisis countries.

Benchmark estimations are complemented by robustness checks employing government debt as the dependent variable. Because this data is only available in quarterly frequency, a new robustness check dataset is constructed. The timespans for estimations correspond to those of the benchmark estimations. As a dependent variable we use ten-year sovereign bond spreads. These spreads are constructed from ten-year bond yields and the Euro swap rate, both obtained from Datastream. The Euro swap rate rather than German bonds are used because it allows the inclusion of Germany (Kilponen, et al., 2015). We could also use bond yields as the dependent variable, but spreads arguably capture the risk element better than yields as they are measured with respect to the risk-free rate.[10]

The event dummies contain the most important monetary policy measures conducted during the crisis: the SMP, the various announcements related to the OMT, several non-standard LTRO operations, the lowering of the rate on the ECB's deposit facility to 0%, and both rounds of the CBPP.[11] The selection of these event dummies is guided by common choices in the literature (see sources listed in Table A.1 in the appendix). The selection of the SMP is quite obvious as it is the only publicly known, official bond-buying program targeting sovereigns before the PSPP started in March 2015.[12] The OMT is selected because of its importance; despite being rather controversial, it was also quite effective (Altavilla et al., 2014). The non-standard LTROs have often been used to buy sovereign bonds and can therefore be considered an indirect program for purchasing sovereign debt (Krishnamurthy, et al., 2014). The 0%-deposit rate marks a historical low since the interest rate has never before been this low since the establishment of the Eurosystem (European Central Bank, 2015c). The CBPPs are also included

[10] In the literature, both spreads (for example Kilponen et al., 2015; Szczerbowicz, 2014) and yields (for example Altavilla et al., 2014; Krishnamurthy et al., 2014; Rivolta, 2014; Eser and Schwaab, 2015; Ghysels et al., 2014) are used. Some studies use sovereign credit default swap (CDS) spreads (Gerlach-Kristen, 2013; or Pattipeilohy et al., 2013 and De Pooter et al., 2015 who use both CDS spreads and yields). But these are not easy to obtain for all countries. For this study, spreads are used for both benchmark datasets (the only difference being the data frequency), and estimations are also repeated using bond yields as a robustness check.

[11] Note that round 3 started after our sample ends.

[12] In view of the latest revelations about the unpublished Agreement on Net Financial Assets (ANFA), this qualifier is unfortunately necessary. The ANFA agreement between the ECB and national central banks (NCBs) allows the latter to buy financial assets. Media reports allege that especially southern European NCBs have taken advantage of this provision to the amount of around €560 billion, with an unknown share of sovereign bonds (see for example the interview by Bundesbank Executive Board member Joachim Nagel (2015)). The effect of the PSPP would be very interesting to estimate as well, but there is not enough data yet.

even though they targeted banks rather than governments (Kilponen, et al., 2015). The decisions on the EFSF and ESM are added to the set of dummy variables as controls. Table A.1 in the appendix presents a list of all event dummy variables.

The second benchmark dataset includes SMP purchase volumes as the dependent variable. Unfortunately, the country-specific daily volumes of sovereign bond purchases under the SMP are still classified by the ECB, which does not publish such detailed data.[13] Thus, the only studies that use these data are written by ECB experts (Eser and Schwaab, 2015; Ghysels et al., 2014). However, the British bank Barclays approximates the weekly country-specific purchase volumes under the SMP (Barclays Capital, 2012). Specifically, Barclays assumes the "total weekly cash purchase number (and weekly redemptions)" published by the ECB are split proportionally to the countries' bond market sizes (Barclays Capital, 2012: 1). These estimates are then adjusted to ECB announcements and market pressures observed by Barclays trading desk (De Pooter, et al., 2015). The resulting dataset appears to be very reliable since Barclays "was a significant counterparty to ECB transactions" (De Pooter, et al., 2015: 9). This dataset is used here to estimate the effect of SMP purchases.[14] Because of its weekly frequency, all other variables in this dataset were obtained or created at weekly frequency as well.

The control variables are, like the dependent variable, the same for both datasets (except for the EFSF/ESM-control dummy, which is not used in the SMP purchases dataset). The empirical literature estimating effects on sovereign bond yields or spreads primarily uses financial market data as control variables. This approach is implemented here with the following variables selected as controls: the lagged dependent variable (that is, bond yield spreads) in order to eliminate auto-correlation of residuals (Szczerbowicz, 2014; Kilponen et al., 2015); the interest rate on the ECB's marginal lending facility[15] in percentage points in order to control for its effects on bond yield spreads (Gerlach-Kristen, 2013); the MSCI Europe to account for the condition of the stock markets (Pattipeilohy et al., 2013); an index containing CDS spreads of EU banks to control for the overall condition of the banking sector and thus the overall lending conditions (Pattipeilohy et al., 2013); the iTraxx Europe (a European CDS index) to control for European risk appetite (Kilponen et al., 2015); and finally the VIX index (which enters the estimations in lagged form to avoid simultaneity) to control for overall risk (used by all the studies referenced above). All of these variables were obtained from Datastream. The event dummies

[13] There is information on the ECB's end-of-year holdings for 2012-2014 at http://www.ecb.europa.eu/press/pr/date/.
[14] We thank Professor Seth Pruitt (Arizona State University) for sharing this data.
[15] Using the rate on MROs did not alter the estimation results.

dataset further contains the aforementioned EFSF/ESM-dummy as a control variable.[16] Bond yield spreads for crisis and non-crisis countries are presented in Figures 1 and 2.[17] Four observations are crucial here. First, the convergence of bond yield spreads to very low levels in the pre-crisis period, as markets assumed the sovereign default risk to be negligible and equal for all countries. Second, with the start of the crisis both the volatility of spreads and the variance of spreads across countries increased, which hints at a re-differentiation of sovereign default risk by the financial markets.[18] Third, the onset of the crisis also saw a divergence of spreads between crisis and non-crisis countries, as the former's spreads embarked on a continuous rise, while the latter's spreads experienced a much more stable and less volatile development—notwithstanding episodes of sharp, sudden increases, though, especially for Belgium. Fourth, the strong increase for crisis countries, especially in Greece, Ireland, and Portugal, resulted in enormously high spread levels that many market participants considered to be a thing of the past, ever since the introduction of the Eurosystem.

Summary statistics of the control variables are presented in Table A.4 in the appendix. Note that the higher the CDS indices (the CDS index for EU banks and the iTraxx) and the VIX index climb, the greater the associated risk. In view of this, the tenfold increase of each measure between the worst and the best of times is quite remarkable. The monetary policy event dummies are described in Table A.1 in the appendix. Each dummy variable contains several events (except for the "0% deposit rate", which consists of only one event), which are listed below each other in the second column. (For reasons of readability the cells in the first column are left blank for additional events of the same variable.) The events are basically self-explanatory; their sources are given in the last column.

The second independent variable, the volume of purchases under the SMP, is displayed in Figures 3 and 4. The two phases of the SMP (first the introduction, then its reactivation; see Table A.1 in the appendix) are clearly visible in Figure 3. The different purchase volumes across countries and the change in geographical focus between the two phases are displayed in Figure 4. At the start of the SMP, the ECB only bought bonds from Greece, Ireland, and Portugal. The reactivation phase saw the buying of primarily Italian and Spanish bonds. Overall, the magnitude of weekly purchases at the peak time exceeded 20 billion euros.

To corroborate the findings of the benchmark estimations, robustness checks with government debt as the dependent variable are implemented. This requires the construction of an additional dataset.

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[16] Other control dummies pertaining to policies of the European institutions turned out to be insignificant and were not used.

[17] See Table A.2 in the appendix for summary statistics; further, Figures A.1 and A.2 and Table A.3 present the equivalent bond yield data.

[18] Wihlborg, et al. (2010: 55) call this "adjustments [that] were long overdue".

For this, central rather than general government debt is used because the latter contains social security bodies and sub-national entities whose budgetary decisions are not as responsive to ECB policies. They either contain more or less automatic budget decisions (like disbursing insurance or welfare benefits) or have a more local political focus. The same rationale is behind a decision to use short-term debt. It is more flexible and better suited to react to short-term changes in the political environment. Thus, we use the central government short-term debt-to-GDP ratio as our dependent variable. The dataset has a quarterly frequency, which is the highest available frequency for sovereign debt data. The debt data is obtained from Eurostat and standardized to GDP with data from Datastream.

The independent variables are adjusted to the quarterly frequency, but otherwise remain the same as in the benchmark estimations. Weekly SMP purchases are aggregated into quarters and the event dummies take the value of unity in the quarter in which the underlying event takes place (this can lead to omission when several events happen in the same quarter). The new dependent variable requires a new set of control variables as well. The controls chosen here are in line with Baskaran and Hessami (2013), whose study is very helpful here. The lagged debt-to-GDP ratio is included to control for path dependency. The inflation rate (calculated as the growth rate of the consumer price index) is chosen to control for macroeconomic effects, and the unemployment rate and GDP growth rate to control for the effect of overall economic conditions. All control variables were obtained in quarterly frequency from Datastream.

Moreover, we provide some descriptive statistics of the new variables. The central government short-term debt-to-GDP ratio is presented in Figure 5. The distribution of the debt level across countries is quite diverse: from relatively high (Belgium, Italy, Portugal, and France) to relatively low (Austria, Germany, and Finland). It is interesting to observe the absence of Greece, Ireland, and Spain among the initial high-debt countries. While Spain headed into the crisis with generally low sovereign debt levels, Greece and Ireland had by far the greatest maximum/minimum debt ratio during the observed time period; they just started from a very low level (see Table A.5 in the appendix). When it comes to volatility, the debt level remained relatively stable for some countries (Austria, Germany, Finland, and Italy), whereas Greece and Spain experienced the highest absolute increase.

The relatively small size of short-term debt compared to total central government debt (which is displayed in Table A.6 in the appendix) does not impede its usability in the paper. After all, the rationale for choosing short-term debt is not about its magnitude but about its responsiveness to political actions. Finally, summary statistics of the control variables are presented in Table A.7 (see appendix). The inflation rate is roughly in a similar range in all countries, with a few negative outliers

in Ireland at the end of 2009. The highest unemployment rate is observed in Spain and Greece and the lowest in the Netherlands and pre-crisis Ireland. The growth rate of GDP plummeted in all countries at the height of the crisis and became strongly negative. Crisis countries are among those who observed the highest growth rates in the pre-crisis period, with Ireland being the fastest growing economy of the Eurozone before the beginning of the crisis.

Figure 1 Bond yield spread of ten-year sovereign bonds (non-crisis countries)

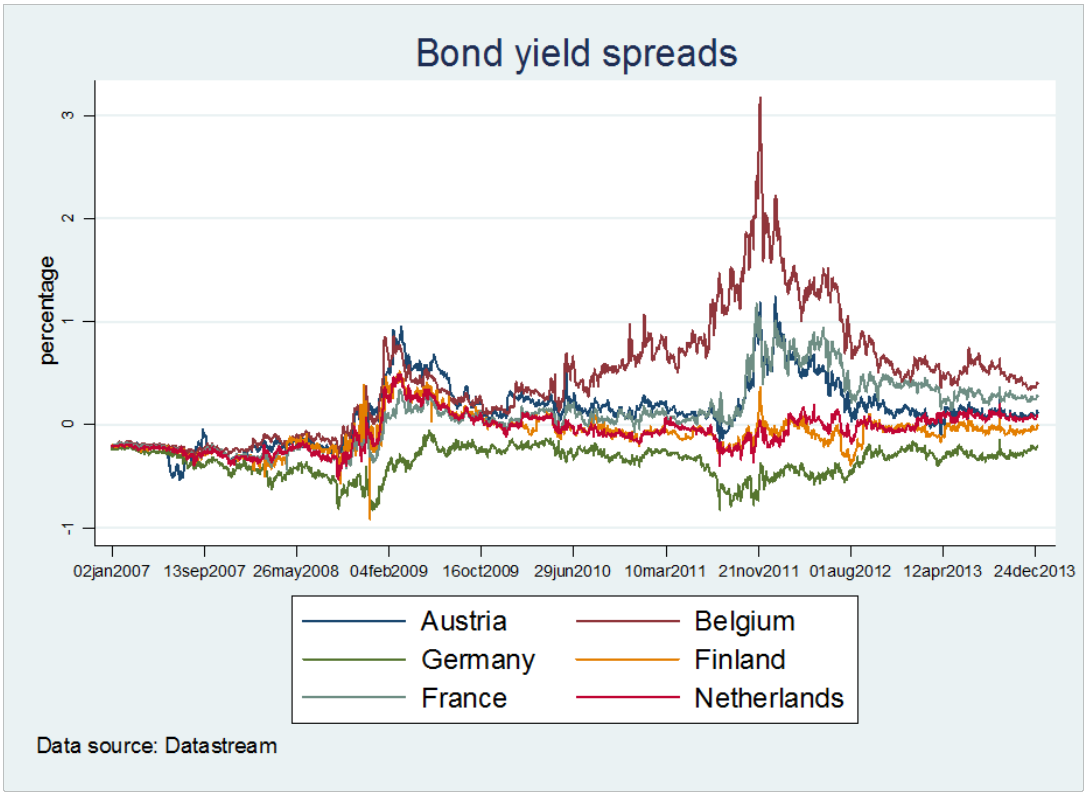


Figure 2 Bond yield spread of ten-year sovereign bonds (crisis countries)

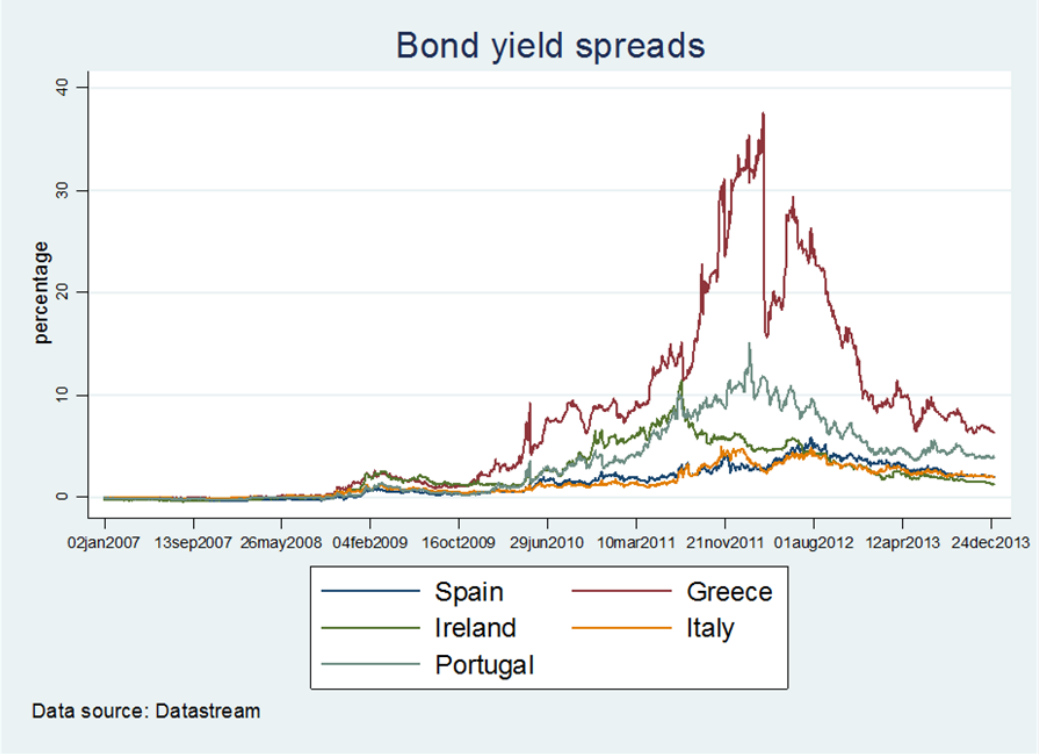


Figure 3 SMP Purchase volumes (all Eurozone countries)

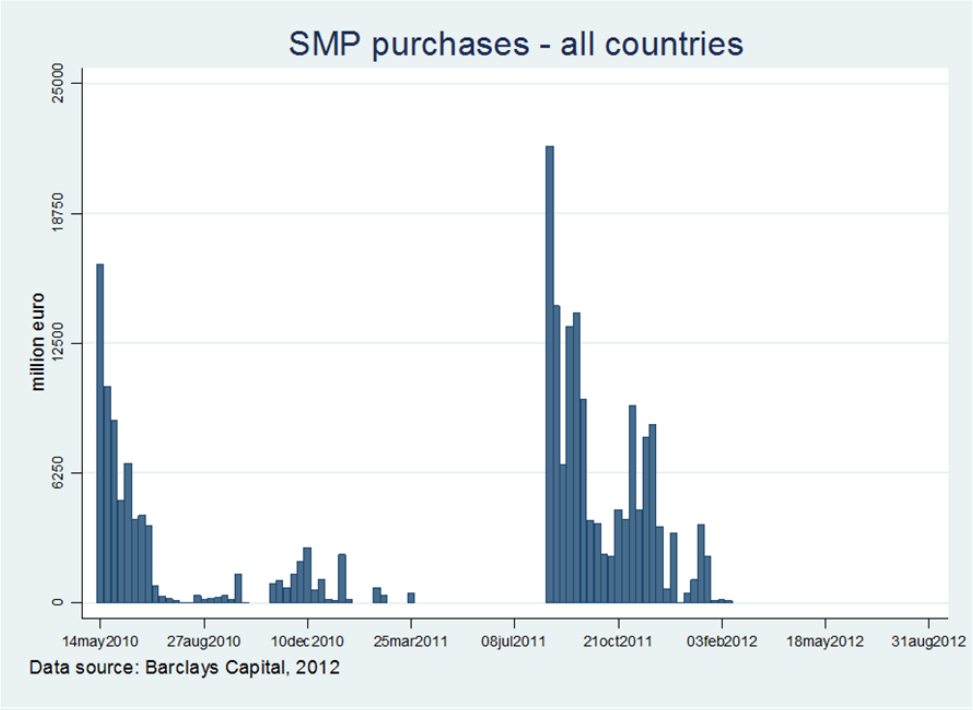


Figure 4 SMP Purchase volumes (crisis countries)

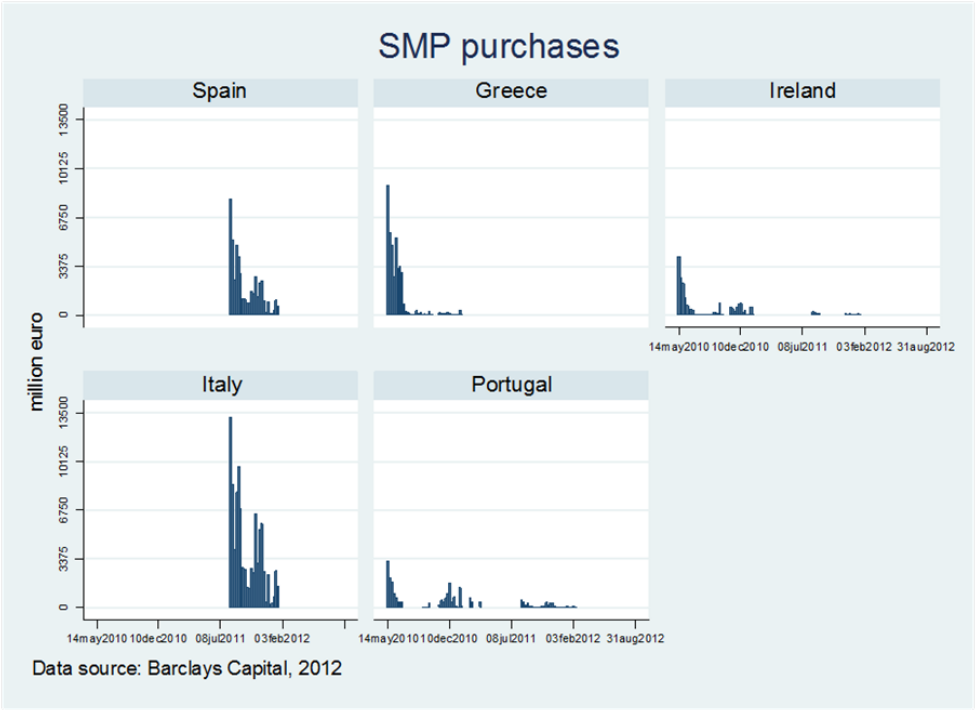
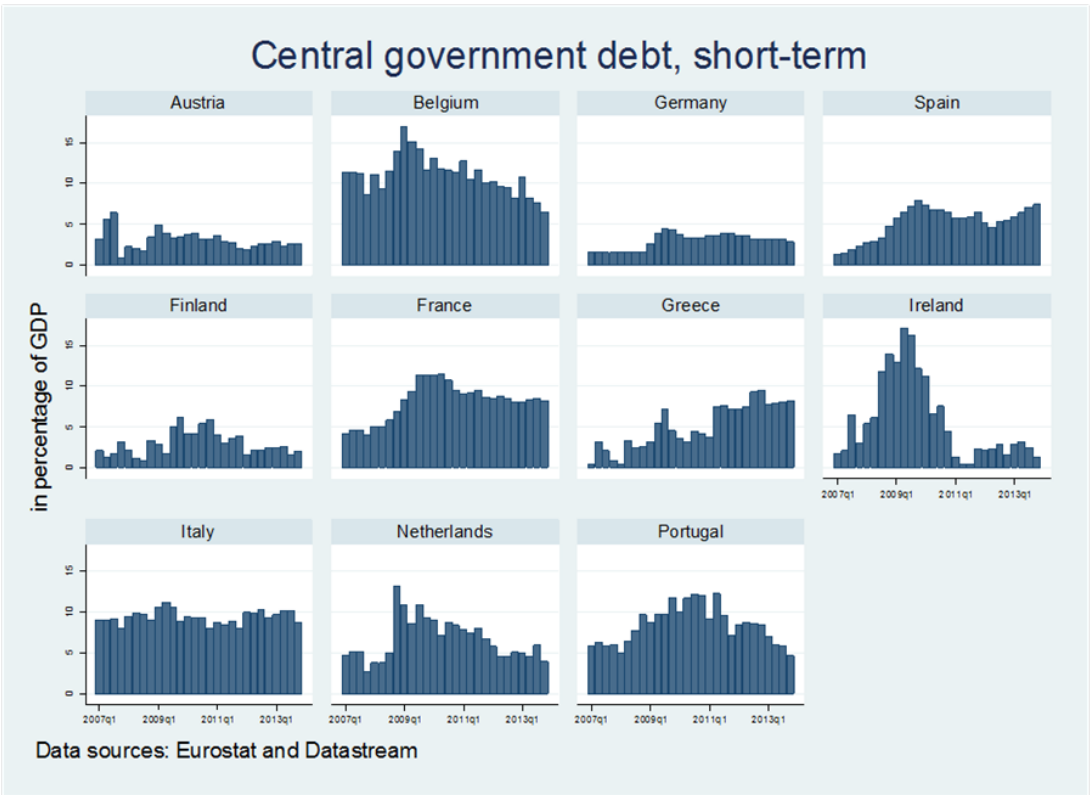


Figure 5 Central government short-term debt



IV. Empirical strategy

Benchmark estimations

The main hypothesis of this paper is that the ECB non-standard monetary policy measures provided Eurozone countries with soft budget constraints by lowering their sovereign bond yield spreads. The event dummies dataset is estimated using what is commonly referred to as an "event study" design. In this design, the effect of one or more event dummy variables on some stock or flow variable is estimated using standard regression techniques.[19] The effect of SMP purchase volumes is estimated separately, also using standard regressions. The literature related to the empirical part of this paper is on monetary policy effectiveness in which the effects of policy measures on bond yields (or bond yield spreads) are estimated using both event dummies and SMP purchase volumes.

Based on daily data, a group of scholars uses ordinary least squares (OLS) to estimate the effect on sovereign bond yields (or spreads) for each Eurozone country separately (Kilponen et al., 2015; Altavilla et al., 2014; Krishnamurthy et al.; 2014). Only a few authors, such as Rivolta (2014) and Szczerbowicz (2014), additionally provide regressions estimating the effect on a combined sample of all countries. The length of the event window (i.e. the number of days over which the event dummy takes the value of one) is typically two days, such that the dummy equals one on the day of the event and the day after the event. The idea is to account for events that occur shortly before or after markets close and thus ensure that the full effect of each event is observed (Altavilla et al., 2014; Kilponen et al., 2015; Krishnamurthy et al., 2014). Our paper uses country clusters instead of separate estimations for each country. To account for different impacts of ECB policies on crisis and non-crisis countries, we run our estimations on three different samples: all countries, crisis countries, and non-crisis countries.[20] Because unit-root tests of sovereign bond yield spreads suggest non-stationarity for the majority of countries (see Table A.7 in the appendix), estimations are carried out using the first difference of spreads. The event window of the dummy variables comprises two days.[21] We use pooled OLS and heteroscedasticity-robust standard errors. For policy event dummies, this yields the following estimation equation:

$$\Delta y_t = \alpha + \beta D_t + \gamma X_t + \delta \Delta y_{t-1} + \varepsilon_t \qquad (1)$$

[19] See for example Rivolta (2014) for a detailed description of event study designs.

[20] Crisis countries include Greece, Ireland, Italy, Portugal, and Spain (so-called GIIPS countries). Non-crisis countries include Austria, Belgium, Finland, France, Germany, and the Netherlands.

[21] Using other event window lengths as robustness checks does not alter the results.

where the dependent variable Δy_t is the sovereign bond yield spread, α is a constant, D_t is the set of ECB monetary policy dummies, X_t is a set of control variables, which are first-differenced except for the EFSF-ESM policy dummy, Δy_{t-1} is the lagged dependent variable, and ε_t is the error term. The parameter β gives the effects of the ECB monetary policy measures. Following our hypothesis, it is expected that the monetary policy dummies have a negative effect on bond spreads, that is

$$\beta < 0. \qquad (2)$$

The methodology used in the literature to examine the effect of SMP purchase volumes is considerably more diverse. It ranges from factor analyses (Pattipeilohy et al., 2013) and the estimation of purpose-built component models (Ghysels et al., 2014) over seemingly unrelated regressions (Gerlach-Kristen, 2013) to panel regression models (De Pooter et al., 2015). Similarly, the data frequency ranges from intra-daily (Ghysels, et al., 2014) to weekly (De Pooter, et al., 2015). The same variety is found concerning the country samples of the estimations. Some studies estimate separate effects for each country (for example Gerlach-Kristen (2013), who only looks at GIIPS countries and Germany), while others estimate effects for samples of several countries (De Pooter et al. (2015), who use data for Ireland, Italy, Portugal, and Spain, or Eser and Schwaab (2015)).

The main independent variable is the volume of a country's bonds purchased under the SMP. Hence, contagion effects of SMP purchases of other countries' bonds are not estimated. Thus, the following equation is estimated using pooled OLS and heteroscedasticity-robust standard errors:

$$\Delta y_t = \alpha + \beta_1 P_t + \beta_2 P_{t-1} + \gamma X_t + \delta \Delta y_{t-1} + \theta \Delta y_{t-2} + \varepsilon_t \qquad (3)$$

where the dependent variable Δy_t is the sovereign bond yield spread, α is a constant, P_t and P_{t-1} are current and lagged volumes of SMP purchases, X_t is a set of first-differenced control variables, Δy_{t-1} and Δy_{t-2} are the first and second lags of the dependent variable, and ε_t is the error term. The parameters β_1 and β_2 give the effect of the SMP purchases. Following our hypothesis, it is expected that SMP purchases have a negative effect on bond spreads, i.e.

$$\beta_1, \beta_2 < 0. \qquad (4)$$

Robustness checks

The robustness checks using the benchmark datasets (we estimate the effect on bond yields instead of bond yield spreads or alter the size of the event window) utilize the same methodology as the benchmark estimations. However, the robustness checks using government debt data are different. Following our hypothesis, unconventional ECB policies are expected to increase government debt. The

transmission channel of the soft budget constraint is treated as a black box here, with the result that we can directly estimate the effect on the central government debt. To ensure comparability with the benchmark estimations, the same independent variables, country samples, and method (pooled OLS) are used. Only the set of control variables and the data frequency change due to the requirements of the new dependent variable.

Thus, the following equation is estimated for monetary policy event dummies:

$$d_t = \alpha + \beta D_t + \gamma Z_t + \delta d_{t-1} + \varepsilon_t \quad (5)$$

where the dependent variable d_t is the central government short-term debt-to-GDP ratio in percentage points, α is a constant, D_t is the set of ECB monetary policy dummies, Z_t is a set of control variables including a dummy related to the EFSF and ESM, d_{t-1} is the lagged dependent variable, and ε_t is the error term. The parameter β gives the effect of the ECB monetary policies. According to our hypothesis, it is expected that the monetary policy dummies have a positive effect on the debt-to-GDP ratio, that is

$$\beta > 0. \quad (6)$$

For the volume of SMP purchases, the following equation is estimated:

$$d_t = \alpha + \beta_1 P_t + \beta_2 P_{t-1} + \gamma Z_t + \delta d_{t-1} + \varepsilon_t \quad (7)$$

where the dependent variable d_t is the central government short-term debt-to-GDP ratio in percentage points, α is a constant, P_t and P_{t-1} are current and lagged volumes of SMP purchases, Z_t is a set of control variables, d_{t-1} is the lagged dependent variable, and ε_t is the error term. The parameters β_1 and β_2 give the effect of the SMP purchases. According to the hypothesis of this paper, it is expected that the SMP purchases have a positive effect on the debt-to-GDP ratio, that is, it is expected that

$$\beta_1, \beta_2 > 0. \quad (8)$$

V. Results

Benchmark estimations

The results for the crisis country and non-crisis country samples of the event dummies dataset are presented in Table 1.[22] The estimation coefficients display the average effect on bond yield spreads for each of the events belonging to a certain policy measure; for example, both the announcement and the

[22] See Tables A.9 to A.11 in the appendix for detailed estimation outputs of all three samples. The estimation results of the sample containing all countries are driven by the crisis countries.

reactivation of the SMP lower the bond yield spread of a crisis country on average by roughly half a percentage point.

Table 1 Estimation Results for Event Dummies

	Dependent variable: Bond yield spreads	
Variable	Crisis	Non-Crisis
Bond_yield_spreads		
LD.	0.0203	-0.1767***
ECB_rate		
D1.	-0.0642***	-0.0283***
MSCI_Europe		
D1.	-0.0003**	-0.00001
CDS_index_EU_banks		
D1.	0.0037***	0.0003***
iTraxx_Europe		
D1.	0.0069***	0.0005**
VIX_index		
LD.	-0.0030**	-0.0006*
OMT	-0.1658***	-0.0346***
SMP	-0.4635***	0.0422**
LTROs	0.0034	-0.0106*
zero_deposit_rate	0.0557	-0.0530***
CBPP	0.1297*	0.0089
EFSF_ESM	-0.0540*	-0.0182***
Constant	0.0032	0.0007

*** p < 0.01

** p < 0.05

* p < 0.1

As expected, the OMT has a significantly negative effect on bond yield spreads of all the countries. But the other policy measures have different impacts on the two country groups. Although the SMP lowers bond spreads for crisis countries, it actually has a small positive effect on non-crisis countries. This unexpected positive effect can be best explained with the accumulation of risky assets on the ECB's balance sheet caused by the purchase of crisis country bonds. Because non-crisis countries are more likely than crisis countries to eventually cover all or part of this risk, particularly against the background of a possible exit from the Eurozone of one or more crisis countries, the increased risk on the ECB's balance sheet negatively influences the risk assessment for non-crisis countries by market participants and increases their spreads accordingly. LTROs and the lowering of the deposit rate to 0%, on the other hand, have a significantly negative effect on non-crisis countries, but are insignificant for crisis countries. Again, the different effects are driven by the difference between crisis and non-crisis

countries. The deposit rate provides the floor for the interbank money market. Lowering it makes money cheaper, as banks are looking for opportunities to invest their money and thus increase their volume of credit provision. The more solvent an economy is, the better it can take advantage of this cheap money. Therefore, the lowering of the deposit rate to zero percent has a greater effect on non-crisis countries. Similarly, LTROs provide the banking sector with liquidity. Because banking sectors in non-crisis countries are larger and more developed, the liquidity provisions have a greater impact on them.

The coefficient of the CBPP is weakly (and positively) significant for crisis countries, while insignificant for non-crisis countries. But this does not contradict our hypothesis, because the CBPP was targeted at banks and not sovereigns. The significantly negative coefficient of the EFSF/ESM-control variable indicates that the various bailout measures (also called support packages) by EU member states could have had the effect of creating SBCs of their own.[23]

Altogether, the effects of the ECB's policy measures on the bond yield spreads confirm the hypothesis of a negative β in equation (2).

Table 2 provides the results for estimations using the volume of SMP purchases. At first glance, the effects of the SMP purchases look fairly small, but this is in part due to the scale of the variable, which is millions of euros. As the weekly purchases were often in the order of billions (see Figures 7 and 8), the effect of purchases worth, for example, ten billion euros lowers spreads by half a percentage point. Both the coefficients of the level and the first lag are significant, but only the level's coefficient is negative. In other words, SMP purchases do have a (initially) significantly negative effect on bond spreads before a "bounce-back" effect kicks in. This "bounce-back" effect is also observed by Eser and Schwaab (2015). Thus, β_1 of equation (4) is indeed negative, but β_2 is positive. The overall effect of SMP purchases is significant, but ambivalent.

Table 2 Estimation Results for SMP Purchase Volumes

D. Bond_yield_spreads	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Bond_yield_spreads						
LD.	0.0408	0.0222	1.840	0.095	-0.0086	0.0902
L2D.	-0.1216	0.0050	-24.400	0.000	-0.1327	-0.1105
ECB_rate						
D1.	0.0654	0.1960	0.330	0.746	-0.3713	0.5021
MSCI_Europe						
D1.	0.0005	0.0001	6.870	0.000	0.0004	0.0007
CDS_index_EU_banks						
D1.	0.0028	0.0010	2.680	0.023	0.0005	0.0051
iTraxx_Europe						

[23] This result suggests a new line for further research.

D1.	0.0097	0.0060	1.610	0.138	-0.0037	0.0231
VIX_index						
LD.	-0.0136	0.0052	-2.640	0.025	-0.0251	-0.0021
SMP_purchases						
--	-0.00004	0.00002	-2.660	0.024	-0.0001	-7.06e-06
L1.	0.00005	0.00002	2.660	0.024	7.84e-06	0.0001
Constant	0.0165	0.0110	1.500	0.166	-0.0081	0.0411
Number of obs	1298					
F(9, 10)	19422.12					
Prob>F	0.0000					
R-Squared	0.0391					
Root MSE	0.6902					

Notes: Std. Err. Adjusted for 11 clusters in country

Combining the results of both datasets, two general findings emerge. First, ECB policies overall have a significantly negative effect on bond yield spreads. Second, different policies work differently in crisis and non-crisis countries. While the OMT effectively lowers bond yield spreads for both country groups, the SMP has the greatest impact in crisis countries, and the zero percent-deposit-rate and LTROs have the greatest impact in non-crisis countries. Overall, the hypothesis that the ECB's unconventional monetary policies create soft budget constraints for Eurozone member countries is accepted.

Robustness checks

Several robustness checks of the benchmark estimations are conducted. When using bond yields instead of bond yield spreads for both the event dummies and the SMP purchase volumes specifications, the results hold (Tables A.12 and A.13 in the appendix). The same is true when the event window lengths are varied; the results of the benchmark specifications are confirmed for one-day, three-day, and five-day event windows (Tables A.14-A.16 in the appendix).[24]

[24] The event dummy dataset was also estimated using the difference-in-difference approach. This yielded only weak and not very robust results. The most significant effect was achieved by the OMT, which does make sense economically, when we assume the OMT had the most lasting effect. (Because difference-in-difference estimates permanent effects, one would expect the measure with the most lasting effect to be the most significant.) The results are not used because of their overall weakness.

Table 3 Robustness Check Estimation Results for Event Dummies: Central Government Short-term Debt

	Dependent variable: Central government short-term debt	
Variable	Crisis	Non-Crisis
Debt_to_GDP_short_term		
L1.	0.8686***	0.9327***
Inflation_rate	0.0750	0.0546
Unemployment_rate	-0.0298	0.0013
GDP_growth_rate	-0.1022**	-0.0700
OMT	1.0189**	0.1723
SMP	-0.0670	0.1577
LTROs	0.1943	0.6853**
zero_deposit_rate	(omitted)	(omitted)
CBPP	0.5985	-1.2220***
EFSF_ESM	-0.6191	-0.2948
Constant	1.1464*	0.2418

*** p < 0.01

** p < 0.05

* p < 0.1

The estimation results for event dummies are presented in Table 3.[25] Similarly to benchmark estimations, the ECB policies have different effects on crisis and non-crisis countries. In crisis countries, the OMT has a significantly positive effect on government debt; it increases the debt-to-GDP ratio by one percentage point (see also Table A.5 in the appendix). In the non-crisis countries, it is the LTROs that have a significantly positive effect. Both findings are meaningful from a substantive standpoint. The OMT was directed at crisis countries and it is therefore not surprising that it exhibits the largest effect in those countries. LTROs on the other side are more relevant for non-crisis countries, as was explained in the previous section. This also holds for their relationship with government debt.

The negative impact of the CBPP on non-crisis countries (and the insignificant effect on crisis countries) is because the CBPP was targeted at banks, and the support of banks by the ECB does not automatically send the message to governments that they will be supported in the same way as well. Furthermore, aid to banks may have released pressure from government finance (as the ECB stepped

[25] See Tables A.17 to A.19 in the appendix for detailed estimation outputs.

in, before national governments had to). The "zero percent deposit rate"-dummy is omitted due to multicollinearity, which is caused by the change in frequency from daily to quarterly. Moreover, the fact that SMP and EFSF/ESM dummies become insignificant is most likely explained by a substantial loss of observations. Generally speaking, an event that happens on a specific day will only be significant in quarterly data if its effect carries through the entire quarter. This seems to be the case for the OMT and LTROs, but not for the SMP. Altogether, the results show that the ECB's unconventional monetary policy increases government debt as expected and thus confirms our hypothesis.

Table 4 Robustness Check Estimation Results for SMP Purchase Volumes: Central Government Short-term Debt

Debt_to_GDP_short_term	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Debt_to_GDP_short_term						
L1.	0.9174	0.0162	56.630	0.000	0.8813	0.9535
Inflation_rate	0.0985	0.2158	0.460	0.658	-0.3824	0.5794
Unemployment_rate	0.0021	0.0137	0.150	0.881	-0.0284	0.0326
GDP_growth_rate	-0.0338	0.0339	-1.000	0.341	-0.1093	0.0416
SMP_purchases						
--	-9,57e-06	0.00001	-0.670	0.519	-0.00004	0.00002
L1.	0.00001	5,76e-06	2.120	0.060	-6,14e-07	0.00003
Constant	0.1021	0.5316	0.190	0.851	-1.0823	1.2866
Number of obs	110					
F(6, 10)	917.82					
Prob>F	0.0000					
R-Squared	0.8733					
Root MSE	1.1641					

Notes: Std. Err. Adjusted for 11 clusters in country

The effects of the SMP purchase volumes are presented in Table 4. Only the lagged volume is significant, but it displays a positive sign. Hence, there is no bounce-back effect on government debt. Even though the SMP purchases increase government debt only modestly, this finding is also in line with benchmark estimations.

VI. Conclusions

In the wake of the Eurozone crisis, the ECB implemented a variety of monetary policy measures. On the one hand, conventional policy instruments were adjusted in response to crisis conditions, for example by lowering the deposit rate to zero percent or extending maturities and changing the tender and allotment procedures of LTROs and MROs. On the other hand, the ECB introduced asset purchase

programs, like the SMP, that directly targeted sovereign bonds. The hypothesis of this paper is that the unconventional policy measures softened the budget constraints of Eurozone countries by lowering sovereign bond yield spreads. Lowering the costs of debt provided Eurozone countries with incentives to further increase sovereign debt.

This hypothesis is tested using pooled OLS to estimate the effect of two different types of monetary policy measures on sovereign bond yield spreads: first, daily event dummies containing policy events relating to the OMT, SMP, LTROs, CBPP, and the lowering of the deposit rate to zero percent; second, the weekly volume of asset purchases under the SMP. The dataset comprises eleven Eurozone countries and the time span of 2007 to 2013 for event dummies and the lifetime of the SMP (May 2010 to September 2012) for SMP purchases. Estimations for both types of policy measures yield two main findings. First, there is an overall significantly negative effect of the policy measures on bond yield spreads. Second, the different policies had dissimilar effects for crisis and non-crisis countries. While the OMT effectively lowered bond yield spreads for both country groups, the SMP was most effective in crisis countries, and the zero percent-deposit-rate and LTROs were most effective in non-crisis countries. Altogether, the hypothesis of soft budget constraints caused by the ECB's unconventional monetary policies is accepted.

This result is confirmed in several robustness checks. Using bond yields instead of bond yield spreads and varying the length of the policy dummies' event windows do not alter the general findings. Additionally, the effect of ECB policies on central government short-term debt is directly estimated using quarterly data. These estimations yield a significantly positive effect of the policies on government debt, thus corroborating the benchmark estimations.

Overall, the estimations in this paper find that the ECB's unconventional monetary policies during the Eurozone crisis had the unintended consequence of providing Eurozone countries with soft budget constraints. Two areas for future research emerge from these findings. First, the need for additional research on the unintended effects of rescue policies—not just of the ECB, but also of other EU institutions and member states. The significantly negative effect of the EFSF/ESM dummy variable on bond yield spreads in the benchmark estimations indicates that various support packages and rescue mechanisms may have created soft budget constraints as well. Second, the observation of soft budget constraints in the Eurozone caused by the ECB's crisis response policies reveals the need for theoretical models on the transmission mechanisms of SBCs in currency unions.

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Appendix

Figure A.1 Bond yields of ten-year sovereign bonds (non-crisis countries)

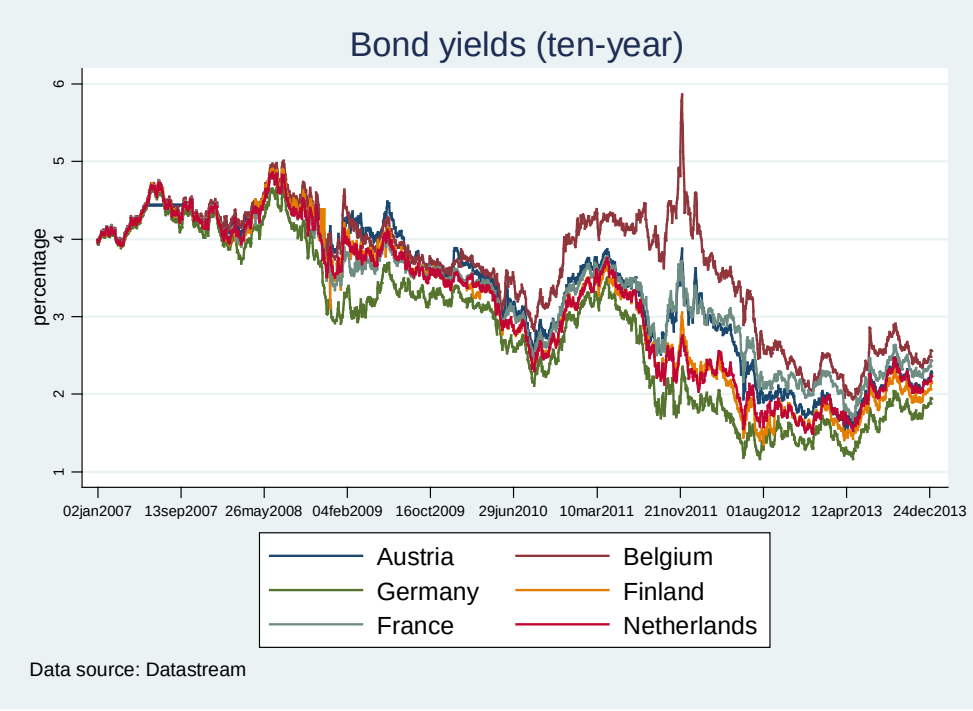

Figure A.2 Bond yields of ten-year sovereign bonds (crisis countries)

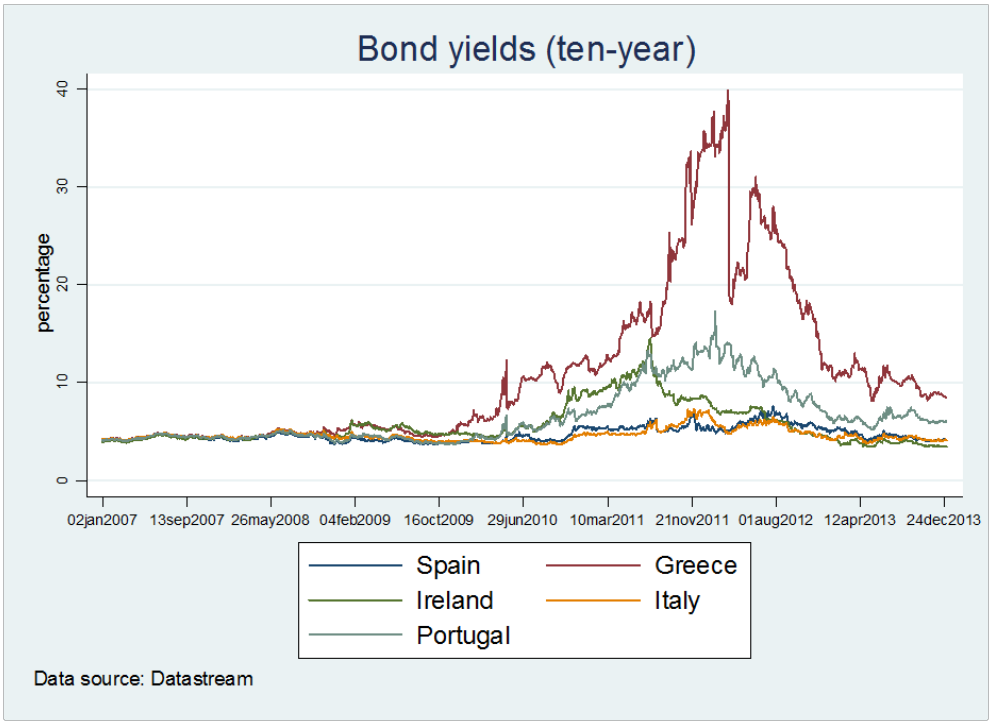

Table A.1 Monetary Policy Event Dummies

Variable	Date	Description	Source(s)
SMP	10 May 2010	Announcement of the Securities Markets Programme	Kilponen et al. (2015); Krishnamurthy et al. (2014); Rivolta (2014); Szczerbowicz (2014)
	7 August 2011	Statement about the active implementation of the Securities Markets Programme	Krishnamurthy et al. (2014); Rivolta (2014)
OMT	26 July 2012	Draghi speech "Whatever it takes" in London	Altavilla et al. (2014); Kilponen et al. (2015); Krishnamurthy et al. (2014); Rivolta (2014); Szczerbowicz (2014)
	2 August 2012	Press conference announcing Outright Monetary Transactions	Altavilla et al. (2014); Krishnamurthy et al. (2014); Rivolta (2014)
	6 September 2012	Publication of technical features of Outright Monetary Transactions	Altavilla et al. (2014); Kilponen et al. (2015); Krishnamurthy et al. (2014); Rivolta (2014); Szczerbowicz (2014)
LTROs	22 August 2007	Announcement of the first supplementary LTRO (three-month maturity, standard tender and allotment procedure)	Kilponen et al. (2015); Rivolta (2014)
	6 September 2007	ECB decision to conduct a supplementary liquidity-providing LTRO with three-month-maturity	Kilponen et al. (2015)
	28 March 2008	ECB decision on supplementary six-month LTROs and continuation of the supplementary three-month LTROs	Kilponen et al. (2015)
	15 October 2008	Announcement of several LTROs (3/6-month maturity, fixed-rate full allotment procedure)	Kilponen et al. (2015); Rivolta (2014)
	7 May 2009	ECB decision to conduct liquidity-providing LTROs with 12-month maturity	Kilponen et al. (2015)
	23 June 2009	Call for bids of a LTRO with 12-month maturity	Rivolta (2014)
	29 September 2009	Call for bids of a LTRO with 12-month maturity	Rivolta (2014)
	15 December 2009	Call for bids of a LTRO with 12-month maturity	Rivolta (2014)
	4 August 2011	ECB decision to conduct a liquidity-providing supplementary LTRO with approximately a six-month maturity with a fixed-rate full allotment tender procedure	Kilponen et al. (2015)
	6 October 2011	Announcement of two LTROs with 12-month maturity	Kilponen et al. (2015); Rivolta (2014)
	25 October 2011	Call for bids of a LTRO with 12-month maturity	Rivolta (2014)
	1 December 2011	Draghi speech before European parliament, hinting at ECB actions	Krishnamurthy et al. (2014)
	8 December 2011	Announcement of two LTROs with 36-month maturity	Kilponen et al. (2015); Krishnamurthy et al. (2014); Rivolta (2014); Szczerbowicz (2014)
	21 December 2011	First allotment date for the 36-month LTROs	Krishnamurthy et al. (2014); Szczerbowicz (2014)
	29 February 2012	Second allotment date for the 36-month LTROs	Krishnamurthy et al. (2014); Szczerbowicz (2014)
0% deposit rate	5 July 2012	ECB lowers deposit rate to 0%	Szczerbowicz (2014)

Variable	Date	Description	Source(s)
CBPPs	7 May 2009	Announcement of the Covered Bond Purchase Programme 1	Rivolta (2014); Szczerbowicz (2014)
	4 June 2009	Publication of technical details of the CBPP1	Kilponen et al. (2015); Rivolta (2014)
	6 October 2011	Announcement of the Covered Bond Purchase Programme 2	Kilponen et al. (2015); Rivolta (2014); Szczerbowicz (2014)
	3 November 2011	Publication of technical details of the CBPP2	Rivolta (2014)
EFSF_ESM	9 May 2010	Decision by EU member states to establish EFSF	Bundesminsterium der Finanzen (2015)
	28 October 2010	European Council agrees on the need to set up a permanent crisis-resolution mechanism	Kilponen et al. (2015)
	29 November 2010	Agreement on the key elements of the European Stability Mechanism.	Kilponen et al. (2015)
	16 December 2010	European Council agrees on limited amendment to the EU Treaty to underpin the permanent mechanism	Kilponen et al. (2015)
	21 March 2011	Eurogroup+ agrees on the organizational and financial details of the ESM	Kilponen et al. (2015)
	20 June 2011	Agreement to increase effective capacity and widen the mandate of the EFSF	Kilponen et al. (2015)
	21 July 2011	Widening of the scope of EFSF/ESM	Kilponen et al. (2015)
	29 November 2011	Agreement on two models for maximizing the capacity of the EFSF (leveraging of EFSF)	Bundesminsterium der Finanzen (2015)
	2 February 2012	Treaty establishing the ESM: New legal text of the ESM treaty	Kilponen et al. (2015)
	30 March 2012	The current overall ceiling for ESM/EFSF lending, as defined in the ESM Treaty, is raised to €700 billion such that the ESM and the EFSF will be able to operate	Kilponen et al. (2015)
	9 July 2012	Eurogroup endorses the ESM investment policy guideline	Kilponen et al. (2015)

Table A.2 Summary Statistics of Bond Yield Spreads

Summary for variables: Bond yield spreads
by categories of: Country

Country	mean	p50	max	min	variance
Austria	0.1252	0.1240	1.242	-0.537	0.0853
Belgium	0.4552	0.4395	3.171	-0.336	0.3072
Germany	-0.3572	-0.3190	-0.057	-0.834	0.0193
Spain	1.4685	1.4120	5.842	-0.386	2.3250
Finland	-0.0829	-0.0705	0.524	-0.913	0.0280
France	0.1041	0.0930	1.175	-0.509	0.0969
Greece	7.7334	6.4490	37.599	-0.162	76.4179
Ireland	2.4431	1.8600	11.398	-0.385	5.7037
Italy	1.4284	1.1100	4.920	-0.182	1.7786
Netherlands	-0.0651	-0.5200	0.493	-0.531	0.0291
Portugal	3.3106	2.5580	15.058	-0.225	12.5336

Table A.3 Summary Statistics of Bond Yields

Summary for variables: Bond yields
by categories of: Country

Country	mean	p50	max	min	variance
Austria	3.3569	3.5480	4.920	1.489	0.8251
Belgium	3.6869	3.9110	5.865	1.932	0.6034
Germany	2.8745	3.0530	4.675	1.162	1.0491
Spain	4.7002	4.4540	7.586	3.716	0.5546
Finland	3.1488	3.3370	4.905	1.350	0.9793
France	3.3358	3.4550	4.853	1.670	0.6286
Greece	10.9652	8.6480	39.850	4.142	64.8983
Ireland	5.6748	4.8080	14.552	3.429	4.1240
Italy	4.6602	4.5070	7.311	3.663	0.4420
Netherlands	3.1666	3.3680	4.859	1.493	0.9098
Portugal	6.5423	5.3420	17.355	3.714	8.1970

Table A.4 Summary Statistics of Control Variables

Variable	mean	p50	max	min	variance
ECB_rate	1.9093	1.0000	5.360	0.250	2.2662
MSCI_Europe	1511.1700	1454.6350	2235.356	794.232	100524.0000
CDS_index_EU_banks	257.1033	247.8380	552.179	51.822	12122.8000
iTraxx_Europe	106.5441	104.5300	215.917	20.094	1840.2360
VIX_index	22.8974	20.0800	80.860	9.890	111.1926

Table A.5 Summary Statistics of the Central Government Short-term Debt-to-GDP Ratio

Summary for variables: Debt to GDP short term
by categories of: Country

Country	mean	p50	max	min	variance
Austria	3.0500	2.8500	6.400	0.800	1.3804
Belgium	11.0500	11.2500	16.900	6.500	5.2856
Germany	2.9357	3.2000	4.400	1.500	0.9453
Spain	5.2214	5.8000	7.900	1.300	3.7655
Finland	2.9643	2.6000	6.200	0.900	2.1216
France	8.1107	8.5000	11.500	4.000	5.2365
Greece	5.1179	4.5500	9.500	0.400	7.5845
Ireland	5.8071	3.1500	17.100	0.500	25.6133
Italy	9.4286	9.4000	11.200	8.000	0.6680
Netherlands	6.6500	5.9000	13.200	2.700	6.5641
Portugal	8.3893	8.5500	12.300	4.700	5.3417

Table A.6 Summary Statistics of the Central Government Debt-to-GDP Ratio (All Maturities)

Summary for variables: Debt to GDP
by categories of: Country

Country	mean	p50	max	min	variance
Austria	61.9714	64.6000	67.800	51.700	20.9629
Belgium	81.9857	83.6000	87.700	73.600	16.8613
Germany	40.2500	41.4500	43.000	36.000	7.0811
Spain	47.2179	47.2000	72.200	27.600	215.6541
Finland	35.3821	37.4000	45.000	24.100	38.5141
France	60.2214	62.5500	69.900	48.600	53.8899
Greece	98.6679	101.2000	133.200	48.100	858.7674
Ireland	47.0929	51.7000	71.000	18.600	262.6822
Italy	93.6286	95.2000	107.800	80.200	74.7732
Netherlands	44.7893	46.0000	54.600	33.900	41.4610
Portugal	66.8071	70.8500	78.600	51.600	89.3518

Table A.7 Summary Statistics of Control Variables (Robustness Checks Dataset)

Country	variable	mean	p50	max	min	variance
Austria	Inflation_rate	2.2041	2.1990	3.772	0.202	0.9616
	Unemployment_rate	6.7838	6.8405	7.947	5.454	0.3418
	GDP_growth_rate	1.0379	1.3290	5.526	-5.969	7.3815
Belgium	Inflation_rate	2.2790	2.4945	5.694	-1.141	2.4670
	Unemployment_rate	7.7023	7.7500	8.500	6.933	0.2814
	GDP_growth_rate	0.9363	0.9520	3.599	-3.841	4.2267
Germany	Inflation_rate	1.7053	1.8245	3.119	-0.207	0.6744
	Unemployment_rate	7.6107	7.6000	9.467	6.800	0.5829
	GDP_growth_rate	1.0510	1.5455	5.575	-6.923	10.9258
Spain	Inflation_rate	2.2066	2.4355	4.922	-0.994	2.2355
	Unemployment_rate	18.5131	19.9835	26.233	7.967	40.1833
	GDP_growth_rate	-0.5627	-1.1375	4.064	-4.263	6.1100
Finland	Inflation_rate	2.2221	2.4300	4.641	-1.000	2.0724
	Unemployment_rate	7.6833	7.8500	8.833	6.200	0.6412
	GDP_growth_rate	0.1036	0.7550	5.765	-9.352	19.0471
France	Inflation_rate	1.5481	1.5910	3.288	-0.398	0.8505
	Unemployment_rate	8.6321	8.8110	9.978	6.867	0.8588
	GDP_growth_rate	0.6432	1.0600	2.927	-3.952	3.4208
Greece	Inflation_rate	2.4148	2.6045	5.550	-2.253	3.8982
	Unemployment_rate	15.5039	12.6055	27.814	7.545	58.0401
	GDP_growth_rate	-3.7596	-3.7925	5.128	-10.200	19.5667
Ireland	Inflation_rate	1.1945	1.7245	5.066	-6.025	10.0918
	Unemployment_rate	11.3678	13.1500	15.100	4.567	15.4808
	GDP_growth_rate	0.3347	0.7260	7.838	-7.550	15.3261
Italy	Inflation_rate	2.0761	1.8800	4.014	0.187	1.0115
	Unemployment_rate	8.5922	8.2200	12.384	5.923	4.1450
	GDP_growth_rate	-1.0576	-1.0240	2.359	-7.179	7.1523
Netherlands	Inflation_rate	1.9827	2.0310	3.198	0.277	0.5062
	Unemployment_rate	5.0381	4.9000	7.633	3.600	1.3597
	GDP_growth_rate	0.4531	0.7410	4.234	-4.473	5.9753
Portugal	Inflation_rate	1.7605	2.2525	3.831	-1.404	2.4564
	Unemployment_rate	12.2440	12.0750	17.285	8.601	8.4619
	GDP_growth_rate	-0.7610	-1.0120	2.814	-4.476	6.6174

Table A.8 Unit-root Tests for Bond Yield Spreads

Augmented Dickey-Fuller unit-root test

H_0: following variable is non-stationary:

Bond_yield_spreads

Country	p-value
Austria	0.0293
Belgium	0.2208
Germany	0.0001
Spain	0.5507
Finland	0.0000
France	0.0041
Greece	0.4423
Ireland	0.6278
Italy	0.5173
Netherlands	0.0019
Portugal	0.6373

Table A.9 Estimation Results for Event Dummies (Crisis Countries)

D. Bond_yield_spreads	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Bond_yield_spreads						
LD.	0.0203	0.0352	0.580	0.565	-0.0487	0.0892
ECB_rate						
D1.	-0.0642	0.0183	-3.510	0.000	-0.1001	-0.0283
MSCI_Europe						
D1.	-0.0003	0.0001	-2.140	0.033	-0.0006	-0.00002
CDS_index_EU_banks						
D1.	0.0037	0.0007	5.450	0.000	0.0024	0.0051
iTraxx_Europe						
D1.	0.0069	0.0013	5.120	0.000	0.0042	0.0095
VIX_index						
LD.	-0.0030	0.0014	-2.220	0.027	-0.0057	-0.0004
OMT	-0.1658	0.0484	-3.430	0.001	-0.2606	-0.0710
SMP	-0.4635	0.1727	-2.680	0.007	-0.8019	-0.1250
LTROs	0.0034	0.0339	0.100	0.920	-0.0630	0.0699
zero_deposit_rate	0.0557	0.0442	1.260	0.207	-0.0309	0.1423
CBPP	0.1297	0.0787	1.650	0.100	-0.0247	0.2841
EFSF_ESM	-0.0540	0.0326	-1.660	0.098	-0.1179	0.0099
Constant	0.0032	0.0037	0.870	0.386	-0.0040	0.0104
Number of obs	7885					
F(12, 7872)	17.03					
Prob>F	0.0000					
R-Squared	0.0403					
Root MSE	0.3224					

Table A.10 Estimation Result for Event Dummies (Non-crisis Countries)

D. Bond_yield_spreads	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
Bond_yield_spreads						
LD.	-0.1767	0.0342	-5.160	0.000	-0.2437	-0.1096
ECB_rate						
D1.	-0.0283	0.0106	-2.670	0.008	-0.0491	-0.0075
MSCI_Europe						
D1.	-0.00001	0.00003	-0.450	0.651	-0.0001	0.00005
CDS_index_EU_banks						
D1.	0.0003	0.0001	4.110	0.000	0.0002	0.0005
iTraxx_Europe						
D1.	0.0005	0.0002	2.580	0.010	0.0001	0.0009
VIX_index						
LD.	-0.0006	0.0003	-1.800	0.072	-0.0012	0.00005
OMT	-0.0346	0.0094	-3.670	0.000	-0.0530	-0.0161
SMP	0.0422	0.0166	2.540	0.011	0.0096	0.0748
LTROs	-0.0106	0.0060	-1.780	0.076	-0.0224	0.0011
zero_deposit_rate	-0.0530	0.0197	-2.690	0.007	-0.0915	-0.0144
CBPP	0.0089	0.0065	1.370	0.170	-0.0038	0.0217
EFSF_ESM	-0.0182	0.0062	-2.930	0.003	-0.0305	-0.0060
Constant	0.0007	0.0004	1.530	0.126	-0.0002	0.0015
Number of obs	9462					
F(12, 9449)	9.76					
Prob>F	0.0000					
R-Squared	0.0509					
Root MSE	0.0438					

Table A. 11 Estimation Results for Event Dummies (All Countries)

D. Bond_yield_spreads	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Bond_yield_spreads						
LD.	0.0210	0.0345	0.610	0.542	-0.0465	0.0886
ECB_rate						
D1.	-0.0450	0.0104	-4.330	0.000	-0.0653	-0.0246
MSCI_Europe						
D1.	-0.0002	0.0001	-2.300	0.022	-0.0003	-0.00002
CDS_index_EU_banks						
D1.	0.0019	0.0003	5.920	0.000	0.0012	0.0025
iTraxx_Europe						
D1.	0.0034	0.0007	5.080	0.000	0.0021	0.0047
VIX_index						
LD.	-0.0018	0.0007	-2.700	0.007	-0.0032	-0.0005
OMT	-0.0932	0.0269	-3.470	0.001	-0.1459	-0.0406
SMP	-0.1866	0.0941	-1.980	0.047	-0.3711	-0.0022
LTROs	-0.0041	0.0159	-0.260	0.798	-0.0351	0.0270
zero_deposit_rate	-0.0050	0.0286	-0.180	0.860	-0.0611	0.0511
CBPP	0.0623	0.0366	1.700	0.089	-0.0095	0.1341
EFSF_ESM	-0.0328	0.0162	-2.020	0.043	-0.0646	-0.0010
Constant	0.0018	0.0017	1.040	0.300	-0.0016	0.0051
Number of obs	17347					
F(12, 17334)	17.53					
Prob>F	0.0000					
R-Squared	0.0209					
Root MSE	0.2219					

Table A.12 Estimation Results for Event Dummies: Bond Yields as Dependent Variable (Comparison of Different Estimation Samples)

	Dependent variable: Bond yields		
	All	Crisis	Non-Crisis
Bond_yields			
LD.	0.0229	0.0179	0.0140
ECB_rate			
D1.	-0.0154	-0.0347*	0.0004
MSCI_Europe			
D1.	0.0005***	0.0003**	0.0006***
CDS_index_EU_banks			
D1.	0.0019***	0.0037***	0.0003***
iTraxx_Europe			
D1.	0.0018***	0.0053***	-0.0010***
VIX_index			
LD.	0.0008	-0.0004	0.0018***
OMT	-0.0700***	-0.1427***	-0.0095
SMP	-0.2428**	-0.5212***	-0.0127
LTROs	-0.0048	0.0028	-0.0110**
zero_deposit_rate	-0.0228	0.0381	-0.0736***
CBPP	0.1084***	0.1761**	0.0528***
EFSF_ESM	-0.0265	-0.0478	-0.0089
Constant	0.0002	0.0016	-0.0010*

*** p < 0.01

** p < 0.05

* p < 0.1

Table A.13 Estimation Results for SMP Purchase Volumes: Bond Yields as Dependent Variable

D. Bond_yields	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Bond_yields						
LD.	0.0374	0.0267	1.400	0.191	-0.0220	0.0969
L2D.	-0.1148	0.0053	-21.810	0.000	-0.1265	-0.1031
ECB_rate						
D1.	0.1107	0.1909	0.580	0.575	-0.3146	0.5361
MSCI_Europe						
D1.	0.0016	0.0001	18.190	0.000	0.0014	0.0018
CDS_index_EU_banks						
D1.	0.0035	0.0010	3.320	0.008	0.0011	0.0058
iTraxx_Europe						
D1.	0.0082	0.0061	1.350	0.207	-0.0053	0.0217
VIX_index						
LD.	-0.0138	0.0053	-2.610	0.026	-0.0256	-0.0020
SMP_purchases						
--	-0.00005	0.00002	-2.920	0.015	-0.0001	-0.00001
L1.	0.00005	0.00002	2.750	0.021	9.18e-06	0.0001
Constant	0.0036	0.0110	0.330	0.748	-0.0208	0.0281
Number of obs	1298					
F(9, 10)	1265.06					
Prob>F	0.0000					
R-Squared	0.0297					
Root MSE	0.6874					

Note: Std. Err adjusted for 11 clusters in country

Table A.14 Comparing Different Event Window Lengths (All Countries)

	Event window length - All countries			
Variable	One day	Two days	Three days	Five days
Bond_yield_spreads				
LD.	0.0235	0.0210	0.0216	0.0219
ECB_rate				
D1.	-0.0450***	-0.0450***	-0.0462***	-0.0437***
MSCI_Europe				
D1.	-0.0002**	-0.0002**	-0.0002**	-0.0001*
CDS_index_EU_banks				
D1.	0.0018***	0.0019***	0.0018***	0.0018***
iTraxx_Europe				
D1.	0.0033***	0.0034***	0.0036***	0.0038***
VIX_index				
LD.	-0.0016***	-0.0018***	-0.0022***	-0.0021***
SMP_1	-0.3141*			
OMT_1	-0.0433			
LTROs_1	0.0485*			
zero_deposit_rate_1	0.0295			
CBPP_1	0.0489			
EFSF_ESM_1	-0.0333			
OMT		-0.0932***		
SMP		-0.1866**		
LTROs		-0.0041		
zero_deposit_rate		-0.0050		
CBPP		0.0623*		
EFSF_ESM		-0.0328**		
SMP_3			-0.1256*	
OMT_3			-0.0546**	
LTROs_3			-0.0036	
zero_deposit_rate_3			-0.0007	
CBPP_3			0.0493**	
EFSF_ESM_3			-0.0116	
SMP_5				-0.0825**
OMT_5				-0.0515***
LTROs_5				0.0130
zero_deposit_rate_5				-0.0134
CBPP_5				0.0367**
EFSF_ESM_5				-0.0136
Constant	0.0009	0.0018	0.0015	0.0013

*** p < 0.01

** p < 0.05

* p < 0.1

Table A.15 Comparing Different Event Window Lengths (Crisis Countries)

	Event window length - Crisis countries			
Variable	One day	Two days	Three days	Five days
Bond_yield_spreads				
LD.	0.0267	0.0203	0.0218	0.0231
ECB_rate				
D1.	-0.0638***	-0.0642***	-0.0665***	-0.0614***
MSCI_Europe				
D1.	-0.0003**	-0.0003**	-0.0003**	-0.0002
CDS_index_EU_banks				
D1.	0.0036***	0.0037***	0.0036***	0.0036***
iTraxx_Europe				
D1.	0.0066***	0.0069***	0.0073***	0.0078***
VIX_index				
LD.	-0.0025**	-0.0030**	-0.0039**	-0.0038**
SMP_1	-0.7861**			
OMT_1	-0.0773			
LTROs_1	0.0856			
zero_deposit_rate_1	0.0757			
CBPP_1	0.1208			
EFSF_ESM_1	-0.0567			
OMT		-0.1658***		
SMP		-0.4635***		
LTROs		0.0034		
zero_deposit_rate		0.0557		
CBPP		0.1297*		
EFSF_ESM		-0.0540*		
SMP_3			-0.3077**	
OMT_3			-0.1121**	
LTROs_3			-0.0012	
zero_deposit_rate_3			0.0350	
CBPP_3			0.0929*	
EFSF_ESM_3			-0.0142	
SMP_5				-0.1889**
OMT_5				-0.0977***
LTROs_5				0.0300
zero_deposit_rate_5				-0.0039
CBPP_5				0.0658*
EFSF_ESM_5				-0.0158
Constant	0.0019	0.0032	0.0028	0.0020

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

Table A.16 Comparing Different Event Window Lengths (Non-crisis Countries)

	Event window length - Non-crisis countries			
Variable	One day	Two days	Three days	Five days
Bond_yield_spreads				
LD.	-0.1722***	-0.1767***	-0.1800***	0.0231
ECB_rate				
D1.	-0.0287***	-0.0283***	-0.0286***	-0.0614***
MSCI_Europe				
D1.	-4.659e-06	-0.00001	-0.00002	-0.0002
CDS_index_EU_banks				
D1.	0.0004***	0.0003***	0.0003***	0.0036***
iTraxx_Europe				
D1.	0.0006***	0.0005**	0.0005**	0.0078***
VIX_index				
LD.	-0.0005*	-0.0006*	-0.0005	-0.0038**
SMP_1	0.0651***			
OMT_1	-0.0150			
LTROs_1	0.0137*			
zero_deposit_rate_1	-0.0038			
CBPP_1	-0.0030			
EFSF_ESM_1	-0.0168**			
OMT		-0.0346***		
SMP		0.0422**		
LTROs		-0.0106*		
zero_deposit_rate		-0.0530***		
CBPP		0.0089		
EFSF_ESM		-0.0182***		
SMP_3			0.0269**	
OMT_3			-0.0116	
LTROs_3			-0.0084*	
zero_deposit_rate_3			-0.0346**	
CBPP_3			0.0164***	
EFSF_ESM_3			-0.0124***	
SMP_5				-0.1889**
OMT_5				-0.0977***
LTROs_5				0.0300
zero_deposit_rate_5				-0.0039
CBPP_5				0.0658*
EFSF_ESM_5				-0.0158
Constant	0.0002	0.0007	0.0006	0.0020

*** p < 0.01

** p < 0.05

* p < 0.1

Table A.17 Robustness Check Estimation Results for Event dummies – Central Government Short-term Debt (Crisis Countries)

Debt_to_GDP_short_term	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Debt_to_GDP_short_term						
L1.	0.8686	0.0475	18.290	0.000	0.7747	0.9626
Inflation_rate	0.0750	0.1046	0.720	0.475	-0.1320	0.2820
Unemployment_rate	-0.0298	0.0195	-1.530	0.129	-0.0683	0.0088
GDP_growth_rate	-0.1022	0.0447	-2.280	0.024	-0.1907	-0.0136
OMT	1.0189	0.4827	2.110	0.037	0.0635	1.9743
SMP	-0.0670	0.6363	-0.110	0.916	-1.3262	1.1923
LTROs	0.1943	0.3185	0.610	0.543	-0.4360	0.8246
zero_deposit_rate	0.0000	(omitted)				
CBPP	0.5985	0.6240	0.960	0.339	-0.6365	1.8334
EFSF_ESM	-0.6191	0.4077	-1.520	0.131	-1.4259	0.1877
Constant	1.1464	0.6220	1.840	0.068	-0.0845	2.3773
Number of obs	135					
F(9, 125)	78.63					
Prob>F	0.0000					
R-Squared	0.8304					
Root MSE	1.4260					

Table A.18 Robustness Check Estimation Results for Event dummies – Central Government Short-term Debt (Non-crisis Countries)

Debt_to_GDP_short_term	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Debt_to_GDP_short_term						
L1.	0.9327	0.0316	29.520	0.000	0.8703	0.9951
Inflation_rate	0.0546	0.1116	0.490	0.625	-0.1659	0.2751
Unemployment_rate	0.0013	0.1124	0.010	0.991	-0.2208	0.2235
GDP_growth_rate	-0.0700	0.0445	-1.570	0.118	-0.1580	0.0179
OMT	0.1723	0.2771	0.620	0.535	-0.3752	0.7199
SMP	0.1577	0.2966	0.530	0.596	-0.4283	0.7436
LTROs	0.6853	0.2708	2.530	0.012	0.1502	1.2204
zero_deposit_rate	0.0000	(omitted)				
CBPP	-1.2220	0.4370	-2.800	0.006	-2.0853	-0.3587
EFSF_ESM	-0.2948	0.2800	-1.050	0.294	-0.8479	0.2584
Constant	0.2418	0.8919	0.270	0.787	-1.5203	2.0039
Number of obs	162					
F(9, 152)	144.22					
Prob>F	0.0000					
R-Squared	0.8769					
Root MSE	1.3094					

Table A.19 Robustness Check Estimation Results for Event dummies – Short-term Central Government Debt (All Countries)

Debt_to_GDP_short_term	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Debt_to_GDP_short_term						
L1.	0.9150	0.0247	36.990	0.000	0.8663	0.9637
Inflation_rate	0.0978	0.0773	1.260	0.207	-0.0544	0.2500
Unemployment_rate	-0.0082	0.0132	-0.620	0.533	-0.0342	0.0177
GDP_growth_rate	-0.0749	0.0291	-2.580	0.010	-0.1321	-0.0177
OMT	0.5615	0.2849	1.970	0.050	0.0008	1.1221
SMP	0.0579	0.3338	0.170	0.863	-0.5992	0.7149
LTROs	0.4937	0.2059	2.400	0.017	0.0885	0.8989
zero_deposit_rate	0.0000	(omitted)				
CBPP	-0.3699	0.3986	-0.930	0.354	-1.1544	0.4145
EFSF_ESM	-0.4822	0.2338	-2.060	0.040	-0.9424	-0.0221
Constant	0.4221	0.2772	1.520	0.129	-0.1235	0.9677
Number of obs	297					
F(9, 287)	183.00					
Prob>F	0.0000					
R-Squared	0.8547					
Root MSE	1.3684					

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