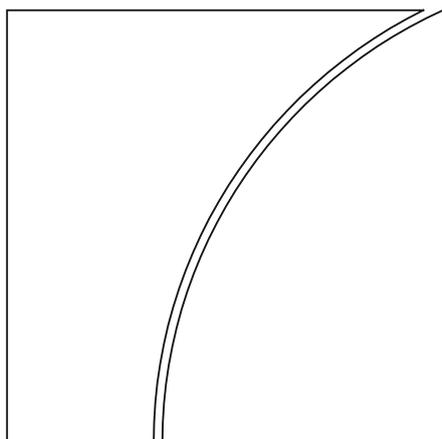




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Keywords: Monetary policy, asset purchases, financial stability, term premia

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# Effects of asset purchases and financial stability measures on term premia in the euro area\*

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## Abstract

We study the effects of the announcements of ECB asset purchases and of financial stability measures in the euro area on ten-year government bond term premia in eleven euro area countries in the wake of the global financial crisis and the euro area sovereign debt crisis. We find that the term premia of euro area countries with higher sovereign risk, as measured by sovereign CDS spreads, decreased more in response to the announcements of asset purchases and financial stability measures. Term premia of countries with the lowest sovereign risk either increased as in Germany, or were not significantly affected or fell slightly, as in the Netherlands and Finland.

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# 1 Introduction

In the wake of the global financial crisis of 2008-09, several central banks in advanced economies, including the European Central Bank (ECB), introduced large-scale asset purchases as unconventional monetary policy measures in order to reduce long-term interest rates and stimulate the economy. In the wake of the euro area sovereign debt crisis of 2010-11, financial stability measures were introduced in Europe in order to help preserve financial stability in Europe. In this paper we study how effective these unconventional monetary policy and financial stability measures have been in reducing the term premia, which also reflect credit risk and liquidity risk, of long-term government bonds in different euro area countries.

We study the effects of the ECB's asset purchase announcements on term premia in eleven euro area countries. We consider the announcement effects of all the asset purchase programmes introduced by the ECB since 2009 in the wake of the global financial crisis and the euro area sovereign debt crisis, consisting of the first three covered bond purchase programmes (CBPP1, CBPP2 and CBPP3), the Securities Markets Programme (SMP), the Outright monetary transactions programme (OMT), the Asset-backed securities purchase programme (ABSPP) and the Public sector purchase programme (PSPP). The CBPP3, ABSPP and PSPP combined are referred to as the expanded asset purchase programme (APP). We also consider the effects of announcements of important financial stability measures in the euro area. We use novel estimates of term premia (which include liquidity and credit risk premia) of 10-year government bonds at the daily frequency for eleven euro area countries, namely Germany, the Netherlands, Finland, Austria, France, Belgium, Italy, Spain, Ireland, Portugal and Greece. Moreover, we relate the announcement effects of the asset purchase programmes and of the financial stability measures to sovereign risk in each country, as measured by sovereign CDS spreads.

Our study fits into the literature on the effects of the ECB's asset purchase programmes, for which Melnic (2017) and Pattipeilohy et al. (2013) provide overviews, and we discuss some of the papers most relevant to our study below. A number of papers studied the effects of the OMT announcement on government bond yields. Altavilla et

al. (2014) find that the OMT announcement reduced two-year government bond yields in Italy and Spain by about 2 percentage points, while leaving them unchanged in Germany and France. Acharya et al. (2015) find that the OMT announcement reduced the government bond yields of peripheral euro area countries. Ehrmann and Fratzscher (2015) find, using ten-year government bond yields, that flight to quality was present at the height of the euro area sovereign debt crisis, but largely disappeared after the OMT announcement. Szczerbowicz (2015) finds that the SMP and OMT announcements were particularly effective in reducing the government bond yields of peripheral euro area countries with high sovereign risk, whereas the French spread reacted very little if at all. Kilponen et al. (2015) find that the SMP and OMT reduced 10-year government bond spreads of several euro area countries over German government bonds. Gibson, Hall and Tavlas (2016) find that the CBPP1, CBPP2 and the SMP reduced the spreads over German government bond yields of ten-year government bond yields in Greece, Ireland, Italy, Portugal, and Spain.

De Santis (2016) finds that vulnerable euro area countries benefited most from the ECB's APP, studying the effects on ten-year government bond yields. For the period of January 2014 to March 2015, Altavilla et al. (2015) study the effects of the ECB's APP announcements on ten-year government bond yields, using dummy variable event regressions. They also consider a broader set of the ECB's official communication interventions which could have conveyed information about the APP. They consider CDS-adjusted government bond yields, and spreads of government bond yields of euro area countries over those of German government bonds. They find that the ECB's APP significantly lowered yields in a broad set of market segments, with effects generally being larger for more risky assets.

Krishnamurthy et al. (2014) study the effects of the SMP and OMT announcements on term premia in Italy, Spain and Portugal. They find that the SMP and OMT reduced government bond yields in Italy, Spain and Portugal. They conclude that default risk and sovereign bond segmentation effects were the dominant channels through which the SMP and the OMT affected the sovereign bond yields of Italy and Spain, and that redenomination risk may have been a third channel in the case of Spain and Portugal, but not for Italy. Dewachter et al. (2016) study the effects of the ECB's SMP, OMT and APP

announcements on government bond term premia in Belgium, France, Italy and Spain, and find that they generally reduced term premia.

Our study of the effects of the announcements of financial stability measures in the euro area is related to earlier studies of their effects on government bonds. Kilponen et al. (2015) find that announcements of financial assistance programmes in the euro area typically increased somewhat the spreads of government bond yields in the guarantor countries, while reducing the spreads of government bond yields in the countries receiving funding over those of German government bonds. Schwendner et al. (2015) find that the spreads of yields of peripheral euro area government bonds over those of core euro area government bonds decreased since the European Financial Stability Facility (EFSF) and the European Stability Mechanism (ESM) were established, and also that market-implied spillover risks decreased. Attinasi et al. (2009) find that announcements of government rescue packages for banks during the global financial crisis from July 2007 to March 2009 contributed to higher government bond yield spreads over those of Germany in ten euro area countries. They conclude that the stress in the national banking sector was transferred to the public sector through governments' rescue packages.

Our study also fits more broadly into the literature on the effects of central bank communication more generally, for which an overview is provided in Blinder et al. (2008).

The effects of monetary policy surprises on long-term government bond yields in the United States have been studied in Wright (2012), Rogers, Scotti and Wright (2015) and Pericoli and Veronese (2018). Pericoli and Veronese (2018) find that monetary policy path surprises in the euro area reflected shifts in sovereign spreads, and had a large impact on the whole range of interest rates.

We find that the term premia of Belgium, Ireland, Italy and Spain decreased significantly in response to the announcements of both asset purchases and financial stability measures, by between 6 and 49 basis points on average per announcement. By contrast, the term premia of Germany increased in response to the announcements of asset purchases and financial stability measures, by around 5 basis points on average per announcement. This increase in the term premia of German government bonds could partly be due to some reversal of a flight to quality into German government bonds following

the announcements.

The paper is organised as follows. Section 2 presents the data, and Section 3 presents the method and results. Finally, Section 4 concludes.

## 2 Data

We use calculations by the National Institute of Economic and Social Research (NIESR) of a decomposition of government bond yields into term premia and expected interest rates at the ten-year maturity for eleven euro area countries, applying the method of Adrian et al. (2013) for US government bonds to government bonds in euro area countries (Chadha et al., 2017). The term premia include liquidity and credit risk premia. Higher term premia indicate that investors require an extra return to hold 10-year government bonds of a country. The eleven euro area countries are Germany, the Netherlands, Finland, Austria, France, Belgium, Italy, Spain, Ireland, Portugal and Greece. Figure 1 shows the developments of term premia in individual euro area countries over the sample period of 1 October 2008 to 30 December 2015. Term premia in Greece, Portugal and Ireland rose very strongly during the euro area sovereign debt crisis of 2010-2011, as concerns about sovereign risk in peripheral euro area countries increased (Allen and Moessner, 2013), and those in Spain and Italy also rose.

[Figure 1 about here]

The announcement dates of the ECB's asset purchase programmes are shown in Table 1. The CBPP1 and CBPP2 announced in May 2009 and October 2011, respectively, were for purchases of covered bonds issued by euro area banks. Purchases of the CBPP1 amounted to €60 billion in 2009, and purchases of CBPP2 amounted to €16 billion purchases when it ended in 2012, while the intended amount was €40 billion when CBPP2 was announced in 2011 (Altavilla et al., 2015). The SMP was first announced in May 2010 for purchases of public sector securities from distressed euro area countries during the euro area sovereign debt crisis of 2010-2011, amounting to around €210 billion at its peak (Altavilla et al., 2015). The OMT was announced in July 2012 and was for purchases

of government bonds, but it was never triggered. The ABSPP was first announced in June 2014 and involved purchases of asset-backed securities (ABS). The CBPP3 was announced in September 2014 and was for purchases of covered bonds. The PSPP was announced in January 2015 and was for purchases of public sector assets. The ABSPP and CBPP3 were subsumed in the APP, consisting of the CBPP3, ABSPP and PSPP.

[Table 1 about here]

The announcement dates of important financial stability measures in the euro area are shown in Table 2. They include the creation of the European Financial Stability Facility (EFSF) in May 2010, the authorisation for the EFSF and the European Stability Mechanism (ESM) to intervene in the government debt primary market in March 2011, an increase in the ceiling of the EFSF/ESM in March 2012, and enabling the use of EFSF/ESM funds to recapitalize Spanish banks in June 2012.

[Table 2 about here]

We control for conventional monetary policy by including in the regressions surprises in the ECB's policy rate, as measured by daily changes in the one-month euro overnight index swap (OIS) rate on the dates when the ECB's governing council announced its policy rate decisions. We also use data on 5-year sovereign credit default spreads (CDS) for euro area countries.

We also control for the effect of macroeconomic news on term premia by including Citigroup economic surprise indices for the euro area. Citigroup economic surprise indices measure economic surprises relative to market expectations (actual releases minus Bloomberg median survey expectations); they are calculated daily in a rolling three-month window and are defined as a weighted series of data surprises (Boesler, 2013). A positive reading suggests that data releases have on balance been higher than median survey expectations, which implies that on average, economic data has been more positive than expected, i.e. that the economy has outperformed expectations. The indices use a time-decay function to account for the limited memory of financial markets; the weights of different economic indicators are given by the relative high-frequency spot foreign exchange effects of one-standard deviation data surprises (Boesler, 2013). We control for

uncertainty using the VSTOXX index from Bloomberg, an implied volatility index on the Eurostoxx equity index.

### 3 Method and results

We regress daily changes in term premia of ten-year government bonds for country  $i$  (in basis points),  $y(t)$ , for eleven euro area countries,  $i = 1, \dots, 11$ , on a dummy variable for the announcements of the ECB’s asset purchase programmes,  $d_{ap}(t)$ , on a dummy variable for the announcements of important financial stability measures in the euro area listed in Table 2,  $d_{fs}(t)$ , surprises in the ECB’s policy rate,  $pol^{sur}(t)$ , to control for conventional monetary policy changes, and on daily changes in the Citigroup economic surprise index for the euro area,  $esi(t)$ , to control for the effects of economic data surprises. For each country  $i$ , the regression equation takes the form

$$\Delta y(t) = c + \beta_{ap}d_{ap}(t) + \beta_{fs}d_{fs}(t) + \gamma pol^{sur}(t) + \delta \Delta esi(t) + \varepsilon_t \quad (1)$$

where  $\Delta$  is the first difference operator,  $d_{ap}(t)$  takes the value of 1 on the days of announcements of the ECB’s asset purchase programmes listed in Table 1, and zero otherwise,  $d_{fs}(t)$  takes the value of 1 on the days of announcements of the financial stability measures listed in Table 2, and zero otherwise. The variable  $pol^{sur}(t)$  measuring surprises in the ECB’s policy rate equals daily changes in the one-month euro overnight index swap (OIS) rate on the dates when the ECB’s governing council announced its policy rate decisions, and is zero otherwise. We use Newey-West adjusted standard errors to control for serial correlation and heteroskedasticity.

[Table 3 about here]

The results of equation (1) are shown in Table 3. We find that the term premia of Italy and the peripheral euro area countries Spain, Ireland and Portugal decreased significantly in response to the announcements of asset purchases, by between 13 and 25 basis points on average per announcement. We also find that the term premia of Italy, Spain and Ireland decreased significantly in response to the announcements of financial stability measures,

by between 23 and 49 basis points on average per announcement.<sup>1</sup> Term premia in Austria, France and Belgium fell by 3 to 6 basis points on average per announcement in response to asset purchase announcements, and by 3 to 11 basis points in response to announcements of financial stability measures. In response to the announcements of asset purchases, the term premia of countries with lowest sovereign risk either increased significantly as in Germany, by 4 basis points on average per announcement, or they were not significantly affected, as in the Netherlands and Finland. In response to the announcements of financial stability measures, the increase in term premia in Germany of 3 basis points on average per announcement is just barely insignificant at the 10% level (with a p-value of 0.11), but as shown below the increase of 5 basis points over a 5-day window is significant. In response to the announcements of financial stability measures, term premia did not change significantly in Belgium, and fell slightly in the Netherlands, but as shown below the change in the Netherlands over a 5-day window is not significant.

Some reversal of a flight to quality into German government bonds with the introduction of asset purchases may have been partly behind the increase in term premia of German government bonds in response to asset purchase announcements. This would be consistent with evidence of some reversal of flight to quality following the OMT announcement found by Ehrmann and Fratzscher (2015). The increase in term premia of German government bonds in response to asset purchase announcements could also be due in part to higher perceived sovereign risk in Germany due to concerns that purchases of government bonds from peripheral euro area countries could lead to transfers from Germany, if one of the peripheral euro area countries should default on its government debt, leading to losses for the Eurosystem which could be shared among Eurosystem central banks according to the ECB's capital key.

[Table 4 about here]

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<sup>1</sup>Due to a restructuring of Greek sovereign debt on 9 March 2012, which led to a large fall in Greek government bond yields, the results for Greece reported in Table 3 are less reliable, which might explain that we find no significant effect of the announcement of asset purchases or financial stability measures on Greek term premia.

As a robustness test, we control for uncertainty in equation (1) by adding a measure of financial market uncertainty in the euro area, the VSTOXX index lagged by one week, in that regression. The results are shown in Table 4, and we can see that the results reported in Table 3 for the main specification are robust to controlling for uncertainty.

We next investigate whether the response of term premia to the announcements of asset purchases and financial stability measures depends on a country's sovereign risk. We analyse this by regressing the coefficients on announcements of asset purchases from equation (1) for country  $i$ ,  $\beta_{ap}^i$ , for all the countries included above, namely Germany, the Netherlands, Finland, Austria, France, Belgium, Italy, Spain, Ireland, Portugal and Greece, on a country's sovereign risk as measured by sovereign CDS spreads,  $CDS_{av}^i$ , on average over the period from October 2008 to December 2013, according to the following equation

$$\beta_{ap}^i = c + \alpha * CDS_{av}^i + \varepsilon^i \quad (2)$$

We run the corresponding regression to equation (2) for the coefficients on announcements of financial stability measures from equation (1) for country  $i$ ,  $\beta_{fs}^i$ ,

$$\beta_{fs}^i = c + \alpha * CDS_{av}^i + \varepsilon^i \quad (3)$$

The results of regressions (2) and (3) are shown in Table 5 (columns 1 and 3). We find that the coefficients for the announcements of both asset purchases and financial stability measures are significantly negatively related to sovereign CDS spreads in each country. This implies that term premia of countries with higher sovereign risk fell by more in response to these announcements.

For robustness, we also run the regressions of equations (2) and (3) using the sovereign CDS spreads on average in December 2013 in each country, instead of on average over the longer period, and the results are shown in columns 2 and 4 of Table 5. The results are robust to using this different CDS average, with the coefficients all remaining significant, and even becoming more negative in all cases. For robustness, we moreover repeat the regressions of equations (2) and (3) when excluding Greece, due to the restructuring of Greek sovereign debt on 9 March 2012 which makes the results for Greece less reliable. While the size of the coefficients changes somewhat when excluding Greece, even becoming

more negative in the case of asset purchase announcements (see Table 5), they remain significant, and the results are robust to excluding Greece.

[Table 5 about here]

Our results that the term premia of countries with higher sovereign risk fell by more in response to the asset purchase announcements are consistent with those of De Santis (2016) that the vulnerable euro area countries benefited most from the ECB's APP, and with those of Szczerbowicz (2015) that the SMP and OMT were particularly effective in reducing the government bond yields of peripheral euro area countries with high sovereign risk, whereas the French spread reacted very little if at all. They are also consistent with the findings by Altavilla et al. (2015) that the APP significantly lowered yields in a broad set of market segments, with effects generally being larger for more risky assets.

Our results that in response to the announcements of financial stability measures the term premia of countries with higher sovereign risk fell by more are consistent with those of Schwendner et al. (2015) that the spreads of peripheral euro area government bond yields over those of core euro area government bond yields decreased since the EFSF and ESM were established. Our results are also consistent with the results of Kilponen et al. (2015) that announcements of financial assistance programmes in the euro area typically increased the perceived riskiness of long-term government bonds in the guarantor countries, while reducing the government bond spreads in the countries receiving funding.

[Table 6 about here]

For robustness, we also control for sovereign CDS spreads in the regression of equation (1), by including sovereign CDS spreads lagged by one week for each country, and then use the resulting coefficients of daily changes in term premia on the announcements of asset purchases and financial stability measures in the cross-country regressions of equations (2) and (3). The results are shown in Table 6. We can see from Table 6 that the results reported in Table 5 for the main specification are robust to controlling for sovereign CDS spreads in the regression of equation (1).

Next, we consider changes in term premia over longer periods of  $n = 5$  and  $n = 10$  days (ie one and two working weeks, respectively), instead of daily changes, in order to

see whether the effects of the announcements of asset purchases and financial stability measures persist over longer periods, and are not just transitory. We do so by using  $n$ -day changes in term premia, the policy rate and economic surprise index in equation (1), instead of daily changes, according to the following equation,

$$\Delta_n y(t) = c + \beta_{ap} d_{ap}(t) + \beta_{fs} d_{fs}(t) + \gamma pol^{sur}(t) + \delta \Delta_n esi(t) + \varepsilon_t \quad (4)$$

where  $\Delta_n y(t) = y(t + n - 1) - y(t - 1)$ , denotes the operator for  $n$ -day changes in term premia, and similarly for other variables. Again, we use Newey-West adjusted standard errors to control for serial correlation and heteroskedasticity.

[Table 7 about here]

Results from equation (4) for 5-day changes are shown in Table 7. The pattern for the coefficients on asset purchase announcements is generally similar to that reported in Table 3 for 1-day changes, but fewer responses are significant. Again, the term premia of Italy and the peripheral euro area countries Spain, Ireland and Portugal decreased significantly in response to the announcements of asset purchases, by somewhat different amounts of between 19 and 39 basis points on average per announcement. We also again find that the term premia of Ireland decreased significantly in response to the announcements of financial stability measures, by 41 basis points on average per announcement, but the responses for Italy, Spain and Portugal are no longer significant.

Again, we find that the term premia in Germany rose significantly in response to the announcements of asset purchases, by 7 basis points on average per announcement, but the increase in response to financial stability measures is now also significant, at 5 basis points on average per announcement. Some of the increase in term premia of German government bonds in response to the announcements of financial stability measures could have been brought about by some reversal of a flight to quality into German government bonds with the announcements of these measures. The increase in term premia of German government bonds in response to the announcements of financial stability measures could also be due to some extent to higher perceived sovereign risk in Germany based on concerns that use of EFSF/ESM funds could lead to transfers from Germany to recapitalise these funds.

For the 5-day window, term premia are again not significantly affected in the Netherlands and Finland in response to asset purchase announcements, and now responses also become insignificant in Austria and France. The response to asset purchase announcements remains significant in Belgium for the 5-day window. We therefore find that the pattern of results obtained for daily changes above is not just due to transitory effects, but is generally robust to using a longer window of a week, although coefficients for fewer countries remain significant. In response to the announcement of financial stability measures, only the decrease in term premia in Ireland and the increase in Germany are significant for the 5-day window.

[Table 8 about here]

Results from equation (4) for 10-day changes are shown in Table 8. The pattern for the coefficients on asset purchase announcements is again similar to that reported in Table 3 for 1-day changes, but much fewer responses are significant. Only the term premia of Italy and the peripheral euro area countries Spain and Portugal continue to decrease significantly in response to the announcements of asset purchases, by somewhat different amounts of between 26 and 36 basis points on average per announcement. The responses to the announcements of financial stability measures become insignificant in all countries for the 10-day event window.

## 4 Conclusions

We studied the effects of the announcements of ECB asset purchases and of financial stability measures in the euro area since 2009, in the wake of the global financial crisis and the euro area sovereign debt crisis, on ten-year government bond term premia in eleven euro area countries. We found that the term premia of euro area countries with higher sovereign risk, as measured by sovereign CDS spreads, decreased more in response to the announcements of asset purchases and financial stability measures, than those of countries with lower sovereign risk. We found that in response to the announcements of asset purchases and financial stability measures, the term premia of countries with the

lowest sovereign risk either increased slightly as in Germany, or were not significantly affected or fell slightly, as in the Netherlands and Finland.

The increase in term premia of German government bonds in response to asset purchase announcements could partly be due to some reversal of a flight to quality into German government bonds. Another reason for this increase could be higher perceived sovereign risk in Germany based on concerns that purchases of government bonds from peripheral euro area countries could lead to transfers from Germany, if one of the peripheral euro area countries should default on its government debt, leading to losses for the Eurosystem which could be shared among Eurosystem central banks according to the ECB's capital key. Similarly, some reversal of a flight to quality into German government bonds with the announcements of financial stability measures may have contributed to the increase in term premia of German government bonds in response to the announcements of these measures, and higher perceived sovereign risk in Germany based on concerns that use of EFSF/ESM funds could lead to transfers from Germany to recapitalise these funds may have been another factor.

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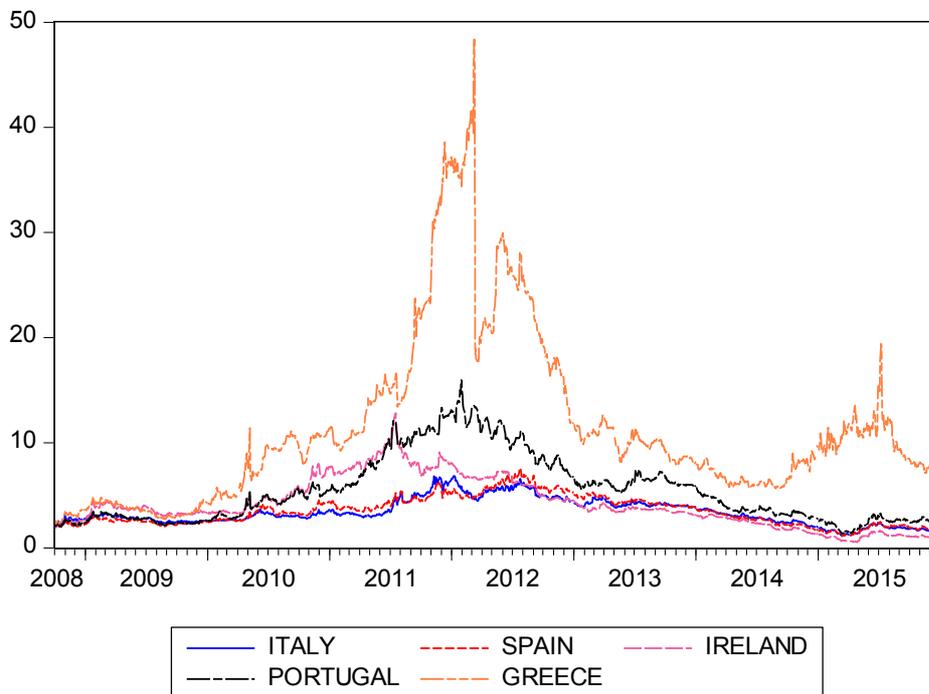
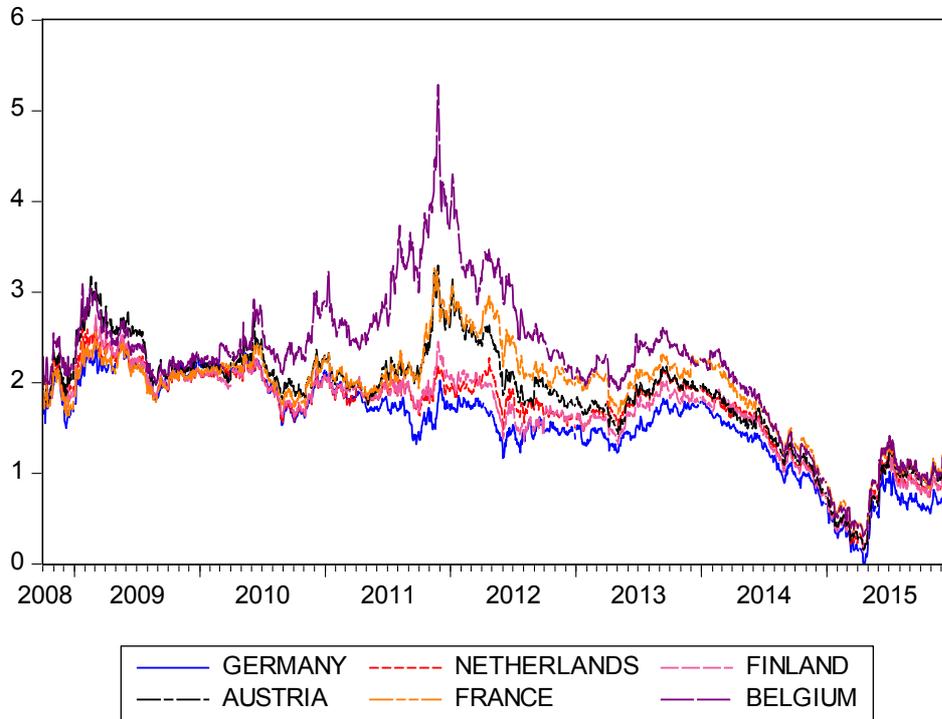
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**Figure 1: Term premia for a maturity of 10 years derived from government bond yields, in percent**



Source: NIESR calculations.

**Table 1: ECB asset purchase announcements**

| Date                       | ECB asset purchase announcements  |
|----------------------------|---|
| 7 May 2009                 | Covered bond purchase programme 1 <sup>a</sup>  |
| 10 May 2010 <sup>b</sup>   | Securities market programme <sup>c</sup>  |
| 8 August 2011 <sup>d</sup> | Securities market programme   |
| 6 October 2011             | Covered bond purchase programme 2 <sup>e</sup>  |
| 26 July 2012               | Speech by ECB president Draghi mentioning "whatever it takes" (Outright monetary transactions programme, OMT) |
| 6 September 2012           | Technical features of OMT   |
| 5 June 2014                | Asset-backed securities purchase programme <sup>f</sup>   |
| 4 September 2014           | Asset-backed securities purchase programme and Covered bond purchase programme 3                              |
| 22 January 2015            | Public sector purchase programme  |
| 9 March 2015               | Public sector purchase programme  |

Notes: <sup>a</sup>Announced together with 1-year longer-term refinancing operations (LTROs). <sup>b</sup>Announced on 9 May, a Sunday, so that incorporated into market prices on 10 May. <sup>c</sup>Announced together with 6-month LTROs and ECB Federal Reserve swap line. <sup>d</sup>Announced on 7 August, a Sunday, so that incorporated into market prices on 8 August. <sup>e</sup>Announced together with 1-year LTROs. <sup>f</sup>Announced together with targeted LTROs.

Sources: Draghi (2012), ECB (2014a), ECB (2014b), ECB (2015), Cœuré (2015), Moessner (2015).

**Table 2: Announcements of euro area financial stability measures**

| Date                       | Announcements of euro area financial stability measures   |
|----------------------------|---|
| 10 May 2010                | European Financial Stability Facility (EFSF) created  |
| 14 March 2011 <sup>a</sup> | EFSF and European Stability Mechanism (ESM) authorised to intervene in government debt primary market |
| 30 March 2012              | EFSF/ESM ceiling increased  |
| 29 June 2012               | Enable use of EFSF/ESM funds to recapitalize Spanish banks  |

Notes: <sup>a</sup> Announcement of Friday 11 March 2011 incorporated into market prices on Monday 14 March 2011 due to its timing.

Sources: Council of the European Union (2010), Heads of State or Government of the Euro area (2011), Eurogroup (2012), Euro area summit statement (2012), ESM (2014).

**Table 3: Effects on ten-year government bond term premia from announcements of asset purchase and financial stability measures in the euro area**

| Dependent variable: Daily changes in term premia for maturity of 10 years (basis points) |          |                       |                       |                          |             |                     |         |
|--|----------|-----------------------|-----------------------|--------------------------|-------------|---------------------|---------|
| Country  | <i>c</i> | <i>d<sub>ap</sub></i> | <i>d<sub>fs</sub></i> | <i>pol<sup>sur</sup></i> | <i>Δesi</i> | Adj. R <sup>2</sup> | No. obs |
| Germany  | -0.094   | 3.677***              | 2.742                 | 0.252***                 | 0.010       | 0.010               | 1813    |
| Netherlands  | -0.045   | 1.747                 | -2.902*               | 0.037                    | 0.021       | 0.001               | 1813    |
| Finland  | -0.041   | -2.051                | -1.349                | 0.053                    | 0.027       | 0.001               | 1813    |
| Austria  | -0.029   | -3.159**              | -3.206***             | 0.029                    | 0.033       | 0.003               | 1813    |
| France   | -0.029   | -2.876*               | -3.607**              | -0.004                   | 0.033       | 0.003               | 1813    |
| Belgium  | -0.012   | -5.874***             | -11.010***            | -0.065                   | 0.025       | 0.014               | 1813    |
| Italy  | 0.142    | -21.568***            | -23.210***            | -0.264                   | 0.021       | 0.057               | 1813    |
| Spain  | 0.192    | -24.550***            | -28.442***            | -0.332                   | 0.041       | 0.074               | 1813    |
| Ireland  | 0.128    | -12.694**             | -48.953**             | 0.166                    | 0.063       | 0.060               | 1813    |
| Portugal   | 0.230    | -21.001**             | -38.871               | -0.155                   | 0.038       | 0.026               | 1813    |
| Greece   | 0.729    | -44.253               | -109.631              | -1.300                   | 0.137       | 0.005               | 1813    |

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively. Newey-West adjusted standard errors. Sample period: 10/01/2008 to 12/30/2015.

**Table 4: Effects on ten-year government bond term premia from announcements of asset purchase and financial stability measures in the euro area, controlling for uncertainty**

| Dependent variable: Daily changes in term premia for maturity of 10 years (basis points) |           |                       |                       |                          |             |                            |                     |
|--|-----------|-----------------------|-----------------------|--------------------------|-------------|----------------------------|---------------------|
| Country  | <i>c</i>  | <i>d<sub>ap</sub></i> | <i>d<sub>fs</sub></i> | <i>pol<sup>sur</sup></i> | <i>Δesi</i> | <i>VSTOXX<sub>-5</sub></i> | Adj. R <sup>2</sup> |
| Germany  | -0.300235 | 3.672373***           | 2.753643              | 0.254911***              | 0.010237    | 0.007838                   | 0.010               |
| Netherlands  | -0.277652 | -1.751452             | -2.888719*            | 0.040122                 | 0.021198    | 0.008837                   | 0.001               |
| Finland  | -0.316422 | -2.057201             | -1.333367             | 0.056063                 | 0.026735    | 0.010466                   | 0.001               |
| Austria  | -0.425277 | -3.167872**           | -3.18374***           | 0.034144                 | 0.032514    | 0.015066                   | 0.003               |
| France   | -0.246581 | -2.880412*            | -3.594981**           | -0.001362                | 0.032909    | 0.008272                   | 0.003               |
| Belgium  | -0.282731 | -5.88019***           | -10.9953***           | -0.061870                | 0.024981    | 0.010311                   | 0.014               |
| Italy  | -0.354466 | -21.5790***           | -23.1826***           | -0.257393                | 0.020614    | 0.018873                   | 0.057               |
| Spain  | -0.264046 | -24.5599***           | -28.4164***           | -0.325705                | 0.040680    | 0.017351                   | 0.074               |
| Ireland  | -0.084972 | -12.69829**           | -48.94149**           | 0.168237                 | 0.063218    | 0.008091                   | 0.060               |
| Portugal   | -0.318374 | -21.01225**           | -38.84067             | -0.148368                | 0.038224    | 0.020839                   | 0.025               |
| Greece   | -4.382588 | -44.36159             | -109.3471             | -1.234653                | 0.136202    | 0.194321**                 | 0.005               |

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively. Newey-West adjusted standard errors. Sample period: 10/01/2008 to 12/30/2015. Number of observations in each regression: 1813. Controlling for lagged VSTOXX (by one week) in the regression.

**Table 5: Regression of the coefficients for announcements of asset purchases and financial stability measures on a country's sovereign risk as measured by CDS spreads**

| Dependent variable <sup>a</sup>     | Coefficient on asset purchases, $\beta_{ap}$ | Coefficient on asset purchases, $\beta_{ap}$ | Coefficient on financial stability measures, $\beta_{fs}$ | Coefficient on financial stability measures, $\beta_{fs}$ |
|-------------------------------------|--|--|---|---|
| <i>All countries<sup>b</sup></i>    |  |  |   |   |
| <i>c</i>                            | -4.457                                       | -1.587                                       | -5.067  | -0.002  |
| <i>CDS<sub>Oct08-Dec13</sub></i>    | -2.248***                                    | -  | -5.723***   | -   |
| <i>CDS<sub>Dec13</sub></i>          | -  | -6.906***                                    | -   | -16.098***  |
| Adj. R <sup>2</sup>                 | 0.695  | 0.820  | 0.898   | 0.866   |
| No. obs                             | 11   | 11   | 11  | 11  |
| <i>Excluding Greece<sup>c</sup></i> |  |  |   |   |
| <i>c</i>                            | 1.069  | -0.448                                       | 4.213   | -2.331  |
| <i>CDS<sub>Oct08-Dec13</sub></i>    | -5.568***                                    | -  | -11.298***  | -   |
| <i>CDS<sub>Dec13</sub></i>          | -  | -8.255**                                     | -   | -13.337***  |
| Adj. R <sup>2</sup>                 | 0.602  | 0.629  | 0.871   | 0.529   |
| No. obs                             | 10   | 10   | 10  | 10  |

Notes: Sovereign CDS spreads in percentage points. <sup>a</sup> Coefficients for regression of daily change in term premia of 10-year government bonds (basis points) on dummy variables for announcements of asset purchases or financial stability measures from equation (1) over the sample period 10/01/2008–12/30/2015 given in Table 3; <sup>b</sup> Germany, the Netherlands, Finland, Austria, France, Belgium, Italy, Spain, Ireland, Portugal, Greece. <sup>c</sup> Germany, the Netherlands, Finland, Austria, France, Belgium, Italy, Spain, Ireland, Portugal.

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively. White heteroskedasticity-consistent standard errors.

**Table 6: Regression of the coefficients for announcements of asset purchases and financial stability measures on a country's sovereign risk as measured by CDS spreads, controlling for lagged CDS spreads in first stage regression**

| Dependent variable <sup>a</sup>     | Coefficient on asset purchases, $\beta_{ap}$ | Coefficient on asset purchases, $\beta_{ap}$ | Coefficient on financial stability measures, $\beta_{fs}$ | Coefficient on financial stability measures, $\beta_{fs}$ |
|-------------------------------------|--|--|---|---|
| <i>All countries<sup>b</sup></i>    |  |  |   |   |
| c                                   | -5.754630*                                   | -3.197827                                    | 5.662410**  | 13.84393**  |
| CDS <sub>Oct08-Dec13</sub>          | -1.691004***                                 | -  | -12.14096***  | -   |
| CDS <sub>Dec13</sub>                | -  | -5.456254***                                 | -   | -32.46150***  |
| Adj. R <sup>2</sup>                 | 0.538832                                     | 0.717417                                     | 0.991252  | 0.853803  |
| No. obs                             | 11   | 11   | 11  | 11  |
| <i>Excluding Greece<sup>c</sup></i> |  |  |   |   |
| c                                   | 0.346068                                     | -1.046006                                    | 4.139454  | -2.364949   |
| CDS <sub>Oct08-Dec13</sub>          | -5.356083***                                 | -  | -11.22602***  | -   |
| CDS <sub>Dec13</sub>                | -  | -8.006578**                                  | -   | -13.25084***  |
| Adj. R <sup>2</sup>                 | 0.595339                                     | 0.634200                                     | 0.868434  | 0.527821  |
| No. obs                             | 10   | 10   | 10  | 10  |

Notes: Sovereign CDS spreads in percentage points. <sup>a</sup> Coefficients for regression of daily changes in term premia of 10-year government bonds (basis points) on dummy variables for announcements of asset purchases or financial stability measures over the sample period 10/01/2008–12/30/2015, controlling for lagged CDS spreads (by one week) in first stage regression; <sup>b</sup> Germany, the Netherlands, Finland, Austria, France, Belgium, Italy, Spain, Ireland, Portugal, Greece. <sup>c</sup> Germany, the Netherlands, Finland, Austria, France, Belgium, Italy, Spain, Ireland, Portugal.  
\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively. White heteroskedasticity-consistent standard errors.

**Table 7: Effects on ten-year government bond term premia from announcements of asset purchase and financial stability measures in the euro area, 5-day changes**

| Dependent variable: 5-day changes in term premia for maturity of 10 years (basis points) |        |            |          |             |               |                     |         |
|--|--------|------------|----------|-------------|---------------|---------------------|---------|
| Country  | c      | $d_{ap}$   | $d_{fs}$ | $pol^{sur}$ | $\Delta sesi$ | Adj. R <sup>2</sup> | No. obs |
| Germany  | -0.402 | 6.568**    | 5.226*   | -0.245      | 0.027         | 0.006               | 1803    |
| Netherlands  | -0.318 | -2.357     | 3.254    | -0.233      | 0.045*        | 0.005               | 1803    |
| Finland  | -0.279 | -1.849     | -1.009   | -0.135      | 0.037         | 0.002               | 1803    |
| Austria  | -0.318 | -3.973     | -1.233   | -0.358*     | 0.070***      | 0.010               | 1803    |
| France   | -0.291 | -5.844     | 6.048    | -0.293      | 0.064**       | 0.011               | 1803    |
| Belgium  | -0.265 | -11.877*** | -4.973   | -0.287      | 0.078         | 0.010               | 1803    |
| Italy  | -0.041 | -29.718*** | 2.876    | -0.322      | 0.044         | 0.012               | 1803    |
| Spain  | 0.138  | -38.796*** | 0.505    | -0.275      | 0.106**       | 0.022               | 1803    |
| Ireland  | -0.218 | -18.538**  | -40.748* | 0.023       | 0.099         | 0.008               | 1803    |
| Portugal   | 0.246  | -37.383*** | -11.219  | -0.153      | 0.061         | 0.003               | 1803    |
| Greece   | 1.945  | -39.838    | -92.420  | -1.248      | -0.210        | -0.001              | 1803    |

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively. Newey-West adjusted standard errors. Sample period: 10/01/2008 to 12/30/2015.

**Table 8: Effects on ten-year government bond term premia from announcements of asset purchase and financial stability measures in the euro area, 10-day changes**

| Dependent variable: 10-day changes in term premia for maturity of 10 years (basis points) |          |                       |                       |                          |                          |                     |         |
|---|----------|-----------------------|-----------------------|--------------------------|--------------------------|---------------------|---------|
| Country   | <i>c</i> | <i>d<sub>ap</sub></i> | <i>d<sub>fs</sub></i> | <i>pol<sup>sur</sup></i> | <i>Δ<sub>10esi</sub></i> | Adj. R <sup>2</sup> | No. obs |
| Germany   | -0.693   | 5.409                 | -2.177                | -0.259                   | 0.039                    | 0.005               | 1790    |
| Netherlands   | -0.602   | -2.505                | -1.803                | -0.246                   | 0.035                    | 0.003               | 1790    |
| Finland   | -0.506   | -2.077                | -6.563                | -0.165                   | 0.029                    | 0.002               | 1790    |
| Austria   | -0.606   | -1.944                | -6.075                | -0.475                   | 0.064**                  | 0.010               | 1790    |
| France  | -0.585   | -2.351                | -3.475                | -0.144                   | 0.057*                   | 0.007               | 1790    |
| Belgium   | -0.689   | -9.168                | -11.404               | -0.036                   | 0.077*                   | 0.009               | 1790    |
| Italy   | -0.293   | -26.945**             | 4.638                 | 0.096                    | 0.042                    | 0.005               | 1790    |
| Spain   | -0.086   | -26.140**             | 0.006                 | -0.181                   | 0.107*                   | 0.010               | 1790    |
| Ireland   | -0.660   | -16.776               | -24.448               | 0.439                    | 0.111                    | 0.003               | 1790    |
| Portugal  | 0.645    | -35.760*              | 17.917                | 0.410                    | 0.069                    | 0.000               | 1790    |
| Greece  | 3.261    | -48.493               | -112.002              | -2.146                   | 0.100                    | -0.001              | 1790    |

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% levels, respectively. Newey-West adjusted standard errors. Sample period: 10/01/2008 to 12/30/2015.

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