ECB Policy and Eurozone Fragility: Was De Grauwe Right?

Orkun Saka [a,*], Ana-Maria Fuertes [a] and Elena Kalotychou [a]

[a] *Cass Business School, City University London, 106 Bunhill Row London EC1Y 8TZ U.K*

ABSTRACT

Paul De Grauwe's Eurozone fragility hypothesis states that sovereign debt markets in a monetary union without a lender-of-last-resort are vulnerable to a self-fulfilling dynamics fuelled by pessimistic investor sentiment that can trigger default. We test this contention by applying an eclectic methodology to a two-year window around Mario Draghi's "whatever-it-takes" pledge that can be understood as the implicit announcement of the Outright Monetary Transactions (OMT) program. A principal components analysis reveals that the perceived commonality in default risk among peripheral and core Eurozone sovereigns increased after the announcement. An event study reveals significant pre-announcement news transmission from Spain to Italy, France, Belgium and Austria that clearly dissipates post-announcement. Country-specific regressions of CDS spreads on systematic risk factors reveal frequent days of large adverse shocks affecting simultaneously those five Eurozone countries during the pre-announcement period. Altogether these findings support the fragility hypothesis and endorse the OMT program.

Keywords: Sovereign debt; Eurozone fragility; Self-fulfilling dynamics; European Central Bank; Outright Monetary Transactions.

JEL classification: E44, F36, G15, C52.

* Corresponding author. Cass Business School, 24 Chiswell Street London, EC1Y 4UE United Kingdom; Tel: +44 (0)75 9306 9236. *E-mail addresses:* orkun.saka.1@cass.city.ac.uk (O.Saka), a.fuertes@city.ac.uk (A.M.Fuertes), e.kalotychou@city.ac.uk (E.Kalotychou).

ECB Policy and Eurozone Fragility: Was De Grauwe Right?

ABSTRACT

Paul De Grauwe's Eurozone fragility hypothesis states that sovereign debt markets in a monetary union without a lender-of-last-resort are vulnerable to self-fulfilling dynamics fuelled by pessimistic investor sentiment that can trigger default. We test this contention by applying an eclectic methodology to a two-year window around Mario Draghi's "whatever-it-takes" pledge that can be understood as the implicit announcement of the Outright Monetary Transactions (OMT) program. A principal components analysis reveals that the perceived commonality in default risk among peripheral and core Eurozone sovereigns increased after the announcement. An event study reveals significant pre-announcement news transmission from Spain to Italy, Belgium, France and Austria that clearly dissipates post-announcement. Country-specific regressions of CDS spreads on systematic risk factors reveal frequent days of large adverse shocks affecting simultaneously those same Eurozone countries during the pre-announcement period. Altogether these findings support the fragility hypothesis and endorse the OMT program.

[Word count: 145]

Keywords: Sovereign debt; Eurozone fragility; Self-fulfilling dynamics; European Central Bank; Outright Monetary Transactions.

JEL classification: E44, F36, G15, C52.

"You have large parts of the euro area in what we call a "bad equilibrium", namely an equilibrium where you may have self-fulfilling expectations that feed upon themselves and generate very adverse scenarios." (ECB President Mario Draghi; 6th September 2012)

1. Introduction

Since 2009, when the debt problems of Greece came to light, the suddenness and magnitude of changes in Eurozone bond yield spreads have sparked a debate among economists regarding the likely causes. The *fundamentalist* viewpoint is that the surge in Eurozone yield spreads is purely a reflection of deteriorating macroeconomic fundamentals. The *multiple-equilibria* view contends that markets may not always function optimally and thus, without any major change in fiscal fundamentals, the decisions of panic-driven investors may lead a country to a self-fulfilling liquidity crisis that otherwise would not have occurred.

The idea that sovereign members of a currency union are more vulnerable to investor sentiment is encapsulated in the "Eurozone fragility hypothesis" (De Grauwe, 2011, 2012). The hypothesis states that, by issuing debt in a currency that they cannot control, member states are susceptible to a self-fulfilling dynamics fuelled by market sentiment. Panic and fear about a sovereign's defaulting on its debt obligations is likely to trigger sudden stops in capital inflows and hence, higher interest rates. The latter make it harder for the sovereign to roll over its short-term debt, creating a perverse feedback effect between market sentiment and interest rates that could trigger a liquidity crisis and ultimately, the feared default.

This self-fulfilling dynamics is unlikely to happen in debt markets of sovereigns that retain control of their currencies because investors recognize the presence of a central bank that, acting as lender-of-last-resort (LOLR), will inject the necessary liquidity in crisis. The fragility hypothesis thus sums the idea that such a self-fulfilling dynamics would not be present in Eurozone debt markets if the European Central Bank (ECB) takes the LOLR role. This paper provides empirical tests of the Eurozone fragility hypothesis from different angles.

Mario Draghi announced on July 26, 2012 that the ECB was prepared within its mandate to do "whatever it takes" to preserve the euro. Draghi's announcement gained more meaning a few days later on August 2, 2012 when the ECB Governing council declared its intention to undertake outright open market operations in secondary government bond markets.[1] On September 6, 2012, the Outright Monetary Transactions (OMT) program was formally launched, under which the ECB would act as LOLR for countries backed by the European Stability Mechanism (ESM). Through this program, the ECB can make purchases or outright transactions in the secondary sovereign bond markets of member countries to ease liquidity pressures. Conditionality (strict fiscal supervision) is attached to avoid moral hazard and bond purchases are fully sterilized to prevent inflationary pressures. Furthermore, the OMT program is only activated for a country if, by unanimity among ESM members, its debt is deemed sustainable (Wolff, 2014).

The main goal of this paper is to investigate whether the important change in the ECB's policy stance (signalled by the OMT program) has effectively curbed the self-fulfilling dynamics in Eurozone debt markets. Our line of argument builds upon the fact that the OMT is neither a form of fiscal distribution among Eurozone members nor a bailout plan. Even if markets had initially misinterpreted the speech as a 'promise' for solvency support, the conditionality attached as part of the requirements of the OMT program rules this out. We examine the sovereign credit default swaps (CDS) of 14 countries in Europe as representative of the credit risk of 'periphery' versus 'core' Eurozone countries, as well as European countries that have not adopted the euro. This can shed light on the way markets have discriminated in terms of sovereign risk pricing between these three groups of countries. We provide convincing evidence that the Eurozone debt markets began to anticipate the LOLR role of the central bank (that materialized in the OMT program) following Draghi's

[1] See http://www.ecb.europa.eu/press/pressconf/2012/html/is120802.en.html

"whatever-if-takes" pledge on July 26, 2012; hence, we focus on this implicit OMT announcement date for most of our analysis and conduct sensitivity analysis later on.

An eclectic methodology is deployed to test De Grauwe's Eurozone fragility hypothesis. A principal component analysis of daily Eurozone CDS spreads reveals a 'structural break' in Eurozone sovereign risk perceptions on the (implicit OMT) announcement date. The first and second principal components suggest that the announcement increases the commonality in sovereign risks of periphery and core Eurozone countries, and marks a change in the way markets discriminate among Eurozone members towards a more fundamental-based approach. Both a news transmission analysis and a herding contagion analysis conducted at the daily frequency produce evidence suggesting that pessimistic self-fulfilling dynamics has been at play in Eurozone debt markets; the implicit OMT announcement significantly lessens this contagion channel. The news transmission study suggests that the Eurozone contagion triggered by news from Spain to Italy, Belgium, France and Austria is only present prior to the announcement. The herding contagion analysis reveals frequent occurrences of simultaneous adverse shocks to the CDS spreads precisely of those same countries that were identified as exhibiting significant news contagion effects but again only pre-announcement.

The findings support De Grauwe's fragility hypothesis and the underlying multiple-equilibria theory of the crisis. The latter does not overlook the importance of fundamentals but adds that, in times of massive economic adjustment, panic amplifies exogenous shocks and can push an otherwise solvent country toward default. Our findings suggest that there is more to the recent Eurozone debt crisis than a strong link between credit spreads and fundamentals.

The rest of the paper is organized as follows. Section outlines the relevant background literature. Section 3 describes the data and methodology. The empirical results are presented in section 4. Section 5 discusses various policy implications and concludes the paper.

2. Literature review

Our paper is motivated by theoretical multiple-equilibria models that predict that fundamentals matter to the extent that countries with sound and weak fundamentals would incur a single outcome, default or no default, respectively, while multiple equilibria can happen for countries with similar fundamentals that lie in between these two poles (Calvo, 1988; De Grauwe, 2012; Gros, 2012; Corsetti & Dedola, 2013). Thus, the multiple-equilibria theory does not preclude increased sensitivity to fundamentals such as fiscal space and public debt ratios in the run-up to the Eurozone debt crisis but rather it contends that they are not the whole story (Aizenman et al., 2013; Grauwe & Ji, 2013). It is well known that peripheral Eurozone countries suffered dramatic rises in their CDS spreads (during the pre-OMT period) compared with non-euro European countries with similar fundamentals; clearly, this leaves a role for self-fulfilling dynamics in the absence of a lender-of-last-resort.

Our paper relates to a burgeoning literature on the recent European sovereign debt crisis that provides evidence on 'contagion' broadly construed (with many nuances) as cross-country linkages driven by market expectations that are somewhat divorced from fundamentals. Beirne & Fratzscher (2013) document herding contagion or cross-country clustering of adverse shocks that cannot be traced to fundamentals. Likewise, De Grauwe & Ji (2013) show that a substantial part of the simultaneous rise in credit spreads of Eurozone countries was driven by market sentiment of panic and fear. Aizenman et al. (2013) show that Eurozone periphery default risk was overpriced in 2010 relative to that of non-euro 'matched' countries (i.e., similar countries in terms of fiscal space) and provide as one of two alternative explanations that the mispricing was due to a wave of contagious pessimism or a "bad" self-fulfilling expectational equilibrium. Alter & Beyer (2013) provide evidence of cross-country links in CDS spreads after controlling for exogenous common factors, while Beetsma et al. (2013), De Santis (2014) find contagion from Greece to other Eurozone member countries.

A parallel literature argues that investors became more sensitive to fundamentals during the crisis, a phenomenon that has been often formalized as “wake up calls” or fundamental contagion (Caceres et al., 2010; Arghyrou & Kontonikas, 2012; Beirne & Fratzscher, 2013 and Manasse & Zavalloni, 2013; Mink & De Haan, 2013). In a similar vein, an alternative more fundamentals-based explanation provided in Aizenman et al. (2013) for their findings is that the CDS market prices the risk of default not only on current but also future fundamentals which were expected to worsen for Eurozone periphery countries due to the adjustment challenges faced given their exchange rate and monetary constrains. Our paper adds to these studies by comparing the dynamics of Eurozone debt markets over two short length (12-month) windows that differ in an incontestable fact – while members of the common currency faced similar fiscal problems, exchange rate and monetary constraints in both windows, only in the post-OMT announcement window the ECB assumed the LOLR role. This important change in the ECB policy stance ought to restrain the dramatic rises in credit spreads in the region only if these had a significant self-fulfilling dynamics component (De Grauwe, 2011).

Finally, our research is related to a stream of the literature that tests the effects of unconventional ECB policies on the market-priced risks of sovereign debt. For instance, De Pooter et al. (2013) find significant stock and flow effects on sovereign bonds’ liquidity risk resulting from ECB bond purchases under the Security Markets Program (SMP). Similarly, Eser and Schwaab (2013) show that the SMP program had a long-lasting impact on the sovereign bond yields of periphery Eurozone countries. Likewise, Ghysels et al. (2014) conclude that the SMP was effective in reducing both the level and volatility of bond yield spreads. Some recent studies found similarly depressing effects in the context of the OMT programme (Falagiarda & Reitz, 2013; Altavilla et al., 2014; Lucas et al., 2014).

3. Data description and preliminary analysis

3.1. Sovereign CDS spreads

The analysis is based on daily midpoint closing spread quotes on 5-year sovereign credit default swap (CDS) contracts from January 1, 2008 to July 25, 2013 from *Datastream*. The CDS contracts pertain to four Eurozone 'periphery' countries (Ireland, Italy, Portugal and Spain), six Eurozone 'core' countries (Austria, Belgium, Finland, France, Germany and the Netherlands), and four European countries that are not members of the euro currency union (Denmark, Norway, Sweden and UK). Following the literature, recent Eurozone members (such as Latvia) and other economically small countries (such as Estonia, Slovakia, Malta and Slovenia) are excluded from the periphery (see, for instance, Arghyrou & Kontonikas, 2012; Beirne & Fratzscher, 2013; De Santis, 2014; Beetsma et al., 2013; De Grauwe & Ji, 2013, 2014). We conjecture that the exclusion of Greece, due to lack of CDS data from March 2012, is immaterial given that the systemic importance of Greece lessens notably in the most recent years (Alter & Beyer, 2014; González-Hermosillo & Johnson, 2014). This conjecture is later substantiated through a sensitivity analysis using bond yield data.

CDS prices are arguably more informative than bond yields for various reasons. Firstly, sovereign CDS data are more liquid and allow more accurate and timely estimates of credit risks (see, e.g., Ang & Longstaff, 2013 and Aizenman et al., 2013). In addition, CDS spreads are recognized as a more direct measure of default risk than bond yield spreads as they are not affected by differences in contractual arrangements, contract-specific liquidity effects, inflation expectations and demand/supply for credit conditions; see, e.g., Longstaff et al. (2011) and Aizenman et al. (2013). Nevertheless, as noted above, we employ bond yield spreads as another proxy for sovereign risk in various robustness checks.

The evolution of daily CDS spreads in Figure 1 shows that an upward trend of pessimism in peripheral Eurozone credit risk erupts around March 2010 when Greece was first rescued. A marked downward trend in CDS spreads is observed after July 26, 2012 when Mario

Draghi stated that the ECB was prepared to do "whatever it takes" to preserve the euro. This is the main event in our study (referred to as the implicit OMT announcement) because although the actual announcement of the OMT program took place barely a month later, it has been argued that Draghi's pledge effectively signalled the new stance of the ECB as LOLR in Eurozone sovereign debt markets (Krugman, 2013; Pisani-Ferry, 2013).

Table 1 summarises the distribution of CDS premiums in basis points over the 12-month window preceding the (implicit OMT) announcement, Panel A, and the 12-month post-announcement window, Panel B; the last column shows the change in CDS spreads. The level and volatility of CDS spreads notably rise during the pre-announcement period; Ireland and Portugal are plausible exceptions since they both received bailout packages earlier on.[2] The CDS spreads of all countries exhibit an overall decrease in the post-announcement window.

As part of our preliminary data analysis, we regress the CDS spreads on macroeconomic fundamentals using quarterly data pooled across the 10 Eurozone countries. Our focus is on four key ratios often used in studies of the Eurozone debt crisis: Debt/GDP which measures the country's government debt relative to GDP (Caceres et al., 2010; Arghyrou & Kontonikas, 2012; Beirne & Fratzcher, 2013; De Grauwe & Ji, 2013, 2014), Budget/GDP or the relative government budget balance (Caceres et al., 2010; Arghyrou & Kontonikas, 2012; Beirne & Fratzcher, 2013; De Santis, 2014), Debt/Tax or 'fiscal space' defined as government debt relative to tax base averaged over the previous five years to account for business cycle fluctuations (Aizenman et al., 2013; De Grauwe & Ji, 2013), and Current Account/GDP or current account balance cumulated from 2009:Q4 divided by the GDP level (Beirne & Fratzcher, 2013; De Grauwe & Ji, 2013, 2014). Figure 2 shows scatterplots and corresponding regression lines pre- and post-announcement which clearly reveal various outliers defined as the country-quarter CDS spreads that were most misaligned with fundamentals.

[2] Ireland and Portugal were bailed out on November 22, 2010 and May 16, 2011, respectively.

The outliers thus identified pertain to the Eurozone periphery (Ireland, Italy, Portugal and Spain) and are only observed in the pre-announcement period. In the lower panel of Figure 2, excluding Portugal and Ireland (under the premise that their bailouts may have diluted the link of their CDS spreads with fundamentals), the outliers pertain to Spain and Italy. The pooled OLS regression results in Table 2 further confirm that fundamentals played a significant role as drivers of CDS spreads in both periods but their explanatory power is stronger post-announcement. These findings constitute evidence that the implicit OMT announcement may have helped the Eurozone debt markets to coordinate on a more fundamental-based equilibrium. We further investigate this conjecture in the next sections.

3.2. Commonality in credit risks of Eurozone sovereigns

We conduct a principal component analysis of daily CDS spreads over the two-year sample period around the implicit OMT announcement. Following Longstaff et al. (2011) and Arghyrou & Kontonikas (2012), we interpret the first two principal components (hereafter, PC1 and PC2) as common risk factors. PC1 represents a Eurozone sovereign risk factor broadly defined as an equal-weighted average of country CDS spreads; thus, the loadings capture the systemic contribution of each sovereign. PC2 represents the divergence among core and periphery countries; a negative (positive) loading indicates a core (periphery) country. This divergence amounts to the risk differential from investing in periphery versus core bonds which Arghyrou & Kontonikas (2012) link with the notion of 'contagion' through a default domino effect and the increased probability of aggregating fiscal risks.

As Table 3 shows, in the pre- announcement window the two components PC1 and PC2 explain together about 75% of the total variation in Eurozone CDS spreads, and the explanatory power of PC2 is 20%. Post-announcement, the two factors capture 96% of the total variation, and the contribution of PC2 falls to 5%. However, this increased commonality across Eurozone spreads cannot be attributed to a convergence trend among these countries'

fundamentals in the post-announcement window since such a trend did not occur (see Figure A1 in on-line Appendix). A better interpretation is that there were additional unobserved risk factors (i.e., self-fulfilling dynamics) in the region which the announcement served to contain.

The contribution of Ireland and Portugal to Eurozone credit risk in the pre-announcement period is small as suggested by respective PC1 loadings of 0.097 and 0.020. This result aligns well with our previous finding (Table 1) that Ireland and Portugal are the only two Eurozone countries that experienced an overall pre-announcement decline in CDS spreads as a result of earlier EU/IMF bailout programs which altered investors' risk perceptions. A similar conclusion is reached by Alter & Beyer (2014) albeit from a different methodology. The loadings of PC2 also provide interesting reading. Before the announcement, markets clearly discriminated against countries such as Spain and Italy but perceived Portugal and Ireland more favourably. Post-OMT announcement, the positive loadings of Spain, Italy, Portugal and Ireland indicate that investors classify them together again alongside Belgium and France.

The dynamics of the two principal components in Figure 3 informally suggests a 'break' at the implicit OMT announcement date on July 26, 2012 which is confirmed by formal tests; thus, investors begin by then to anticipate the LOLR stance symbolized by the OMT program soon after.[3] PC1 and PC2 exhibit distinct behaviour pre- and post-announcement. PC1 swings wildly around a high plateau pre-announcement and stabilizes at a much lower level post-announcement. This further suggests that the announcement serves to restrain overreaction and mispricing of Eurozone credit risks. PC2 exhibits a steep upward trend in the first half of 2012, echoing investors' perception of growing divergence ('periphery' versus 'core') in Eurozone credit risk. The OMT announcement marks the beginning of a reversal.

[3] More formally, the Chow breakpoint test reveals a significant change in the conditional mean (level) of PC1 and PC2 on the day of the implicit OMT announcement (July 26, 2012); however, the evidence of a break on September 6, 2012 is relatively weaker as the test only suggests a break in the mean level of PC1 but not of PC2. Detailed results are tabulated in Table A1 in the on-line Appendix.

4. Empirical results

4.1. Spain-news transmission

In this section we conduct an event study to assess the impact of news specific to a "troubled" Eurozone country on other Eurozone member countries and on non-euro (or standalone) European countries; a similar approach has been adopted in extant studies of contagion such as Mink & De Haan (2013). The first task then is to choose a periphery country as the main contagion source over the entire sample period under study from July 26, 2011 to July 25, 2013. Greece, Portugal and Ireland are ruled out since they received rescue packages at earlier stages and hence, lost their capacity to generate contagion later on (Alter & Beyer, 2014; González-Hermosillo & Johnson, 2014). Spain is a good candidate since it experiences the peak of its debt problems during the sample period (its CDS spreads peaked 2 days before the implicit OMT announcement) and the Eurozone core versus periphery contagion factor (PC2) loadings reveal that Spain is perceived as the riskiest country before the announcement.

In order construct a Spain-specific news variable ($News_{t,Spain}$), a key input in the event-study analysis, we identify the days of most salient events though the OLS regression

$$\Delta CDS_{Spain,t} - r_{f,t} = \alpha + \beta(\Delta European_t - r_{f,t}) + u_{Spain,t} \quad (1)$$

where $\Delta CDS_{Spain,t}$ denotes the daily change in the Spanish CDS spread, $\Delta European_t$ is the daily change in a European sovereign risk index constructed as an average of the CDS spreads of the remaining 9 Eurozone countries and 4 non-euro European countries in the sample, and $r_{f,t}$ is the ECB's daily Euro OverNight Index Average (EONIA) rate from *Datastream*. We estimate the model, which can be broadly perceived as a CAPM benchmark, separately over the pre- and post- announcement windows using the OLS method and examine the residuals.[4]

[4] Innovations to Spanish CDS spreads might influence other countries' spreads but it is unlikely that they can drive the entire European index; thus, endogeneity does not represent a serious concern here.

We identify the 10 days in each window (pre- and post-OMT announcement) that show the largest (absolute) residuals $|u|_{Spain,t}$ and relate those days to news from *Reuters* and *Bloomberg Businessweek* that may have caused the unexpected CDS change. This residual approach mitigates the possibility of 'event contamination' by market-wide (i.e., Eurozone) shocks since it identifies the Spain-specific event dates as days when the actual change in the Spanish CDS premium deviates substantially from the expected (CAPM-based) change.

Table 4 shows the 10 most salient Spain-specific events thus identified in each window and associated news; the symbols R (*Reuters*) and B (*Bloomberg*) indicate the news source. Building upon the semi-strong form of the efficient markets hypothesis, we assume that a large residual on any day reflects news arriving on that day; that is, the CDS premium quickly incorporates all public information. Of course, the *Reuters* or *Bloomberg Businessweek* news may not always represent the actual underlying causes of significant market movements. Yet it provides a good approximation of what the average or representative investor might think about the important events of each day and about their potential effects on debt markets (Mink & De Haan, 2013). The discrete Spanish-news variable is constructed as $News_{Spain,t} = d_t * \hat{u}_{t,Spain}$ where d_t is equal to 1 on the salient news dates and 0 elsewhere.

Next we estimate by OLS the following CAPM type model to measure the news contagion

$$\Delta CDS_{i,t} - r_{f,t} = \beta(\Delta European_t - r_{f,t}) + \alpha_0 + \alpha_1 News_{Spain,t} + \varepsilon_{i,t} \qquad (2)$$

where $\Delta CDS_{i,t}$ is the daily change in the Eurozone country *i*th CDS spread, and $\varepsilon_{i,t}$ is an innovation; $\Delta European_t$ and $r_{f,t}$ are as defined after equation (1). The parameter of interest, α_1, captures the responsiveness of CDS spread changes in country *i* to news specific to the Spanish economy (contagion from Spain); $\alpha_t \equiv \alpha_0 + \alpha_1 News_t$ is a time-varying abnormal return that captures the model's mispricing; the European risk factor loading, β, measures the

sensitivity of the *i*th country CDS premium to the European CDS premium. Table 5 shows he estimation results over the pre- and post-OMT announcement windows.[5]

In the pre-OMT announcement window, the Spanish-news impact is positive for Austria, Belgium, France, Italy and the Netherlands although insignificant so for the latter. The strongest Spanish-news impact is found for Italy, in line with extant evidence of co-movements of Spanish and Italian debt spreads (e.g., González-Hermosillo & Johnson, 2014). These results suggest that pre-announcement, investors' perception of the creditworthiness of other Eurozone countries is tainted by Spanish news. This evidence is consistent with our early findings from the principal component analysis. In contrast, the Spanish-news coefficient for Portugal and Ireland is negative which confirms that the epicentre of the crisis had moved away from them, namely, investors' perception had shifted favourably towards countries that had applied strict austerity measures relative to the new 'strugglers' that were resisting those actions. Post-announcement, no significantly positive Spanish-news coefficient is obtained and thus, there is no news transmission from the troubled Spanish sovereign bond market to any other Eurozone bond market.[6] How do we explain the significant lessening in the Spanish news contagion effects before and after the implicit OMT announcement?

Under the premise that the ECB "whatever-it-takes" pledge was most credibly interpreted by investors as a hint of the bank's intention to act as LOLR (not as some form of fiscal redistribution or a bailout plan), our explanation is that there was self-fulfilling dynamics in the region. If the news transmission had been purely a wake-up call (i.e., news about Spain

[5] Inspired by Arghyrou & Kontonikas (2012), we estimate the country-specific CAPM equation (2) without the Spain-news variable but expanded with PC2 as a proxy for contagion within the Eurozone. For none of the countries the PC2 coefficient is significant post-OMT. The only contagion effect pre-OMT is revealed for Spain (a significantly positive coefficient at the 1% level) which confirms the role played by this country as contagion-source; see Table A9 of the on-line Appendix.

[6] We assess the significance of the news impact differential ($H_0: \alpha_1^{pre} = \alpha_1^{post}$ vs $H_A: \alpha_1^{pre} > \alpha_1^{post} 0$) with an *F* test statistic. To do so, we estimate the CAPM benchmark equation (2) including the two dummy variables $News_{Spain,t}^{pre}$ and $News_{Spain,t}^{post}$ (pre- and post-announcement Spanish news, respectively) as regressors. The null is strongly rejected at the 1% significance level, as shown in Table A2 of the on-line Appendix, for Austria, Belgium, France and Italy.

prompting investors to closely pay attention to other countries' fundamentals) then one would not expect the OMT to have such calming down effect on the news transmission.

CDS spreads of Eurozone member countries respond to (generally) adverse Spain-specific news but not necessarily because of the information content about their own current or future fundamentals; if this was the reason then the effect ought to have been present both pre- and post-announcement. The news transmission occurred most likely because, in the absence of a LOLR, investors' panic and fear channelled the markets toward a 'bad' equilibrium. Moreover, the finding of insignificant Spanish-news transmission for stand-alone countries (e.g., Denmark and UK, as shown in Table 6) further strengthens the evidence in favour of the Eurozone fragility hypothesis as it proves that the phenomenon was specific to members of the currency union. In the next section, we test the fragility hypothesis from a different angle.

4.2 Herding effects

Following Beirne & Fratzscher (2013) and De Grauwe & Ji (2013) among others, our analysis of herding effects builds upon the notion that a simultaneous rise in sovereign CDS premiums that cannot be explained by common risk factors represents a "debt run" against the particular group of countries. Such phenomenon is commonly interpreted as reflecting contagion through unobservables such as herding due to investor sentiments of panic and fear.

We analyze the clustering of large unexplained changes in the pricing of sovereign risk (i.e., herding effect) through OLS estimation of the following CAPM type equation

$$\Delta CDS_{i,t} - r_{f,t} = \alpha + \beta(\Delta European_t - r_{f,t}) + \varepsilon_{i,t} \quad (3)$$

using daily data over the two-year sample period around the implicit OMT announcement; the estimation is carried out per country $i = 1, \ldots, N$ ($N = 14$) which produces N distributions of daily residuals, $\hat{\varepsilon}_{i,t}, t = 1, \ldots, T$ (T=523 residuals). Our focus is on the right-tail of the distribution, that is, the most extreme positive residuals (i.e., unexpected CDS spread changes

above those explained by the European risk factor) defined using the 20th or 10th percentile rule. The herding contagion index is conservatively defined on each day of the sample period as the proportion of countries with extreme positive residuals if this proportion exceeds 80% (i.e. clustering of extreme bad news) and zero otherwise.

Based on our findings from the principal components decomposition of CDS spreads and the Spain-news transmission analysis, the sample countries are allocated to three groups; a 'contagion' set comprising Austria, Belgium, France, Italy and Spain; a 'non-contagion' set comprising Finland, Germany, Ireland, the Netherlands and Portugal; and a non-euro set (or control group) with Denmark, Norway, Sweden and the UK. According to De Grauwe's Eurozone fragility hypothesis, the market perception of creditworthiness of these stand-alone countries cannot be tainted by self-fulfilling dynamics precisely because they retain sovereign control over their own currencies; namely, they have a superior force of last resort (their central bank) that prevents investors from precipitating a liquidity crisis (De Grauwe, 2011). Figure 4 shows the daily herding contagion indices for all three groups of countries.

As for the 'contagion' group, we identify a large number of days with simultaneous large unexpected changes in the pricing of sovereign risk preceding the implicit OMT announcement. However, even with the lenient 20th percentile rule, only three such clusters are identified post-announcement, and two of them occur on the days immediately before the formal OMT announcement on September 6, 2012 so they would not have qualified as post-announcement herding days had the formal OMT announcement been adopted as threshold to define the windows. The strict 10th percentile rule produces similar findings. In contrast, for the 'non-contagion' set and the non-euro set, we identify less than a handful of days with herding in both the pre- and post-announcement windows.

A formal Chow type test suggests that the mean level of the daily herding index for the 'contagion' Eurozone set is significantly higher (at the 1% level) in the pre-announcement

window than post-announcement; detailed results are shown in Table A3 of the on-line Appendix. Thus, herding (or fear-driven) contagion afflicted several Eurozone debt markets before, but not after, the implicit OMT announcement; these findings, in conjunction with our previous analysis, endorse De Grauwe's fragility hypothesis.[7]

4.3 Robustness checks

This section discusses additional estimations and tests. We begin by adopting a pricing equation which is more in the spirit of the arbitrage pricing theory (Ross, 1976; APT). This is the route taken also by empirical studies that employ market indices as proxies for unobserved sources of commonality among sovereigns (e.g., Bekaert et al., 2011; Manasse & Zavalloni, 2013). Accordingly, we estimate the following pricing equation with daily data

$$\Delta CDS_{Spain,t} - r_{f,t} = \alpha + \beta_1(\Delta European_t - r_{f,t}) + \beta_2(\Delta Financial_t - r_{f,t}) + \beta_3(\Delta Global_t - r_{f,t}) + u_{Spain,t} \quad (4)$$

where the betas $(\beta_1, \beta_2, \beta_3)$ measure the sensitivity of the country's spreads to three common risk factors: one for European sovereigns, a second for financial intermediaries, and a third one for global sovereigns. $European_t$ is as defined after equation (1), $Financial_t$ is the Markit iTraxx Senior Financials index based on the 25 most liquid CDS reference entities for senior debt issued by European financial firms, and $Global_t$ is an equally-weighted average of CDS spreads of the same 26 (non-European) sovereigns as in Longstaff et al. (2011) that proxies global sovereign credit risk. The data are sourced from *Datastream*.

[7] Our focus is on the unexpected movements in sovereign CDS spreads that are driven by 'bad' news (the right-tail of the residual distribution) because De Grauwe's fragility hypothesis in the context of the recent Eurozone sovereign debt crisis goes hand-in-hand with market sentiments of panic and fear (De Grauwe, 2011, 2012). However, more generally, self-fulfilling dynamics applies in both directions; the multiple-equilibria theory rationalizes both contagious pessimism and contagious optimism. In a robustness check we construct herding contagion indices pertaining to good news (left-tail of residuals) as shown in Figure A2 of the on-line Appendix; the results confirm our main findings.

As in the preceding analysis (reported in Section 4.1) we estimate the pricing model, separately, over the one-year windows before and after the implicit OMT announcement, in order to identify salient Spain-specific news dates. Once those event dates are identified we re-construct the discrete Spain news variable $News_{Spain,t}$ and estimate the contagion model

$$\Delta CDS_{i,t} - r_{f,t} = \beta_1(\Delta European_t - r_{f,t}) + \beta_2(\Delta Financial_t - r_{f,t}) + \\ +\beta_3(\Delta Global_t - r_{f,t}) + \alpha_0 + \alpha_1 News_{Spain,t} + \varepsilon_{i,t} \quad (5)$$

where the relevant coefficient that captures contagion from Spain is α_1. The estimation results in Table 5 show a significantly positive news coefficient for Italy, Belgium, as with the CAPM, but also for France and Austria providing somewhat stronger evidence of news transmission from Spain to these two countries. The difference in the pre- and post-announcement news coefficients of these countries (Ho: $\alpha_1^{pre} - \alpha_1^{post} = 0$) is strongly significant according to an *F* test statistic; detailed results are provided in Table A2 of the on-line Appendix. Likewise, the unreported herding contagion indexes derived from the APT benchmark with three common risk factors, instead of equation (3), did not challenge our previous findings; the results are reported in Figure A3 in the on-line Appendix.

In another robustness check we compare shorter (6-month as opposed to 12-month) windows around the implicit OMT announcement. The pre-announcement period is from January 26, 2012 to July 25, 2012, and the post-announcement period from July 27, 2012 to January 25, 2013. These shorter windows allow less room for changes in fundamental channels of cross-country credit risk transmission such as trade or financial links and hence, permit us to assess in a more 'sterilized' manner the impact of the implicit OMT announcement. We focus now on the 5 most salient event dates (instead of 10) in each period owing to the shorter periods. The results summarized in Table 7 confirm that the contagion

from Spain news to the CDS premiums of other Eurozone countries (e.g., Italy and Belgium) unambiguously loses significance after the implicit OMT announcement.

Next we re-deploy the different approaches (principal components, Spain-news transmission and herding effects) by adopting as "announcement date" the day of the formal OMT announcement on September 6, 2012. The results summarized in Figures A4 and A5, and Table A4 of the on-line Appendix do not change our main findings.

Next, we generalize the Spain-news transmission and herding contagion analysis to a setting that allows for time variation in the common risk factor loadings (the beta coefficients in the benchmark). Thus, we estimate by OLS the CAPM and APT pricing equations sequentially over rolling estimation windows. The event indicator $News_{Spain,t}$ is obtained as follows; the residual for day *t* is obtained as the difference between the actual CDS change on that day and the expected CDS change for that day according to the pricing model estimated over the corresponding rolling window (spanning a one-year period of 261 days). The window is then rolled forward one day to obtain the residual for day *t*+1 and so forth. The results from this analysis make no material difference to the news identification; in fact, about 90% of the dates thus detected are listed in Table 4. It is also reassuring to see that the evidence of herding contagion does not materially change when we sequentially estimate the CAPM benchmark over rolling windows. Detailed results are provided in Table A5 (Spain-news identification) and Figure A6 (herding effects) of the on-line Appendix.

In a final robustness check we analyze bond yield spreads defined, as it is usual, with reference to Germany. Detailed results are provided in the on-line Appendix; Figure A7 and Tables A6-A7 summarize the principal components analysis. Figure A8 and Table A8 show, respectively, the herding contagion indices and F tests for the significance of the change in herding pre- and post-announcement. These analyses include Greece as periphery Eurozone

country. The findings are robust to using different measures of sovereign credit risk and the exclusion of Greece from the sample period due to lack of CDS spreads data is immaterial.

5. Summary and policy implications

The turmoil in Eurozone debt markets that erupted more than five years ago revived an old debate. Fundamental theorists blame periphery countries' deteriorating fundamentals. However, without denying the role of fundamentals, multiple-equilibria theorists argue that a self-fulfilling dynamics fuelled by market sentiments of fear and panic has been at play in the region pushing countries towards a worse equilibrium than is justified by fundamentals alone.

In the spirit of the multiple-equilibria discourse, De Grauwe (2011) articulates the Eurozone fragility hypothesis which states that countries that have adopted the euro are prone to sudden reversals in capital flows triggered by market sentiment of fear which can ultimately trigger the feared default. This self-fulfilling dynamics is unlikely to occur in the US, UK or Japan because the financial markets know that these countries have a central bank acting as lender-of-last resort (LOLR). Absent the latter, the Eurozone member countries are in essence like "emerging countries" issuing debt in a foreign currency; thus, their credit risk spreads can be subject to self-fulfilling dynamics that misaligns them with fundamentals.

ECB President Mario Draghi announces on July 26, 2012 that the ECB is prepared within its mandate to do "whatever it takes" to preserve the euro; a month later, the ECB introduces the Outright Monetary Transactions (OMT) program that represents the lender-of-last resort stance. In response to German Eurosceptics' protests against the legality of the OMT program, the German Constitutional Court on February 2014 passes the case to the European Court of Justice. Our paper contributes to making an informed judgment on this matter.

It provides empirical evidence that supports De Grauwe's Eurozone fragility hypothesis by showing, through an eclectic methodology subject to various robustness checks, that the sovereign debt crisis afflicting many Eurozone countries should be ascribed to more than

fundamentals. A principal component analysis of Eurozone CDS spreads suggests that their commonality increases post-announcement. The link between Eurozone fundamentals and CDS spreads is found to increase post-announcement. The transmission of news about Spain and herding contagion significantly lessen after the announcement.

These findings suggest that a self-fulfilling dynamics was present in Eurozone debt markets and Draghi's implicit OMT announcement served to contain it. This policy stance of the ECB has helped not only 'periphery' members (such as Italy and Spain) but also 'core' members (such as Belgium and France) that are struggling to restore their economies to their pre-crisis state, even as their southern neighbours face the risk of deflation and stagnation.

In suggesting that fundamentals are not the whole story, our findings challenge the 'you-deserve-what-you-get' attitude of advocates of strict austerity programs. Our findings stress the institutional role that the ECB plays in preventing debt runs in the region. A positive (albeit not sufficient) step in addressing the Eurozone structural fragility is the unanimous political backing by its members of the ECB's role as a lender of last resort. However, further structural reforms at supranational level such as a fiscal union possibly with centralized taxation and redistribution power are also crucial to fully overcome such fragility.

Acknowledgements

We are grateful to Paul De Grauwe, José-Luis Peydró, Thorsten Beck, Christian Wagner and an anonymous referee at Centre for European Policy Studies (CEPS) for their useful comments and suggestions. We also thank participants at the Rimini Conference in Economics and Finance (June, 2014), Young Finance Scholars' Conference and Quantitative Finance Workshop at the University of Sussex (May 2014), and seminar participants at Cass Business School, Keele University and Brunel University.

References

Aizenman, J., M. Hutchison and Y. Jinjarak, (2013), "What is the risk of European sovereign debt defaults? Fiscal space, CDS spreads and market pricing of risk", *Journal of International Money and Finance*, Vol. 34, pp. 37–59.

Altavilla, C., D. Giannone and M. Lenza, (2014), "The financial and macroeconomic effects of the OMT announcements", CSEF Working Paper No. 352. Centre for Studies in Economics and Finance Working Paper 352, University of Naples.

Alter, A., and A. Beyer (2014), "The dynamics of spillover effects during the European sovereign debt turmoil", *Journal of Banking and Finance,* Vol. 42, pp. 134–53.

Ang, A., and F. A. Longstaff, (2013), "Systemic sovereign credit risk: Lessons from the U.S. and Europe", *Journal of Monetary Economics,* Vol. 60, No. 5, pp. 493–510.

Arghyrou, M. G., and A. Kontonikas, (2012), "The EMU sovereign-debt crisis: Fundamentals, expectations and contagion", *Journal of International Financial Markets, Institutions and Money,* Vol. 22, No. 4, pp. 658–77.

Beetsma, R., M. Giuliodori, F. De Jong and D. Widijanto (2013), "Spread the news: The impact of news on the European sovereign bond markets during the crisis", *Journal of International Money and Finance*, Vol. 34, pp. 83–101.

Beirne, J., and M. Fratzscher (2013), "The pricing of sovereign risk and contagion during the European sovereign debt crisis", *Journal of International Money and Finance*, Vol. 34, pp. 60–82.

Bekaert, G., M. Ehrmann, M. Fratzscher and A. J. Mehl (2011), "Global Crises and Equity Market Contagion", NBER Working Paper No. 17121, Cambridge.

Caceres, C., V. Guzzo and M. Segoviano (2010), "Sovereign Spreads: Global Risk Aversion, Contagion or Fundamentals?" IMF Working Paper 120, Washington, D.C.

Calvo, G. A. (1988), "Servicing the public debt: The role of expectations", *American Economic Review*, Vol. 78, No. 4, pp. 647–61.

Caporin, M., L. Pelizzon, F. Ravazzolo and R. Rigobon (2013), "Measuring Sovereign Contagion in Europe", NBER Working Paper 18741, Cambridge.

Corsetti, G., and L. Dedola (2013), "The Mystery of the Printing Press: Self-fulfilling Debt Crises and Monetary Sovereignty", CEPR Discussion Paper No. DP9358, London.

De Grauwe, P. (2011), "The European Central Bank: Lender of Last Resort in the Government Bond Markets?" CESifo Working Paper No. 3569, Center for Economic Studies, Ludwig-Maximilians-Universität, and Ifo Institute, Munich, September.

De Grauwe, P. (2012), "The Governance of a Fragile Eurozone", *Australian Economic Review*, Vol. 45, No. 3, pp. 255-68.

De Grauwe, P. (2014). *Economics of Monetary Union*. Tenth Edition. Oxford University Press.

De Grauwe, P., and Y. Ji (2013), "Self-fulfilling crises in the Eurozone: An empirical test", *Journal of International Money and Finance*, Vol. 34, pp. 15–36.

De Grauwe, P., and Y. Ji (2014), "How much fiscal discipline in a monetary union?" *Journal of Macroeconomics*, Vol. 39, Part B, pp. 348–60.

De Pooter, M., Martin, R. F., and Pruitt, S. (2013), "The liquidity effects of official bond market intervention", Federal Reserve Board of Governors Discussion Paper.

De Santis, R. A. (2014), "The euro area sovereign debt crisis: Identifying flight-to-liquidity and spillover mechanisms", *Journal of Empirical Finance*, Vol. 26, pp. 150–70.

Eser, F. and Schwaab, B. (2013), "Assessing asset purchases within the ECBs securities markets programme", European Central Bank Working Paper 1587.

Falagiarda, M., and S. Reitz (2013), "Announcements of ECB Unconventional Programs: Implications for the Sovereign Risk of Italy", Kiel Working Paper No. 1866, Kiel Institute for the World Economy, Kiel, August.

Forbes, K. (2012), "The 'Big C': Identifying Contagion", NBER Working Paper No. 18465, National Bureau of Economic Research, Cambridge, October.

Ghysels, E., Idier, J., Manganelli, S., and Vergote, O. (2014), "A high frequency assessment of the ECB securities markets programme", European Central Bank Working Paper 1642.

González-Hermosillo, B., and C. Johnson (2014), "Transmission of Financial Stress in Europe: The Pivotal Role of Italy and Spain, but not Greece", IMF Working Paper No. WP/14/76, International Monetary Fund, Washington, D.C., April.

Gros, D. (2012), “A Simple Model of Multiple Equilibria and Default”, CEPS Working Document No. 366, Brussels.

Longstaff, F. A., J. Pan, L. H. Pedersen and K. J. Singleton, (2011), “How sovereign is sovereign credit risk?” *American Economic Journal: Macroeconomics,* Vol. 3, No. 2, pp. 75-103.

Lucas, A., B. Schwaab and X. Zhang (2014), “Conditional Euro Area Sovereign Default Risk”, *Journal of Business and Economic Statistics*, Vol 32, No. 2, pp. 271-84.

Manasse, P., and L. Zavalloni (2013), *“Sovereign Contagion in Europe: Evidence from the CDS Market”*, DSE Working Paper 863, Department of Economics, University of Bologna.

Mink, M., and J. De Haan (2013), “Contagion during the Greek sovereign debt crisis”, *Journal of International Money and Finance*, Vol. 34, pp. 102–13.

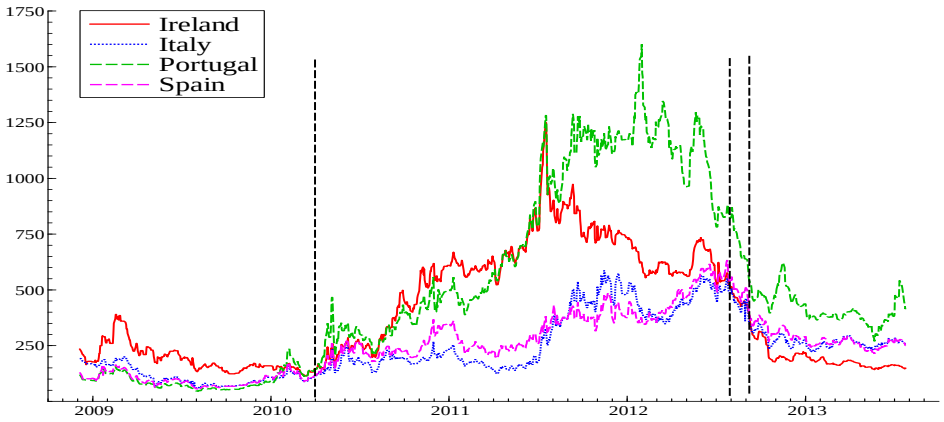
Pisani-Ferry, J. (2013), “The euro on the mend”, Project Syndicate, 30 June (www.project-syndicate.org/commentary/the-unfinished-recovery-of-the-euro-by-jean-pisani-ferry).

Ross, S. A. (1976), “The arbitrage theory of capital asset pricing”, *Journal of Economic Theory,* Vol. 13, No. 3, pp. 341-60.

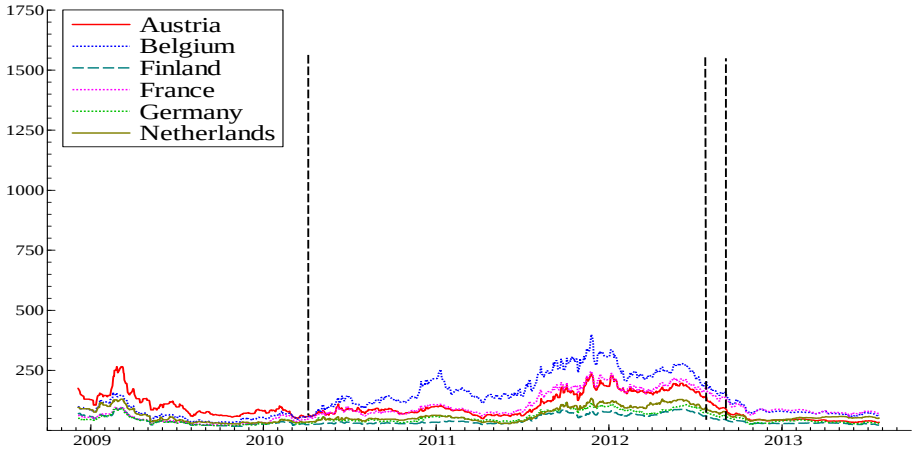
Wolff, G. B. (2014). “The OMT programme was justified but the fiscal union question remains, Comments on 'Did the German court do Europe a favour?” by Mody, A., http://www.bruegel.org/nc/blog/detail/article/1391-the-omt-programme-was-justified-but-the-fiscal-union-question-remains/

Figure 1. Daily sovereign CDS spreads from December 5, 2008 to July 25, 2013

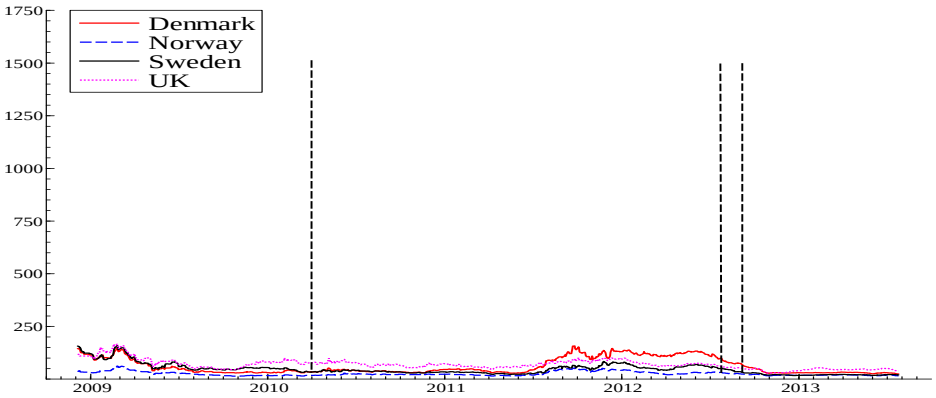
Panel A: Peripheral Eurozone countries



Panel B: Core Eurozone countries

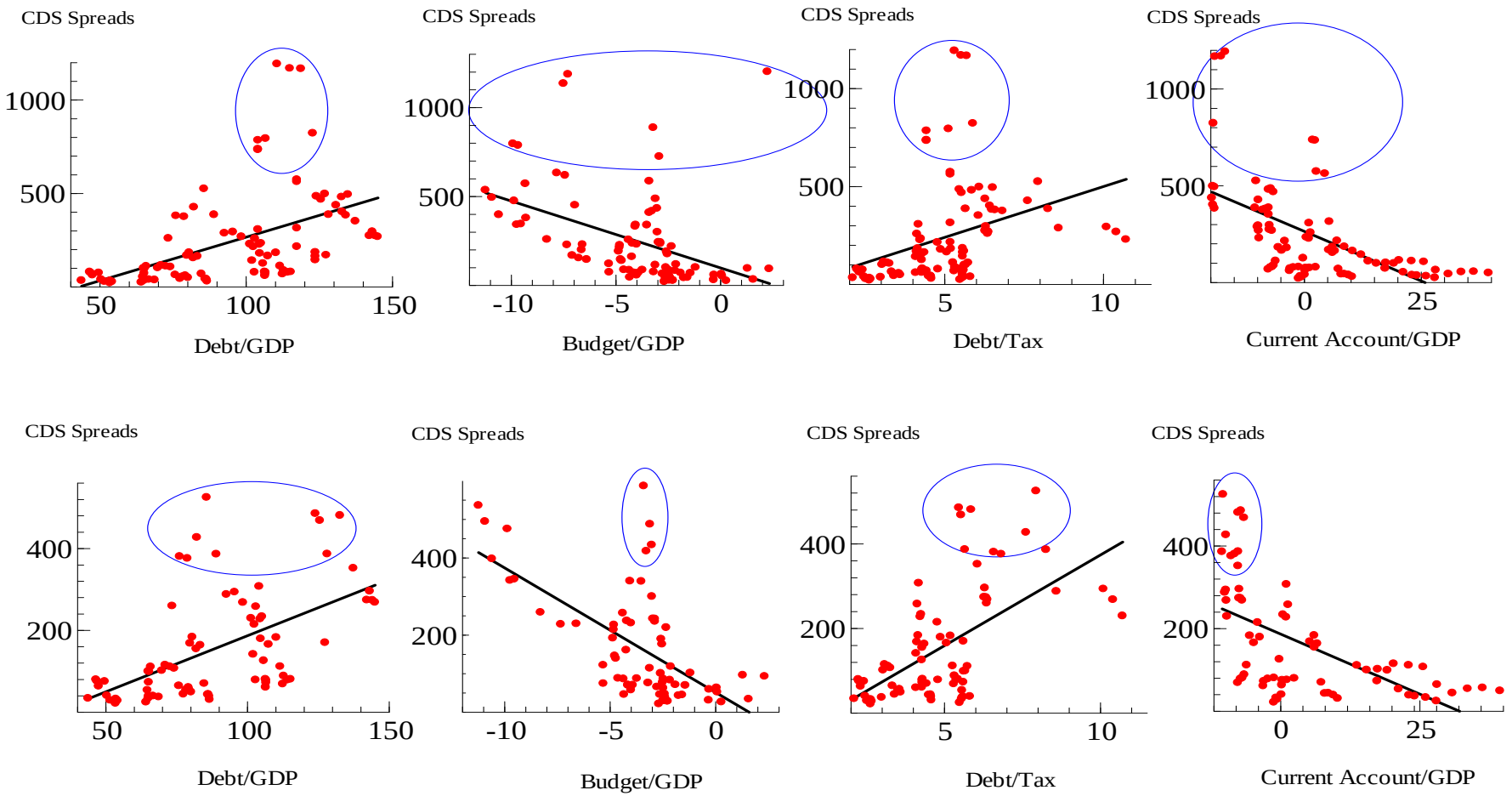


Panel C: Stand-alone European countries



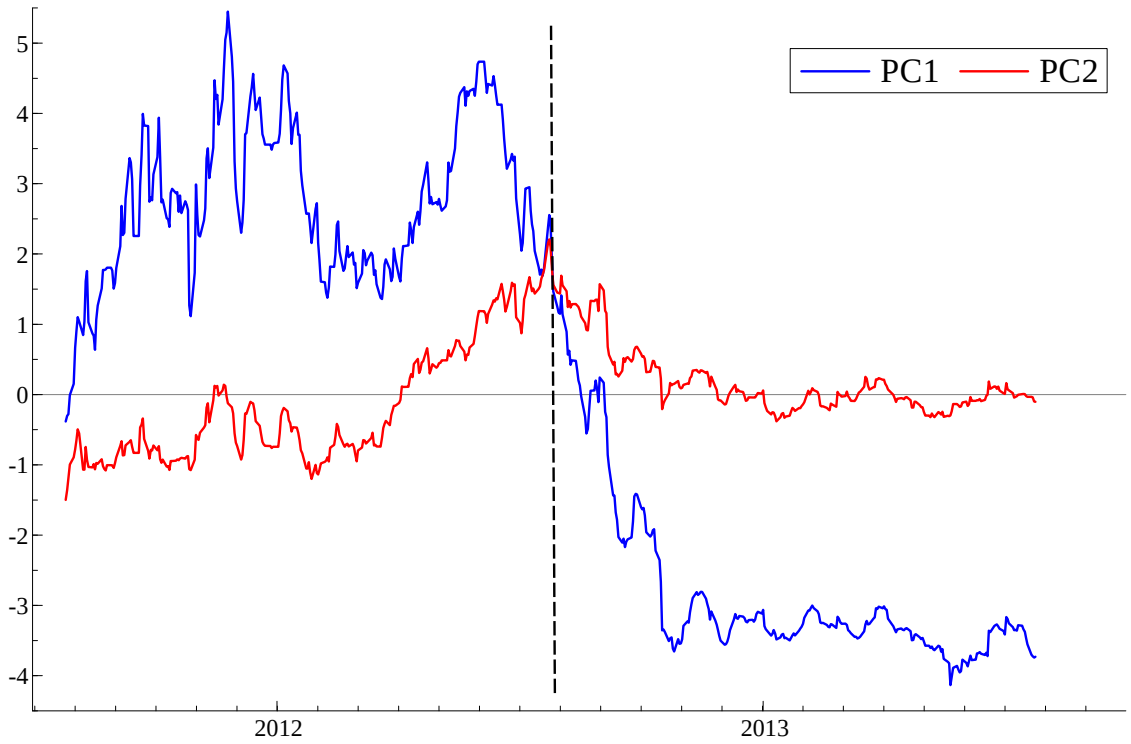
Note: The graphs show the daily evolution of the CDS spreads (in basis points) of 10 Eurozone countries distinguished as 'core' and 'peripheral', and four non-euro European countries. The first vertical line on March 31, 2010 marks the date of the first rescue package for Greece. The second vertical line on July 26, 2012 marks the date of ECB President Mario Draghi's statement that the Bank was prepared to do "whatever it takes to preserve the euro"; this paper refers to this date as the implicit Outright Monetary Transactions program (OMT) announcement. The third vertical line marks the formal OMT announcement on September 6, 2012.

Figure 2. Scatterplots and OLS regression line for Eurozone CDS spreads versus macro fundamentals from mid-2011 to mid-2013



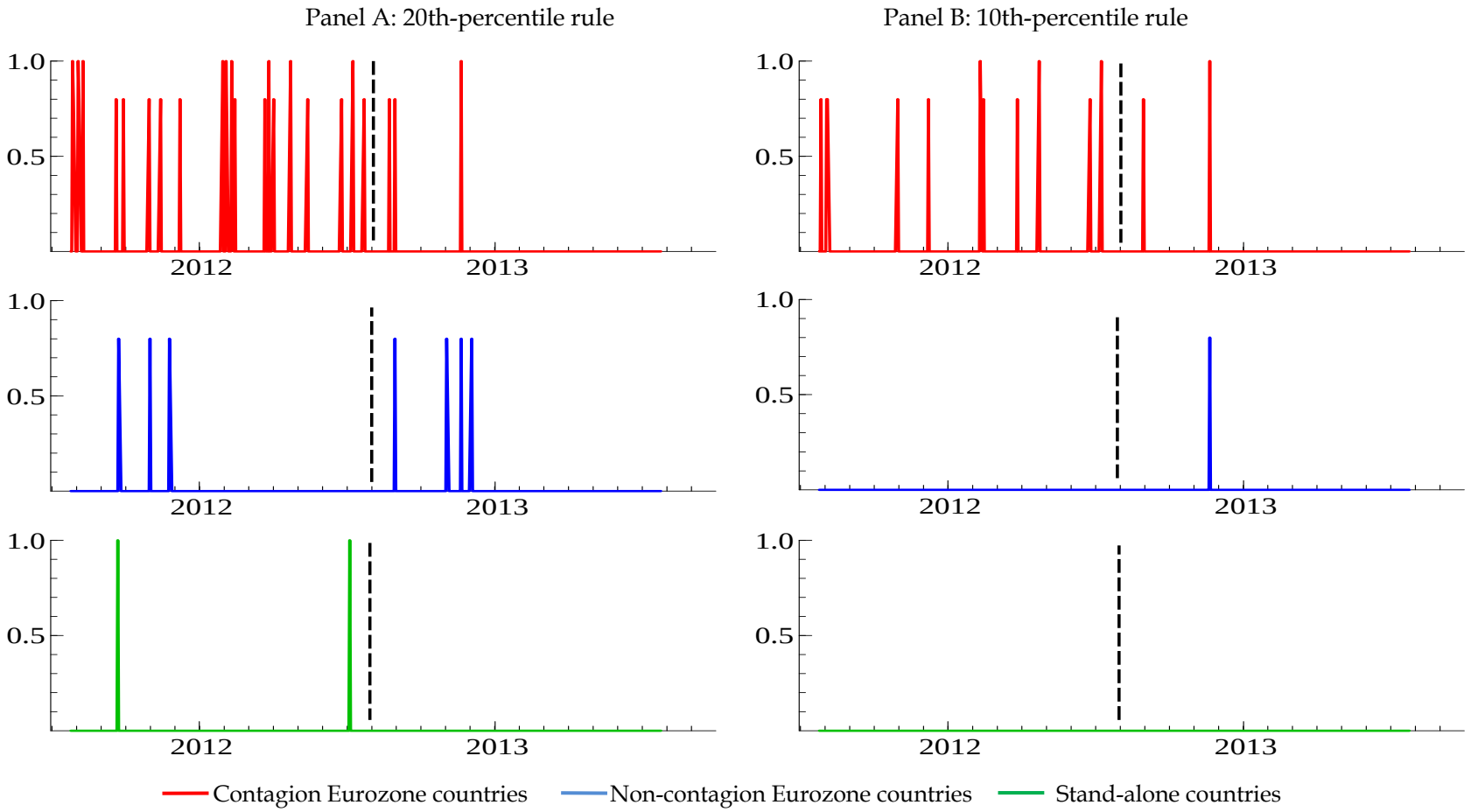
Note: The four graphs in the upper panel are based on pooled quarterly observations for 10 Eurozone countries (Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal and Spain) and the ones in the lower panel are for the same set of countries excluding Ireland and Portugal. The Y-axis represents the quarterly CDS spreads and the X-axis represents the corresponding macroeconomic indicators of these countries over the two-year period from mid-2011 to mid-2013.

Figure 3. First and second principal components of daily Eurozone CDS spreads



Note: The first and second principal components plotted are extracted from the correlation matrix of daily CDS spreads over the two-year sample period around the implicit OMT announcement (on July 26, 2012; vertical dashed line) that commences on July 26, 2011 and ends on July 25, 2013. The CDS spreads pertain to 10 Eurozone countries, of which 4 are 'peripheral' countries (Ireland, Italy, Portugal and Spain) and 6 are 'core' countries (Austria, Belgium, Finland, France, Germany and the Netherlands) according to the standard classification.

Figure 4. Herding contagion index



Note: The graph plots on each day of the two-year sample period around the implicit OMT announcement (July 26, 2012; vertical dotted line) the herding contagion index. The index is defined as the proportion of CDS spreads that experienced unexpected extreme increases in their CDS spreads according to the CAPM benchmark, equation (3), if this exceeds 80%, and zero otherwise; extreme is defined according to the 20th percentile or 10th percentile criteria applied to the residual distribution. The residuals are obtained through OLS estimation. The 'contagion' Eurozone countries are Austria, Belgium, France, Italy and Spain; the 'non-contagion Eurozone countries are Finland, Germany, Ireland, the Netherlands and Portugal. The stand-alone (non-euro) countries are Denmark, Norway, Sweden and the UK.

Table 1. Descriptive statistics for daily sovereign CDS spreads of European countries

	Panel A: Pre- announcement (July 26, 2011 to July 25, 2012)					Panel B: Post- announcement (July 26, 2012 to July 25, 2013)				
	Average	StDev.	Min.	Max.	ΔCDS	Average	StDev.	Min.	Max.	ΔCDS
Periphery Eurozone countries										
Ireland	696.76	110.06	522.25	973.43	- 370.31	222.95	97.65	142.39	550.71	- 401.40
Italy	452.92	68.16	271.88	586.70	276.63	288.96	63.31	221.96	515.71	- 257.80
Portugal	1133.30	145.71	781.71	1601.00	- 125.39	453.77	120.28	269.42	881.56	- 465.33
Spain	435.54	78.32	314.91	634.35	294.89	306.69	80.52	213.72	583.56	- 332.86
Core Eurozone countries										
Austria	164.72	28.42	86.91	236.13	50.47	50.92	21.12	31.60	127.89	- 94.11
Belgium	260.92	40.15	175.76	398.78	26.14	88.32	31.10	54.66	191.44	- 128.39
Finland	70.63	8.95	44.34	87.24	15.54	31.85	7.13	22.02	57.57	- 35.55
France	184.25	24.23	112.23	245.27	66.34	88.18	22.54	57.11	168.47	- 97.27
Germany	88.00	11.97	59.97	118.38	20.43	39.45	10.88	22.85	75.82	- 47.36
Netherlands	103.13	16.58	52.19	133.84	41.82	54.61	10.24	37.98	89.43	- 37.97
Non-Eurozone countries										
Denmark	117.54	15.23	65.31	157.46	32.04	38.27	16.46	24.50	93.44	- 68.94
Norway	36.15	8.47	20.84	52.11	4.15	19.76	3.10	15.28	30.96	- 15.40
Sweden	58.71	10.29	32.69	84.23	19.77	23.61	7.27	17.04	50.99	- 30.63
United Kingdom	78.25	11.53	58.66	101.64	- 10.24	44.85	7.38	27.60	58.41	- 20.34

Notes: The table summarizes the distribution of daily sovereign CDS spreads (in basis points) of 14 European countries over the two yearly windows surrounding the implicit OMT announcement on July 26, 2012. ΔCDS denotes the change in the CDS spread from the initial day to the last day of the corresponding window.

Table 2. Pooled OLS regressions of quarterly CDS spreads on fundamentals

	Pre-announcement (mid 2011 to mid 2012)		Post- announcement: (mid 2012 to mid 2013)	
	t-statistic	Adj.R^2	t-statistic	Adj.R^2
Debt/GDP	3.48**	0.35	5.59**	0.49
Budget/GDP	-2.39*	0.13	-4.75**	0.37
Debt/Tax	1.91	0.05	3.10**	0.28
Current Account/GDP	-3.43**	0.46	-4.79**	0.51

Notes: The table reports the OLS slope coefficient estimates of regressions of CDS spreads on four macro indicators in the one-year windows before and after the implicit OMT announcement on July 26, 2012. The estimation is based on pooled quarterly data for 10 Eurozone countries. Autocorrelation and heteroskedasticity robust Newey-West t-statistics are reported. ** and * denote significance at the 1% and 5% levels, respectively.

Table 3. Principal component decomposition of daily Eurozone CDS spreads

	Eigenvalues	Total variation explained (%)		Country loadings (eigenvectors) PC1	PC2
Panel A: Pre-announcement (July 26, 2011 to July 25, 2012)					
PC1	5.646	56.46	Austria	0.385	-0.025
PC2	1.877	75.22	Belgium	0.320	-0.398
PC3	1.253	87.76	Finland	0.346	0.040
PC4	0.470	92.46	France	0.405	-0.037
PC5	0.334	95.80	Germany	0.368	-0.109
PC6	0.229	98.09	Ireland	0.020	-0.533
PC7	0.072	98.81	Italy	0.368	0.095
PC8	0.057	99.38	Netherlands	0.377	0.162
PC9	0.034	99.72	Portugal	0.097	-0.449
PC10	0.028	100.00	Spain	0.208	0.552
Panel B: Post-announcement (July 26, 2012 to July 25, 2013)					
PC1	9.148	91.48	Austria	0.328	-0.025
PC2	0.450	95.98	Belgium	0.328	0.039
PC3	0.223	98.21	Finland	0.322	-0.135
PC4	0.070	98.91	France	0.325	0.004
PC5	0.044	99.35	Germany	0.310	-0.344
PC6	0.028	99.63	Ireland	0.327	0.056
PC7	0.014	99.77	Italy	0.320	0.106
PC8	0.011	99.89	Netherlands	0.282	-0.628
PC9	0.007	99.96	Portugal	0.294	0.613
PC10	0.004	100.00	Spain	0.323	0.276

Notes: The table reports eigenvalues λ_j, j=1,…,10 and the proportion of the total variation in CDS spreads of 10 Eurozone countries that is explained by each principal component given by $\lambda_j/\Sigma\lambda_j$. The last two columns report the eigenvectors or country loadings to construct the first and second principal components (denoted PC1 and PC2, respectively). The principal components are extracted from the correlation matrix of daily sovereign CDS spreads over the two-year sample period around the implicit OMT announcement (on July 26, 2012). The principal components are summarized, separately, over the two yearly windows surrounding the implicit OMT announcement. The 10 Eurozone countries are 4 'peripheral' (Ireland, Italy, Portugal and Spain) and 6 'core' (Austria, Belgium, Finland, France, Germany and the Netherlands) according to the standard classification.

Table 4. Spain-specific daily news

Date	News Description	Residual (%)	ΔCDS (%)
Panel A: Pre-announcement (July 26, 2011 to July 25, 2012)			
10.08.2011	Spain's Banca Civica BCIV.MC said on Wednesday its non-performing loan ratio at the end of the first half was 5.43 percent compared to 4.70 percent at the end of 2010 (R).	5.77	11.34
23.08.2011	An agreement between Spain's ruling Socialists and other political parties over controlling public spending is possible, Spanish Prime Minister Jose Luis Rodriguez Zapatero said on Tuesday (R).	-5.01	0.64
23.09.2011	Spain approved the sale of a stake in state-owned lottery operator Loterias y Apuestas del Estado on Friday, leaving what will be the country's biggest initial public offering on track despite tough markets and political opposition. While revenue from privatisation sales cannot be used to reduce a European country's annual public deficit under EU rules, the proceeds will mean Spain has to issue less debt (R).	-4.33	7.14
14.11.2011	Spain's borrowing costs risk hitting euro-era highs at auction this week, fuelling fears it is getting dragged back into the heart of the euro zone debt crisis as markets await evidence of a new government's commitment to economic reform (R).	6.07	9.07
03.01.2012	Registered unemployment in Spain, where almost half of young people are out of work, rose for a fifth month in December as the euro area's fourth-largest economy contracted. The number of people registering for unemployment benefits rose 1,897 to 4.42 million, the Labor Ministry in Madrid said in an e-mailed statement today (B).	5.85	6.45
04.01.2012	The heavily indebted Spanish region of Valencia delayed a 123 million euro repayment to Deutsche Bank by a week, its deputy chief minister said, but did not call on the country's government to guarantee the funds. Ratings agency Fitch said in December it believed the government would step in to help Valencia if it faced problems (R).	4.81	7.17
02.03.2012	Spain set itself a softer deficit target for 2012 than originally agreed under the euro zone's austerity drive, putting a question mark over the credibility of the European Union's new fiscal pact (R).	4.65	4.86
27.03.2012	Spain's economy is suffering its second recession since 2009, the Bank of Spain said today, a development that obstructs the government's efforts to reorder public finances as it prepares the budget for this year (B).	5.42	- 0.01
18.06.2012	Spanish bond yields hit a new euro-era high above 7 percent on Monday as initial relief after a pro-bailout vote in Greek elections gave way to pessimism about the problems surrounding the bigger Spanish economy (R).	4.29	3.76
09.07.2012	European ministers were set to grant Spain an extra year to reach its deficit targets in exchange for further budget savings but remained far from pinning down details of bank rescues and emergency bond-buying that are of greater concern to markets. Spain faces budget risks despite the looser target (R).	5.59	2.38

(*Cont.*)

Date	News Description	Residual (%)	ΔCDS (%)
Panel B: Post-announcement (July 26, 2012 to July 26, 2013)			
30.08.2012	Spanish consumer prices surged in August driven by higher fuel costs and a value-added tax hike in September could drive another jump, complicating Spain's efforts to get out of recession and generate the growth needed to reduce its debts (R).	6.87	3.03
17.09.2012	Ten-year Spanish government bond yields extended their rise on Monday, driven by pressure ahead of this week's auctions and lingering doubts over when, or if, Spain will seek financial aid (R).	3.40	1.87
18.09.2012	Spain will consider seeking a bailout if the conditions imposed are acceptable, Deputy Prime Minister Soraya Saenz de Santamaria said as loan defaults at Spanish banks climbed and lending dropped (B).	5.10	5.52
17.10.2012	Spanish government bond yields fell to their lowest since early April on Wednesday after Moody's kept Spain's investment grade rating, removing an immediate threat to the euro zone's fourth largest economy (R).	- 5.11	- 16.81
18.10.2012	Spain's banks face more loan losses as the pace of an economic slump risks turning a worst-case scenario dismissed in stress tests into reality, according to data published by the Bank of Spain on its website today (R).	4.09	2.63
22.10.2012	Spanish bonds fell for a second day on speculation Prime Minister Mariano Rajoy's regional election victory gives him more room to delay seeking a bailout that would allow Europe's central bank to buy the nation's debt (B).	6.28	3.70
23.10.2012	The Bank of Spain said on Tuesday that Spain was at risk of missing its 2012 budget deficit target of 6.3 percent of GDP, including regions and social security, as a prolonged recession slashes revenues (R).	3.98	5.68
04.02.2013	Ten-year Spanish government bond yields rose on Monday as the country's opposition party called for the resignation of Prime Minister Mariano Rajoy over a corruption scandal (R).	3.94	6.07
26.02.2013	Spain is no closer to seeking bond-buying help from the European Central Bank than it was before Italy's election, which has triggered renewed market turmoil, Economy Minister Luis de Guindos said on Tuesday (R).	3.76	7.92
22.07.2013	Spain's Prime Minister on Monday said he would soon appear in Parliament to face questions over a corruption scandal that has dented his ruling People's Party's credibility and upset Spaniards as they go through deep cuts in social welfare (R).	3.55	- 2.16

Notes: The news source is *Reuters* (R), or *Bloomberg Businessweek* (B). The residuals shown in the penultimate column, obtained by OLS estimation of the CAPM equation (1), are a proxy for the salience of the Spain-specific news on the corresponding days listed in the first column. The last column reports the actual daily change in the Spanish CDS spread. The spreads (and residuals) are expressed in percentage points.

Table 5. Spain-specific news effects on Eurozone sovereign CDS spreads

Panel A: Pre-announcement (July 26, 2011 to July 25, 2012)

	Austria		Belgium		Finland		France		Germany	
	CAPM	APT	CAPM	APT	CAPM	APT	CAPM	APT	CAPM	APT
European	**1.137	**0.751	**1.141	**0.938	**0.822	**0.628	**1.107	**0.850	**0.973	**0.616
	(0.085)	(0.067)	(0.069)	(0.072)	(0.081)	(0.092)	(0.086)	(0.125)	(0.085)	(0.090)
Financial	-	*0.107	-	0.036	-	**0.110	-	**0.107	-	0.077
		(0.045)		(0.044)		(0.039)		(0.038)		(0.048)
Global	-	**1.485	-	**1.239	-	**0.965	-	**1.289	-	**1.312
		(0.097)		(0.076)		(0.077)		(0.083)		(0.092)
α_0	0.002	0.001	0.000	-0.001	0.001	0.000	0.002	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
News (α_1)	**0.219**	****0.432**	****0.404**	****0.506**	**-0.086**	**0.210**	**0.207**	***0.281**	**-0.148**	**0.011**
	(0.184)	**(0.099)**	**(0.097)**	**(0.118)**	**(0.178)**	**(0.138)**	**(0.134)**	**(0.120)**	**(0.165)**	**(0.101)**
Adj. R^2	0.57	0.68	0.68	0.72	0.45	0.49	0.59	0.64	0.52	0.63

	Ireland		Italy		Netherlands		Portugal	
	CAPM	APT	CAPM	APT	CAPM	APT	CAPM	APT
European	**0.612	**0.636	**1.236	**1.190	**0.951	**0.676	**0.681	**0.736
	(0.050)	(0.063)	(0.054)	(0.097)	(0.072)	(0.080)	(0.064)	(0.078)
Financial	-	0.039	-	**0.089	-	0.104	-	-0.043
		(0.026)		(0.030)		(0.055)		(0.041)
Global	-	**0.544	-	**1.098	-	**1.186	-	**0.607
		(0.075)		(0.081)		(0.090)		(0.098)
α_0	-0.002	-0.002	0.003	0.001	0.002	0.002	-0.000	0.000
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
News (α_1)	***-0.547**	***-0.544**	****0.566**	****0.562**	**0.086**	**0.225**	***-0.410**	****-0.561**
	(0.229)	**(0.240)**	**(0.137)**	**(0.122)**	**(0.163)**	**(0.135)**	**(0.175)**	**(0.171)**
Adj. R^2	0.47	0.48	0.72	0.73	0.50	0.57	0.40	0.41

(*Cont.*)

Panel B: Post-announcement (July 26, 2012 to July 26, 2013)

	Austria		Belgium		Finland		France		Germany	
	CAPM	APT	CAPM	APT	CAPM	APT	CAPM	APT	CAPM	APT
European	**0.735	**0.643	**0.870	**0.734	**0.502	**0.449	**0.845	**0.794	**0.726	**0.624
	(0.078)	(0.091)	(0.106)	(0.117)	(0.091)	(0.108)	(0.107)	(0.123)	(0.127)	(0.138)
Financial	-	-0.006	-	-0.033	-	-0.034	-	-0.037	-	-0.015
		(0.046)		(0.039)		(0.050)		(0.037)		(0.042)
Global	-	**0.720	-	**0.895	-	**0.472	-	**0.718	-	**0.730
		(0.095)		(0.079)		(0.086)		(0.092)		(0.146)
α_0	*-0.003	**-0.004	-0.001	**-0.003	-0.002	**-0.003	0.000	-0.002	-0.001	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
News (α_1)	**-0.058**	**-0.070**	**-0.107**	**-0.113**	***-0.236**	**-0.236**	**-0.158**	**-0.137**	**-0.273**	**-0.281**
	(0.117)	**(0.126)**	**(0.281)**	**(0.293)**	**(0.118)**	**(0.135)**	**(0.281)**	**(0.316)**	**(0.380)**	**(0.411)**
Adj. R^2	0.41	0.43	0.49	0.52	0.24	0.25	0.46	0.46	0.26	0.27

	Ireland		Italy		Netherlands		Portugal	
	CAPM	APT	CAPM	APT	CAPM	APT	CAPM	APT
European	**0.700	**0.665	**1.096	**1.089	**0.627	**0.588	**0.846	**0.771
	(0.099)	(0.113)	(0.088)	(0.107)	(0.098)	(0.117)	(0.138)	(0.143)
Financial	-	-0.006	-	0.065	-	-0.059	-	**0.171
		(0.045)		(0.048)		(0.031)		(0.053)
Global	-	**0.593	-	**0.811	-	**0.538	-	**0.779
		(0.105)		(0.067)		(0.073)		(0.108)
α_0	*-0.003	**-0.005	0.002	-0.002	0.000	-0.002	0.000	-0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
News (α_1)	**0.054**	**0.075**	**-0.115**	**-0.144**	**-0.142**	**-0.105**	**-0.288**	**-0.423**
	(0.177)	**(0.206)**	**(0.683)**	**(0.722)**	**(0.241)**	**(0.265)**	**(0.283)**	**(0.284)**
Adj. R^2	0.47	0.47	0.45	0.44	0.40	0.40	0.33	0.36

Notes: The table reports the OLS estimation of the CAPM benchmark, equation (2), which controls for European sovereign risk, and the APT benchmark, equation (5), which additionally controls for global sovereign risk and European financial risk. The main parameter of interest is $\boldsymbol{\alpha_1}$ that measures the impact of Spanish-specific (predominantly bad) news. Autocorrelation and heteroskedasticity robust Newey-West standard errors are shown in parentheses. ** and * denote significance at the 1% and 5% levels.

Table 6. Spain-specific news effects on non-Eurozone sovereign CDS spreads

Pre-announcement: 26.07.2011 – 25.07.2012				
	Denmark	Norway	United Kingdom	Sweden
	CAPM	CAPM	CAPM	CAPM
European	**0.988	**0.691	**0.758	**0.935
	(0.071)	(0.095)	(0.058)	(0.091)
α_0	0.002	0.000	-0.001	0.002
	(0.002)	(0.002)	(0.001)	(0.002)
News (α_1)	**-0.136**	**0.245**	**-0.076**	***-0.239**
	(0.117)	**(0.268)**	**(0.102)**	**(0.096)**
Adj. R^2	0.48	0.25	0.50	0.33
Post-announcement: 26.07.2012 – 25.07.2013				
	Denmark	Norway	United Kingdom	Sweden
	CAPM	CAPM	CAPM	CAPM
European	**0.470	**0.554	**0.421	**0.491
	(0.097)	(0.107)	(0.075)	(0.085)
α_0	**-0.003	-0.001	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
News (α_1)	**-0.157**	**-0.128**	**-0.182**	**0.068**
	(0.250)	**(0.135)**	**(0.256)**	**(0.217)**
Adj. R^2	0.21	0.24	0.20	0.16

Notes: The table reports the OLS estimation of the CAPM benchmark, equation (2), which controls for European sovereign risk, for 4 stand-alone European countries: Denmark, Norway, Sweden and the UK. The parameter of interest is $\boldsymbol{\alpha_1}$ that measures the impact of Spanish-specific (predominantly bad) news. Autocorrelation and heteroskedasticity robust Newey-West standard errors are shown in parentheses. ** and * denote significance at the 1% and 5% levels, respectively.

Table 7. Spanish-specific news effects over 6-month windows

	Pre-announcement 26.01.2011 – 25.07.2012		Post-announcement 26.07.2012 – 25.01.2013	
	CAPM	APT	CAPM	APT
Austria	**0.354	**0.299	0.023	-0.023
	(0.124)	(0.109)	(0.133)	(0.134)
Belgium	**0.472	**0.447	0.029	0.063
	(0.106)	(0.112)	(0.375)	(0.376)
Finland	0.521	0.445	-0.121	-0.054
	(0.324)	(0.379)	(0.142)	(0.142)
France	**0.563	*0.526	0.143	0.250
	(0.214)	(0.220)	(0.227)	(0.271)
Germany	0.224	0.140	-0.106	-0.025
	(0.207)	(0.170)	(0.414)	(0.428)
Ireland	*-1.031	-0.939	0.062	0.155
	(0.481)	(0.494)	(0.202)	(0.240)
Italy	**0.536	**0.459	-0.733	-0.820
	(0.130)	(0.076)	(0.905)	(1.010)
Netherlands	**0.630	**0.560	-0.084	0.008
	(0.214)	(0.197)	(0.309)	(0.321)
Portugal	*-0.462	-0.448	-0.044	-0.305
	(0.231)	(0.249)	(0.220)	(0.229)

Notes: The table repeats the analysis of Spain-specific news based on news identification over shorter 6-month windows around the implicit OMT announcement. In each window only the five days of most salient news are considered in the construction of $News_{t,Spain}$. The table reports the OLS estimate of the coefficient of the Spanish-news variable (α_1) in the CAPM equation (2) which controls only for European sovereign risk, and the APT equation (5) that additionally controls for global sovereign risk and European financial risk. Autocorrelation and heteroskedasticity robust Newey-West standard errors are reported in parentheses. ** and * denote significant coefficients at the 1% and 5% level, respectively.