

CONTAGION OR WAKE-UP CALL? ANOTHER LOOK AT THE EMU
SOVEREIGN DEBT CRISIS

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Abstract. – We test whether the sharp increase in sovereign spreads with respect to Germany observed on average in Euro area countries after the burst of the Greek crisis (September 2009) is due to a deterioration of the macroeconomic and fiscal scenario, or to elements of “contagion”: More in detail, we consider several forms of contagion, distinguishing between an increased attention devoted by investors to those variables which ultimately determine the creditworthiness of a sovereign (“wake-up call” contagion) and irrational (or self-fulfilling) investor behaviour, disconnected from fundamentals (“pure” contagion). We consider among the fundamentals also indicators of internal and external imbalances which, before the crisis, were ignored by most economists and policy-makers alike. Our empirical analysis suggest that markets participants, after the Greek crisis, started to pay more attentions to fundamentals (which were apparently not important before the crisis). Moreover, we did not find evidence of “pure” contagion.

1) Introduction

Since the idea of the European Monetary Union (EMU) started to be debated in policy circles and among economists, there was a consensus that it required sound public finances in each member State. It was more controversial, instead, whether market forces - by requiring higher interest rates *vis à vis* profligate fiscal policies and, in the limit, denying lending - would have been sufficient to achieve the necessary fiscal discipline.

In the end, the architects of the Euro deemed that market forces “might either be too slow and weak or too sudden and disruptive” (Committee for the study of economic and monetary union, 1989) and decided to rely on an articulated set of fiscal rules, enshrined in international treaties and EU regulations to complement market-based discipline.

The aim of the present paper is to reconsider some elements of such debate in the light of the first ten years of the EMU, and in particular of the recent Euro area sovereign debt crisis. We focus on the two issues implicitly raised by the above-mentioned statement of the Delors committee: (a) to what extent the very small sovereign spreads observed in the pre-crisis period were due to an insufficient weight given by investors to a country’s fundamentals? (b) to what extent the sharp increase in several Euro area sovereign spreads following the Greek events was “excessive” given the fundamentals? In particular, was the spread of market tensions outside Greece an instance of “contagion”?

While several other papers have studied the relationship between spread and fiscal fundamentals in EMU, ours contributes to the discussion in two ways. First, a broader set of fundamentals is considered. Indeed one of the lessons of the EMU crisis is that even countries with an initial low level of public debt and deficit can incur in a sudden deterioration of their fiscal position, for example as an effect of financial sector bailouts (which basically transform private liabilities into public debt) or sharp GDP contractions due to macro-imbalances. This risk was considered obvious for emerging markets at least since the Asian crisis of the late nineties, but it was not taken into account by the EMU rules and –as we show in our paper – by investors. Second, we clarify and

distinguish different meanings that can be given to the word “contagion”, and measure their relative importance in explaining the post-crisis behaviour of European sovereign spreads.¹

The rest of the paper proceeds as follows: in Section 2, we clarify our definition of contagion; in Section 3 we give a brief narrative of the EMU sovereign debt crisis; in Section 4, we discuss our empirical strategy; in Section 5 we show our results, discuss several extensions and perform some robustness checks; finally, in Section 6 we provide some tentative conclusions and draw some policy implications of our results.

2) The analysis of contagion: a conceptual framework

In a very broad and informal way, contagion can be defined as the transmission of the instability from a specific financial market or institution to other markets or institutions, either within or across national boundaries. In the main part of the paper we are only concerned with contagion across sovereign bond markets, thus we leave aside the issue of contagion from the sovereign debt market to other financial markets or to the banking sector (addressed among others by Acharya et al, 2011, Alter and Schuler, 2011, Angeloni and Wolff, 2012).²

In the economic literature, more precise and circumscribed definitions of contagion are adopted.³ Indeed, the spread of instability from the crisis country to a second country can be due to a common cause (for example, a general increase in risk aversion), or to the adverse impact of the crisis on the fundamentals of the second country. We follow, among others, Eichengreen et al. (1996), Masson (1998), Goldstein et al. (2000), and do not apply the term contagion to this cases. Instead, we only consider as contagion those episodes in which the increased instability is unrelated to the change in fundamentals, be they country-specific or global (such as general risk aversion).

Furthermore, within this narrow class of episodes, we aim at distinguishing between three kind of circumstances:

- Wake-up-call contagion, i.e. a situation in which the crisis initially restricted to one country provides new information, that prompts investors to reassess the default risk of other countries (this concept is used, for example, by Goldstein, 1998, Masson, 1999, Goldstein et al., 2000). In this case, domestic fundamentals justified a flight from sovereign debt even before the crisis event, but investors did not priced/perceived correctly the risk.⁴
- Shift-contagion, which occurs when the normal cross-market channel intensifies after a crisis in one country. It can be seen as analogous to wake-up call contagion except for the fact that it is due to an increased sensitivity to common factors (for example, global risk aversion) instead of country-specific factors. We borrow the term and the concept from the work of Forbes and Rigobon (e.g. Forbes and Rigobon, 2000).

¹ Of course, the two contributions are related: to understand whether spreads are excessive given fundamentals, is necessary to take a stance concerning the relevant fundamentals.

² However, as we will see below (Section 5), we take into account the possibility that the state of banks may have an impact on sovereign spreads.

³ For thorough surveys of the contagion literature see Pericoli and Sbracia (2003), and Dungey et al. (2005).

⁴ The wake-up call hypothesis has been first put forward by Goldstein (1998) to explain contagion from Thailand (a relatively small and closed economy) to the other Asian countries in the Asian crisis of the late nineties. He argues that the other countries were affected by the same structural and institutional weaknesses (crony capitalism, weak banking system, et cetera) of Thailand, but investors ignored those weaknesses until the Thai “wake-up call”.

- “Pure” contagion. This residual category covers any instance of contagion which is unrelated not only to the change in fundamentals but also to *the level* of fundamentals, be they country-specific (as in the case of the wake-up call contagion) or global (as in the case of shift-contagion). It may be due to self-fulfilling (and therefore individually rational) loss of confidence (Calvo, 1988), to irrational herding behaviour (Chari and Kehoe, 2003), or to margin calls and other wealth effects for investors, triggered by capital losses in the country which originated the crisis (Kodres and Pritsker, 2002, Calvo and Mendoza, 2000, Schinasi and Smith, 2000).

3) The EMU sovereign crisis: a bird’s eye view on the events

At the beginning of 2009, when the 10th anniversary of the launch of a single currency was being celebrated across Europe, many commentators considered the Euro a major success (see, e.g. European Commission, 2009). Concerning Government bond yield spreads, the convergence between interest rates had been fast in the period 1992-1998, as the introduction of the common currency approached; the average spread in long-term government bond yields declined from about 200 basis points at the beginning of the 1990s to 24 points at the end of 1998. From 1999 onwards the spreads continued to narrow, although not in a continuous manner. At the end of 2007 yield differentials were negligible (16 basis points on average), suggesting that differences in liquidity and credit risks between Euro area countries were perceived as not significant. Sovereign risk, as assessed by international rating agencies, exhibited a similar evolution.

Due to the financial turmoil triggered by the Lehman Brothers’ bankruptcy in September 2008, some tensions started to appear, and by the end of that year the average yield spread in the Euro area was slightly above 100 basis points, but strains on the government securities markets of some European countries became worrisome only towards the end of 2009, reflecting the investors’ concern on public finances, which had deteriorated sharply as a consequence of the crisis (Fig. 1).⁵

The concern mainly focused on Greece. After a series of upward revisions, the last of which equal to nearly 3 percentage points of GDP in October 2009, the Greek government estimated that the net borrowing amounted to 12.7 per cent of GDP in 2009, up from 7.7 per cent in 2008. This in turn triggered a series of credit downgradings for Greek sovereign paper, and in April 2010 Standard & Poor’s downgraded Greek debt to junk status. The tensions originated in Greece spread to the government securities of other Euro area countries, notably Portugal and, to a lesser extent, Ireland and Spain.

The intervention of EU authorities, in particular the establishment of a financial stabilization mechanism (the European Financial Stability Facility, EFSF), and launch by the ECB of a programme of purchases of public and private debt securities issued in the Euro area (the Securities Market Programme, SMP) lessened the market tensions temporarily.⁶

⁵ On 24 March 2009, Fitch’s international rating agency cut Portugal’s rating from AA to AA- and on 9 April also Greece’s, from BBB+ to BBB-. On 11 April, the euro area member states reached agreement on the terms of a three-year schedule of bilateral loans to Greece, to be activated according to need jointly with IMF.

⁶ On 2 May the EU authorities agreed on a financial support plan that provided for bilateral loans amounting to a total of €80 billion in three years; at the same time IMF granted €30 billion. On 3 May the Governing Council of the ECB suspended the application to securities issued or guaranteed by the Greek government of the minimum rating requirements for eligibility as collateral for refinancing operations. To reduce the risk of contagion and safeguard the smooth operation of the Euro area markets, on 10 May the Council of the European Union established a financial stabilization mechanism that allows Euro area countries to obtain a loan. Resources amounting to €500 billion can be mobilized, of which €60 billion to be disbursed by the EU and €440 billion by the EFSF, which was established on 7

At the beginning of August strains reappeared on the government bond markets of Greece, Ireland and Portugal, triggered by fresh concern about the state of the public finances and banks of those countries. The spreads over the German ten-year bond rose further, peaking at the end of September. For the first time, a widening of the spread was observable also for other Euro area countries (notably Italian).⁷ The tensions intensified again at the beginning of November, reflecting the serious difficulties in Ireland.⁸

After easing in January 2011, the pressure on the sovereign debt of some Euro area countries increased again in February and early March. The three main rating agencies downgraded the debt of Ireland, Greece and Spain. The turbulence abated temporarily following the extraordinary meeting of Heads of State and Government on 11 March, which increased the effective lending capacity of the EFSF from €255 billion to €440 billion and established the characteristics of the permanent mechanism (the European Stability Mechanism, ESM). At the end of March the yield spreads on Portuguese over German government securities rose sharply, reflecting that country's government crisis and the downgrading of its debt. On 8 April Portugal requested assistance from the EU and the IMF, which the EU finance ministers approved the same day.

Despite the approval by the Greek Parliament of a new package to adjust the public finances and the decision taken by the Eurogroup on 2 July to disburse a second *tranche* of the loan to Greece, the pressures in the government securities markets of some euro area countries intensified further and spread to Spanish, Italian and Belgian bonds.⁹

At the end of July a new programme of financial assistance for Greece was approved and measures were taken to enhance the EFSF's effectiveness (their ratification process was completed on 13 October). After narrowing in August, the yield spread vis-à-vis the German Bund of the government securities of a number of member countries, including Italy and Spain, reached high levels again in September. Ireland alone registered a narrowing of spreads, benefiting from the gradual improvement in the situation of its economy and public finances.

At the end of the year sovereign debt strains in the Euro area worsened further and spread to many countries of the area, becoming systemic. Despite important corrections to public finances made by national governments, the uncertainty heightened, in a context of deteriorated growth prospects.¹⁰

June 2010. On 10 May the Governing Council of the ECB also adopted a series of measures aimed at safeguarding the proper functioning of the monetary policy transmission mechanism and the stability of the Euro area financial system. In particular, the Council launched the SMP.

⁷ In the third quarter of 2010, the international rating agencies downgraded the government securities of Ireland, Portugal and Spain.

⁸ On 21 November Ireland made an official request for a loan to the EU and the IMF, which was accepted on 28 November. On the same day the finance ministers of the Euro area countries established the main features of a permanent mechanism for safeguarding the financial stability in the area (the European Stability Mechanism, ESM), which, among other things, provide for losses not to be shared with private investors until July 2013. Between November and December the three main international rating agencies reduced Ireland's credit rating. On 23 December Fitch downgraded Portugal as well.

⁹ On 5 July Moody's downgraded Portuguese government paper to high default risk. On 12 July Irish government securities were similarly downgraded.

¹⁰ On 26 October and 9 December the Euro area heads of state or government took a series of additional decisions to: a) improve European governance, b) clarify the role of private investors in resolving the Greek crisis, c) reinforce the instruments for financial stabilization, d) enhance the quality and quantity of banks' capital and favour their access to longer-term funding, e) increase the financial resources at the disposal of the IMF to support countries in difficulty.

The yield spreads of Euro area government securities over German Bunds reached new highs since the introduction of the Euro in Greece, Portugal, Italy, Spain, Belgium and France, despite massive purchases of government securities by the ECB under its SMP. Ireland's spread also rose, but remained below its mid-July peak. Since the end of September ten countries of the area have undergone a debt downgrade by at least one of the main rating agencies. On 13 January the rating agency's Standard and Poor's downgraded the sovereign debt of nine Euro area countries, including France, which lost its AAA rating, Spain and Italy.

4) Contagion and the EMU crisis

Several papers assess the determinants of sovereign spreads in EMU (Favero et al., 2010; Beber et al., 2010; Schuknecht et al., 2009; Attinasi et al., 2009; Sgherri and Zoli, 2009; Hallerberg and Wolff, 2008; Akitoby Statmann, 2008). Typically, they explore the role of (a) country-specific factors influencing the risk of default, namely fiscal fundamentals and market liquidity and (b) common factors, such as the market appetite for risk.¹¹ In particular, they bring to the data a simple empirical model such as:

$$(1) \quad s_{it} = \alpha_{0i} + \alpha_1 s_{it-1} + \beta_0 Z_{it} + \beta_1 F_t + \varepsilon_{it},$$

where Z_{it} is a vector of country-specific variables and F_t is a vector of variables which are common across countries. Instead, they differ with respect to the frequency at which the spread is measured (from daily to yearly), in the included regressors, in the estimation method (in particular, some adopt a pooled cross-section/time-series approach, others provided country-specific estimates). Of course, high-frequency studies (such as Favero et al., 2010 and Beber et al. 2010) do not consider the role of fiscal and macro fundamentals, which are mostly constant over the period that they analyze.

Very few papers consider the issue of sovereign contagion within EMU. Among them, some simply augment equation 1 with a further Z_{it} variable which captures developments in all the other EMU countries different from i . In particular, Caceres et al. (2010) employ a measure of “distress dependence” built extracting from the vector of CDS premia the marginal probability of default for each country, then inferring from those marginals the joint default probability, and finally building and adding-up the default probability of country i conditional on the default of the other countries. Similarly, Hondroyiannis et al. (2010) add a “contagion variable” defined as a weighted combination of other countries' spreads.

In our empirical analysis we go another step further, and enrich the set-up of equation (1) in order take into account the three different kinds of contagion effects outlined in Section 2.¹² In particular, we estimate the following model:

$$(2) \quad s_{it} = \alpha_{0i} + \alpha_1 s_{it-1} + \beta_0 Z_{it} + \beta_1 F_t + \gamma_0 D_t + \gamma_1 D_t Z_{it} + \gamma_2 D_t F_t + \varepsilon_{it},$$

where D_t is a dummy taking value of one after the outbreak of the Greek crisis, that is, the revision of the official public finance figures by the new government in October 2009.

¹¹ An early and very influential example is given by Codogno et al. (2003).

¹² Moreover, neither Caceres et al. (2010) nor Hondroyiannis et al. (2010) consider the last couple of years, when the current crisis manifested.

Therefore, the coefficient γ_1 captures the “wake-up call” effect (a more pronounced post-crisis sensitivity to country-specific fundamentals), the coefficients γ_2 captures shift-contagion (an increased sensitivity to common factors) and γ_0 captures “pure contagion” (this way of decomposing the effects of a crisis is similar to the one found in Eichengreen and Mody, 2000).

Notice also that in our specification we allow for country-specific fixed effects, to control for time-invariant unobserved characteristics. Indeed, the previous literature has pointed to some very slow moving features which influence a sovereign’s credit worthiness, such as the political system (Akitoby and Strassman, 2008) or debt intolerance (Quian et al. 2011).

Our model can be viewed as a straightforward application of the Oxaca-Blinder decomposition to the change in sovereign spread, as in Eichengreen and Mody (2000). That is, in our model the change in spreads with respect to the pre-crisis period is decomposed in two parts: the part due to a change in the regressors, and the part due to a change in the coefficients. In particular, the change in the constant term is what we identify as the “pure” contagion effect. Formally, if one defines the equilibrium value of the spread as:

$$S_{it} \equiv \frac{\alpha_{0i}}{1-\alpha_1} + \frac{\beta_0}{1-\alpha_1} Z_{it} + \frac{\beta_1}{1-\alpha_1} F_t + \frac{\gamma_1}{1-\alpha_1} D_t + \frac{\gamma_2}{1-\alpha_1} D_t Z_{it} + \frac{\gamma_3}{1-\alpha_1} D_t F_t,$$

one gets:

$$(3) \quad S_{i,post} - S_{i,pre} \equiv \frac{\hat{\beta}_0}{1-\hat{\alpha}_1} (Z_{i,post} - Z_{i,pre}) + \frac{\hat{\beta}_1}{1-\hat{\alpha}_1} (F_{post} - F_{pre}) + \frac{\hat{\gamma}_1}{1-\hat{\alpha}_1} + \frac{\hat{\gamma}_2}{1-\hat{\alpha}_1} Z_{i,post} + \frac{\hat{\gamma}_3}{1-\hat{\alpha}_1} F_t,$$

where the “pre-” and “post-” sub-indices are used to indicate the pre-crisis and post-crisis sample averages, respectively. In equation (3), the post-crisis change in spreads is decomposed into a non-contagion component (due to the change in country-specific and global fundamentals) and three contagion components: $\frac{\hat{\gamma}_1}{1-\hat{\alpha}_1}$ (“pure” contagion), $\frac{\hat{\gamma}_2}{1-\hat{\alpha}_1} Z_{i,post}$ (wake-up call contagion), and $\frac{\hat{\gamma}_3}{1-\hat{\alpha}_1} F_t$ (the shift-contagion component). As we remarked above, the latter two effects, even if they are not related to the change in fundamentals, depend on their level.

Our approach is also particularly close to Von Hagen et al. (2011). They apply an empirical model similar to ours on EMU data, and find that the relationship between fiscal variables and spreads becomes much sharper after the Lehman bankruptcy, in September in 2008. The main difference between von Hagen et al. (2011) and our paper is that we focus on another possible break (the Greek crisis in October 2009), and that we consider a broader set of country-specific fundamentals. However, in Section 3.3 we extend our baseline model to be able to take into account also the possible effects of the Lehman bankruptcy.

In distinguishing between the three types of contagion, our contribution is also akin to the recent paper by Bekaert et al. (2011). The authors use an international asset pricing framework with global and local factors to predict equity returns, defining unexplained increases in factor loadings as indicative of contagion, and find evidence of systematic contagion with its severity inversely related to the quality of countries’ economic fundamentals and policies. They conclude that the “wake-up

call” holds for equity markets, with markets and investors focussing substantially more on country-specific characteristics during the crisis.

Finally, we see the approach pioneered by Gande and Parsley (2005) as very relevant and complementary to ours. They consider a sample of emerging countries and allow rating news from any one of them to influence the sovereign spreads in the others. In section 5.3 below, we also consider a uni-directional version of their methodology, substituting our crisis dummy with a variable summarizing Greek rating developments.¹³

5) Empirical analysis

5.1) Data and descriptive statistics

We cover nine Euro area countries (Austria, Belgium, Finland, France, Ireland, Italy, Portugal, Spain and The Netherlands) using monthly data for January 2000 to December 2011. As it customary in the literature, we exclude Greece (the “ground zero” country) from the analysis.¹⁴

Our dependent variable is the 10-year government bond yield spread with respect to the corresponding German Bund.

Concerning our independent variables, in our baseline specification we consider as common factor (the F_t variable in equation 2) the CBOE volatility index VIX, which is the most used indicator of the propensity of investors to bear the credit risk.^{15, 16} Concerning country-specific fundamentals (Z_{it} in equation 2), we include the general government debt, the private debt (defined as household plus non financial corporation), GDP growth and the current account balance.¹⁷

The inclusion of the private debt and the current account balance, while non-standard in the literature on advanced economies (an exception is Gourinchas and Obstfeld, 2012), is very frequent in studies concerning emerging economies, and has strong economic rationale. They are both indicators of an economy’s leverage (respectively internal and external). While a current account deficit does not mean *per se* a higher sovereign vulnerability, it is often associated with worrisome macroeconomic developments. For example, external capital inflows (which are the mirror image of the current account deficit) may trigger a boom in the non-tradeable sector (particularly, the housing

¹³ A couple of recent papers on the EMU use multi-equation econometric techniques, which can be seen as multi-equation extensions of Gande and Parsley (2005). Arezki et al. (2011) estimate a VAR allowing for the mutual interdependence of sovereign debt markets and the stock market. De Santis (2012) allows for a long-run co-integrating relationship between spreads and other variables.

¹⁴ We have verified that our main results do not change if Greece is included in the regressions.

¹⁵ The CBOE volatility index VIX is considered “a good indicator of the level of fear or greed in U.S. and global capital markets. When investors are fearful, the VIX level is significantly higher than normal. Market participants require additional compensation in the form of above-average excess returns for riskier assets.” (see Antognelli et al., 2000). Data on government bond yields and VIX are taken from Thomson Financial Reuters. These data are released daily, and we compute monthly averages of them.

¹⁶ To make our explanatory variables consistent with the specification of the dependent variable, for each country we take differences with respect to Germany.

¹⁷ All variables are taken as a ratio to GDP and in difference with respect to the corresponding German variables.

market), increasing the risk of a subsequent burst.¹⁸ A similar reasoning can be applied to the private sector debt: if households and firms turn out to be unable to repay their debt, this might jeopardize public finances either because they are directly bailed-out by the government or –as it often happens – because the government bails-out the domestic banks that lent to households and firms in the first place. In any case, countries with a very low initial public debt might increase it significantly and overnight. Interestingly, these variables are to be monitored at the European level within the context of the new Macroeconomic Imbalances Procedure (European Commission, 2012).¹⁹

Fiscal and macroeconomic variables are taken from the Eurostat quarterly database. These data are generally released with a delay of one quarter. Our monthly series are obtained keeping the value of the variable constant in each month of the quarter. In our specification we thus assume that spreads react contemporaneously to liquidity and volatility factors but it reacts with a 3-month lag to fiscal and macroeconomic variables.

In Table 1 we report some descriptive statistics of the variables used in our benchmark specification, distinguishing between two sub-periods (before and during the crisis). In the upper part of each panel we summarize the evolution of our dependent variable, i.e. the average yield spread, and the financial factors that in our specification are assumed to influence it. In the bottom part we summarize the development of our fiscal and macroeconomic fundamentals. All statistics refer to the sub-sample of countries excluding Germany and Greece.

The spread between the government bond yields in these nine Euro area countries and the German one increased on average from 19 basis points in the period before the crisis to 115 points from 2009-M10 onwards. The evolution of the volatility index indicates that international risk aversion has increased on average during the Euro area sovereign crisis; however, as considerable financial markets tensions already emerged following the Lehman Brothers' bankruptcy, the difference across sub-periods is not sizeable.

Turning to fundamentals, both fiscal and macroeconomic conditions deteriorated significantly during the sovereign crisis. Among internal imbalances, the general government debt in our nine euro area countries increased on average by 15 percentage points of GDP; the increase in the private debt has been even larger (50 points). GDP slowed, from 1.8 to 1.2 per cent. Also the countries' external position worsened: on average the current account deficit increased from 0.6 to 0.8 per cent of GDP; with respect to Germany the deterioration has been greater (2.5 percentage points of GDP), reflecting strongly diverging competitiveness paths between Germany, on one side, and the other countries, on the other.

5.2) *Econometric analysis*

We estimate equation (2) with OLS, allowing for country-specific fixed effects. As it can be seen from the first column of table 2, while in the pre-crisis period all the variables have the expected sign (in particular, an increase in public debt or private debt, a worsening in the current account, a growth slowdown or an increase in risk aversion all increase spreads), the relationship is only

¹⁸ This would in turn induce sizable output gaps and revenue shortfalls, increasing public debts and jeopardizing its sustainability. This is the interpretation of the EMU crisis given by Spaventa and Giavazzi (2011) for some EMU countries.

¹⁹ Concerning external imbalances, the European scoreboard also includes the net investment position (the flow counterpart of the current account balance), the change in export market shares, the change in unit labour costs, and the change in the real effective exchange rate. Concerning internal imbalances, the scoreboard includes the private sector credit flow (the flow counterpart of domestic debt), the change in the house price index, and the unemployment rate.

significant in the case of growth and of the VIX index. Instead, in the post-crisis period the relationship becomes significant for all the fundamental variables, except for the current account. Moreover, the effect is in all the cases reinforced in the post crisis period. We interpret this as evidence that a wake-up call effect exists for EMU countries. Finally, the crisis dummy is significant, but with the negative sign, so that no “pure contagion” effect is present, while the “shift-contagion” term is positive (*coeteris paribus* the same level of risk aversion implies, after the crisis, a higher spread).

5.3) Extensions and Robustness checks

5.3.1) *Taking other fundamentals into account.* - As a first robustness exercise, we check whether some of the variables omitted from the baseline analysis are actually relevant in explaining the dynamics of spreads. First, we enlarge the model to account for liquidity, as it is often considered one important determinant of spreads (table 2, column 2). We consider two alternative measures of liquidity (to save space, only results for the first proxy are shown): the first is the share of long and medium term sovereign bond issuance in the Euro area (used by many authors, among which Attinasi et al. 2009); the second is the traded volumes of total government securities maturing at 9- to 11-years relative to Germany, which are available from Thomson Financial Reuters at a monthly frequency (also used by many, e. g. Codogno et al., 2003). In both cases, we found it statistically insignificant (both alone and interacted with the crisis dummy).

Second, we consider the funding ratio of banks, computed as the amount of loans to Euro area residents minus the amount of deposits (standardized by dividing it by the latter variable; table 2, column 3). This could be potentially relevant, as it captures a possible cross-market channel of contagion: from banks to sovereigns. However, it also appears to be insignificant (notice also that our private debt index also goes some way in capturing banking sector vulnerability).

5.3.2) *Evaluating different proxies for fundamentals.* - We consider another widely used proxy for the global risk aversion, namely the spread between the US Corporate AAA rates and the BBA rates. The change does not bring any significant difference.

5.3.3) *The definition of the contagious event.* – A possible pitfall of our analysis is that it relies on a very sharp hypothesis concerning the start of the EMU sovereign crisis. Moreover, our 0/1 dummy might also be seen as an inappropriate way to model the post-crisis development of the Greek fiscal situation. We address both problems by using, instead of our crisis dummy, a variable summarizing the Greek credit rating (we borrow this approach from Gande and Parsley, 2005). In particular, we transform the sovereign credit rating information (expressed in letters) of the three major credit rating agencies (Fitch, Standard & Poor’s and Moody’s) into a numerical variable using the linear scale used by Gande and Parsley (2005) and De Santis (2012). The variable takes 22 values from 1 (triple-A) to 22 (default). We also take into consideration the changes in the credit watch: a negative credit watch increases the value of the variable by 0.5 while a positive credit watch corresponds to a decrease of 0.5.²⁰ The results are similar to our baseline regression (table 3). In particular, while the fundamental variables appear with the “right” sign, most of them are not significant per se (the two exceptions being the VIX index – as before – and the private debt). When they are interacted with the “Greek situation” variable, instead, most of them are significant (the exception being GDP growth). In particular, the analysis makes clear that a worsening of the situation in Greece magnifies the positive effect of the private and public debt on the spreads of the other EMU countries, as well as the positive effect of current account deficits and of global risk aversion.

²⁰ The value is an average of the results for the three main rating agencies.

Finally, as in our baseline model, the Greek fiscal situation index, taken *per se*, has a positive effect on other countries' spreads.

Another related issue is the need to disentangle the effects of the financial crisis originated in the US in 2008 from the effects of the EMU sovereign debt crisis. To this aim, we distinguish, two sub periods within the pre-crisis period: the first one starts at the very beginning of our sample and ends in September 2008, when Lehman went bankrupt and the US-originated subprime financial crisis erupted; the second sub-period starts from September 2008 and ends just before the official statement of the Greek authorities that it is considered the beginning of the EMU sovereign debt crisis. Interestingly, while it emerges that the Lehman dummy (which takes a value of 1 in the second sub-period of the pre-crisis period and zero otherwise) is significant (but, as it is the case for our crisis dummy), the interactions of the Lehman dummy with the country-specific fundamentals are never significant, and the results concerning the Greek crisis dummy and its interactions with fundamentals remain unchanged (table 4).

6) Conclusions

To summarize our results, we found that, while the markets did not consider macro-economic fundamentals as relevant in pricing sovereign bonds before October 2009, after that date they differentiated among sovereigns based on the soundness of their fundamentals.

These findings provide some tentative answers to the questions that we posed in the introduction: (a) was the very small sovereign spread observed in the pre-crisis period insufficient, given Euro area countries' fundamentals? (b) to what extent the sharp increase in several Euro area sovereign spreads following the Greek events was "excessive" given the fundamentals?

Our evidence suggests an affirmative answer to the first question: for most of the time since the start of the EMU, the market attitude towards Euro area sovereigns appeared as a "benign neglecting" of developments in the fundamental variables which are the main determinants of a sovereign creditworthiness and, ultimately, should drive the price of sovereign bonds.

On the contrary, the increase in sovereign spreads after the Greek events does *not* appear as an instance of irrational or self-fulfilling contagion: indeed, post-crisis cross-country differences in bond spreads can be explained and justified by cross-country differences in fundamentals.

All in all, the conclusions of the Delors' committee concerning the unreliability of market-based fiscal discipline are partially confirmed by our findings. On the one hand, the framers of the EMU were right when they pointed to the inattentiveness of investors in good times. On the other hand, it seems that, when a "wake up call" arrives, investors quickly re-consider their choices, and discriminate correctly between sovereigns, aligning spreads with underlying creditworthiness: no evidence of irrational or indiscriminate contagion is found in the data.

It is true that the correction of the pre-crisis bond mis-pricing, while welcomed, is clearly "sudden and disruptive": it takes much less time to investors to flight from a country than to governments to correct their fundamental imbalances. In the future, one can hope that the experience of the losses suffered from the Greek default, together with market-friendly policies which highlight the fundamental imbalances of EMU countries even in good times -for example, the timely dissemination of the Commission "scoreboards" and of the results of the Macroeconomic Imbalance Procedure - will induce a more attentive behaviour of investors even in good times.

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FIGURES AND TABLES

Fig. 1 – Yield spreads between ten-year government bonds and the German Bund

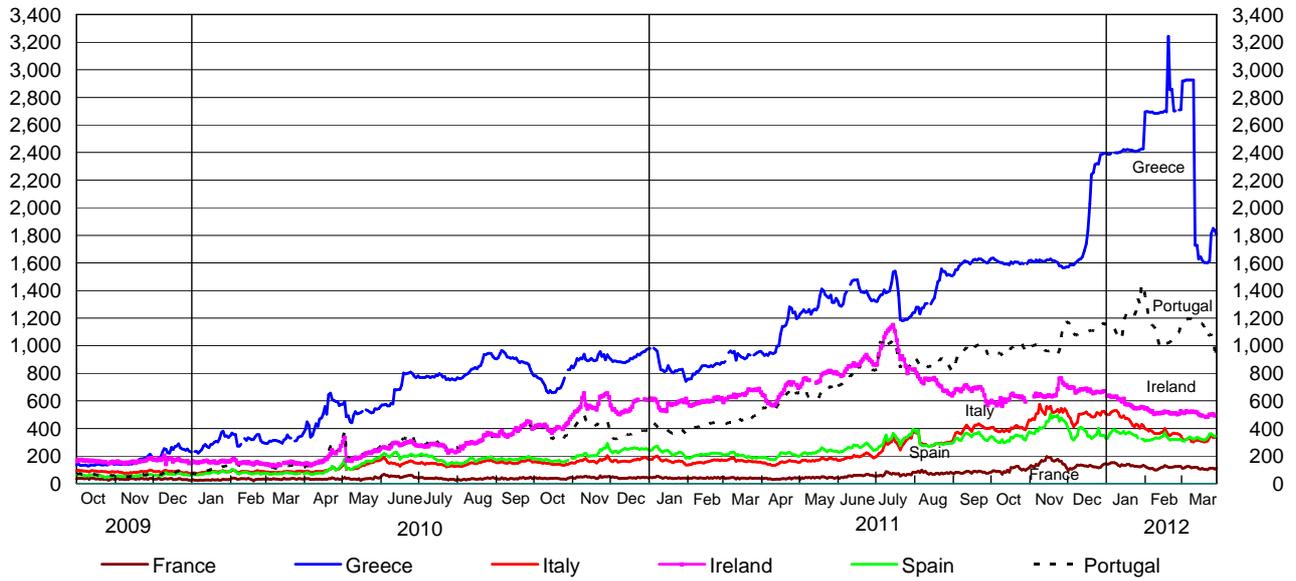


Table 1 – Descriptive statistics

Variables	Mean	St. dev.	Min	Max
Before the crisis				
Spread	19.3	27.9	-22.1	242.4
Liquidity variable	-21.6	14.7	-66.0	24.8
International risk aversion	21.9	9.2	10.4	59.9
Public debt	63.9	24.7	24.6	117.3
Private debt	202.6	52.5	121.9	406.8
GDP growth	1.8	2.9	-9.7	12.4
Current account	-0.6	5.5	-13.3	13.7
During the crisis				
Spread	115.5	129.9	12.3	615.9
Liquidity variable	-17.5	10.3	-41.3	16.8
International risk aversion	22.8	4.7	17.6	34.5
Public debt	79.3	21.5	43.3	119.9
Private debt	252.5	67.9	170.2	406.8
GDP growth	1.2	2.1	-6.0	5.6
Current account	-0.8	5.2	-12.9	9.4

Table 2 – Regression results

	(1)		(2)		(3)	
<i>Spread t-1</i>	0,925 (0.032)	***	0,918 (0.035)	***	0,918 (0.035)	***
<i>General government debt</i>	0,022 (0.045)		0,039 (0.039)		0,026 (0.038)	
<i>Private debt</i>	0,023 (0.026)		0,028 (0.026)		0,034 (0.0314)	
<i>GDP growth</i>	-0,540 (0.219)	**	-0,546 (0.217)	**	-0,547 (0.214)	**
<i>Current account</i>	0,036 (0.089)		0,053 (0.079)		0,013 (0.075)	
<i>VIX</i>	0,207 (0.041)	***	0,207 (0.042)	***	0,208 (0.041)	***
<i>Liquidity</i>			0,021 (0.013)			
<i>Funding gap</i>					-0,050 (0.048)	
Crisis Period (after september 2009)						
<i>Crisis dummy</i>	-42,571 (12.985)	**	-51,356 (13.950)	***	-51,260 (15.284)	***
<i>Public debt*crisis</i>	0,249 (0.088)	**	0,298 (0.107)	**	0,298 (0.117)	**
<i>Private debt*crisis</i>	0,186 (0.031)	***	0,169 (0.021)	***	0,171 (0.036)	***
<i>GDP growth*crisis</i>	-2,175 (0.710)	**	-2,318 (0.927)	**	-2,263 (0.937)	**
<i>Current account*crisis</i>	-0,927 (0.750)		-1,127 (0.672)		-1,093 (0.667)	
<i>VIX*crisis</i>	1,200 (0.457)	**	1,212 (0.441)	**	1,210 (0.440)	**
<i>Issuances*crisis</i>			-0,448 (0.222)	*		
<i>Funding gap*crisis</i>					0,033 (0.134)	
R ² (within)	0,971		0,972		0,972	
R ² (between)	0,995		0,994		0,990	
R ² (overall)	0,973		0,974		0,973	
Observations	873		873		873	

Notes: Fixed effect estimates. Huber-White robust standard errors in parentheses.

Table 3 – Regression results

<i>Spread t-1</i>	0,869 (0.031)	***
<i>General government debt</i>	0,123 (0.072)	
<i>Private debt</i>	0,089 (0.024)	***
<i>GDP growth</i>	-0,598 (0.332)	
<i>Current account deficit</i>	0,024 (0.095)	
<i>VIX</i>	0,379 (0.086)	***
<i>Greek rating</i>	-7,532 (2.380)	**
<i>Public debt*Greek rating</i>	0,079 (0.029)	**
<i>Private debt*Greek rating</i>	0,064 (0.015)	***
<i>GDP growth*Greek rating</i>	0,578 (0.349)	
<i>Current account*Greek rating</i>	-0,264 (0.111)	**
<i>VIX*Greek rating</i>	0,213 (0.103)	*
R ² (within)	0,971	
R ² (between)	0,977	
R ² (overall)	0,971	
Observations	873	

Notes: Fixed effect estimations. Huber-White robust standard errors in parentheses.

Table 4 – Regression results

<i>Spread t-1</i>	0,944 (0,042)	***
<i>General government debt</i>	0,063 (0,046)	
<i>GDP growth</i>	-0,053 (0,158)	
<i>Private debt</i>	0,046 (0,017)	**
<i>Current account</i>	0,071 (0,069)	
<i>VIX</i>	0,082 (0,043)	*
Financial crisis Period (after september 2008)		
<i>Financial crisis dummy</i>	-16,228 (5,417)	**
<i>Public debt*Financial crisis</i>	-0,021 (0,070)	
<i>GDP growth*Financial crisis</i>	-0,649 (0,667)	
<i>Private debt*Financial crisis</i>	-0,020 (0,034)	
<i>Current account*Financial crisis</i>	-0,172 (0,2934)	
<i>VIX*Financial crisis</i>	0,457 (0,127)	***
Sovereign Crisis Period (after september 2009)		
<i>Sovereign Crisis dummy</i>	-45,754 (12,774)	***
<i>Public debt*Sovereign crisis</i>	0,199 (0,0663)	**
<i>GDP growth*Sovereign crisis</i>	2,267 (0,0,715)	**
<i>Private debt*Sovereign crisis</i>	0,153 (0,032)	***
<i>Current account*Sovereign crisis</i>	-0,896 (0,680)	
<i>VIX*Sovereign crisis</i>	1,399 (0,475)	**
R ² (within)	0,972	
R ² (between)	0,991	
R ² (overall)	0,974	
Observations	873	

Notes: Fixed effect estimates. Huber-White robust standard errors in parentheses.