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ABSTRACT

A common European bond would yield a common European Monetary Union risk free rate. We present tentative estimates of this common risk free for the European Monetary Union countries from 2004 to 2009 using variables motivated by a theoretical portfolio selection model. First, we analyze the determinants of EMU sovereign yield spreads and find significant effects of the credit quality, macro, correlation, and liquidity variables. However, their effects are different before and after the current financial crisis, being stronger in the latter period. Robustness tests with different data frequencies, benchmarks, liquidity variables, cross section regressions and balanced panels confirm the initial results. We propose four different estimates of the common risk free rate and show that, in most cases, this common rate could imply savings in borrowing costs for all the countries involved.

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We present tentative estimates of a new financial variable: the common risk free rate of interest for the European Monetary Union (EMU) members. We show how to estimate it for a given set of countries and discuss its uses for monetary policy management and its implication for financial markets' integration. The results suggest that this common rate, in most cases, could imply savings in borrowing costs for all the countries involved.

The possibility of a common European bond has attracted the interest of the financial press and is receiving increased attention from policy makers[1]. There are potential wider benefits for the Eurozone as well as specific benefits for market agents such as issuers, dealers, and investors. A large common bond issue could have benefits even for countries with low credit risk (Germany, France), as it could rival American's treasuries market for liquidity. Moreover a single issuer would make EMU bonds more attractive to investors in large foreign-exchange reserves (China, Japan) and enhance the euro's standing as a reserve currency, as well as lowering borrowing costs for all countries that took part in it[2].

This common risk free rate can be used as a benchmark for measuring the benefits from financial market integration in the EMU. We conjecture and provide some evidence that our estimates of this rate would be close to what a common EMU-based single bond would yield for a specified maturity. We can then compare actual rates offered by the different EMU countries with sovereign bonds with this common rate. This allows us to compute the savings in terms of financing cost per year for the different EMU members.

[1] EPDA(2008,2009)
[2] Additional technical advantages such as minimizing the possibilities of "squeezes" are discussed in Pagano and Von Thadden (2004)

Our results suggest that average savings in borrowing costs for all EMU countries are positive irrespective of the common risk free rate measure employed. Of course, there are many institutional design features that must be resolved (seniority, amount relative to total debt issues, guarantee fund, etc.) before such a common bond can be launched. But our paper provides a first insight into one central issue, namely, what should be the required compensation a given country X should pay to the actual issuer (let's assume that the issuer is the ECB or other EMU-wide agency) to be allowed to share a given issue of EMU-based single bonds. We argue that this compensation should be the Credit Default Swap (CDS) spread on X's sovereign bonds[3]. The benefits for country X in using the common bond (instead of the sovereign bond) will be the enhanced rating and liquidity the common bond would provide plus additional premiums for country X's macro fundamentals, and exposure to global risk

Motivated by a simple theoretical portfolio selection model, we first analyze the determinants of EMU sovereign yield spreads and find significant effects of the credit quality, macro, correlation, and liquidity variables. We also find that these effects are different before and after the current financial crisis, being stronger in the latter period. Robustness tests with different data frequencies, benchmarks, liquidity variables, cross section regressions and balanced panels confirm the initial results.

We define the 'Hedged Yield' of the sovereign debt of a country as the difference of actual yield and the corresponding CDS spread. Based on these hedged yields we build four different estimates of the common risk free rate and show that, in

[3] As a matter of fact, the CDS spread should be the upper limit for the compensation because CDS market spreads usually include counterparty risk that should be much lower if the insurance seller is the ECB.

most cases, this common rate could imply savings in borrowing costs for all the countries involved.

The remainder of the paper is organized as follows: Section 1 reviews some current literature on the subject; Section 2 introduces a theoretical model that allows us to determine the main components of the sovereign bond yields. Section 3 describes the data. Section 4 discusses the empirical results and the construction of the common risk free rate; Section 5 discusses some policy implications. Section 6 presents some robustness tests and Section 7 offers some concluding remarks and proposes future lines of research.

1. Related Literature on EMU Sovereign Bond spreads

Since the formation of the European Monetary Union (EMU henceforth) the topic of the determinants of the sovereign bonds' yield spreads within the EMU has been the subject of intense and increasing research. Researchers have tried to find out which are the factors that explain the differences between sovereign yields in the EMU countries, but so far no clear consensus has emerged. Codogno, Favero and Misale (2003) find that for most EMU countries only international risk factors have explanatory power while liquidity factors play a smaller role. Amira (2004) finds that sovereign yields increase with maturity, issue size and gross fees and decrease with credit rating. Geyer, Kossmeier and Pichler (2004) report that EMU government bond spreads are related to common factors whereas they do not find evidence for a significant impact of macroeconomic or liquidity related variables. Bernoth, von Hagen and Schuknecht (2006) report that global risk factors as well as idiosyncratic macroeconomic factors affect yield spreads, whereas liquidity plays a marginal role. Gomez-Puig (2008) finds

that idiosyncratic factors (credit risk and liquidity) mostly drive yield differentials but systemic risk factors play only a marginal role. Favero, Pagano and Von Thadden (2008) find that one aggregate risk factor is consistently priced, that liquidity differentials are priced for a subset of countries, and that the interaction of liquidity differentials with the risk factor is consistently priced. In all these papers the benchmark for comparing the yield spreads is based on the German 10-year bund or German zero coupon curves. Beber, Brandt and Kavajecz (2009), however, use as benchmark the Euro-swap curve and show that the bulk of yield spread is explained by differences in credit quality as measured by the CDS, whereas liquidity plays a nontrivial role especially for low credit risk countries and in times of high market uncertainty. In summary, most papers suggest that credit quality-related factors, common business cycle factors (international or EMU), and, to a lower extent, liquidity-related factors are critical drivers of sovereign yield differentials.

The selection of the appropriate benchmark reference, however, has not received extensive attention in the literature. The most common view associates the benchmark bond with the lowest yield. If that were all that mattered for benchmark status, then the German market would provide, on average, the benchmark at all maturities. Analysts who take this view accept that the appropriate criterion for benchmark status is that this is the security against which others are priced, and they simply assume that the security with lowest yield takes that role. A plausible alternative, however, is to interpret benchmark to mean the most liquid security, which is therefore most capable of providing a reference point for the market. But the Italian market, not the German, is easily the most liquid for short-dated bonds;[4] and perhaps the French is most liquid at

[4] Most of the trading for 10-year German bonds occurs on the futures market; this market is then more liquid and deeper than the cash market.

medium maturities.[5] Dunne, Moore and Portes (2002) consider in detail the meaning of the term "benchmark" bond. They investigate two possible criteria, using Granger-causality and cointegration tests. They find rather different results with the two methods, reflecting their different temporal focus. But with neither of them do they find the unambiguous benchmark status for German securities that would come from a simple focus on the securities with the lowest yield at a given maturity. They suggest looking for benchmark portfolios rather than a single benchmark security. This may be particularly appropriate in this partially integrated market and it is the approach we take in this paper. We take the benchmark to be a weighted average of the total gross debt at nominal value issued by the general governments of the different EMU members.

2. Theoretical Model

The model we use to motivate the explanatory variables employed in the empirical part of the paper is an extension of the portfolio model of bond yield differentials developed in Bernoth et al (2006). Consider a domestic (benchmark) investor allocating a fraction θ_t (θ^*_t) of his real wealth w_t (w^*_t) to a domestic D (benchmark F) security and a fraction $1-\theta_t$ ($1-\theta^*_t$) to a benchmark (domestic) security. Assume that both the domestic and benchmark securities are subject to default risk. The default process is assumed to follow a correlated bivariate Bernoulli process (x_t , x^*_t), with domestic (benchmark) default probability $1-P_t$ ($1-P_t^*$). In the event of default the investor receives a fraction τ_t (τ_t^*) of his gross domestic (benchmark) payment, $\tau_t \in [0,1+r)$ ($\tau_t^* \in [0,1+r^*)$) where r (r^*) is the interest rate on the domestic (benchmark) bond. There are proportional transaction costs l_t (l^*_t) decreasing with domestic (benchmark) market liquidity. To

[5] Favero, et al. (2008) set the French bond as the benchmark for the five-year maturity. This choice is supported by the evidence in Dunne, Moore and Portes (2002) and by the fact that traders view the French

simplify the presentation the coefficient of risk aversion ρ is assumed to be the same for both investors. Let S_t be the total supply of bond issued by the domestic government and assuming that the market clears, market equilibrium requires that

$$S_t = \hat{\theta}_t w_t + \hat{\theta}_t^* w_t^* \quad (1)$$

where the first term in the right hand side denotes the optimal amount of domestic bonds held by the domestic investor and the second term denotes the optimal amount of domestic bonds held by the benchmark investor. Assuming that the investors maximize a one period mean-variance utility function it is possible to solve for the interest rate differential between the two economies (details of the model can be found in Appendix I):

$$r_t - r_t^* = (l_t - l_t^*) + S_t \frac{\rho}{2} Var\left[(1 + r_t - \tau_t)x_t - (1 + r_t^* - \tau_t^*)x_t^*\right] - \frac{\rho}{2}(w_t + w_t^*)\left[(1 + r_t^* - \tau_t^*)^2 P_t^* (1 - P_t^*)\right]$$
$$+ \frac{\rho(w_t + w_t^*)}{2}\left[(1 + r_t - \tau_t)(1 + r_t^* - \tau_t^*)Cov(x_t, x_t^*)\right] + (1 + r_t - \tau_t)(1 - P_t) - (1 + r_t^* - \tau_t^*)(1 - P_t^*) \quad (2)$$

Defining

$$k = (1 + r_t - \tau_t)$$
$$k^* = (1 + r_t^* - \tau_t^*)$$

The model can then be written:

$$r_t - r_t^* = kE[1 - x_t] - k^* E[1 - x_t^*] + (l_t - l_t^*) + A_1 S_t Var[kx_t - k^* x_t^*] + A_2(kk^* Cov[x_t, x_t^*] - (k^*)^2 Var[x_t^*]) \quad (3)$$

where

$$A_1 = \frac{\rho}{2}$$
$$A_2 = A_1[w_t + w_t^*]$$

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bond as the most liquid for that maturity.

Equation (3) decomposes the yield spread into four components. The first two terms are the *default risk premium* which is related with individual (country-specific) default probabilities. The higher is the domestic (benchmark) country-specific default probability the higher (lower) is the spread. Also, the riskier the domestic bond is in comparison with the benchmark, the greater will be the premium. Overall the effect of increases in the default risk premium will tend to increase yield spreads[6]. The third term on the right hand side is the *liquidity premium*. The less liquid the domestic bond is in comparison with the benchmark' liquidity, the greater will be this premium. The fourth term depends on the total debt S_t (which we later proxy with macro factors like budget and trade balances), the volatility of the differences in the default processes, and their interaction. The last term in the equation is a measure of *covariance risk* (or global risk) in excess of the volatility of the benchmark's default risk.

To test this model empirically we need to specify proxies for the components in equation (3). We use the CDS spreads as a proxy of the default risk premium as suggested in Beber et al. (2009)[7]. As a measure of liquidity we use the bond's daily turnover volume; the difference between the domestic and benchmark economy serves to estimate the liquidity premium[8]. We also include two macro measures directly related with the total supply of bond issued by domestic government and the health of the trade sector: total debt over GDP and net trade balance over GDP, both of them in deviations from the benchmark. Also, we use the interaction between the total debt over

[6] In the domestic (benchmark) cases the default risk premium decreases (increases) with an increase in the recovery rates in case of default τ_t (τ_t^*).

[7] To deal with possible endogeneity problems we use the one day-lagged CDS spread

[8] We realize that there is no generally held definition of liquidity. Many other measures have been suggested in the literature. In fact there is a close relationship between many of the measures and actual transactions costs, and the assumption that liquidity proxies measure liquidity seems to be granted, see Goyenko, Holden and Trzcinka (2008). Moreover, volume and other liquidity measures are usually employed in policy analysis, see European Central Bank (2009). In Section 6.4 we perform some robustness tests with respect to different specifications of the liquidity variable.

GDP and the volatility of the differences between the domestic and benchmark yields[9] as a measure of both the total supply of debt and its relative risk. Since the overall investor's risk attitude is not observable we proxy the global risk aversion with the Chicago Board Options Exchange Volatility Index VIX[10]. Finally, the correlation between the domestic bond yield and the benchmark bond yield is used as a proxy for country-specific covariance risk.

3. Data

The data consists of daily sovereign yields with maturities of 3, 5, 7, and 10 years for eleven EMU countries from January, 1 2004 to February 27, 2009. We also split the sample into two sub samples to take into account the effects of the ongoing financial crisis. The first sample covers the period from January 1, 2004 to August, 8, 2007 and the second from August 9, 2007 to February 27, 2009. Appendix II provides additional details about the definition, sources, and timing of the data used in the study. Table 1 provides data on the total gross government debt for the EMU countries and each country market's share. The three largest issuers are Germany (25%), Italy (25%) and France (21%) and the smallest are Austria (2.7%), Portugal (1.6%) and Ireland (1.1%). Table A.1, panels 1 to 12 provides descriptive statistics by country and for the benchmark.

In all cases the yields increase and the volatilities decrease with maturity. In general average trading volume decreased in the second sub sample[11] suggesting that transaction costs increased across the board in the crisis period as well as CDS spreads

[9] The volatility of the differences between the domestic and benchmark yields accounts for the differences in the default processes.

[10] The VIX is often used as a proxy for investor's attitude toward risk and appears to explain movements of the bond spreads in recent years, see Hartelius et al. (2008) and Pan and Singleton (2007).

[11] There are slight increases in Belgium, Ireland and the Netherlands

and yield volatilities[12]. There is also evidence of an overall worsening of the trade balance across countries after the crisis started[13] as well as a decrease of the ratio of debt to GDP[14].

For the 3, 5, 7, and 10 year sovereign yields, and for the full sample, the lowest averages are 3.30, 3.51, 3.70 and 3.91 respectively for Germany; the highest averages are 3.56, 3.82, 4.02, and 4.28 for Greece. Both the standard deviations and the minimum and maximum values indicate that there can be significant time-series variation in the sovereign yields. For example, 3-year yield for Italy ranges from 2.29 to 5.02 during the sample period.

Average daily trading volume (in millions of Euros) also presents wide variation ranging from the high volumes for Germany (16,813) and Italy (11,772) to the low volumes for Finland (239) and Ireland (130).

Average CDS rates vary substantially across countries. The lowest average in the whole sample is 8.41 basis points for Germany; the highest average is 40.25 basis points for Greece[15]. The macro factors also vary widely across countries. For instance the country with highest average Debt/GDP ratio is Italy (104%) and the lowest Ireland (27%) and the country with worse average trade balance is Greece (-6.5%) and the best one is

[12] It is interesting to note that some countries viewed by the market as having very little average sovereign risk (CDS spread around 2 basis points) before the crisis, like Germany, Austria, Belgium, France, or The Netherlands, were penalized in different ways once the crisis unfolds, being Germany (16 b.p.) and France (20 b.p.) viewed as the safest, then The Netherlands (25 b.p.) and finally Belgium (33 b.p.) and Austria (37 b.p.). However all countries experienced, in specific days, very high CDS premium, for instance Germany (91.8 b.p.), France (96 b.p.) or Austria (272 b.p.)

[13] The only exception being Italy whose (negative) external balance does not change.

[14] Portugal is the only exception with a ratio of 63% after the crisis in comparison with 61% before it.

[15] Both the standard deviations and the minimum and maximum values indicate that there can also be significant time-series variation in the sovereign CDS premium. For example, the cost of credit protection for Ireland ranges from 2.80 to 395.80 basis points during the sample period.

Ireland (+5.6%). Regarding the average interaction debt factor, which measures not only the total debt outstanding but also its risk with respect to the benchmark, varies between 10 for Greece and 2 for Ireland, increasing markedly once the crisis starts to 16 and 4 respectively[16]. Finally, the average correlation between the domestic 10-year government yield and the benchmark is highest for Germany (0.98) and lowest for Austria (0.87) decreasing in all countries in the second sub sample, with France being the highest (0.96) and Greece the lowest (0.76). This decrease in the correlations could reflect a decrease in the degree of integration in the sovereign bond market of the EMU area in time periods of financial distress[17]

4. Empirical Results

Having established the factors to be used as explanatory variables for the sovereign yields spreads (as suggested by the theoretical model), we now turn our attention to examine the economic and statistical significance of the variables in explaining both the cross-section as well as the time series of yields spreads. We group the data by country (11 countries) and maturity (3, 5, 7 and 10 years) totaling 44 groups which form an unbalanced panel.[18] We first fit a panel regression to the whole sample period. We then examine whether the relative influence of these explanatory variables differs between the relative calmer first sub period and the second sub period of heightened market uncertainty.

[16] Similar increases are also observed in all other countries.
[17] Analyses of financial integration in the Euro Area sovereign bond market can be found in Adam et al. (2002), Adjaouté and Danthine (2003) Baele et al. (2004) and Schulz and Wolff (2008) among others. They conclude that despite the great convergence between yields, yield differentials have not disappeared completely under EMU and so, European sovereign bonds are still not perfect substitutes.
[18] The panel is unbalanced because we do not have information on some variables from the beginning of the sample. However, there are no missing values once we include the first realization of the series.

Average correlations among dependent and explanatory variables are presented[19] in Table 2. As expected, sovereign yields spreads are positively related to CDSs lagged by one day. This is consistent with our theoretical model's prediction that increases in default risk premiums are associated with increases in yield spreads. The negative correlation between yield spreads and the liquidity variable is in agreement with the theoretical prediction that the less liquid the domestic bond market is in comparison with the benchmark' liquidity, the greater will be the yield spread. The positive correlations for the Debt/GDP, Interaction variable and global risk suggest that as they each increase, sovereign yield spreads increase. The negative correlation for the Trade balance variable suggests that trade deficit increase government yield spreads. Overall, the signs are again in agreement with the ones suggested by the theoretical model; our main objective, however, is to examine the joint effect of these explanatory variables on the yield spreads.

4.1. Unbalanced Panel Regression

We regress the difference between the sovereign yield in EMU country *i* and the benchmark portfolio yield onto differences in country *i*'s credit quality, liquidity and macro measures from their respective cross-sectional weighted averages (or benchmark values) and onto global risk measures. We employ a Prais-Winsten regression with correlated panels, corrected standard errors (PCSEs) and robust to heteroskedasticity, contemporaneous correlation across panels and serial autocorrelation within panels. The correlation within panels is treated as a first-order autocorrelation AR(1) and the

[19] All the variables, with the exception of the measure of global risk and the correlation between the domestic Government and benchmark yields, are in deviations from the benchmark

coefficient of this process common[20] to all the panels.[21] Our panel regression model is described by the equation:

(4)

$$r_{it} - r_{it}^{*} = \alpha + \sum_{k=1}^{K} \beta_k (X_{k,i,t} - X_{k,BNCH,t}) + \sum_{j=1}^{M} \gamma_j D_{j,t} + \chi\, Y_{i,t} + \delta\, Z_t + \psi\, C_{i,t} + \varepsilon_{i,t}$$

where the dependent variable is the spread between the government bond's yield of country *i*, r_{it} at four different maturities (3,5,7,and 10 years) and the benchmark yield r^{*}_{it}, at the same maturities. The benchmark yields are obtained as the weighted average of the Government yields of the EMU countries in the sample for the corresponding maturity (3, 5, 7, and 10 years). The weights are proportional to the portion of debt outstanding by each country with respect to the total amount outstanding by all these countries[22]. The $X_{k,i,t}$ are credit risk, liquidity and macro explanatory variables (CDS_{t-1}, Volume, Total debt/GDP, Trade Balance/GDP) and $X_{BNCH,t}$ are their respective weighted averages over the eleven countries, obtained using the same procedure employed to build the benchmark yield[23]. Notice that we specify the credit, liquidity and macro variables as differences from their cross-sectional weighted averages (or benchmark value). This approach stresses the fact that credit risk; liquidity and macro variables are relative concepts. The $D_{j,t}$ are dummy variables to take into account the maturity effect in bond yields (3,5, and 7 years). The $Y_{i,t}$ is the interaction term of total debt/GDP of country *i* times the volatility of the difference between domestic yield and benchmark yield. The Z_t is the global risk factor measured as the log of the VIX index

[20] Better fit, as measured by the Schwarz Information Criteria, is obtained using an AR(1) autocorrelation structure common to all panels instead of a panel-specific AR(1) autocorrelation structure.
[21] Each element in the covariance matrix of the disturbances is computed with all available observations that are common to the two panels contributing to the covariance.
[22] To gain a better perspective of the dependent variable, it is worth mentioning that its maximum (minimum) average value is equal to 21.5 (-8.9) basis points for Greece (Germany).

and $C_{i,t}$ is the correlation between the country *i* yield (for its corresponding maturity) and the benchmark's yield.

The results of the panel regressions are reported in Table 3. Column 1 gives the results for the whole sample period, Column 2 for the period before the financial crisis, and Column 3 for the crisis period. The explanatory power of the regressions, reflected in their adjusted R^2 , are 20% ,12% and 25% respectively. Consistent with intuition as well as with our theoretical model and the previous literature, the CDS lagged one period has a strong positive impact on sovereign yield spread which indicates that a lower credit quality increases the yield spread. The liquidity differential is also significant. The negative coefficient suggests that higher than average liquidity is associated with lower yield spreads. However the impact of the liquidity is insignificant in the first sub- sample (the period before the financial crisis). In the second sub-sample (the period during the crisis) the effect of liquidity is significant, consistent with Beber et al. (2009). The two macro factors (relative to GDP) and the global risk factor have also a positive and significant impact in the sovereign yield spread. The effect of the term measuring the interaction of total debt relative to GDP and the standard deviation of the domestic yield minus the benchmark yield is positive and significant. Recall that this variable measures both the total supply of debt and its relative risk against the benchmark. Therefore the economic meaning of this variable is that, for a given debt level, an increase in the volatility of the difference of the domestic yield and benchmark yield increases yield spreads. The more the two rates grow apart the higher the effect on yield spreads. This could be the case in a situation where a given country's spreads tends to diverge from the benchmark behavior and then the market penalizes this

[23] Notice that the CDS variable is different for different maturities, whereas the other variables are the same for all maturities.

divergence demanding higher yield spreads. If two countries present the same divergence from the benchmark yield behavior, the penalization is higher for the country with the higher level of debt relative to GDP. Finally the dummy variables coefficients reflect the decreasing premium for longer maturities.

A comparison of Columns 2 and 3 of Table 3 suggests that the financial crisis has penalized more heavily country's sovereign yields with relatively high credit risk, lower liquidity, higher indebtness, and with higher exposure to global risk.

Since there is a potential endogeneity between a country's sovereign yields and its CDS rates, in the panel regression results reported in Table 3 we have used a one period (day) lag in the CDS explanatory variable. This is a standard procedure to deal with potential endogeneity. To further address this issue, we have run and identical panel regression but omitting the CDS explanatory variable. These results are reported in Table 4 for the whole sample period (Column1) and for the two sub-periods (Columns 2 and 3). As can be seen from this table the results are qualitatively very similar to those in Table 3, confirming the significance of the other explanatory variables and suggesting that endogeneity is not a serious issue in our case. As expected, the explanatory power of the panel regressions is lower given that we are omitting a powerful explanatory variable (CDS). In Section 4.2 we will further investigate this issue by running panel regression of "hedged yields" (the difference between actual yields and the corresponding CDS spreads) on the other explanatory variables.

Finally, we analyze the effect of the cross-sectional dispersion between countries in the explanatory variables on the dependent variable. For this aim, we first calculate the

standard deviation of each dependent variable across countries at each date *t*. Then, we compute the average of these standard deviations for the whole sample, the first sub sample (period before the crisis) and the second sub sample (crisis period) and finally, we multiply this average by the corresponding coefficient depending on the sample period employed for its estimation (see Table 3). In Table 5 we report the results of this sensitivity analysis of the determinants of the yield spreads. Specifically, we report the magnitude of the change, in basis points, of the dependent variable given a change equal to the average of the standard deviations across countries of a given explanatory variable over all dates.[24] We focus on the cross-sectional dimension of the panel and employ the time-series dimension to calculate the average effect across time. [25] This allows us to evaluate how the different macro or risk factors of the countries under study affect the yield spreads.

For the whole sample the largest effect on yield spreads is caused by deviations between the countries' CDSs spreads (4.94 b.p.). However these effects are very different in the two sub samples. In the first one the changes in the dependent variable are usually small, around 1.4 b.p., whereas in the second sub sample the changes are more substantial, around 12.2 b.p. It seems that the sensitivity of yield spreads to changes in CDS increased noticeably once the crisis started which supports the idea of a flight to quality in terms of Beber et al. (2009) terminology.

[24] The standard deviation of the following variables: CDS spread (lagged one day); interaction of total debt divided by GDP and the standard deviation of the difference between domestic and benchmark yields; and the correlation between domestic Government yield and benchmark yield are calculated for the five year's maturity.

[25] We repeat the sensitivity analysis focused on the time-series dimension of the panel. By means of this analysis, we estimate the change in the dependent variable after a change of one standard deviation in a given explanatory variable across time and countries. Results are in line with the ones in Table 5 but are not reported in this paper given that our aim is to focus on how the differences between countries affect the deviations in the yield spreads and so, we focus in the cross-section dimension.

The variable with the second strongest effect is the total debt issued relative to GDP. In the whole sample the average change in the dependent variable is 3.59 b.p. and, as it occurs with the rest of explanatory variables, its effect is very different in the two sub samples being almost three times higher in the sample corresponding to the crisis period. Given the economic interpretation discussed above, it seems that increased divergence from the average behaviour is substantially (and possibly non-linearly) penalized by the market.

A similar effect to the one found in the CDSs, but with a lower order of magnitude, is found with respect to the liquidity variable. Before the crisis the effect is negligible but during the crisis the effect is significant and leads to a decrease of 4.55 b.p. This suggests the existence of a flight to liquidity during the crisis period.

The effects of the rest of variables show again fairly large differences in the two sub samples.[26] Both the interaction of total debt relative to GDP and the standard deviation of the domestic yield minus the benchmark yield, and the correlation between the government yield and benchmark yield increased their effect to a considerable extent in the second sub sample in comparison with the first one.

Summarizing the results, the effect of the explanatory variables varies widely between the sub samples, being generally stronger in the crisis period. The effect is also stronger when the deviations from the average take place in the credit quality position (CDSs).

[26] The Global Risk Measure (VIX Index) is not included in this sensitivity analysis as it is the same for all the countries in the sample.

4.2 Computing Common Risk Free Rates

The results in the previous section motivate the following question. What should be the yield of a common eurozone bond, free, at least to some extent, from the effect of the risk factors (credit, liquidity, macro, correlation) that influence the yield of individual sovereign bonds? The existence of a common European bond would imply the existence of a common European interest rate[27]. In this section, we attempt to provide some alternative measures for this rate and discuss the hypothetical benefits that it would yield. A common risk free rate could produce benefits for every EMU country because of the enhanced rating and liquidity of the common bond and from the reduction of the effects associated with macro fundamentals and global risk.

It seems reasonable to suggest that to be allowed to profit from the reduction in borrowing costs this common rate would provide, each EMU country interested in participating in an issue of common bonds should compensate the bond issuer for the specific country's credit risk. As a starting point for this analysis we suggest that the CDSs on its sovereign bonds is the best proxy publicly available to measure the country risk and so, the CDS spreads represent the compensation that a given country should pay in order to be allowed to participate in the issuance of common bonds. In what follows we refer to the 'Hedged Yield' of the sovereign debt of a country as the difference of actual yield and the corresponding CDS spread.

In what follows we propose four possible alternatives for a common risk free rate.

1) The first one we propose, which we call Common Risk-Free Rate 1, is the Hedged Yield free of liquidity, correlation and macro risk effects[28], computed in the following steps:

   a) We run the following Prais-Winsten regression:

   (5)

$$r_{it} - CDS_{it} = \alpha + \sum_{k=1}^{K} \beta_k X_{k,i,t} + \sum_{j=1}^{M} \gamma_j D_{j,t} + \chi Y_{i,t} + \delta Z_{i,t} + \varepsilon_{i,t} \qquad i = 1,...44$$

   where the dependent variable is the Hedged Yield of country *i* (i=1,…,11) at four different maturities (3, 5, 7 and 10 years). The $X_{k,i,t}$ are liquidity and macro explanatory variables (Volume, Total debt/GDP, Trade Balance/GDP) of country *i.* The $D_{j,t}$ are dummy variables to take into account the maturity effect in bond yields (3,5, and 7 years). The $Y_{i,t}$ is the interaction term of total debt relative to GDP times the volatility of the difference between domestic yield and benchmark yield. The $Z_{i,t}$ is the global risk factor measured as the logarithm of VIX.

   This regression is similar to the one in (4) with the exception that the dependent variable is the hedged yield and the liquidity and macro variables are not deviations from the benchmark.

   b) We define the Common Risk Free Rate 1 (CRFR1) at time t for the corresponding maturity according to:

$$CRFR1_t = \hat{\alpha} + \hat{\gamma}_j + \bar{\hat{\varepsilon}}_t \qquad j = 1,\ 2,\ 3. \quad (6)$$

   where $\hat{\alpha}$ is the estimated constant, $\hat{\gamma}_j$ is the estimate of the dummy parameter for the maturities of 3, 5 and 7 years, respectively, and $\bar{\hat{\varepsilon}}_t$ is the average cross-sectional

[27] As Galati and Tsatsaronis (2001) remark, the most vivid illustration of the shortcomings of the Government bond market is the absence of a single established reference yield curve for the new currency.

residual among the eleven EMU countries at time t. $\hat{\alpha}$ gives the average common hedged risk free rate without the effect of the other variables, $\hat{\gamma}_j$ gives the term structure effect and $\bar{\hat{\varepsilon}}_t$ gives the time series variation in interest rates.

The second risk free rate we propose, which we call Common Risk-Free Rate 2, is defined as Common Risk-Free Rate 1 but using weights in the Prais-Winsten regression according to the debt outstanding by each EMU member relative to the total debt outstanding. The steps are the same as in the computation of Common Risk Free Rate 1[29].

For purposes of comparison, we also propose two common risk free rates that do not adjust for liquidity, correlation and macro effects. "Benchmark Hedged Yield" is the weighted average of the individual Hedged Yields. The weights are proportional to the portion of debt outstanding by each of the EMU countries with respect to the total amount outstanding by all these countries. Finally, "Minimum Hedged Yield" is the minimum Hedged Yield across the eleven EMU members. To compute this measure, we first select the country with the minimum weekly average yield and then, using its daily yields during the corresponding week we compute the Minimum Hedged Yield.

We would expect that, in general, the Common Risk Free Rate measures would be lower than the Hedged Yield measures since, in addition to adjusting for the risk of default (CDSs), they also adjust for liquidity, correlation and macro effects[30].

[28] The impact of these effects is estimated by means of a Prais-Winsten regression with correlated panels corrected standard errors (PCSEs) and robust to heteroskedasticity, contemporaneous correlation across panels and serial autocorrelation.

[29] Detailed results on the computation of Common Risk Free Rates 1 and 2 are available on request.

The four different estimates of the common 5-year risk free rate are shown in Figure 1. Note that the four measures are closely related but none of them is consistently below the others. In the first part of the sample the lowest rate is the Common Risk Free rate 1 but, near the end of the sample, the lowest rate is the Minimum Hedged Yield.

5. Policy Implications: Savings in Borrowing Costs

The four measures previously defined can be used to estimate the possible savings in borrowing costs from the issuance of common bonds in the EMU. We obtain these savings for a given country and maturity by subtracting from the corresponding yield the CDS spread and the four estimates of the common risk free rate. The results are reported in Table 6, Panel A gives the results for the whole sample period, Panel B for the period before the financial crisis, and Panel C for the crisis period. In the whole sample, average savings in borrowing costs are usually positive irrespective of the common risk free rate measure employed[31]. However savings, as expected, are substantially higher with Common Risk Free Rates 1 and 2. The country that, on average, gets the biggest decrease in financing costs is Greece while Ireland[32] is the one getting the smallest decrease.[33] This is also the case in the period before the crisis, but in the crisis period Finland and Greece reaps the biggest savings.[34] On average, the savings associated with the Common Risk Free 1 (Common Risk Free 2 and Min. Hedged Yield) are around 35 (23 and 16) basis points a year for all maturities in the whole

[30] Strictly speaking only Common Risk free rates 1 and 2 are truly risk free rates because they are unrelated with the risk factors by construction.
[31] As expected, in the case of the Benchmark Yield, there are very low average savings. In contrast with the results for the other three rates, not every country will benefit from using the Benchmark Yield
[32] The reason for the low decrease in financing costs for Ireland is the high CDS spread of this country given that this spread represents the compensation that Ireland should pay in order to participate in the issuance of common bonds.
[33] For some maturities, the savings for Finland are higher than for Greece. However, we have only 202 observations for Finland in comparison with the almost 900 observations for Greece.
[34] It is important to remember that the number of observations for Finland during the crisis period is 202 while for the rest of the countries this number is equal to 392.

sample. Countries above (below) the average are Belgium, Finland, France, Greece, Italy and Portugal (Austria, Germany, Ireland, Spain, and Netherlands)[35].

Adjaouté and Danthine (2003) argue that a unified market is Pareto superior to a fragmented market given that yields will be lower in the former. As Adjaouté and Danthine (2003) point out, the pricing differences between yields reflect a failure of integration and imply costs to the euro-area Treasuries. They estimate that at the debt levels in the euro area in 2000 the annual cost may be as high as €5 billion which could be saved with a common bond.[36] They consider that the integration could occur simply by the establishment of a centralized agency in charge of issuing debt on behalf of the euro area's governments.[37] However, they do not give additional details about how to achieve this integration and how to estimate the common rates derived from the centralized debt issuance. According to our estimations of the common risk free rate, the average savings could be higher than in Adjaouté and Danthine (2003). Our estimations suggest that the average annual savings for the EMU in the period that spans from September 2005 to February 2009 might be around €21.25 (€13.71, €8.38 and €0.07) billions if the common rate is defined as the Common Risk Free Rate 1 (Common Risk Free Rate 2, Min. Hedged Yield and Benchmark Yield).[38] As Favero

[35] In the first period the savings are somewhat bigger being CRFR1 (CRFR2) 39 (27) and lower for MHY (6). In the second period average savings are lower with CRFR1 (CRFR2) 29 (17) and higher for MHY (22) perhaps reflecting heightened systemic risk.

[36] Adjaouté and Danthine (2003) estimate this amount by multiplying the outstanding debt of the Euro area minus Germany in 2000 (2,470 billion) by the average difference of the yields with respect to German yield which is employed as the benchmark (20 basis points).

[37] Such a proposal was made in 1999 with a view of harmonizing the maturity structures, delivering a true and single benchmark curve and helping reduce the cost that some member states have to pay to primary dealers in order to promote their debt outside the country (Favero et al., 2000). Adjaouté and Danthine (2003) proposal was met with considerable skepticism, because such a set-up implies some collective responsibility for national debts, which runs contrary to the Maastricht Treaty but they also argue that the debate on the establishment of a multilateral agency should be reopened.

[38] The annual average savings are obtained by multiplying the annual average debt outstanding in the EMU during the period 2003-2008 by the average annual profits in terms of yields for the period 2004-2009 (see Panel A of Table 6). The average yield value is obtained as the average of the four different maturities.

and Von Thadden (2004) state, the possibility of joint bond issuance by euro-area countries has been repeatedly considered because of its ability to exploit fully the liquidity benefits, among others, of a unified market. They also suggest that this scheme has been discarded because it would generate an implicit debt guarantee by some countries in favour of others. Our tentative evidence, based on hedged yields, suggests that a common bond market with a common yield would reap liquidity benefits for all countries involved.

6. Robustness Tests

In this section, we report the results of several checks on the basic results. The robustness tests consider cross-section regressions, changes in the benchmark, using balance panel regressions and alternative liquidity measures, and employing alternative data frequencies. In all cases the results are robust to the alternative specifications.

6.1. Cross Section Regressions

As a first robustness test we run a cross-section regression every day and then we test for the significance of the time series of coefficients, see Fama and Macbeth (1973). Equation (7) details our cross-section regression model:

(7)

$$r_{it} - r_{it}^{*} = \alpha_t + \sum_{k=1}^{K} \beta_{k,t}(X_{k,i,t} - X_{k,BNCH,t}) + \sum_{j=1}^{M} \gamma_{j,t} D_{j,t} + \chi_{i,t} Y_{i,t} + \delta_{i,t} Z_{i,t} + \varepsilon_{i,t} \qquad i = 1,...44$$

$$t = 1,...,1294$$

where the dependent variable is the spread between the government bond's yield of country i (i=1,…,11) r_{it} at four different maturities (3,5,7,and 10 years) and the benchmark yield r^{*}_{it} , at the same maturities. The benchmark yields are obtained as the weighted average of the Government yields of the EMU countries in the sample for the

corresponding maturity (3, 5, 7, and 10 years). The weights are proportional to the portion of debt outstanding by each country with respect to the total amount outstanding by all these countries. The $X_{k,i,t}$ are credit risk, liquidity and macro explanatory variables (CDS_{t-1} , Volume, Total debt/GDP, Trade Balance/GDP) and $X_{k,BNCH,t}$ are their respective weighted averages over the eleven countries. Notice that we specify the credit, liquidity and macro variables as differences from their cross-sectional weighted averages. This approach stresses that credit risk; liquidity and macro stance are relative concepts. The $D_{j,t}$ are dummy variables to take into account the maturity effect in bond yields (3, 5, and 7 years). The $Y_{i,t}$ is the interaction term of total debt relative to GDP times the volatility of the difference between domestic yield and benchmark yield. The $Z_{i,t}$ is the global risk factor .[39]

In order to estimate the cross-sectional effects of the above variables, we run a cross-sectional regression by OLS for every date in the sample (1294 in total) and compute the average coefficient for the whole sample and for the two subsamples. Petersen (2009) states that the Fama-MacBeth standard errors are biased in exactly the same way as the OLS estimates and the magnitude of the bias is a function of the serial correlation of both the independent variable and the residual within a cluster and the number of time periods per firm (or cluster). Thus, we must adjust the standard errors for the

[39] This is measured, in this case, as the standard deviation of the difference between the domestic Government yield and the EMU benchmark Government yield, because in equation (7), neither the VIX index nor the variable defined from the correlation between the domestic and the benchmark yields can be employed in the regression analysis. The reason is that the former variable is the same for all countries while the last one causes multicollinearity problems.

autocorrelation of the estimated slope coefficients.[40] We employ the Fama-MacBeth methodology with Newey-West standard errors.[41]

The results of the cross section regressions are reported in Table 7. Column 1 gives the results for the whole sample period, Column 2 for the period before the financial crisis, and Column 3 for the crisis period. The average R^2 of the cross-sectional regressions are 73%, 69% and 83% respectively[42]. The magnitude of the regression coefficient suggests that a one standard deviation increase in the CDS above the weighted average is associated with an average increase in the sovereign yield spread of 6.4, 3.4 and 13 basis points respectively. These are the most significant economic effects found for the explanatory variables. The two macro factors (relative to GDP) have a significant impact in the sovereign yield spread. One standard deviation increase in the total debt and the net trade balance, both above the weighted average, is associated with an average increase in the sovereign yield spread of 2.2, 0.7 and 5.8 basis points and a decrease of 1, 0.5 and 0.9 basis points respectively.

The effect of the term measuring the interaction of total debt and the standard deviation of the domestic yield minus the benchmark yield is positive and significant. One standard deviation increase in this variable is associated with an average increase in the sovereign yield spread of 1.6, 0.8 and 3.5 basis points respectively.

[40] As Petersen (2009) states, when there is only a time effect, the correlation of the estimated slope coefficients across years is zero and the standard errors estimated by the Fama-MacBeth are unbiased.
[41] In order to find an unbiased *t*-statistic, we regress the estimated coefficients on a constant using the Newey-West adjustment to control for serial correlation. This methodology is also employed in Davydenko and Strebulaev (2007).
[42] To gain a better understanding of the effects of the explanatory variables on the dependent variable, it is worth noting that the maximum (minimum) average value by country for the deviation between the Government yield and the benchmark yield is equal to 21.5 (-8.9) basis points for Greece (Germany).

The relative riskiness of a given country as measured by the volatility of the difference between the domestic Government yield and the EMU benchmark is not significant in any of the three samples. With respect to the liquidity differential variable the negative coefficient suggests that higher than weighted average liquidity is associated with lower yield spreads. The economic impact of the liquidity differential is the lowest of all the explanatory variables in the analysis for the whole sample and almost the lowest for the first subsample. However, in the analysis for the crisis period the impact of the liquidity differential increases considerably and is the third most important after CDS_{t-1} and Total debt/GDP. One standard deviation increase in liquidity above the average in the crisis period is associated with an average change in the sovereign yield spread of -4.9 basis points. Finally the dummy variables coefficients reflect the decreasing premium for longer maturities.

Overall the results of the cross sectional regressions are consistent with the ones given by the unbalanced panel regression reported in Section 4.1 indicating that the main results of the analysis are robust to different specifications of the regressions. The sensitivity analysis' results for the cross-sectional regression are also similar to those reported in Table 5 for the panel regressions.

6.2 Changing the Benchmark

We next address the issue of how robust are our results to the choice of benchmark. In particular, as is common in the literature, we use the German bond as a benchmark.

Table 8 presents the results of estimating the panel regression equation (4) using two different benchmarks. Besides the benchmark used in this study, which is obtained from the relative weights calculated from the total debt outstanding by each country over the

total amount in the EMU, we present the results obtained using the German bond as the benchmark. As can be seen from the Table, our main results are not very sensitive to the choice of benchmark.

6.3 Balanced Panel

To be able to use as much of the data as possible and deal with missing observations the panel regressions estimated in this paper have been unbalanced. In this section we look at the robustness of our results to the use of a balanced panel.

Table 9 presents the results of fitting equation (4) to a balanced panel data formed by ten of the eleven countries and ranging from March 2006 to February 2009.[43] The estimation is done by means of Generalized Least Squares (GLS). The GLS procedure allows estimation in the presence of AR(1) autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels. Even though the data used in this regression is somewhat different, the results obtained are similar to those obtained for the unbalanced panel. In fact, the magnitude and significance of the explanatory variables provides stronger support for the specification used.

6.4 Liquidity measures

We also analyze the robustness of our results to alternative specifications of the liquidity measure. Table 10 presents the results of fitting model (4) to the full sample using three alternative liquidity measures: total daily turnover volume, bid-ask spreads

[43] We exclude Finland and the observations before the 27th of March, 2006 in order to have a balanced panel. The reason is that for some countries, the CDSs series present missing values before that date. In the case of Finland there are only 202 observations on CDSs.

and average daily turnover volume.[44] In all cases the liquidity coefficients have the expected signs and are significant and the results for the other variables do not change materially.

6.5 Data frequency

Some macro series (Gross Debt outstanding) have annual frequency; other series (GDP) have quarterly frequency while others (Net Trade Balance) have monthly frequency. In fact these are the data frequencies employed in Curto et al. (2008) or Codogno et al. (2003) among others. As an additional robustness test we analyze the regression in equation (4) using data with a monthly and quarterly frequency. In both cases the number of observations decreases substantially with respect to the case where we use daily frequency. However, results are in line with the ones obtained using a daily data and are available on request. Overall the above outcomes suggest that our main findings are not sensitive to the data's time frequency[45].

7. Summary and Conclusions

In this paper we study the determinants of EMU sovereign bonds yields and then present estimations of the hypothetical risk free rate a common bond would yield. To model the determinants of yield spreads we first propose a theoretical portfolio selection model to motivate the variable selection. Then for the period 2004 to 2009 we fit an unbalanced panel model, using as a benchmark a weighted average of the total gross debt issued by the governments of the different EMU members. We find that credit

[44] This average volume is calculated as the ratio between the total daily turnover volume and the number of bonds issued by the corresponding country.

[45] Gomez-Puig (2007) transforms the macro variables employed in her analysis into variables with a daily frequency. For this transformation, she extrapolates the corresponding variable assuming a daily constant rate of increase. We find that the results obtained after extrapolating the macro variables, assuming a constant rate of increase between two different values of the corresponding variable, are equivalent to the ones obtained in Table 3.

quality, macro, correlation, and liquidity variables have a significant effects on EMU sovereign yield spreads. However, their effects are different before and after the current financial crisis, being stronger in the latter period. Robustness tests with different data frequency, benchmarks, liquidity variables, cross section regressions and balanced panel confirm the initial results.

Motivated by the these results we try to answer the following question: What should be the yield of a common eurozone bond, free, at least to some extent, from the effect of the risk factors (credit, liquidity, macro, correlation) that influence the yield of individual sovereign bonds? We present four different estimations of this hypothetical common risk free rate and show that, in most cases, average savings in borrowing costs for all EMU countries are positive irrespective of the common risk free rate measure employed.

We realize that there are many complex institutional design features that must be resolved before an actual common bond issue for the eurozone could be a reality, but our paper provides a first insight into one central issue. Namely, what should be the required compensation a given country should pay to the formal issuer to be allowed to share a given issue of EMU-based single bonds. We argue that this compensation should be the CDS spread on a given country sovereign bonds. The benefits for a given country in using the common bond (instead of the sovereign) will be the enhanced rating and liquidity the common bond would provide plus additional premiums for country macro fundamentals, and exposure to global risk.

Our results may be interpreted as tentative evidence in favour of the hypothesis that a common bond and a common risk free rate in the EMU could produce substantial savings in borrowing costs for all the countries involved. Looking forward, we expect more conclusive evidence on other common risk free rate measures as well as in other market segments. The procedures of this paper can also be applied to other sovereign bonds and common currency areas.

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Appendix I

We consider a domestic (benchmark) investor allocating a fraction θ_t (θ^*_t) of his real wealth w_t (w^*_t) to a domestic D (benchmark, F) security and a fraction $1-\theta_t$ ($1-\theta^*_t$) to a benchmark (domestic) security. We assume that both the domestic and benchmark securities are subject to default risk. The default process is assumed to follow a correlated bivariate Bernoulli process (x_t , x^*_t), with domestic (benchmark) default probability $1-P_t$ ($1-P_t^*$). In the event of default the investor receives a fraction τ_t (τ_t^*) of his gross domestic (benchmark) payment, $\tau_t \in [0,1+r)$ ($\tau_t^* \in [0,1+r^*)$) where r (r^*) is the interest rate on the domestic (benchmark) bond. There are proportional transaction costs l_t (l^*_t) decreasing with domestic (benchmark) market liquidity. The coefficient of risk aversion ρ is the same for both investors. The utility function of both the domestic and foreign investors depends positively on the expected real wealth, $E_t[w_{t+1}]$ and negatively on its variance $Var_t[w_{t+1}]$. The domestic investor maximizes the following mean-variance utility function:

$$E_t[w_{t+1}] - \frac{\rho}{2} Var_t[w_{t+1}] \qquad (A.1)$$

where according to the previous notation, the expected wealth and variance of wealth are, respectively:

$$\begin{aligned} E_t[w_{t+1}] &= (1+r_t)\theta_t w_t P_t + \tau_t \theta_t w_t (1-P_t) - \theta_t w_t l_t + \\ &+ (1+r_t^*)(1-\theta_t) w_t P_t^* + \tau_t^* (1-\theta_t) w_t (1-P_t^*) - (1-\theta_t) w_t l_t^* \end{aligned}$$

$$\begin{aligned} Var_t[w_{t+1}] &= (1+r_t-\tau_t)^2 \theta_t^2 w_t^2 P_t (1-P_t) + (1+r_t^*-\tau_t^*)^2 (1-\theta_t)^2 w_t^2 P_t^* (1-P_t^*) + \\ &+ 2 w_t^2 \theta_t (1-\theta_t)(1+r_t-\tau_t)(1+r_t^*-\tau_t^*) Cov(x_t, x_t^*) \end{aligned} \qquad (A.2)$$

The domestic investor maximizes his corresponding utility function to obtain the optimal fraction of his wealth to allocate to the domestic bond, $\hat{\theta}_t$:

$$\begin{aligned} \hat{\theta}_t = \frac{(1+r_t)P_t + \tau_t(1-P_t) - l_t - (1+r_t^*)P_t^* - \tau^*(1-P_t^*) + l_t^* + }{\rho w_t \Big[(1+r_t-\tau_t)^2 P_t (1-P_t) + (1+r_t^*-\tau_t^*)^2 P_t^* (1-P_t^*) } \\ \frac{+ \rho w_t (1+r_t^*-\tau_t^*)^2 P_t^* (1-P_t^*) - \rho w_t (1+r_t-\tau_t)(1+r_t^*-\tau_t^*) Cov(x_t, x_t^*)}{- 2(1+r_t-\tau_t)(1+r_t^*-\tau_t^*) Cov(x_t, x_t^*) \Big]} \end{aligned} \qquad (A.3)$$

The foreign investor maximizes his corresponding mean-variance utility function:

$$E_t[w_{t+1}^*] - \frac{\rho}{2} Var_t[w_{t+1}^*] \qquad (A.4)$$

The foreign investor's expected wealth and variance of wealth are the following:

$$E_t\left[w^*_{t+1}\right] = (1+r_t)\theta^*_t w^*_t P_t + \tau_t \theta^*_t w^*_t (1-P_t) - \theta^*_t w^*_t l_t + \\ + (1+r^*_t)(1-\theta^*_t) w^*_t P^*_t + \tau^*_t (1-\theta^*_t) w^*_t (1-P^*_t) - (1-\theta^*_t) w^*_t l^*_t$$

$$Var_t\left[w^*_{t+1}\right] = (1+r_t - \tau_t)^2 \theta^{*2}_t w^{*2}_t P_t (1-P_t) + (1+r^*_t - \tau^*_t)^2 (1-\theta^*_t)^2 w^{*2}_t P^*_t (1-P^*_t) + \\ + 2 w^{*2}_t \theta^*_t (1-\theta^*_t)(1+r_t - \tau_t)(1+r^*_t - \tau^*_t) Cov(x_t, x^*_t) \qquad (A.5)$$

The foreign investor maximizes his utility function to obtain the optimal fraction of his wealth to allocate to the domestic bond, $\hat{\theta}^*_t$:

$$\hat{\theta}^*_t = \frac{(1+r_t)P_t + \tau_t(1-P_t) - l_t - (1+r^*_t)P^*_t - \tau^*(1-P^*_t) + l^*_t + }{\rho w^*_t \left[(1+r_t-\tau_t)^2 P_t (1-P_t) + (1+r^*_t - \tau^*_t)^2 P^*_t (1-P^*_t)\right.} \\ \frac{+ \rho w^*_t (1+r^*_t - \tau^*_t)^2 P^*_t (1-P^*_t) - \rho w^*_t (1+r_t - \tau_t)(1+r^*_t - \tau^*_t) Cov(x_t, x^*_t)}{\left. - 2(1+r_t - \tau_t)(1+r^*_t - \tau^*_t) Cov(x_t, x^*_t)\right]} \qquad (A.6)$$

After imposing market clearing equation (1) and rearranging terms we get the final expression:

$$r_t - r^*_t = (l_t - l^*_t) + S_t \frac{\rho}{2} Var\left[(1+r_t-\tau_t)x_t - (1+r^*_t - \tau^*_t)x^*_t\right] - \frac{\rho}{2}(w_t + w^*_t)\left[(1+r^*_t - \tau^*_t)^2 P^*_t (1-P^*_t)\right] + \\ + \frac{\rho(w_t + w^*_t)}{2}\left[(1+r_t - \tau_t)(1+r^*_t - \tau^*_t) Cov(x_t, x^*_t)\right] + (1+r_t - \tau_t)(1-P_t) - (1+r^*_t - \tau^*_t)(1-P^*_t) \qquad (A.7)$$

Appendix II

This appendix provides additional details about the definition, sources, and timing of the data used in the study.[46]

1. Sovereign Yields Spreads. 3, 5, 7 and 10 years daily sovereign yields are obtained from Datastream. The dependent variable in equation (4) is defined as the difference between the domestic sovereign yield and the benchmark yield. The benchmark yield is defined as the weighted average of the EMU Government yields. The weights are proportional to the portion of debt outstanding by each of the EMU countries with respect to the total amount outstanding in the EMU. The general governments gross debt data employed to form the weights are reported in Table 1 and are obtained from the AMECO database.

2. Liquidity (total bond daily turnover volume). Liquidity is proxied by the total daily turnover volume reported in Datastream. The total turnover volume is obtained as the sum of the turnover volumes of all the sovereign bonds issued by a given country. This volume is reported in terms of monthly information on the average daily turnover volume per bond during a given month by Datastream. The turnover volume for the total number of bonds issued by a given Government derives from trades entered into TRAX. In equation (4), we employ the deviation of the logarithm of the domestic total bond daily turnover volume, in million of Euros, from the log of the benchmark total bond daily turnover volume, in million of Euros.

3. CDS. The daily CDS spreads in the study are obtained from the Datastream system. These CDS spreads are midmarket indicative prices for three, five, seven and ten year CDS contracts. In all cases, the CDS contract references the sovereign (as opposed to a central bank or some other entity). For all countries CDSs are Euro-denominated. CDSs quotes are given in basis points. In equation (4) the explanatory variable referent to CDSs is obtained as the difference between the domestic and benchmark (weighted average) CDS spreads lagged one day, in percentages.

4. Debt/GDP. This variable is the ratio between the general Government gross debt at nominal value and the GDP, obtained from Ecowin. As the frequency of the gross debt is annual, the frequency of this ratio is also annual. In equation (4), we employ the difference between the domestic and benchmark Debt/GDP ratios as explanatory variable.

5. Interact.(Debt). This variable is an interaction term representing the product of Debt/GDP and the monthly standard deviation of the domestic yield minus the benchmark yield. This variable has monthly frequency.

6. Trade Balance/GDP. This variable is the ratio between the net trade balances at the end of every month divided by the GDP. The net trade balance data as well as GDP data are obtained from Ecowin. The frequency of this ratio is monthly. The explanatory variable of equation (4) is obtained as the deviation of the domestic Trade Balance/GDP ratio from the benchmark equivalent ratio.

7. VIX (Global risk). This variable represents the overall global risk and it is proxied by the Chicago Board Options Exchange Volatility Index (VIX) (it is a measure of the implied volatility of S&P 500 index options). VIX is obtained from the Reuters system. We take the logarithm of VIX when we employ it as an explanatory variable. VIX has daily frequency.

8. Corr (domestic, benchmark). This variable is the monthly correlation between the domestic Government bond yield and the EMU benchmark bond yield. This correlation is reported for the 3, 5, 7 and 10 years maturities. The frequency of this variable is monthly.

9. Yield – CDS. This variable is the difference between the Government yield minus the CDS spread for the same maturity (3, 5, 7 and 10 years). The deviation of this variable from the benchmark equivalent measure is employed as dependent variable in equation (5). This variable has daily frequency.

[46] For yearly, quarterly and monthly data we use end of previous year (quarter or month) data. For instance, in the case of the Debt/GDP variable which has yearly frequency, we use the value at the end of 2004 for the whole year 2005. Thus, we are assuming that investors at any time in 2005 know the value of Debt/GDP variable at the end of 2004 but do not know its 2005 end-of-year value.

Table A.1: Summary Statistics by country

This table reports the summary statistics of the variables employed in the paper for eleven EMU countries and for the benchmark. Yield 3y, Yield 5y, Yield 7y and Yield 10y refer to the Government bond yield for a constant maturity of 3, 5, 7 and 10 years, respectively, and they are reported in percentage. Liquidity refers to the total bond daily turnover volume which is measured in millions of Euros. CDS(-1) is the Credit Default Swap spread (in basis points) lagged one day. Debt/GDP represents the total gross debt outstanding at the end of the year divided by the GDP at that moment and it is measured in percentage. Interact (Debt) is the product of Debt/GDP and the standard deviation of the domestic yield minus the benchmark yield. Trade Balance/GDP refers to the net trade balance at the end of every month divided by the GDP at that moment and it is reported in percentage. Global Risk is a measure of the overall risk which is obtained from the Chicago Board Options Exchange Volatility Index (VIX) and it is a measure of the implied volatility of S&P 500 index options. Corr(domestic, benchmark) represents the monthly correlation between the domestic Government bond yield and the EMU benchmark bond yield. This correlation is obtained for the 3, 5, 7 and 10 years maturities although we only report the correlation corresponding to a maturity of 10 years. (Yield - CDS3y), (Yield - CDS5y), (Yield - CDS7y), (Yield - CDS10y) are the difference, reported in percentage, between the Government yield and the CDS spread, both of them with the same constant maturity equal to 3, 5, 7 and 10 years, respectively. For the CDS(-1), (Yield - CDS3y), (Yield - CDS5y), (Yield - CDS7y) and (Yield - CDS10y), we report the summary statistics after the 5th of September 2005. The reason is that for some countries these variables present missing values before the previous date. This homogenization of the sample allows us to compare these variables between different countries and also the benchmark.

Panel 1: Summary statistics for Austria

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.380	0.653	3.346	0.189	1.946	4.813	2.224
	1st period	902	3.213	0.598	3.049	0.490	2.314	4.627	2.224
	2nd period	392	3.766	0.611	3.941	-0.577	2.577	4.813	2.339
Yield 5y:	Total	1294	3.593	0.534	3.635	0.064	2.347	4.833	2.500
	1st period	902	3.444	0.503	3.446	0.247	2.541	4.673	2.500
	2nd period	392	3.938	0.438	4.027	-0.119	2.352	4.833	3.048
Yield 7y:	Total	1294	3.781	0.453	3.797	-0.110	2.535	4.816	2.796
	1st period	902	3.645	0.430	3.723	0.057	2.542	4.717	2.796
	2nd period	392	4.095	0.330	4.131	0.081	2.572	4.816	3.417
Yield 10y:	Total	1294	3.982	0.415	4.034	-0.336	2.479	4.886	2.936
	1st period	902	3.844	0.397	3.897	-0.102	2.306	4.754	2.936
	2nd period	392	4.299	0.247	4.303	0.105	3.073	4.886	3.711
Liquidity:	Total	1294	622	206	564	1.156	4.683	1434	311
	1st period	902	622	190	567	0.811	3.249	1156	328
	2nd period	392	623	240	545	1.497	5.505	1434	311
CDS(-1):	Total	877	17.782	42.114	2.300	3.289	13.907	272.270	0.500
	1st period	485	1.928	0.579	1.900	3.579	23.658	6.400	0.500
	2nd period	392	37.398	57.233	10.100	1.895	5.819	272.270	2.200
Debt/GDP:	Total	1294	62.973	2.206	63.700	-0.498	1.814	65.500	59.500
	1st period	902	64.206	1.203	64.800	-0.699	2.306	65.500	62.000
	2nd period	392	60.138	1.091	59.500	1.124	2.262	62.000	59.500
Interact. (Debt):	Total	1294	6.034	2.701	5.745	1.175	3.720	13.286	2.551
	1st period	902	4.943	1.525	4.782	0.469	2.863	9.048	2.551
	2nd period	392	8.544	3.117	7.824	0.140	1.537	13.286	3.627
Trade Balance/GDP:	Total	1294	-0.002	0.004	-0.001	-0.512	2.736	0.007	-0.012
	1st period	902	-0.001	0.004	-0.001	-0.570	3.117	0.007	-0.012
	2nd period	392	-0.003	0.005	-0.002	-0.254	2.107	0.006	-0.012
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.872	0.133	0.917	-2.118	6.970	0.987	0.413
	1st period	902	0.886	0.096	0.918	-1.685	4.987	0.987	0.597
	2nd period	392	0.841	0.190	0.904	-1.549	3.789	0.987	0.413
Yield - CDS 3y:	Total	877	3.513	0.834	3.680	-1.484	5.526	4.743	0.011
	1st period	485	3.575	0.545	3.640	-0.269	2.540	4.618	2.326
	2nd period	392	3.436	1.085	3.883	-1.304	3.714	4.743	0.011
Yield - CDS 5y:	Total	877	3.621	0.728	3.757	-1.409	5.394	4.745	0.501
	1st period	485	3.667	0.492	3.714	-0.209	2.658	4.661	2.545
	2nd period	392	3.564	0.939	3.940	-1.301	3.785	4.745	0.501
Yield - CDS 7y:	Total	877	3.732	0.632	3.842	-1.312	5.043	4.703	1.107
	1st period	485	3.750	0.437	3.772	-0.072	2.648	4.701	2.792
	2nd period	392	3.709	0.810	4.011	-1.320	3.749	4.703	1.107
Yield - CDS 10y:	Total	877	3.863	0.554	3.969	-1.181	4.538	4.732	1.670
	1st period	485	3.837	0.390	3.881	0.043	2.631	4.732	3.032
	2nd period	392	3.894	0.706	4.173	-1.384	3.803	4.724	1.670

Panel 2: Summary statistics for Belgium

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.379	0.679	3.395	0.184	1.900	4.963	2.190
	1st period	902	3.181	0.618	3.004	0.506	2.218	4.588	2.190
	2nd period	392	3.835	0.588	3.978	-0.549	2.736	4.963	2.403
Yield 5y:	Total	1294	3.613	0.552	3.634	0.072	2.324	4.968	2.508
	1st period	902	3.431	0.505	3.410	0.297	2.543	4.654	2.508
	2nd period	392	4.030	0.411	4.090	0.007	2.433	4.968	3.181
Yield 7y:	Total	1294	3.798	0.471	3.810	-0.096	2.484	4.924	2.770
	1st period	902	3.630	0.429	3.700	0.112	2.644	4.689	2.770
	2nd period	392	4.185	0.305	4.198	0.185	2.574	4.924	3.570
Yield 10y:	Total	1294	4.014	0.442	4.073	-0.196	2.350	5.043	3.067
	1st period	902	3.840	0.392	3.891	-0.025	2.279	4.737	3.067
	2nd period	392	4.412	0.254	4.390	0.164	3.430	5.043	3.402
Liquidity:	Total	1294	1402	353	1312	0.853	3.803	2803	853
	1st period	902	1381	354	1274	1.140	4.721	2803	853
	2nd period	392	1451	346	1400	0.195	2.098	2253	876
CDS(-1):	Total	877	16.136	28.400	2.500	2.792	10.753	157.750	1.000
	1st period	485	2.091	0.343	2.000	1.161	8.472	4.500	1.000
	2nd period	392	33.514	35.489	20.300	1.696	5.038	157.750	2.500
Debt/GDP:	Total	1294	91.077	5.183	92.100	-0.005	1.769	98.700	83.900
	1st period	902	93.763	3.666	94.300	-0.100	2.086	98.700	87.800
	2nd period	392	84.895	1.702	83.900	1.124	2.262	87.800	83.900
Interact. (Debt):	Total	1294	8.725	3.790	8.112	0.986	3.293	17.919	3.589
	1st period	902	7.104	2.312	6.943	0.596	3.157	13.669	3.589
	2nd period	392	12.454	3.896	11.673	0.142	1.530	17.919	7.146
Trade Balance/GDP:	Total	1294	0.013	0.010	0.013	-0.585	2.749	0.029	-0.013
	1st period	902	0.016	0.008	0.018	-0.555	2.435	0.029	-0.003
	2nd period	392	0.007	0.010	0.008	-0.210	2.464	0.023	-0.013
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.952	0.069	0.977	-2.245	6.705	0.997	0.721
	1st period	902	0.980	0.012	0.980	-0.955	3.505	0.997	0.949
	2nd period	392	0.888	0.097	0.925	-0.455	1.563	0.990	0.721
Yield - CDS 3y:	Total	796	3.654	0.691	3.739	-1.465	5.726	4.807	0.960
	1st period	404	3.747	0.418	3.683	0.096	2.656	4.582	2.833
	2nd period	392	3.557	0.879	3.911	-1.204	3.693	4.807	0.960
Yield - CDS 5y:	Total	877	3.681	0.595	3.768	-0.763	3.400	4.786	1.652
	1st period	485	3.669	0.492	3.707	-0.212	2.649	4.632	2.507
	2nd period	392	3.695	0.702	3.955	-0.980	3.210	4.786	1.652
Yield - CDS 7y:	Total	796	3.851	0.479	3.901	-0.919	4.032	4.709	2.154
	1st period	404	3.881	0.347	3.855	0.223	3.039	4.653	3.086
	2nd period	392	3.820	0.583	4.035	-0.982	3.099	4.709	2.154
Yield - CDS 10y:	Total	796	3.987	0.418	4.001	-0.667	3.580	4.776	2.418
	1st period	404	3.947	0.328	3.925	0.320	3.021	4.692	3.226
	2nd period	392	4.028	0.491	4.175	-1.073	3.534	4.776	2.418

Panel 3: Summary statistics for Finland

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.351	0.676	3.313	0.185	1.876	4.885	2.080
	1st period	902	3.194	0.621	3.013	0.535	2.247	4.601	2.195
	2nd period	392	3.711	0.661	3.912	-0.689	2.675	4.885	2.080
Yield 5y:	Total	1294	3.565	0.549	3.592	0.111	2.222	4.881	2.467
	1st period	902	3.423	0.516	3.381	0.320	2.496	4.653	2.467
	2nd period	392	3.891	0.479	4.000	-0.301	2.412	4.881	2.819
Yield 7y:	Total	1294	3.739	0.471	3.767	-0.058	2.405	4.827	2.739
	1st period	902	3.604	0.441	3.681	0.080	2.539	4.670	2.739
	2nd period	392	4.050	0.383	4.124	-0.282	2.526	4.827	3.219
Yield 10y:	Total	1294	3.947	0.415	3.989	-0.249	2.365	4.984	3.013
	1st period	902	3.826	0.402	3.873	-0.062	2.193	4.714	3.013
	2nd period	392	4.225	0.294	4.257	-0.166	2.855	4.984	3.506
Liquidity:	Total	1294	239	89	231	1.177	5.381	637	90
	1st period	902	251	94	234	1.202	5.218	637	99
	2nd period	392	211	71	202	0.535	2.867	361	90
CDS(-1):	Total	202	30.879	24.558	18.400	0.661	2.096	93.920	6.500
	1st period	0	.	.	.	.	.	.	.
	2nd period	202	30.879	24.558	18.400	0.661	2.096	93.920	6.500
Debt/GDP:	Total	1294	40.603	3.506	41.300	-0.470	1.805	44.300	35.100
	1st period	902	42.540	1.961	44.100	-0.574	1.764	44.300	39.200
	2nd period	392	36.146	1.790	35.100	1.124	2.262	39.200	35.100
Interact. (Debt):	Total	1294	3.940	1.724	3.728	1.062	3.692	8.656	1.691
	1st period	902	3.218	1.047	3.224	0.370	2.477	5.880	1.691
	2nd period	392	5.599	1.829	4.720	0.346	1.648	8.656	3.290
Trade Balance/GDP:	Total	1294	0.015	0.009	0.015	0.767	4.271	0.045	-0.003
	1st period	902	0.017	0.009	0.016	1.011	4.792	0.045	0.000
	2nd period	392	0.009	0.007	0.006	0.502	2.163	0.023	-0.003
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.961	0.039	0.975	-2.115	7.318	0.995	0.813
	1st period	902	0.974	0.021	0.977	-2.191	8.657	0.995	0.890
	2nd period	392	0.931	0.052	0.948	-1.004	2.857	0.988	0.813
Yield - CDS 3y:	Total	202	3.314	1.029	3.408	-0.205	1.571	4.819	1.427
	1st period	0	.	.	.	.	.	.	.
	2nd period	202	3.314	1.029	3.408	-0.205	1.571	4.819	1.427
Yield - CDS 5y:	Total	202	3.518	0.841	3.732	-0.181	1.594	4.797	1.903
	1st period	0	.	.	.	.	.	.	.
	2nd period	202	3.518	0.841	3.732	-0.181	1.594	4.797	1.903
Yield - CDS 7y:	Total	202	3.674	0.723	3.897	-0.211	1.567	4.724	2.354
	1st period	0	.	.	.	.	.	.	.
	2nd period	202	3.674	0.723	3.897	-0.211	1.567	4.724	2.354
Yield - CDS 10y:	Total	202	3.874	0.604	4.074	-0.324	1.670	4.854	2.789
	1st period	0	.	.	.	.	.	.	.
	2nd period	202	3.874	0.604	4.074	-0.324	1.670	4.854	2.789

Panel 4: Summary statistics for France

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.332	0.691	3.326	0.137	1.858	4.821	1.900
	1st period	902	3.175	0.615	2.974	0.550	2.219	4.592	2.216
	2nd period	392	3.693	0.721	3.954	-0.896	2.913	4.821	1.900
Yield 5y:	Total	1294	3.556	0.551	3.587	0.095	2.148	4.836	2.524
	1st period	902	3.427	0.495	3.409	0.341	2.550	4.644	2.540
	2nd period	392	3.854	0.558	4.012	-0.711	2.756	4.836	2.524
Yield 7y:	Total	1294	3.742	0.468	3.791	-0.046	2.349	4.864	2.774
	1st period	902	3.630	0.433	3.718	0.051	2.521	4.687	2.774
	2nd period	392	4.002	0.441	4.099	-0.514	2.675	4.864	3.018
Yield 10y:	Total	1294	3.958	0.416	4.006	-0.213	2.275	4.896	3.025
	1st period	902	3.855	0.408	3.897	-0.062	2.116	4.738	3.025
	2nd period	392	4.194	0.331	4.248	-0.312	2.792	4.896	3.390
Liquidity:	Total	1294	4927	1149	5018	-0.210	2.260	7249	2602
	1st period	902	5024	1149	5036	-0.258	2.264	7249	2602
	2nd period	392	4702	1120	4772	-0.135	2.279	6732	2725
CDS(-1):	Total	877	10.220	17.438	2.400	2.716	9.898	96.930	0.500
	1st period	485	1.954	0.525	1.900	2.796	16.221	5.400	0.500
	2nd period	392	20.446	22.167	11.000	1.546	4.299	96.930	1.100
Debt/GDP:	Total	1294	64.338	1.195	63.900	0.638	2.164	66.400	62.900
	1st period	902	64.562	1.370	64.900	0.142	1.533	66.400	62.900
	2nd period	392	63.823	0.131	63.900	-1.124	2.262	63.900	63.600
Interact. (Debt):	Total	1294	6.012	3.240	5.106	1.195	3.505	15.143	2.339
	1st period	902	4.441	1.465	4.254	0.366	1.968	7.400	2.339
	2nd period	392	9.627	3.312	11.511	-0.067	1.569	15.143	4.840
Trade Balance/GDP:	Total	1294	-0.006	0.004	-0.006	0.016	2.455	0.003	-0.015
	1st period	902	-0.005	0.003	-0.005	0.190	2.526	0.003	-0.011
	2nd period	392	-0.011	0.003	-0.010	0.068	1.834	-0.006	-0.015
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.975	0.021	0.980	-2.245	9.125	0.996	0.892
	1st period	902	0.978	0.018	0.983	-2.352	10.546	0.996	0.904
	2nd period	392	0.969	0.026	0.973	-1.780	6.097	0.994	0.892
Yield - CDS 3y:	Total	877	3.548	0.725	3.674	-1.017	3.809	4.743	1.137
	1st period	485	3.569	0.552	3.637	-0.251	2.435	4.586	2.315
	2nd period	392	3.522	0.894	3.891	-1.089	3.133	4.743	1.137
Yield - CDS 5y:	Total	877	3.655	0.622	3.731	-0.900	3.584	4.746	1.585
	1st period	485	3.659	0.487	3.699	-0.183	2.564	4.629	2.551
	2nd period	392	3.650	0.758	3.926	-1.045	3.087	4.746	1.585
Yield - CDS 7y:	Total	877	3.756	0.532	3.838	-0.694	3.137	4.757	2.075
	1st period	485	3.735	0.438	3.771	-0.086	2.640	4.662	2.746
	2nd period	392	3.781	0.630	3.991	-0.967	2.967	4.757	2.075
Yield - CDS 10y:	Total	877	3.886	0.452	3.952	-0.483	2.719	4.766	2.599
	1st period	485	3.831	0.392	3.870	0.057	2.648	4.707	2.990
	2nd period	392	3.956	0.510	4.103	-0.955	3.007	4.766	2.599

Panel 5: Summary statistics for Germany

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.300	0.696	3.281	-0.019	2.011	4.660	1.613
	1st period	902	3.187	0.607	2.986	0.530	2.139	4.542	2.255
	2nd period	392	3.558	0.811	3.872	-1.000	2.860	4.660	1.613
Yield 5y:	Total	1294	3.519	0.553	3.576	-0.115	2.272	4.655	2.164
	1st period	902	3.439	0.493	3.402	0.285	2.410	4.607	2.556
	2nd period	392	3.702	0.635	3.915	-0.922	2.892	4.655	2.164
Yield 7y:	Total	1294	3.703	0.465	3.771	-0.235	2.369	4.673	2.619
	1st period	902	3.641	0.433	3.720	-0.015	2.440	4.661	2.767
	2nd period	392	3.844	0.504	3.984	-0.827	2.902	4.673	2.619
Yield 10y:	Total	1294	3.919	0.403	3.982	-0.295	2.249	4.728	3.004
	1st period	902	3.863	0.403	3.914	-0.135	2.187	4.723	3.004
	2nd period	392	4.047	0.373	4.119	-0.696	2.909	4.728	3.097
Liquidity:	Total	1294	16813	3878	16668	-0.005	2.441	26414	9037
	1st period	902	17531	4067	18232	-0.221	2.396	26414	9037
	2nd period	392	15161	2772	15620	-0.330	1.943	19361	9920
CDS(-1):	Total	877	8.417	14.874	2.800	3.128	12.961	91.850	0.600
	1st period	485	2.013	0.491	2.000	0.497	2.923	3.800	0.600
	2nd period	392	16.340	19.533	7.000	1.855	5.730	91.850	1.600
Debt/GDP:	Total	1294	65.970	1.501	65.600	-0.009	1.549	67.800	63.800
	1st period	902	66.071	1.637	65.600	-0.256	1.474	67.800	63.800
	2nd period	392	65.738	1.091	65.100	1.124	2.262	67.600	65.100
Interact. (Debt):	Total	1294	6.383	3.338	5.887	1.369	4.258	16.735	2.458
	1st period	902	4.783	1.452	4.635	0.255	1.954	7.868	2.458
	2nd period	392	10.065	3.533	10.804	0.256	1.813	16.735	5.265
Trade Balance/GDP:	Total	1294	0.026	0.004	0.025	0.003	2.917	0.034	0.015
	1st period	902	0.025	0.003	0.025	0.614	3.046	0.033	0.020
	2nd period	392	0.027	0.005	0.028	-0.833	2.891	0.034	0.015
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.981	0.036	0.994	-2.781	9.384	0.999	0.856
	1st period	902	0.994	0.005	0.995	-1.876	6.817	0.999	0.978
	2nd period	392	0.952	0.054	0.985	-0.901	2.090	0.997	0.856
Yield - CDS 3y:	Total	877	3.508	0.769	3.683	-1.289	4.531	4.615	0.822
	1st period	485	3.579	0.538	3.641	-0.297	2.424	4.537	2.342
	2nd period	392	3.419	0.975	3.832	-1.164	3.179	4.615	0.822
Yield - CDS 5y:	Total	877	3.616	0.653	3.748	-1.232	4.516	4.600	1.283
	1st period	485	3.679	0.475	3.730	-0.284	2.606	4.597	2.556
	2nd period	392	3.539	0.815	3.859	-1.161	3.307	4.600	1.283
Yield - CDS 7y:	Total	877	3.719	0.558	3.839	-1.088	4.211	4.646	1.756
	1st period	485	3.762	0.431	3.812	-0.216	2.666	4.646	2.741
	2nd period	392	3.667	0.680	3.905	-1.140	3.364	4.605	1.756
Yield - CDS 10y:	Total	877	3.856	0.462	3.947	-0.835	3.614	4.704	2.303
	1st period	485	3.856	0.387	3.899	-0.060	2.621	4.704	2.973
	2nd period	392	3.855	0.540	4.025	-1.141	3.464	4.640	2.303

Panel 6: Summary statistics for Greece

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.562	0.736	3.692	0.034	1.789	5.212	2.281
	1st period	902	3.250	0.630	3.046	0.515	2.122	4.666	2.281
	2nd period	392	4.280	0.366	4.253	0.293	3.070	5.212	3.470
Yield 5y:	Total	1294	3.823	0.652	3.825	0.248	2.464	5.962	2.620
	1st period	902	3.538	0.509	3.488	0.287	2.396	4.748	2.620
	2nd period	392	4.478	0.439	4.384	0.498	2.837	5.962	3.627
Yield 7y:	Total	1294	4.024	0.579	4.029	0.304	2.927	6.045	2.878
	1st period	902	3.762	0.430	3.854	0.003	2.448	4.800	2.878
	2nd period	392	4.625	0.404	4.528	0.869	3.320	6.045	3.963
Yield 10y:	Total	1294	4.283	0.514	4.305	0.325	3.142	6.113	3.230
	1st period	902	4.053	0.384	4.087	-0.066	2.207	4.917	3.230
	2nd period	392	4.810	0.365	4.707	1.177	4.001	6.113	4.332
Liquidity:	Total	1294	2872	1560	3143	0.607	3.189	7370	430
	1st period	902	3494	1355	3431	0.826	3.717	7370	1135
	2nd period	392	1441	934	1082	1.381	4.164	3808	430
CDS(-1):	Total	877	40.251	63.893	13.500	2.584	8.690	292.300	4.400
	1st period	485	10.109	3.610	11.000	-0.135	1.474	16.000	4.400
	2nd period	392	77.542	81.295	50.000	1.404	3.525	292.300	7.100
Debt/GDP:	Total	1294	97.123	1.613	97.900	-0.368	1.412	98.800	94.800
	1st period	902	98.010	1.016	98.600	-1.335	3.297	98.800	95.900
	2nd period	392	95.081	0.480	94.800	1.124	2.262	95.900	94.800
Interact. (Debt):	Total	1294	10.123	5.657	8.385	1.707	5.854	30.906	3.992
	1st period	902	7.533	2.258	7.373	0.466	2.450	13.035	3.992
	2nd period	392	16.082	6.559	14.743	0.566	2.704	30.906	7.389
Trade Balance/GDP:	Total	1294	-0.065	0.008	-0.064	-0.212	2.483	-0.048	-0.083
	1st period	902	-0.064	0.008	-0.062	-0.484	2.764	-0.048	-0.083
	2nd period	392	-0.066	0.008	-0.068	0.382	2.500	-0.049	-0.079
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.900	0.189	0.980	-3.281	15.033	0.996	-0.033
	1st period	902	0.960	0.068	0.985	-2.584	8.125	0.996	0.730
	2nd period	392	0.764	0.283	0.915	-1.676	5.102	0.994	-0.033
Yield - CDS 3y:	Total	877	3.621	0.674	3.727	-0.765	3.158	4.802	1.515
	1st period	485	3.621	0.562	3.679	-0.260	2.460	4.643	2.311
	2nd period	392	3.622	0.791	3.942	-0.945	2.956	4.802	1.515
Yield - CDS 5y:	Total	877	3.707	0.575	3.787	-0.521	2.765	4.800	1.839
	1st period	485	3.711	0.510	3.756	-0.236	2.589	4.704	2.514
	2nd period	392	3.702	0.646	3.927	-0.669	2.617	4.800	1.839
Yield - CDS 7y:	Total	877	3.784	0.529	3.857	-0.617	3.037	4.739	1.905
	1st period	485	3.764	0.464	3.811	-0.180	2.588	4.729	2.707
	2nd period	392	3.808	0.599	4.023	-0.895	3.098	4.739	1.905
Yield - CDS 10y:	Total	877	3.927	0.479	4.009	-0.864	3.729	4.807	2.069
	1st period	485	3.900	0.401	3.946	-0.042	2.560	4.807	2.997
	2nd period	392	3.960	0.559	4.176	-1.283	3.933	4.695	2.069

Panel 7: Summary statistics for Ireland

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.414	0.615	3.448	0.104	1.973	4.889	2.273
	1st period	902	3.207	0.568	3.044	0.468	2.228	4.566	2.273
	2nd period	392	3.891	0.427	3.955	-0.052	2.324	4.889	2.599
Yield 5y:	Total	1294	3.645	0.569	3.668	0.079	2.425	5.125	2.488
	1st period	902	3.435	0.510	3.447	0.409	3.031	4.833	2.488
	2nd period	392	4.128	0.371	4.121	0.195	2.453	5.125	3.431
Yield 7y:	Total	1294	3.806	0.521	3.826	0.107	2.928	5.822	2.719
	1st period	902	3.604	0.445	3.688	0.091	2.700	4.732	2.719
	2nd period	392	4.271	0.361	4.237	0.948	4.109	5.822	3.668
Yield 10y:	Total	1294	3.986	0.484	4.052	0.287	3.538	5.839	3.016
	1st period	902	3.788	0.384	3.833	-0.179	1.938	4.553	3.016
	2nd period	392	4.444	0.364	4.381	1.534	5.371	5.839	3.887
Liquidity:	Total	1294	130	61	117	2.385	10.714	407	58
	1st period	902	118	42	109	1.198	4.466	296	58
	2nd period	392	160	83	143	1.920	6.191	407	64
CDS(-1):	Total	877	31.985	67.372	7.978	3.258	13.546	395.800	1.500
	1st period	485	4.968	3.933	2.500	1.226	3.392	16.578	1.500
	2nd period	392	65.413	90.134	27.000	1.921	5.776	395.800	2.800
Debt/GDP:	Total	1294	27.352	2.511	27.300	0.262	1.502	31.100	24.700
	1st period	902	28.472	2.213	29.400	-0.412	1.999	31.100	24.700
	2nd period	392	24.774	0.044	24.800	-1.124	2.262	24.800	24.700
Interact. (Debt):	Total	1294	2.781	1.435	2.410	1.517	5.799	8.026	1.047
	1st period	902	2.162	0.788	2.155	0.791	3.233	4.105	1.047
	2nd period	392	4.206	1.570	3.402	0.960	3.590	8.026	1.851
Trade Balance/GDP:	Total	1294	0.056	0.013	0.055	0.466	3.742	0.097	0.023
	1st period	902	0.058	0.013	0.058	0.596	3.319	0.097	0.035
	2nd period	392	0.051	0.011	0.050	-0.426	3.505	0.070	0.023
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.899	0.136	0.951	-2.833	12.018	0.994	0.263
	1st period	902	0.937	0.062	0.959	-2.347	7.966	0.987	0.707
	2nd period	392	0.810	0.203	0.896	-1.427	4.321	0.994	0.263
Yield - CDS 3y:	Total	877	3.445	0.823	3.684	-1.710	6.459	4.663	-0.127
	1st period	485	3.546	0.497	3.638	-0.335	2.814	4.551	2.316
	2nd period	392	3.320	1.088	3.811	-1.346	3.895	4.663	-0.127
Yield - CDS 5y:	Total	877	3.571	0.743	3.697	-1.359	5.484	4.813	0.507
	1st period	485	3.650	0.484	3.676	0.149	3.225	4.813	2.479
	2nd period	392	3.474	0.964	3.797	-1.190	3.520	4.743	0.507
Yield - CDS 7y:	Total	877	3.656	0.625	3.759	-1.290	5.087	4.707	1.302
	1st period	485	3.700	0.428	3.723	0.089	3.031	4.707	2.681
	2nd period	392	3.602	0.802	3.877	-1.241	3.533	4.630	1.302
Yield - CDS 10y:	Total	877	3.747	0.516	3.852	-1.404	5.161	4.555	1.795
	1st period	485	3.740	0.346	3.774	-0.223	2.381	4.471	2.964
	2nd period	392	3.755	0.671	4.030	-1.429	3.937	4.555	1.795

Panel 8: Summary statistics for Italy

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.451	0.690	3.521	0.171	1.844	5.024	2.297
	1st period	902	3.224	0.616	3.016	0.542	2.160	4.622	2.297
	2nd period	392	3.974	0.557	4.093	-0.649	3.228	5.024	2.569
Yield 5y:	Total	1294	3.712	0.569	3.769	0.087	2.235	5.094	2.632
	1st period	902	3.507	0.506	3.456	0.335	2.391	4.718	2.632
	2nd period	392	4.184	0.402	4.207	0.029	2.876	5.094	3.275
Yield 7y:	Total	1294	3.931	0.499	3.992	-0.090	2.494	5.169	2.872
	1st period	902	3.740	0.444	3.821	0.061	2.400	4.801	2.872
	2nd period	392	4.370	0.305	4.332	0.678	3.021	5.169	3.841
Yield 10y:	Total	1294	4.189	0.458	4.261	-0.262	2.398	5.243	3.150
	1st period	902	4.009	0.409	4.060	-0.113	2.145	4.903	3.150
	2nd period	392	4.604	0.247	4.564	0.663	3.064	5.243	4.132
Liquidity:	Total	1294	11772	7520	10137	0.887	3.056	33001	2504
	1st period	902	14029	7513	12919	0.617	2.769	33001	3088
	2nd period	392	6579	4262	5096	2.082	6.653	20595	2504
CDS(-1):	Total	877	31.212	44.519	10.800	2.441	7.937	198.400	5.300
	1st period	485	9.289	2.158	9.000	0.248	2.362	13.800	5.300
	2nd period	392	58.336	55.685	39.400	1.295	3.233	198.400	7.800
Debt/GDP:	Total	1294	104.995	1.183	104.400	0.580	1.677	106.900	103.800
	1st period	902	105.074	1.157	104.400	0.340	1.576	106.900	103.800
	2nd period	392	104.814	1.222	104.100	1.124	2.262	106.900	104.100
Interact. (Debt):	Total	1294	9.311	4.191	8.310	0.991	3.136	20.199	3.492
	1st period	902	7.379	2.281	7.136	0.500	2.636	12.672	3.492
	2nd period	392	13.757	4.204	14.847	-0.135	1.698	20.199	7.447
Trade Balance/GDP:	Total	1294	-0.003	0.005	-0.003	0.339	3.709	0.010	-0.013
	1st period	902	-0.003	0.004	-0.003	0.531	3.999	0.010	-0.012
	2nd period	392	-0.003	0.005	-0.003	-0.014	3.066	0.006	-0.013
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.969	0.066	0.992	-3.165	12.300	0.999	0.678
	1st period	902	0.992	0.007	0.994	-1.541	4.842	0.999	0.970
	2nd period	392	0.917	0.103	0.978	-1.203	3.035	0.993	0.678
Yield - CDS 3y:	Total	877	3.546	0.790	3.693	-1.303	4.678	4.734	0.774
	1st period	485	3.581	0.553	3.638	-0.240	2.446	4.594	2.306
	2nd period	392	3.502	1.008	3.955	-1.267	3.458	4.734	0.774
Yield - CDS 5y:	Total	877	3.650	0.689	3.768	-1.143	4.191	4.784	1.307
	1st period	485	3.690	0.494	3.731	-0.208	2.594	4.662	2.544
	2nd period	392	3.601	0.871	3.976	-1.108	3.093	4.784	1.307
Yield - CDS 7y:	Total	877	3.762	0.588	3.862	-0.880	3.504	4.816	1.899
	1st period	485	3.775	0.451	3.815	-0.152	2.674	4.718	2.727
	2nd period	392	3.746	0.722	4.037	-0.979	2.862	4.816	1.899
Yield - CDS 10y:	Total	877	3.899	0.489	3.967	-0.558	2.823	4.828	2.472
	1st period	485	3.863	0.411	3.909	-0.003	2.644	4.786	2.941
	2nd period	392	3.943	0.568	4.157	-0.908	2.809	4.828	2.472

Panel 9: Summary statistics for Netherlands

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.339	0.660	3.375	0.124	1.876	4.796	2.048
	1st period	902	3.177	0.609	3.004	0.523	2.248	4.596	2.217
	2nd period	392	3.712	0.623	3.893	-0.891	3.236	4.796	2.048
Yield 5y:	Total	1294	3.556	0.533	3.599	0.091	2.249	4.815	2.515
	1st period	902	3.423	0.500	3.406	0.302	2.547	4.655	2.515
	2nd period	392	3.860	0.480	3.965	-0.414	2.597	4.815	2.722
Yield 7y:	Total	1294	3.747	0.455	3.772	-0.016	2.455	4.904	2.779
	1st period	902	3.631	0.428	3.707	0.074	2.567	4.682	2.779
	2nd period	392	4.014	0.400	4.089	-0.238	2.503	4.904	3.145
Yield 10y:	Total	1294	3.970	0.409	4.032	-0.289	2.340	4.854	3.061
	1st period	902	3.845	0.399	3.901	-0.026	2.205	4.774	3.061
	2nd period	392	4.256	0.263	4.265	-0.178	3.078	4.854	3.513
Liquidity:	Total	1294	1166	287	1225	-0.056	2.480	1892	547
	1st period	902	1111	271	1120	0.081	2.573	1892	547
	2nd period	392	1292	284	1331	-0.546	3.066	1842	578
CDS(-1):	Total	877	12.279	25.174	2.750	3.071	11.592	131.000	1.000
	1st period	485	1.939	0.767	1.690	2.452	9.440	5.230	1.000
	2nd period	392	25.071	33.502	9.500	1.755	4.697	131.000	1.900
Debt/GDP:	Total	1294	49.719	2.817	51.800	-0.417	1.327	52.400	45.700
	1st period	902	51.277	1.768	52.000	-1.693	3.985	52.400	47.400
	2nd period	392	46.134	0.742	45.700	1.124	2.262	47.400	45.700
Interact. (Debt):	Total	1294	4.852	2.191	4.402	0.941	3.186	10.610	1.920
	1st period	902	3.866	1.262	3.612	0.360	2.290	6.855	1.920
	2nd period	392	7.122	2.191	7.317	-0.024	1.725	10.610	3.909
Trade Balance/GDP:	Total	1294	0.024	0.005	0.024	0.169	2.482	0.036	0.013
	1st period	902	0.023	0.005	0.023	0.178	2.454	0.034	0.013
	2nd period	392	0.025	0.005	0.025	0.074	2.459	0.036	0.014
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.937	0.049	0.946	-1.581	5.750	0.991	0.765
	1st period	902	0.940	0.044	0.952	-1.437	4.643	0.988	0.808
	2nd period	392	0.929	0.057	0.935	-1.538	5.574	0.991	0.765
Yield - CDS 3y:	Total	877	3.531	0.728	3.666	-1.249	4.770	4.718	0.863
	1st period	485	3.560	0.548	3.625	-0.266	2.510	4.583	2.296
	2nd period	392	3.495	0.901	3.832	-1.324	3.907	4.718	0.863
Yield - CDS 5y:	Total	877	3.636	0.632	3.738	-0.999	3.933	4.720	1.466
	1st period	485	3.657	0.490	3.700	-0.200	2.639	4.639	2.528
	2nd period	392	3.610	0.773	3.876	-1.104	3.276	4.720	1.466
Yield - CDS 7y:	Total	877	3.742	0.561	3.825	-0.830	3.414	4.784	2.011
	1st period	485	3.739	0.439	3.768	-0.073	2.627	4.663	2.749
	2nd period	392	3.747	0.683	3.995	-1.020	2.958	4.784	2.011
Yield - CDS 10y:	Total	877	3.899	0.469	3.990	-0.726	3.213	4.750	2.398
	1st period	485	3.840	0.395	3.887	0.113	2.589	4.750	3.026
	2nd period	392	3.972	0.540	4.133	-1.314	3.782	4.704	2.398

Panel 10: Summary statistics for Portugal

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.431	0.683	3.506	0.134	1.878	4.981	2.225
	1st period	902	3.212	0.628	3.004	0.489	2.104	4.636	2.225
	2nd period	392	3.934	0.520	4.048	-0.383	2.870	4.981	2.650
Yield 5y:	Total	1294	3.661	0.551	3.715	-0.034	2.313	4.965	2.547
	1st period	902	3.471	0.511	3.445	0.244	2.397	4.680	2.547
	2nd period	392	4.099	0.357	4.117	0.316	2.742	4.965	3.418
Yield 7y:	Total	1294	3.839	0.477	3.897	-0.198	2.428	4.957	2.781
	1st period	902	3.667	0.440	3.751	0.044	2.428	4.699	2.781
	2nd period	392	4.236	0.280	4.242	0.347	2.888	4.957	3.638
Yield 10y:	Total	1294	4.118	0.446	4.189	-0.275	2.365	5.128	3.011
	1st period	902	3.942	0.399	3.994	-0.100	2.227	4.833	3.011
	2nd period	392	4.524	0.237	4.507	0.367	2.997	5.128	3.913
Liquidity:	Total	1294	467	187	456	0.324	2.252	888	159
	1st period	902	493	178	476	0.326	2.372	888	201
	2nd period	392	406	192	368	0.547	2.146	801	159
CDS(-1):	Total	877	24.101	32.091	8.200	2.183	7.245	163.200	3.400
	1st period	485	6.171	1.700	6.000	0.101	1.615	9.500	3.400
	2nd period	392	46.285	37.569	37.000	1.208	3.509	163.200	6.600
Debt/GDP:	Total	1294	61.518	3.137	63.600	-0.483	1.388	64.700	56.900
	1st period	902	60.491	3.246	58.300	0.166	1.178	64.700	56.900
	2nd period	392	63.881	0.480	63.600	1.124	2.262	64.700	63.600
Interact. (Debt):	Total	1294	5.897	2.868	5.453	1.085	3.445	13.741	1.796
	1st period	902	4.516	1.468	4.295	0.435	2.413	7.710	1.796
	2nd period	392	9.076	2.775	8.828	0.114	1.632	13.741	5.274
Trade Balance/GDP:	Total	1294	-0.049	0.007	-0.049	0.140	2.474	-0.033	-0.063
	1st period	902	-0.046	0.006	-0.048	0.558	2.709	-0.033	-0.055
	2nd period	392	-0.056	0.006	-0.057	1.278	4.195	-0.040	-0.063
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.922	0.096	0.945	-2.987	12.274	0.998	0.513
	1st period	902	0.942	0.044	0.952	-0.706	2.729	0.998	0.831
	2nd period	392	0.875	0.152	0.935	-1.608	3.961	0.988	0.513
Yield - CDS 3y:	Total	877	3.583	0.685	3.719	-0.985	3.823	4.727	1.166
	1st period	485	3.597	0.553	3.676	-0.327	2.514	4.614	2.295
	2nd period	392	3.565	0.820	3.895	-1.127	3.438	4.727	1.166
Yield - CDS 5y:	Total	877	3.661	0.566	3.759	-0.652	2.966	4.667	1.839
	1st period	485	3.681	0.493	3.734	-0.276	2.671	4.638	2.498
	2nd period	392	3.636	0.645	3.857	-0.787	2.706	4.667	1.839
Yield - CDS 7y:	Total	877	3.731	0.494	3.797	-0.481	2.574	4.640	2.453
	1st period	485	3.730	0.450	3.761	-0.119	2.578	4.640	2.711
	2nd period	392	3.732	0.543	3.923	-0.727	2.435	4.555	2.453
Yield - CDS 10y:	Total	877	3.928	0.421	3.967	-0.342	2.447	4.749	2.706
	1st period	485	3.880	0.398	3.921	0.048	2.558	4.749	3.032
	2nd period	392	3.988	0.441	4.118	-0.785	2.716	4.663	2.706

Panel 11: Summary statistics for Spain

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.368	0.679	3.416	0.188	1.870	4.891	2.205
	1st period	902	3.167	0.622	2.972	0.538	2.229	4.591	2.205
	2nd period	392	3.831	0.568	3.980	-0.520	2.664	4.891	2.504
Yield 5y:	Total	1294	3.602	0.547	3.628	0.075	2.293	4.891	2.525
	1st period	902	3.424	0.505	3.393	0.332	2.526	4.655	2.525
	2nd period	392	4.011	0.400	4.085	0.058	2.360	4.891	3.275
Yield 7y:	Total	1294	3.786	0.470	3.816	-0.097	2.454	4.909	2.785
	1st period	902	3.626	0.434	3.707	0.093	2.529	4.692	2.785
	2nd period	392	4.153	0.321	4.185	0.084	2.581	4.909	3.519
Yield 10y:	Total	1294	4.001	0.437	4.057	-0.252	2.322	4.958	3.044
	1st period	902	3.835	0.397	3.878	-0.022	2.245	4.742	3.044
	2nd period	392	4.385	0.238	4.367	0.307	2.795	4.958	3.850
Liquidity:	Total	1294	3140	2010	3679	0.330	2.270	8418	429
	1st period	902	3958	1777	3997	-0.021	3.016	8418	703
	2nd period	392	1255	987	941	2.280	7.197	4431	429
CDS(-1):	Total	877	22.516	34.635	4.600	2.231	7.501	170.000	1.500
	1st period	485	3.022	0.866	2.750	1.248	3.888	5.800	1.500
	2nd period	392	46.636	40.397	35.800	1.286	3.677	170.000	3.200
Debt/GDP:	Total	1294	42.497	4.533	43.000	-0.069	1.618	48.700	36.200
	1st period	902	44.857	3.183	46.200	-0.327	1.877	48.700	39.600
	2nd period	392	37.067	1.484	36.200	1.124	2.262	39.600	36.200
Interact. (Debt):	Total	1294	3.781	1.650	3.567	1.156	4.442	9.063	1.230
	1st period	902	3.245	1.114	3.289	0.162	2.062	5.333	1.230
	2nd period	392	5.013	1.990	4.185	0.645	2.176	9.063	2.656
Trade Balance/GDP:	Total	1294	-0.029	0.004	-0.029	0.618	3.526	-0.016	-0.037
	1st period	902	-0.028	0.004	-0.029	0.612	3.437	-0.017	-0.037
	2nd period	392	-0.030	0.005	-0.029	0.842	3.796	-0.016	-0.037
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.948	0.071	0.972	-2.746	9.864	0.996	0.684
	1st period	902	0.964	0.055	0.981	-4.419	22.769	0.996	0.684
	2nd period	392	0.909	0.086	0.947	-1.509	4.010	0.985	0.691
Yield - CDS 3y:	Total	877	3.510	0.731	3.660	-1.128	4.164	4.627	0.943
	1st period	485	3.556	0.558	3.645	-0.290	2.502	4.560	2.269
	2nd period	392	3.452	0.898	3.831	-1.160	3.332	4.627	0.943
Yield - CDS 5y:	Total	877	3.602	0.610	3.723	-0.845	3.366	4.621	1.579
	1st period	485	3.649	0.493	3.694	-0.213	2.602	4.621	2.524
	2nd period	392	3.545	0.726	3.830	-0.913	2.761	4.577	1.579
Yield - CDS 7y:	Total	877	3.686	0.530	3.790	-0.744	3.121	4.640	2.037
	1st period	485	3.716	0.438	3.753	-0.079	2.581	4.640	2.747
	2nd period	392	3.648	0.623	3.881	-0.898	2.632	4.509	2.037
Yield - CDS 10y:	Total	877	3.824	0.446	3.890	-0.649	3.070	4.667	2.395
	1st period	485	3.805	0.386	3.838	0.114	2.556	4.667	2.998
	2nd period	392	3.846	0.510	4.031	-1.089	3.168	4.547	2.395

Panel 12: Summary statistics for the benchmark

		Obs.	Mean	Std. Dev.	Median	Skewness	Kurtosis	Max.	Min.
Yield 3y:	Total	1294	3.373	0.676	3.385	0.174	1.820	4.836	2.229
	1st period	902	3.196	0.613	2.996	0.534	2.179	4.589	2.253
	2nd period	392	3.780	0.639	3.977	-0.766	2.868	4.836	2.229
Yield 5y:	Total	1294	3.608	0.542	3.646	0.102	2.193	4.873	2.571
	1st period	902	3.457	0.500	3.424	0.313	2.460	4.660	2.571
	2nd period	392	3.954	0.470	4.055	-0.388	2.593	4.873	2.898
Yield 7y:	Total	1294	3.802	0.461	3.830	-0.082	2.476	4.899	2.805
	1st period	902	3.668	0.435	3.749	0.041	2.474	4.714	2.805
	2nd period	392	4.110	0.361	4.160	-0.069	2.534	4.899	3.376
Yield 10y:	Total	1294	4.031	0.413	4.086	-0.308	2.463	4.956	3.068
	1st period	902	3.903	0.402	3.962	-0.098	2.174	4.786	3.068
	2nd period	392	4.325	0.260	4.329	0.311	2.776	4.956	3.766
Liquidity:	Total	1294	9109	3178	9088	0.363	2.635	17573	3973
	1st period	902	10047	3148	10433	0.015	2.813	17573	4041
	2nd period	392	6950	1964	6844	0.837	3.419	12102	3973
CDS(-1):	Total	877	18.331	28.873	5.360	2.614	9.022	145.582	2.541
	1st period	485	4.450	0.730	4.379	-0.026	2.496	5.904	2.541
	2nd period	392	35.506	36.500	21.425	1.452	3.781	145.582	4.349
Debt/GDP:	Total	1294	75.235	1.396	75.562	-0.648	2.400	77.014	72.229
	1st period	902	75.911	0.730	75.562	0.621	1.802	77.014	75.143
	2nd period	392	73.680	1.317	73.034	0.997	2.223	75.891	72.229
Interact. (Debt):	Total	1294	1.439	1.498	0.938	3.040	12.103	7.509	0.479
	1st period	902	0.816	0.283	0.796	1.476	6.031	1.817	0.479
	2nd period	392	2.871	2.070	2.063	1.495	3.703	7.509	1.158
Trade Balance/GDP:	Total	1294	0.002	0.002	0.002	-0.018	2.842	0.008	-0.003
	1st period	902	0.003	0.002	0.003	0.104	2.955	0.008	-0.003
	2nd period	392	0.001	0.002	0.001	-0.215	1.819	0.005	-0.003
Global Risk (VIX):	Total	1294	19.092	11.685	14.915	2.616	10.126	80.860	9.890
	1st period	902	13.711	2.446	13.230	1.077	4.635	25.160	9.890
	2nd period	392	31.475	14.737	24.985	1.366	3.827	80.860	16.120
Corr(domestic, benchmark):	Total	1294	0.922	0.096	0.945	-2.987	12.274	0.998	0.513
	1st period	902	0.942	0.044	0.952	-0.706	2.729	0.998	0.831
	2nd period	392	0.875	0.152	0.935	-1.608	3.961	0.988	0.513
Yield - CDS 3y:	Total	877	3.536	0.751	3.680	-1.189	4.326	4.686	0.921
	1st period	485	3.576	0.549	3.640	-0.268	2.453	4.574	2.315
	2nd period	392	3.486	0.942	3.888	-1.181	3.315	4.686	0.921
Yield - CDS 5y:	Total	877	3.641	0.643	3.748	-1.032	3.917	4.694	1.448
	1st period	485	3.675	0.487	3.723	-0.224	2.603	4.632	2.546
	2nd period	392	3.599	0.794	3.913	-1.069	3.097	4.694	1.448
Yield - CDS 7y:	Total	877	3.743	0.553	3.839	-0.849	3.446	4.694	1.971
	1st period	485	3.753	0.441	3.795	-0.146	2.649	4.672	2.737
	2nd period	392	3.730	0.666	3.980	-1.004	2.963	4.694	1.971
Yield - CDS 10y:	Total	877	3.880	0.465	3.948	-0.630	2.973	4.728	2.497
	1st period	485	3.847	0.396	3.893	0.006	2.615	4.728	2.975
	2nd period	392	3.920	0.536	4.105	-1.027	3.073	4.695	2.497

Table 1: General Government Gross Debt

This table reports the total gross government debt outstanding at the end of the year for eleven EMU members for the period 2003-2008 in billions (milliards) of Euros. It also reports the proportion of the total debt outstanding by each of the EMU members.

		2003	2004	2005	2006	2007	2008
Austria:	Amount outs.	**150.7**	**155.8**	**159.5**	**161**	**176.4**	**193.2**
	% of the total	2.78%	2.75%	2.75%	2.73%	2.76%	2.77%
Belgium:	Amount outs.	**273.2**	**278.6**	**279.7**	**281.2**	**308.7**	**325.7**
	% of the total	5.04%	4.91%	4.82%	4.77%	4.83%	4.68%
Finland:	Amount outs.	**67.24**	**65.05**	**65.54**	**63.03**	**62.14**	**71.61**
	% of the total	1.24%	1.15%	1.13%	1.07%	0.97%	1.03%
France:	Amount outs.	**1076.9**	**1145.4**	**1149.9**	**1208.8**	**1327.1**	**1531.6**
	% of the total	19.87%	20.20%	19.83%	20.50%	20.78%	21.99%
Germany:	Amount outs.	**1451.1**	**1521.9**	**1569**	**1576.6**	**1641.8**	**1752.7**
	% of the total	26.77%	26.83%	27.05%	26.74%	25.71%	25.17%
Greece:	Amount outs.	**183.2**	**195.3**	**204.4**	**216.4**	**237.2**	**254.1**
	% of the total	3.38%	3.44%	3.52%	3.67%	3.71%	3.65%
Ireland:	Amount outs.	**43.9**	**44.6**	**44.2**	**47.6**	**80.3**	**102.1**
	% of the total	0.81%	0.79%	0.76%	0.81%	1.26%	1.47%
Italy:	Amount outs.	**1444.6**	**1512.8**	**1582**	**1599**	**1663.6**	**1732.1**
	% of the total	26.65%	26.67%	27.28%	27.12%	26.05%	24.87%
Netherlands:	Amount outs.	**257.6**	**266.1**	**255.9**	**258.8**	**346.2**	**332.2**
	% of the total	4.75%	4.69%	4.41%	4.39%	5.42%	4.77%
Portugal:	Amount outs.	**84**	**94.8**	**100.5**	**103.7**	**110.4**	**123.4**
	% of the total	1.55%	1.67%	1.73%	1.76%	1.73%	1.77%
Spain:	Amount outs.	**388.4**	**391**	**389.4**	**380.7**	**432.5**	**545.4**
	% of the total	7.16%	6.89%	6.71%	6.46%	6.77%	7.83%
Total:	Amount outs.	**5420.84**	**5671.35**	**5800.04**	**5896.83**	**6386.34**	**6964.11**
	% of the total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: Ameco Database. Economic and Financial Affairs, European Commission.

Table 2: Correlation between explanatory variables

This table reports the correlation between the dependent and explanatory variables employed in equations (4), (5) and (7). Gov. Yield refers to the difference between the domestic Government yield and the benchmark yield. CDS(-1) refers to the difference between the domestic and benchmark CDS spreads (in percentage) lagged one day. Liquidity represents the deviation of the logarithm of the domestic total bond daily turnover volume, in millions of Euros, from the log of the benchmark total bond daily turnover volume Debt/GDP refers to the difference between the domestic and benchmark total gross debt outstanding at the end of the year divided by the corresponding GDP at that moment. GDP at that moment. Inter. (Debt) is an interaction term that represents the product of Debt/GDP and the standard deviation of the domestic yield minus the benchmark yield. Trade Balance/GDP refers to the deviation of the domestic net trade balance at the end of every month divided by the GDP from the benchmark equivalent measure. Global Risk is a measure of the overall risk which is obtained from the Chicago Board Options Exchange Volatility Index (VIX) and it is a measure of the implied volatility of S&P 500 index options. Corr(dom. & bnchmk y.) is the monthly correlation between the domestic Government bond yield and the EMU benchmark bond yield. Yield - CDS refers to the deviation of the domestic Government yield minus the CDS spread for the same maturity from the benchmark equivalent measure. Gov. Yield is employed as dependent variable in equations (4) and (7) while Yield - CDS is the dependent variable in equation (5). Panel 1 reports the correlations for the whole sample while Panel 2 and 3 report the correlations before 09/08/2007 and after this date, respectively.

Panel 1

Observations = 44062	Gov. Yield	CDS(-1)	Liquidity	Debt/GDP	Inter. (Debt)	Trade Bal./GDP	Global Risk	Corr(dom&bchmk)	Yield - CDS
Gov. Yield									
CDS(-1)	0.849								
Liquidity	-0.014	-0.073							
Debt/GDP	0.290	0.142	0.600						
Inter. (Debt)	0.608	0.535	-0.016	0.180					
Trade Bal./GDP	-0.275	-0.144	-0.210	-0.476	-0.170				
Global Risk: log(VIX)	0.224	0.192	0.024	-0.045	0.540	0.011			
Corr(dom. & bnchmk y.)	-0.398	-0.481	0.241	0.137	-0.725	-0.045	-0.333		
Yield - CDS	0.311	-0.219	0.073	0.245	0.169	-0.208	0.053	0.115	

Panel 2

Observations = 27574	Gov. Yield	CDS(-1)	Liquidity	Debt/GDP	Inter. (Debt)	Trade Bal./GDP	Global Risk	Corr(dom&bchmk)	Yield - CDS
Gov. Yield									
CDS(-1)	0.607								
Liquidity	0.316	0.180							
Debt/GDP	0.600	0.486	0.638						
Inter. (Debt)	0.184	0.019	-0.152	0.190					
Trade Bal./GDP	-0.498	-0.426	-0.329	-0.504	-0.245				
Global Risk: log(VIX)	0.077	0.008	0.013	0.035	0.119	0.020			
Corr(dom. & bnchmk y.)	0.147	0.082	0.378	0.300	-0.548	-0.136	0.072		
Yield - CDS	0.710	0.013	0.217	0.369	0.272	-0.273	0.121	0.096	

Panel 3

Observations = 16488	Gov. Yield	CDS(-1)	Liquidity	Debt/GDP	Inter. (Debt)	Trade Bal./GDP	Global Risk	Corr(dom&bchmk)	Yield - CDS
Gov. Yield									
CDS(-1)	0.865								
Liquidity	-0.172	-0.181							
Debt/GDP	0.297	0.163	0.5349						
Inter. (Debt)	0.631	0.546	-0.0098	0.330					
Trade Bal./GDP	-0.295	-0.164	0.0394	-0.428	-0.247				
Global Risk: log(VIX)	0.192	0.163	-0.0153	-0.018	0.448	0.041			
Corr(dom. & bnchmk y.)	-0.461	-0.533	0.2294	0.039	-0.758	0.002	-0.370		
Yield - CDS	0.269	-0.242	0.0142	0.249	0.175	-0.234	0.066	0.125	

Table 3: Determinants of the deviations between the Government Yield and the Benchmark Yield

This table reports the results of the unbalanced panel regressions. The dependent variable is the deviations between the Government yields and the Benchmark yields which are obtained as the weighted average of the Governments yields of the different European Monetary Union countries in the sample. The weights are proportional to the portion of debt outstanding by each of the EMU countries with respect to the total amount outstanding by all these countries. Our database is formed by eleven EMU countries and spans from January 2004 to February 2009. All the variables (dependent and explanatory) except the measure of global risk and the measure of correlation between the domestic Government and benchmark yields are presented in deviations from the value of the same variable for the benchmark. We group the panels by country and maturity (3, 5, 7 and 10 years) such that we have, at most, 44 groups which form an overall unbalanced panel. We estimate the coefficients of the determinants of deviations between yields by means of a Prais-Winsten regression with correlated panels corrected standard errors (PCSEs) and robust to heteroskedasticity, contemporaneous correlation across panels and serial autocorrelation within panels. The correlation within panels is treated as a first-order autocorrelation AR(1) and the coefficient of this process common to all the panels. Each element in the covariance matrix of the disturbances is computed with all available observations that are common to the two panels contributing to the covariance. Column (1) reports the results for the whole sample, Column (2) reports the results for the period before the crisis (January 2004 - August 2007) and Column (3) includes the results for the crisis period (August 2007 - February 2009). The results presented correspond to the estimated coefficient and the t-statistic (between brackets).

		(1)	(2)	(3)
CDS(-1)		0.540	0.401	0.548
		(40.27)	(12.70)	(25.78)
Log (Total bond daily turnover volume)		-0.011	0.000	-0.032
		(-5.92)	(0.11)	(-5.95)
Total debt issued divided by GDP		0.145	0.093	0.262
		(12.20)	(16.45)	(8.72)
Interation of total debt divided by GDP and the standard deviation of the domestic yield minus the benchmark yield		1.254	0.488	1.219
		(12.78)	(2.62)	(6.97)
Net Trade Balance divided by GDP		-49.427	-41.960	-69.228
		(-6.42)	(-12.12)	(-3.54)
Global risk measure: log(VIX index)		0.014	0.007	0.017
		(4.97)	(3.32)	(2.55)
Correlation between domestic Government yield and EMU benchmark Government Yield		0.077	0.009	0.092
		(4.56)	(0.51)	(2.85)
Dummy for the 3-year yield		0.013	0.020	-0.003
		(3.99)	(14.18)	(-0.33)
Dummy for the 5-year yield		0.012	0.014	0.007
		(4.28)	(9.61)	(0.98)
Dummy for the 7-year yield		0.005	0.005	0.002
		(2.23)	(4.06)	(0.50)
Constant		-0.137	-0.039	-0.162
		(-7.41)	(-2.14)	(-4.08)
Autorregressive (AR(1)) coefficient		0.899	0.833	0.894
R-squared		0.199	0.119	0.253
Observations		47904	31416	16488
Number of groups		44	40	44
Observations per group	Minimum	202	485	202
	Average	1089	785	375
	Maximum	1294	902	392
Wald chi2 (10 df)		2820.880	1307.570	1155.960
Prob. > chi2		0	0	0

Table 4: Determinants of the deviations between the Government Yield and the Benchmark Yield without including CDSs

This table reports the results of the unbalanced panel regression excluding the CDS variable, that is, the variables employed in this table are the same as in Table 3 with the exception of the deviation of the domestic CDS spread from the benchmark which is now excluded. All the variables (dependent and explanatory) except the measure of global risk and the measure of correlation between the domestic Government and benchmark yields are presented in deviations from the value of the same variable for the benchmark. We group the panels by country and maturity (3, 5, 7 and 10 years) such that we have, at most, 44 groups which form an overall unbalanced panel. We estimate the coefficients of the determinants of deviations between yields by means of a Prais-Winsten regression with correlated panels corrected standard errors (PCSEs) and robust to heteroskedasticity, contemporaneous correlation across panels and serial autocorrelation within panels. The correlation within panels is treated as a first-order autocorrelation AR(1) and the coefficient of this process common to all the panels. Each element in the covariance matrix of the disturbances is computed with all available observations that are common to the two panels contributing to the covariance. Column (1) reports the results for the whole sample, Column (2) reports the results for the period before the crisis (January 2004 - August 2007) and Column (3) includes the results obtained for the crisis period (August 2007 - February 2009). The results presented correspond to the estimated coefficient and the t-statistic (between brackets).

		(1)	(2)	(3)
Log (Total bond daily turnover volume)		-0.016	-0.002	-0.036
		(-6.12)	(-2.61)	(-4.49)
Total debt issued divided by GDP		0.222	0.124	0.404
		(11.91)	(22.04)	(7.73)
Interation of total debt divided by GDP and the standard deviation of the domestic yield minus the benchmark yield		1.205	0.175	0.948
		(11.18)	(0.95)	(4.93)
Net Trade Balance divided by GDP		-45.276	-47.545	-70.116
		(-4.38)	(-12.63)	(-2.41)
Global risk measure: log(VIX index)		0.016	0.006	0.016
		(5.42)	(2.29)	(2.33)
Correlation between domestic Government yield and EMU benchmark Government Yield		0.039	-0.009	0.034
		(2.16)	(-0.51)	(0.94)
Dummy for the 3-year yield		0.019	0.025	0.001
		(4.03)	(19.44)	(0.08)
Dummy for the 5-year yield		0.016	0.017	0.011
		(4.18)	(13.35)	(0.94)
Dummy for the 7-year yield		0.008	0.007	0.007
		(2.72)	(6.80)	(0.75)
Constant		-0.098	-0.021	-0.054
		(-4.81)	(-1.1)	(-1.21)
Autorregressive (AR(1)) coefficient		0.940	0.852	0.945
R-squared		0.024	0.079	0.026
Observations		56936	39688	17248
Number of groups		44	44	44
Observations per group	Minimum	1294	902	392
	Average	1294	902	392
	Maximum	1294	902	392
Wald chi2 (10 df)		448.030	1202.400	135.210
Prob. > chi2		0	0	0

Table 5: Sensitivity Analysis of the Determinants of the deviations between the Government Yield and the Benchmark Yield

This table provides the sensitivity analysis of the determinants of the deviations between the Government yields and the Benchmark yields. All the variables (dependent and explanatory) except the correlation between the domestic and benchmark yields are presented in deviations from the value of the variable for the benchmark. Column (1) reports the results for the whole sample, Column (2) reports the results for the period before the crisis (January 2004 - August 2007) and Column (3) includes the results for the crisis period (August 2007 - February 2009). Each column reports the response, in basis points, of the dependent variable (deviation of the domestic Government yield from the benchmark yield) to a change equal to the average of the standard deviations of a given explanatory variable across countries over all dates. For this aim, we first calculate the standard deviation of each dependent variable across countries at each date t. Then, we compute the average of these standard deviations for the whole sample, the first subsample (period before de crisis) and the second subsample (crisis period) and finally we multiply this average by the corresponding coefficient depending on the sample period employed for its estimation (see Table 3). The standard deviation of variables: CDS spread (lagged one period); interaction of total debt divided by GDP and yield S.D.; and correlation between Gov. yield and benchmark yield are presented for a maturity of five years.

	(1)	(2)	(3)
CDS (lagged one period) spread	4.94	1.39	12.19
Total bond daily turnover volume	-1.72	0.01	-4.55
Total debt issued divided by GDP	3.59	2.29	6.64
Interation of total debt divided by GDP and the yield S.D.	1.29	0.22	2.87
Net Trade Balance divided by GDP	-1.75	-1.48	-2.47
Correlation between Gov. yield and benchmark yield	0.45	0.03	0.99

Table 6: Savings in borrowing costs derived from a single EMU bond for different maturities

This table reports the estimated average benefits by country and the overall EMU average benefits, in basis points, for the maturities of 3, 5, 7 and 10 years derived from the existence of a single EMU bond market. In Panel A, we report the average benefits for the period that spans from September 7th, 2005 to February 27th, 2009. The beginning of the sample is set in September 2005 in order to facilitate comparisons between countries due to the lack of CDSs data for some maturities before that date. CDSs are necessary to obtain the hedged yield which enables us to estimate the savings in borrowing costs. In Panel B, we report the potential average benefits for the period before the subprime crisis (September 2005 - August 2007) and Panel C includes average benefits during the crisis period (August 2007 - February 2009). We report the potential benefits obtained under different versions of the Common risk-free rate. Common Risk-Free Rate 1 denotes the rate estimated by excluding the effect of country specific and global risk factors, the liquidity factor and macro factors from the hedged yield. The effect of the previous factors is estimated by means of a iso regression with correlated panels corrected standard errors (PCSEs) and robust to heteroskedasticity, contemporaneous correlation across panels and serial autocorrelation (AR(1)) within panels. The dependent variable in the previous regression is the hedged yield, and the explanatory variables are the same as those in Table 4 but in absolute terms instead of deviations from the benchmark. The Common Risk-Free Rate 2 is equivalent to the previous rate and it is obtained after excluding the same factors from the hedged yield but the effect of this factors is now estimated with a weighted Prais-Winsten regression similar to the previous one but with the weights defined from the ratio between the debt outstanding by a given country and the total debt outstanding by the 11 EMU countries. Min. Hedged Yield denotes the minimum hedged yield day among all the daily hedged yields of the 11 EMU countries for the maturities of 3, 5, 7 and 10 years. Benchmark Yield refers to the hedged yield of the benchmark which is obtained as the weighted average of the Governments yields of the different EMU countries in the sample. The weights are proportional to the portion of debt outstanding by each of the EMU countries with respect to the total amount outstanding by all these countries. Finally, in the last column we show the average profits (in basis points) in terms of yields for the overall EMU derived from the existence of a single EMU bond for the different maturities.

Panel A: September 2005 - February 2009

		Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Average
3y	Common Risk-Free Rate 1	32.5	37.9	38.8	36.0	32.0	43.3	25.7	35.8	34.3	39.5	32.2	35.3
	Common Risk-Free Rate 2	20.0	25.3	26.8	23.5	19.4	30.8	13.2	23.2	21.8	26.9	19.6	22.8
	Min. Hedged Yield	10.6	17.2	45.0	14.1	10.0	21.4	3.8	13.8	12.4	17.5	10.2	16.0
	Benchmark Yield	-2.3	3.4	15.2	1.2	-2.8	8.5	-9.1	1.0	-0.5	4.7	-2.6	1.5
5y	Common Risk-Free Rate 1	33.2	39.2	41.0	36.6	32.7	41.8	28.2	36.1	34.7	37.2	31.3	35.7
	Common Risk-Free Rate 2	20.7	26.6	29.2	24.1	20.2	29.3	15.7	23.6	22.2	24.6	18.8	23.2
	Min. Hedged Yield	11.0	17.0	45.2	14.4	10.5	19.6	6.0	13.9	12.5	15.0	9.1	15.9
	Benchmark Yield	-2.0	4.0	17.7	1.4	-2.5	6.6	-7.0	0.9	-0.5	2.0	-3.9	1.5
7y	Common Risk-Free Rate 1	34.6	39.5	40.5	37.0	33.3	39.8	27.1	37.6	35.7	34.5	30.0	35.4
	Common Risk-Free Rate 2	22.1	27.0	28.7	24.5	20.8	27.3	14.5	25.1	23.1	22.0	17.5	23.0
	Min. Hedged Yield	11.6	17.7	42.1	14.0	10.4	16.8	4.1	14.6	12.7	11.5	7.0	14.8
	Benchmark Yield	-1.1	4.1	15.1	1.3	-2.3	4.1	-8.6	1.9	0.0	-1.2	-5.7	0.7
10y	Common Risk-Free Rate 1	33.7	39.8	37.3	36.1	33.0	40.1	22.1	37.3	37.4	40.3	29.8	35.2
	Common Risk-Free Rate 2	21.2	27.3	25.5	23.6	20.5	27.6	9.6	24.8	24.9	27.8	17.3	22.8
	Min. Hedged Yield	14.1	21.5	39.1	16.5	13.4	20.5	2.5	17.7	17.7	20.6	10.2	17.6
	Benchmark Yield	-1.7	4.6	10.9	0.7	-2.4	4.7	-13.3	1.9	1.9	4.9	-5.6	0.6

Panel B: September 2005 - August 2007

		Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Average
3y	Common Risk-Free Rate 1	39.8	40.0	-	39.1	40.2	44.3	36.8	40.3	38.2	41.9	37.8	39.9
	Common Risk-Free Rate 2	27.0	27.2	-	26.4	27.4	31.6	24.1	27.6	25.5	29.2	25.1	27.1
	Min. Hedged Yield	6.9	7.4	-	6.2	7.3	11.4	3.9	7.5	5.4	9.1	5.0	7.0
	Benchmark Yield	-0.1	-0.2	-	-0.8	0.3	4.4	-3.1	0.5	-1.6	2.1	-2.0	-0.1
5y	Common Risk-Free Rate 1	39.9	40.1	-	39.1	41.0	44.3	38.1	42.2	38.9	41.2	38.0	40.3
	Common Risk-Free Rate 2	27.1	27.3	-	26.3	28.3	31.5	25.4	29.4	26.1	28.5	25.3	27.5
	Min. Hedged Yield	6.8	7.0	-	6.0	8.0	11.2	5.1	9.1	5.8	8.2	5.0	7.2
	Benchmark Yield	-0.8	-0.6	-	-1.6	0.4	3.6	-2.5	1.5	-1.8	0.6	-2.7	-0.4
7y	Common Risk-Free Rate 1	40.7	40.7	-	39.2	41.8	42.0	35.7	43.1	39.5	38.7	37.3	39.9
	Common Risk-Free Rate 2	27.9	27.9	-	26.4	29.1	29.3	22.9	30.4	26.8	25.9	24.5	27.1
	Min. Hedged Yield	7.5	7.9	-	6.1	8.7	8.9	2.6	10.0	6.4	5.6	4.2	6.8
	Benchmark Yield	-0.4	-0.8	-	-1.9	0.8	1.0	-5.4	2.1	-1.5	-2.4	-3.8	-1.2
10y	Common Risk-Free Rate 1	39.7	39.8	-	39.0	41.6	45.9	29.9	42.2	40.0	44.0	36.5	39.9
	Common Risk-Free Rate 2	26.9	27.0	-	26.2	28.8	33.2	17.1	29.4	27.2	31.2	23.7	27.1
	Min. Hedged Yield	10.4	11.2	-	9.7	12.3	16.6	0.6	12.9	10.7	14.7	7.2	10.6
	Benchmark Yield	-1.1	-1.5	-	-1.8	0.8	5.2	-10.9	1.5	-0.8	3.2	-4.3	-1.0

Panel C: August 2007 - February 2009

		Austria	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Spain	Average
3y	Common Risk-Free Rate 1	23.5	35.7	38.8	32.2	21.9	42.2	12.0	30.2	29.5	36.5	25.2	29.8
	Common Risk-Free Rate 2	11.2	23.4	26.8	19.9	9.6	29.8	-0.4	17.8	17.2	24.1	12.8	17.5
	Min. Hedged Yield	15.1	27.2	45.0	23.7	13.4	33.7	3.5	21.7	21.0	28.0	16.7	22.6
	Benchmark Yield	-5.1	7.1	15.2	3.6	-6.7	13.5	-16.6	1.5	0.9	7.8	-3.4	1.6
5y	Common Risk-Free Rate 1	25.0	38.1	41.0	33.6	22.5	38.8	16.0	28.7	29.6	32.2	23.1	29.9
	Common Risk-Free Rate 2	12.7	25.8	29.2	21.3	10.2	26.6	3.7	16.4	17.3	19.9	10.8	17.6
	Min. Hedged Yield	16.2	29.4	45.2	24.9	13.7	30.1	7.3	19.9	20.8	23.4	14.3	22.3
	Benchmark Yield	-3.6	9.5	17.7	5.1	-6.1	10.3	-12.5	0.1	1.0	3.6	-5.5	1.8
7y	Common Risk-Free Rate 1	27.1	38.2	40.5	34.3	22.8	37.0	16.4	30.8	30.9	29.3	21.0	29.8
	Common Risk-Free Rate 2	14.9	26.0	28.7	22.1	10.6	24.8	4.2	18.6	18.7	17.1	8.8	17.7
	Min. Hedged Yield	16.7	27.8	42.1	23.9	12.4	26.6	6.0	20.4	20.5	18.9	10.6	20.5
	Benchmark Yield	-2.1	9.0	15.1	5.1	-6.3	7.8	-12.8	1.6	1.7	0.2	-8.2	1.0
10y	Common Risk-Free Rate 1	26.4	39.7	37.3	32.5	22.5	32.9	12.5	31.3	34.1	35.7	21.6	29.7
	Common Risk-Free Rate 2	14.2	27.6	25.5	20.4	10.3	20.8	0.3	19.1	22.0	23.6	9.4	17.6
	Min. Hedged Yield	18.7	32.0	39.1	24.8	14.8	25.2	4.7	23.6	26.4	28.0	13.9	22.8
	Benchmark Yield	-2.6	10.7	10.9	3.5	-6.5	3.9	-16.5	2.3	5.1	6.7	-7.4	0.9

Table 7: Determinants of the deviations between the Government Yield and the Benchmark Yield (Cross Section Analysis)

This table reports the results of the cross-sectional regrassions. All the variables (dependent and explanatory) are presented in deviations from the value of the variable for the benchmark. We run a cross-sectional regression by OLS for every date (1294) in the sample and calculate the average coefficient for the 1294 regressions which is reported in the first column. We find that the estimated slope coefficients present autocorrelation and for this reason, in the second column we report the t-statistic obtained from the Newey-West adjusted standard errors. These errors are obtained after regressing with Newey-West standard errors adjustment the loadings on each factor, which are shown in the first column, on a constant. Intercept that was included at the first stage is not reported. The third column reports the portion of cross-sectional regressions where the sign of the coefficient is the same as the expected sign. The fourth column shows the change in the dependent variable after a change in the explanatory variable equal to the standard deviation of this variable. Last column reports the portion of variance in the dependent variable explained by the corresponding explanatory variable. This portion is calculated after multiplying the coefficient by the ratio of the standard deviations of the independent variable and the dependent variable. Panel A reports the results for the whole sample, Panel B reports the results for the period before the crisis (January 2004 - August 2007) and Panel C includes the results for the crisis period (August 2007 - February 2009).

Panel A

	Coefficient	Corrected t-stat	Right Sign (%)	1 S.D. change	Explained var. (%)
CDS spread lagged one period	0.970	20.54	0.983	0.064	0.282
Log (Total bond daily bond turnover volume)	-0.010	-3.85	0.556	-0.011	0.000
Total debt issued divided by GDP	0.100	7.48	0.760	0.022	0.040
Interaction of total debt divided by GDP and the standard deviation of the domestic yield minus the benchmark yield	1.619	6.93	0.688	0.016	0.011
Net Trade Balance divided by GDP	-30.447	-4.91	0.693	-0.010	0.010
Dummy for the 3-year yield	0.016	4.47	0.705	0.007	0.007
Dummy for the 5-year yield	0.013	3.15	0.635	0.005	0.003
Dummy for the 7-year yield	0.007	2.57	0.610	0.003	0.001
Std. Dev. of the difference between the domestic Government yield and EMU benchmark Government yield	0.524	0.70	0.516	0.002	0.001
Constant	-0.029	-5.27	0.693		
Average R-squared	0.733				
Cross-Sections with Condition Matrix Above 30	27				

Panel B

	Coefficient	Corrected t-stat	Right Sign (%)	1 S.D. change	Explained var. (%)
CDS spread lagged one period	1.106	18.21	0.976	0.034	0.285
Log (Total bond daily bond turnover volume)	0.004	3.58	0.351	0.004	0.004
Total debt issued divided by GDP	0.031	4.30	0.671	0.007	0.011
Interaction of total debt divided by GDP and the standard deviation of the domestic yield minus the benchmark yield	1.934	6.19	0.712	0.008	0.013
Net Trade Balance divided by GDP	-16.795	-3.19	0.672	-0.005	0.010
Dummy for the 3-year yield	0.022	8.52	0.821	0.009	0.019
Dummy for the 5-year yield	0.015	5.40	0.712	0.006	0.007
Dummy for the 7-year yield	0.008	4.96	0.704	0.003	0.003
Std. Dev. of the difference between the domestic Government yield and EMU benchmark Government yield	1.023	1.27	0.542	0.001	0.001
Constant	-0.025	-7.02	0.736		
Average R-squared	0.691				
Cross-Sections with Condition Matrix Above 30	27				

Panel C

	Coefficient	Corrected t-stat	Right Sign (%)	1 S.D. change	Explained var. (%)
CDS spread lagged one period	0.697	15.100	0.997	0.130	0.276
Log (Total bond daily bond turnover volume)	-0.037	-7.300	0.964	-0.049	0.063
Total debt issued divided by GDP	0.238	9.770	0.939	0.058	0.174
Interaction of total debt divided by GDP and the standard deviation of the domestic yield minus the benchmark yield	0.989	3.410	0.642	0.035	0.007
Net Trade Balance divided by GDP	-57.821	-4.040	0.737	-0.019	0.008
Dummy for the 3-year yield	0.004	0.470	0.527	0.002	0.002
Dummy for the 5-year yield	0.009	0.830	0.517	0.004	0.001
Dummy for the 7-year yield	0.004	0.560	0.578	0.002	0.001
Std. Dev. of the difference between the domestic Government yield and EMU benchmark Government yield	-0.477	-0.310	0.465	-0.011	0.000
Constant	-0.036	-2.430	0.606		
Average R-squared	0.831				
Cross-Sections with Condition Matrix Above 30	0				

Table 8: Determinants of the deviations between the Government Yield and the Benchmark Yield for different benchmarks

This table reports the results of the unbalanced panel regressions using an alternative benchmark: the German bond yield. All the variables (dependent and explanatory) except the measure of global risk and the measure of correlation between the domestic Government and benchmark yields are presented in deviations from the value of the variable for the benchmark. We group the panels by country and maturity (3, 5, 7 and 10 years) such that we have, at most, 44 groups which form an overall unbalanced panel. We estimate the coefficients of the determinants of deviations between yields by means of a Prais-Winsten regression with correlated panels corrected standard errors (PCSEs) and robust to heteroskedasticity, contemporaneous correlation across panels and serial autocorrelation within panels. The correlation within panels is treated as a first-order autocorrelation AR(1) and the coefficient of this process common to all the panels. Each element in the covariance matrix of the disturbances is computed with all available observations that are common to the two panels contributing to the covariance. Column (1) reports the results for the benchmark employed in Table 3 and it is equivalent to the first column of that table. The results in Column (2) are obtained by using the values of Germany as the benchmark. The results presented correspond to the estimated coefficient and the t-statistic (between brackets).

		(1)	(2)
CDS(-1)		0.540	0.608
		(40.27)	(37.30)
Log (Total bond daily turnover volume)		-0.011	-0.002
		(-5.92)	(-0.67)
Total debt issued divided by GDP		0.145	0.063
		(12.20)	(3.68)
Interation of total debt divided by GDP and the standard deviation of the domestic yield minus the benchmark yield		1.254	1.552
		(12.78)	(12.58)
Net Trade Balance divided by GDP		-49.427	-40.363
		(-6.42)	(-4.25)
Global risk measure: log(VIX index)		0.014	0.059
		(4.97)	(6.51)
Correlation between domestic Government yield and EMU benchmark Government Yield		0.077	0.056
		(4.56)	(2.53)
Dummy for the 3-year yield		0.013	-0.029
		(3.99)	(-3.75)
Dummy for the 5-year yield		0.012	-0.011
		(4.28)	(-2.09)
Dummy for the 7-year yield		0.005	-0.007
		(2.23)	(-1.92)
Constant		-0.137	-0.192
		(-7.41)	(-5.5)
Autorregressive (AR(1)) coefficient		0.899	0.903
R-squared		0.199	0.289
Observations		47904	42728
Number of groups		44	40
Observations per group	Minimum	202	202
	Average	1089	1068
	Maximum	1294	1294
Wald chi2 (10 df)		2820.880	2736.250
Prob. > chi2		0	0

Table 9: Determinants of the deviations between the Government Yield and the Benchmark Yield using a balanced panel

This table reports the results of the balanced panel regressions. The data includes only ten of the eleven EMU countries and spans the period from March 2006 to February 2009. In order to have a balanced panel Finland and the observations before the 27th of March are excluded. All the variables (dependent and explanatory) except the measure of global risk and the measure of correlation between the domestic Government and benchmark yields are presented in deviations from the value of the variable for the benchmark. We group the panels by country and maturity (3, 5, 7, and 10 years) such that we have, at most 40 groups which form a balanced panel. The estimation is done using Generalized Least Squares. The GLS procedure that we employ allows estimation in the presence of AR(1) autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels. Column (1) reports the results for the whole sample, Column (2) reports the results for the period before the crisis (March 2006 - August 2007) and Column (3) includes the results for the crisis period (August 2007 - February 2009). The results presented correspond to the estimated coefficient and the t-statistic which is reported between brackets.

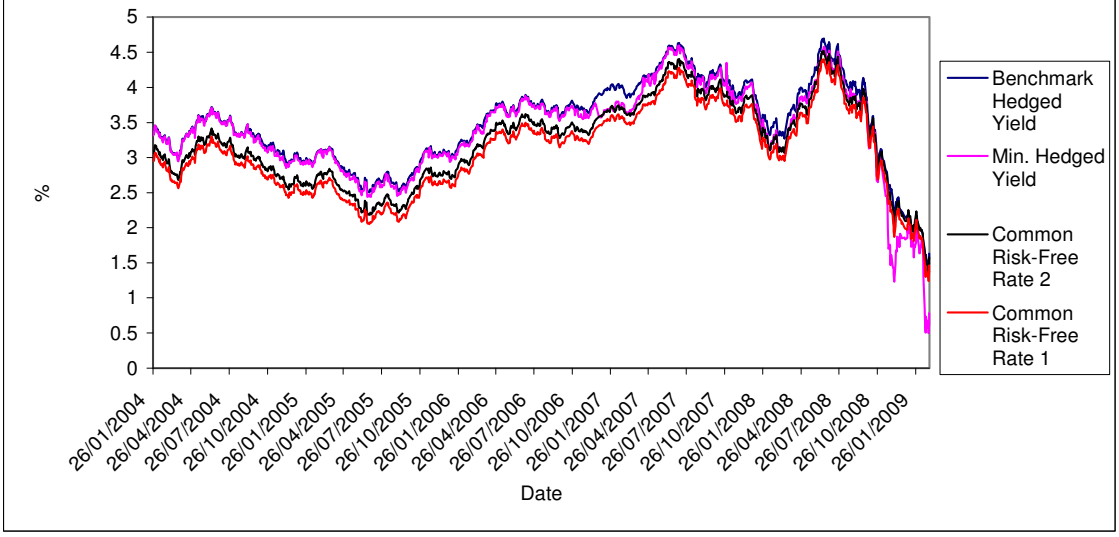
	(1)	(2)	(3)
CDS(-1)	0.443	0.307	0.425
	(47.51)	(15.16)	(33.07)
Log (Total bond daily turnover volume)	-0.013	-0.002	-0.028
	(-8.19)	(-4.23)	(-8.28)
Total debt issued divided by GDP	0.211	0.145	0.283
	(20.87)	(39.09)	(14.67)
Interation of total debt divided by GDP and the standard deviation of the domestic yield minus the benchmark yield	0.251	0.086	0.303
	(13.61)	(7.23)	(11.65)
Net Trade Balance divided by GDP	-39.408	-52.877	-31.654
	(-6.53)	(-24.24)	(-2.72)
Global risk measure: log(VIX index)	0.007	0.002	0.006
	(7.81)	(4.53)	(3.78)
Correlation between domestic Government yield and EMU benchmark Government Yield	0.011	0.001	0.022
	(3.76)	(0.65)	(5.84)
Dummy for the 3-year yield	0.003	0.015	-0.003
	(6.81)	(89.17)	(-3.68)
Dummy for the 5-year yield	0.004	0.010	0.001
	(11.89)	(89.86)	(2.03)
Dummy for the 7-year yield	0.001	0.001	0.000
	(2.73)	(33.06)	(-0.36)
Constant	-0.034	-0.014	-0.037
	(-8.57)	(-7.87)	(-5.81)
Autorregressive (AR(1)) coefficient	0.896	0.802	0.897
Log likelihood	105533	74407	43017
Observations	35040	19360	15680
Number of groups	40	40	40
Time Periods	876	484	392
Wald chi2 (10 df)	4270.960	14834.930	2014.640
Prob. > chi2	0	0	0

Table 10: Determinants of the deviations between the Government Yield and the Benchmark Yield using different liquidity measures

This table reports the results of the unbalanced panel regression using altermative liquidity measures. Column (1) reports the results for the whole sample using as liquidity proxy the total daily turnover volume, Column (2) reports the results obtained after using the bid-ask spread as the liquidity measure and Column (3) shows the results obtained if we employ as a proxy for liquidity the average daily turnover volume. This average volume is calculated as the ratio between the total daily turnover volume and the number of bonds issued by the corresponding country. The results presented correspond to the estimated coefficient and the t-statistic (between brackets). We estimate the coefficients of the determinants of deviations between yields by means of a Prais-Winsten regression with correlated panels corrected standard errors (PCSEs) and robust to heteroskedasticity, contemporaneous correlation across panels and serial autocorrelation within panels. The correlation within panels is treated as a first-order autocorrelation AR(1) and the coefficient of this process common to all the panels. Each element in the covariance matrix of the disturbances is computed with all available observations that are common to the two panels contributing to the covariance.

		(1)	(2)	(3)
CDS(-1)		0.540	0.366	0.540
		(40.27)	(11.51)	(40.14)
Liquidity		-0.011	23.193	-0.012
		(-5.92)	(6.09)	(-4.74)
Total debt issued divided by GDP		0.145	0.087	0.132
		(12.20)	(15.29)	(11.25)
Interation of total debt divided by GDP and the standard deviation of the domestic yield minus the benchmark yield		1.254	0.431	1.242
		(12.78)	(2.43)	(12.64)
Net Trade Balance divided by GDP		-49.427	-43.260	-50.583
		(-6.42)	(-12.27)	(-6.51)
Global risk measure: log(VIX index)		0.014	0.006	0.014
		(4.97)	(3.15)	(4.98)
Correlation between domestic Government yield and EMU benchmark Government Yield		0.077	0.011	0.075
		(4.56)	(0.66)	(4.41)
Dummy for the 3-year yield		0.013	0.020	0.014
		(3.99)	(14.18)	(3.96)
Dummy for the 5-year yield		0.012	0.013	0.012
		(4.28)	(9.53)	(4.26)
Dummy for the 7-year yield		0.005	0.005	0.005
		(2.23)	(3.94)	(2.22)
Constant		-0.137	-0.041	-0.131
		(-7.41)	(-2.25)	(-7.1)
Autorregressive (AR(1)) coefficient		0.899	0.833	0.900
R-squared		0.199	0.122	0.195
Observations		47904	31416	47904
Number of groups		44	40	44
Observations per group	Minimum	202	485	202
	Average	1089	785	1089
	Maximum	1294	902	1294
Wald chi2 (10 df)		2820.880	1167.780	2748.060
Prob. > chi2		0	0	0

Figure 1: Common Risk-Free Rates



The figure shows the four proposed alternatives for a 5-year common risk free rate in the EMU area. These alternatives according to the order of the legend are (i) Benchmark Hedged Yield obtained as a weighted average of the hedged yield, which is defined as the difference between the sovereign yield and the corresponding CDS, whose weights are proportional to the debt outstanding by each of the EMU countries with respect to the total amount outstanding by all these countries. (ii) Min. Hedged Yield obtained as the minimum hedged yield among the eleven EMU members. First, we find the country with the minimum average weekly hedged yield and we employ the daily hedged yields of that country during the corresponding week, when its hedged yield is the minimum, to form the Min. Hedged Yield. (iii) Common Risk-Free Rate 2 defined as the hedged yield exempt of liquidity, risk and macro effects such that the influence of these effects is estimated by means of a Prais-Winsten regression with correlated panels corrected standard errors (PCSEs) and robust to heteroskedasticity, contemporaneous correlation across panels and serial autocorrelation and using weights proportional to the debt outstanding by each EMU member. (iv) Common Risk-Free Rate 1 obtained as Common Risk-Free Rate 2 but without using weights.