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Common Currency and Determinants of Government Bond Risk Premiums

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Abstract

The problem of governments' over-indebtedness is one of the most important challenges for today's EMU governance. As numbers suggest, the problem of extensive deficits has appeared in the EMU long before the burst of the global financial crisis. We suspect that the membership in a currency area might be partially blamed for such progression of indebtedness. This paper examines the determinants of government risk premiums in the EU Member States to answer if the risk premium assigned by the market may give currency area Member States additional incentives for profligacy. Controlling other factors, we investigate the pattern in which fiscal deficits and GDP growth affect the yield of 10-year-maturity government bonds in the euro area and the non-euro area EU Member States. Our results are straightforward. The market penalizes EU countries that do not belong to the euro area for bad economic performance and extensive deficits from 4 to 7 times stronger. Our estimates confirm the strong impact of the common credibility problem in the EMU but also support the key role of financial stress in determining the cost of government debt.

Keywords: government bond yields, common credibility, bond market, EMU

JEL Classification: C23, E43, F36

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1 Introduction

The global financial crisis has clearly shown what can happen when a group of countries relying on a common currency and a common set of responsibilities does when facing an economic downturn. The recent sharp increase in fiscal deficits and the size of the accumulated public debt, particularly in the euro area, raises an important question. Were extensive deficits in the Economic and Monetary Union (EMU) the result of necessary Keynesian fiscal policy or were they a shortcoming of the common backbone in the form of the euro currency?

Confronted with the crisis, the EMU Member States substantially increased their public debt reaching by the end of 2012, an average of approximately 91% of their GDP (weighted average by nominal GDP). Short term over-expansionary fiscal policy was run by numerous countries and also by the core of the euro area - Germany and France. In this paper we investigate the determinants of the EU Member States government bonds yields in order to answer if the monetary unification exposes its members to additional incentives to borrow.

A prerequisite for our reasoning is that even before the crisis, during the sound economic time, the average level of debt in the EMU Member States oscillated around 70% of GDP - far above the Maastricht criterion. Not surprisingly, the public debt of the EMU Members remaining outside the currency union was more modest and did not evolve so rapidly during the crisis. Part of the reason may be a higher debt tolerance of, in general, wealthier countries belonging to the EMU (Reinhart *et al.* 2003). Nevertheless, it is evident that the general government debt in the EU Member States, that remain outside the currency union, has rested below the EMU average. These numbers seem to suggest that countries within the EMU can experience additional incentives for profligacy, which is literally an incentive stemming from the lower cost of debt servicing and an expected bailout in the case of solvency problems.

In this paper we tackle the problem of answering if such incentives exist and, if yes, how strong they are. We assume that the market efficiently discounts the probability of a country's possible problems by servicing its debt. As short term interest rates seem to have lee fundamental valuation, i.e. they are driven mostly by other factors than the default risk premium, we can assume that the yield of 10-year maturity government bonds is the best way to measure the probability which investors assign to a country's default. We have used a panel of all 28 EU countries over the last several years, controlling other factors, to investigate the extent to which the cost of public debt in the EMU is explained by their own and by the entire unions fundamentals - factors that influence the behaviour of real economy in the long-run. By applying such an approach we can verify and compare how markets evaluate the probability of a default in countries that belong to the EMU in contrast to countries that do not. We suspect that the premium investors assign to the debt of EMU Member States base their choice significantly on the union's fiscal soundness, which is a result of common credibility and a reason for profligacy. We use panel data regression and

control for short-run disruptions, which together with macroeconomic fundamentals have an important role in the determining of government bond yields, especially during periods of financial stress.
The paper is structured as follows. In Chapter 2 is the literature review which deals with the determinants of sovereign bond yields. We have presented econometric methodologies and empirical results which many authors have previously used. In Chapter 3 we have included theoretical considerations on the free-rider and the moral hazard problem among EMU Member States. In Chapter 4 we have presented and justified the specification of the model and data used for its estimation. Subsequently, Chapter 5 presents empirical results. and explains their significance for policy design in the EMU. In Chapter 6 we have our conclusion where we have explained significance of our results for policy design in the EMU.

2 Measuring risk at capital market using extreme value theory

The problem of explaining the cost of public debt is not new to economic literature. There is a broad range of both single-country and panel data studies exploring the linkages between macroeconomic indicators and bond yields. Depending on the methods used, the countries investigated and the time horizons used, studies often give spurious results. Even the most commonly analysed determinants such as the size of public debt and fiscal deficit are suspected to have given various strengths of impacts. One percentage point increase in the projected fiscal deficit, according to different sources, may account for from five to 100 basis points increase in the 10-year government bond yield (for summary of results see Haugh *et al.* (2009)).
The fashion of employing econometric panel data models and differentiating between the structural and institutional factors affecting the cost of public debt has been followed by Baldacci & Kumar (2010). The authors investigated the impact of fiscal deficits and public debt on long-term interest rates during the period 1980-2008 in a group of 31 advanced and emerging economies. They considered a combination of non-linear effects, institutional features and spillovers from financial markets. Using fixed effects least squares estimates, they proved that higher deficits lead to a significant increase in long-term interest rates. An increase of one percentage point of GDP to debt ratio leads to an upsurge in bond yields of around five basis points, with the precise magnitude dependent on the initial conditions.
To explore the effects of government debts and deficits on long-term interest rates Ardagna *et al.* (2004) have used a panel of 16 developed countries and vector auto regression (VAR) specification. They differentiate between short and long term determinants and also account for non-linear influence of public debt. Significant interdependence between the cost of debt and the debt-to-GDP ratio was observed only in economies with above-average levels of debt. By using a dynamic VAR

approach, the authors were able to estimate a cumulative effect of the increase in debt and find that the growth of the debt-to-GDP ratio cumulatively increases the yield of long-maturity government bonds by even 150 basis points in a ten year time horizon.

Barrios *et al.* (2009) focuses on the changing impact of international/domestic factors on the cost of public debt caused by the global financial crisis. To account for credit risk, the authors include a panel of seven EMU countries with a significant history of Collateralised Debt Obligations. With such an approach they have found a limited impact of deteriorated fiscal balances compared to the general sentiments on the market. On average an increase of one percentage point in the budget deficit (vis-a-vis Germany) implied an upswing of only 2.4 basis points in the government bond yield spread before the crisis. On the contrary, the changing perception i.e. the increase in risk-aversion during the crisis led to an upswing of 11.2 basis points in response to a one percentage growth of public debt.

A similar goal was set by Schuknecht *et al.* (2010) who checked if the crisis changed how the pattern of 10-year maturity Eurobonds are valued. In line with Barrios *et al.* (2009), the empirical results of this study suggest that bond yield spreads can still largely be explained on the basis of economic principles during the crisis. Furthermore, markets penalize fiscal imbalances stronger now than before the spread of crisis.

Poghosyan (2013) using the Pooled Mean Group estimator put emphasis on distinguishing between the short and long-run factors and how they affect the cost of public debt. The variability of public debt in a group of 22 countries brings forward evidence supporting the long-run relationship between sovereign borrowing costs and the economic fundamentals. According to the research, long run government bond yields increase by about two basis points in response to a one percentage point increase in the government debt-to-GDP ratio and by about 45 basis points in response to one percentage point increase in the potential growth rate. Among short term determinants surmised by Poghosyan are: first difference of public debt, inflation, output growth, primary balance and the short term real interest rate. The author controls for the EU membership and finds that the membership in the European Union decreases the yield by 25 basis points and very substantially decreases the dependence of the cost of a country's public debt on their own long-term fundamentals. Although the author accounts for the problem of the membership in the union, he does not fully address the problem of common credibility in a currency area, which was raised by Chinn & Frankel (2007). The authors were unable to answer their question of whether the aggregate euro area debt might explain real interest rates of particular economies better than their own long term government debt because they had too few observations at their disposal to address this conjecture.

The literature review suggests some key takeaways. Firstly, there are numerous methods used to investigate the impact on sovereign bond yields: relative and irrelative to US bonds, static and dynamic models, structural and unstructural approaches, linear and non-linear impacts of determinants. Studies using these

methods prove the relevance of fundamental factors in explaining the cost of public debt. Of those methods, public debt overhang and potential GDP growth are the most frequently investigated. Results prove that it is important to distinguish between long-term determinants and short-term influence factors. Surprisingly, among those, the influence of financial stress and spill overs from financial markets play a minor role in the literature. Moreover, even though the short term influence factors have a significant impact on 10-year maturity government bond yields, the fundamental relations were proved to be pretty stable. Despite this fact, the rapidly changing investors' sentiments during the crisis changed the strength of the impact of the fundamental factors. Some studies, in which the cost of public debt of the EMU Member States was investigated, addressed the existence of the problem of common credibility. As sound currency areas have better credibility in guaranteeing the servicing of the debt of their Member States, economic soundness of a currency area may be another important factor in determining the cost of sovereign debt.

3 Fiscal free-riding in the EMU

Nominal short term interest rates are linked with the size of public debt in at least three ways. Firstly, the extensive government spending increases interest rates due to higher inflation expectations, particularly in economies where there are concerns about the monetization of debt (Mankiw *et al.* 2003). Secondly, fiscal expansion may crowd out private investment resulting in a lower ratio of capital to labor stock. A higher marginal product of capital leads to higher real and nominal interest rates (Baldacci & Kumar 2010). Thirdly, increased deficits lead to the excess supply of government debt and subsequently its lower prices.

However, these mechanisms have a very limited impact on the long term interest rate - the yield of 10-year maturity government bonds. The long term interest rate is mainly driven by the risk premium assigned, by investors, to the sustainability of a country's public debt.

In the EMU, where countries are bounded by a common currency, this mechanism may create space for fiscal free-riding. Expecting support from the union, if a Member State faces fiscal troubles investors may assign a risk premium based on a smaller extent of the country's fundamentals. But on the contrary, they link it with the economic situation of the union as a whole. Another incentive could be that fiscal solvency at the national level is also no longer necessary for price stability, as long as the other countries' governments run surpluses Beetsma & Bovenberg (1995). Government bonds yield is increased by investors uncertainty with respect to the pace of the economic activity. Increasing the debt or slowing down the pace of the economic activity when a country belongs to the union might not have as dire consequences as in the case of standalone countries. Relationship in a monetary union might be considered a game of several agents with a common utility function. Thus, the burden of one's own fiscal or economic growth problems could only be partially borne by the

agent. Knowing that the entire union will share in the burden of their decisions, countries might have an additional incentive to increase their debt. As a result, the Member States run uncoordinated monetary policies and excessive debts which they are not fully accountable for (Beetsma & Giuliodori 2010).. If they were not a part of a monetary union, we suspect that fiscal profligacy or a lack of economic soundness would have been punished by markets with comparably higher interest rates, higher prices and, in some cases, also exchange rate depreciation.
To deal with the fiscal problems, EU authorities have implemented different incentive schemes and surveillance mechanisms within the Stability and Growth Pact and the Macroeconomic Imbalance Procedure. Nevertheless, in practice unenforceable fiscal rules and weak penalizing mechanisms laid down by the European Commission failed to prevent some of the Member Countries from being tempted to free-load by exploiting common credibility (Barbone & Poniatowski 2013). Although the mechanism was strengthened in 2011, its effectiveness is still uncertain. With the knowledge Member States have of the incentives to borrow, it would be possible to give a clearer answer of how strong the preventive instruments should be for countries within and outside the monetary union.

4 Data and methodology

This section discusses the choice of variables and data we have used in the empirical analysis. It also describes the method used to encompass financial stress and the world economic climate. It explains the methodology that let us differentiate between the different patterns of sovereign debt valuation within members of the currency area.

4.1 Data

The sample taken for analysis covers current 28 EU Member States and yearly changes in their economic and financial situation over the time span 2001-2013. Amongst others, the dataset consists of several macroeconomic aggregates and indicators taken from Eurostat. These are: (1) real GDP growth, (2) general government debt to GDP ratio, (3) Net International Investment Position. In empirical analysis we also use the historical values of long term interest rate - the yield of 10-year maturity governments bonds and short term interest rate which is the yield of 3-month-maturity Eurobonds. For the purpose of measuring the development of world economic soundness we use the IFO measure for the World Economic Climate. This measure stands for an assessment of economic trends gathered from a survey conducted on experts from 123 countries (Plenk *et al.* 2013). Not only have we used a synthetic number for the experts evaluation of world economic situation, but we also quantified the level of country-specific financial stress based on data from daily quotations of countries' main stock exchange indexes.

Variables, their definition and their sources are presented in Table 1 whereas the descriptive statistics are shown in Table 2.

Table 1: Description of variables

Variable	Definition	Source
i_{it}^{10y}	yield of 10-year maturity government bonds	ECB
$i_t^{3m,EU}$	yield of 3-month maturity Eurobonds	ECB
WEC_t	World Economic Climate	IFO
$NIIP_{it}$	Net International Investment Position to GDP	Eurostat
$GDebt_{it}$	general government debt to GDP	Eurostat
dy_{it}	real GDP growth	Eurostat
r_{it}	value of the main stock index	various

Table 2: Summary statistics

Variable	Obs.	Std. Dev.	Mean	Min.	Max.
i_{it}^{10y}	335	4.81	2.07	1.40	22.49
dy_{it}	364	2.03	3.73	-17.7	11.2
dy_t^{EMU}	364	0.93	1.89	-4.4	3.2
$GDebt_{it}$	336	52.18	29.50	3.7	170.3
$GDebt_t^{EMU}$	336	74.58	8.41	66.5	90.8
WEC_t	364	94.08	11.41	71.72	109.72
r_{it}	325	4595.76	6743.77	2.89	43719
$i_t^{3m,EU}$	364	2.33	1.44	0.1	4.63
$NIIP_{it}$	333	-0.28	0.46	-1.21	1.69

4.2 Measuring financial stress

For the purpose of measuring country-specific financial stress, we investigated the stock exchange markets. As periods of financial stress are associated with increased uncertainty about the future value of assets and diminished willingness to hold risky and illiquid assets, we used the variability of countries' main stock exchange indexes as measures of financial vulnerability (Cevik *et al.* 2013). We expect that the stock market becomes more volatile, i.e. conditional variability is higher, during periods of tensions on financial markets. Since the vast majority of the analysed countries have a sufficient history of stock exchange transactions, to grasp this uncertainty we followed the common fashion of estimating the conditional heteroscedasticity of the main

stock exchange indexes. For the analysis we employed a Generalized Auto-Regressive Conditional Heteroscedasticity model proposed by Bollerslev (1986). Diagnostics of time series for each country suggested that we should employ in the model the first order of lags for both: a variance squared and an error term squared form auto-regressive model of the stock exchange return rates. We were able to estimate models with such a specification for 24 EU countries.
The GARCH process estimated for Estonia was non-stationary. In the case of Portugal and Denmark, the response surfaces did not ensure convergence of the models, even for altered specifications. For Malta we did not estimate the model because of the lack of data on historical quotations of MSE index.
The GARCH(1,1) model which was the best daily times series is as follows:

$$\begin{aligned} r_{i,t} &= \alpha_{i,0} + \alpha_{i,1} r_{i,t-1} + \varepsilon_{i,t} \\ \sigma^2_{i,t} &= \beta_{i,0} + \beta_{i,1}\sigma^2_{i,t-1} + \beta_{i,3}\varepsilon^2_{i,t-1} \\ \varepsilon_{i,t} &= \sigma_{i,t}\epsilon_{i,t} \\ \forall_i \epsilon_{i,t} &\sim N(0,1) \end{aligned} \tag{1}$$

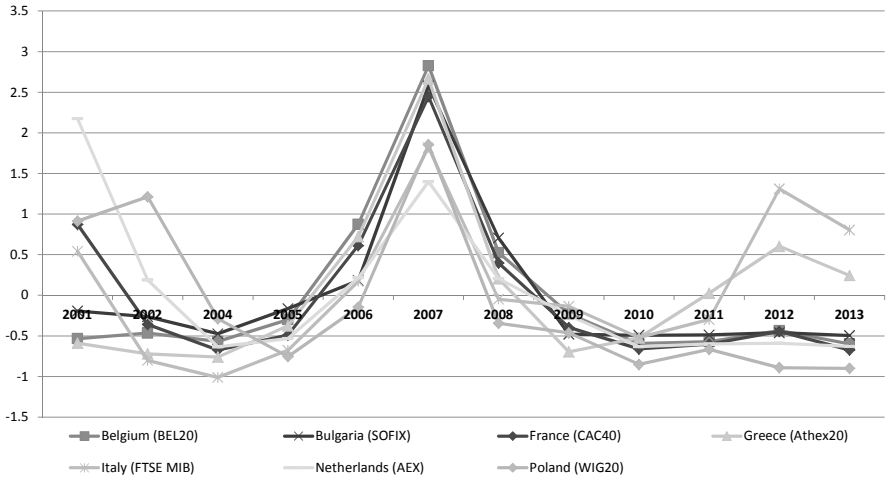
where $r_{i,t} = i_t - i_{t-1}$ and i_t stands for the value of stock index for country i. For all the country models the Augmented Dickey Fuller test suggested stationarity of r_t at the confidence level 0.05 and the test proposed by Bollerslev (1986) suggested stationarity of all GARCH processes. Specification of GARCH models explaining conditional variability of stock indexes is presented in the Appendix I.
To account for yearly financial stress in the random effects panel data regression, we computed simple average of daily values of σ^2_i. To ensure the comparability between countries, the values of conditional heteroscedasticity were standardized separately for each index.
Retrospective analysis proved that the estimated GARCH models replicate important events on financial markets. Estimated conditional heteroscedasticity for sample stock indexes is presented in Figure 1. Simultaneously, for each of the countries a twelve-years maximum was obtained at the beginning of the global financial crisis in 2007. For all indexes, the increased values of the variability could be observed in 2001 after the burst of the dot-com bubble. For a group of countries, which includes among others Greece and Italy, we detected peaks of stress also occurring during the second wave of crisis in 2012.

4.3 Model specification

With help of the model we aimed to investigate the impact of financial stress, short-term interest rates and country and union's fiscal sustainability. Specification of the econometric model proposed for this study takes into account all these components. The model has the following structure

$$\Delta i^{10y}_{it} = \alpha \Delta fs_{it} + \beta \Delta fis_{it} + D^{EMU}\gamma \Delta EMU_{it} + \zeta \Delta i^{EU,3m}_t + const + \epsilon_{it} \tag{2}$$

Figure 1: Formation of financial stress in sample countries



Note: vertical axis defines values of conditional heteroscedasticity after the standardization – values with respects to mean and standard error specific for each stock index

where fs_{it} denotes a vector of variables describing the world economic climate and a country's financial stress, fis_{it} denotes a set of variables describing country's fiscal conditions, EMU_{it} is a vector of variables describing the fiscal situation of the entire EMU and $i_t^{EU,3m}$ is the short term market interest rate in the EU, i.e. the yield of 3-months maturity Eurobonds. α, β, γ and ζ are vectors of parameters.
The complete specification of the model is as follows:

$$\begin{aligned}\Delta i_{it}^{10y} &= \alpha_1 \Delta WEC_t + \alpha_2 \sigma_{it}^2 + \beta_1 NIIP_{it} + (\beta_2 + D^{EMU}\beta_2^{EMU})\Delta GD_{it} + \\ &+ (\beta_3 + D^{EMU}\beta_3^{EMU})\Delta dy_{it} + D^{EMU}\gamma_1^{EMU} GD_t^{EMU} + \\ &+ D^{EMU}\gamma_2^{EMU} dy_t^{EMU} + \zeta \Delta i_t^{EU,3m} + const + \epsilon_{it}\end{aligned} \tag{3}$$

where WEC_t stands for the IFO World Economic Climate, σ_{it}^2 is stock exchange conditional volatility, $NIIP$ denotes Net International Investment Position, D^{EMU} stands for the EMU membership dummy. GD_t^{EMU} and GD_{it} respectively stand for the general government debt in the EMU and in the EU country i. dy_t^{EMU} and dy_{it} denote real GDP growth in the EMU and in the EU country i. $i_t^{EU,3m}$ is short term market interest rate in EU.
Before the estimation, we suspected a positive impact of stock exchange volatility and general government debt. If the market assigns a premium to the EMU Member States for the general economic condition in the union γ_1^{EMU}, would take positive value and γ_2^{EMU} would be negative. If countries within the monetary union are penalized less based on their own fundamentals β_2^{EMU} would be negative and β_3^{EMU}

would be positive. Moreover, we expect a negative impact of the GDP growth rate, Net International Investment Position and the World Economic Climate. We assumed as well a positive comovement with the European short term interest rate.
In order to meet the stationarity criterion, the model explains the first difference of the 10-year-maturity bond yields. As the role of the model is to account for time and entity-specificity envisaged by the financial stress and fiscal characteristics, we used random effects ordinary least squares estimator with a standard error robust to autocorrelation and heteroscedasticity.
We presumed that estimates might be biased because of endogeneity in the model, resulting from simultaneity between government debt and long term interest rates. Simultaneity may come from the fact that a shift in the yield has a direct influence on its total stock, as newly emitted debt is subject to higher interest expenses (Ardagna *et al.* 2004). Thus, apart from OLS, we applied instrumental variable estimation, instrumenting general government debt with its first lag and constant term. As the constant term appeared to be statistically significant in the auxiliary equation, we confirmed our conviction that IV regression should be used instead of OLS with lagged debt as an explanatory variable. For the verification of our presumption about endogeneity we performed a Hausman test, that at the confidence level 0.05 suggested rejecting the null which is the difference between least squares and instrumental variables regression is not systematic. We concluded that it was necessary to account for endogeneity.
The specification of the model has been tested thoroughly. Before estimating the model, using a rule of thumb, we verified the possible problem of multicolinearity between the exogenous variables. As values of Variance Inflation Factor were less than five, there were no signals of multicollinearity. We investigated as well the possible problem of non-stationarity and applied the Fischer panel unit root tests which are able to deal with unbalanced panels. Tests were performed on the bond yield and all the exogenous variables. Results suggested rejecting the null at the confidence level 0.05 and did not justify the use of the panel co-integration model. Specification of the model has also been tested for entity and time fixed effects. All performed tests confirmed the proper specification of the model.

5 Empirical results

The bi-variate correlation coefficients presented in Table 3 suggest an intricate pattern in the links between the fiscal variables, the economic climate and the yields on government securities. Simple correlation coefficients between the long-term interest rate and explanatory variables are statistically insignificant. Interestingly, the correlation between the cost of debt with the short term interest rate on Eurobonds and the volatility on stock markets is very close to zero. However, these results may appear counter-intuitive, they suggest that the pattern of the links between variables is not simple and that there are numerous other factors determining the sovereign

bond yield.

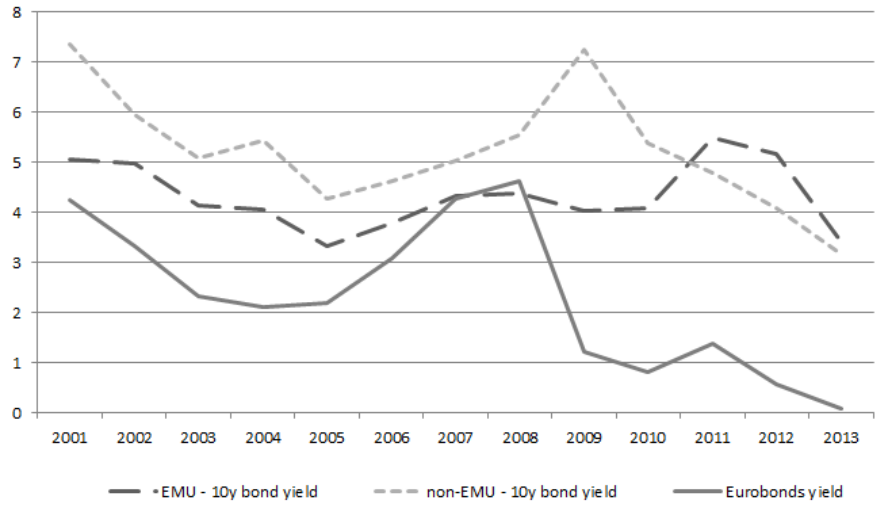
Table 3: Bi-variate correlation of variables

	i^{10y}	dy	dy^{emu}	GD	GD^{emu}	WEC	σ^2	i^{3m}	$NIIP$
i^{10y}	1.00								
dy	-0.30	1.00							
dy^{emu}	-0.11	0.71	1.00						
GD	0.17	-0.38	-0.10	1.00					
GD^{emu}	0.07	-0.44	-0.39	0.27	1.00				
WEC	-0.15	0.59	0.84	-0.07	-0.24	1.00			
σ^2	0.00	-0.10	-0.11	-0.06	-0.11	-0.29	1.00		
i^{3m}	0.00	0.37	0.39	-0.22	-0.82	0.02	0.39	1.00	
$NIIP$	-0.49	0.09	0.06	-0.15	-0.13	0.06	-0.06	0.06	1.00

The main question behind this study is to answer if common credibility of the EMU countries has an important role in the pattern of valuation of the sovereign bond yields. We kept in mind the substantial role of countries economic and fiscal fundamentals and assumed that world economic climate and tensions on financial markets are other important determinants. Even with such a wide inclusion of explanatory variables, we would have omitted important reasons for the currently very low level of yields if did not use the short-term interest rate as an explanatory variable. Graph 2 presents a formation of the average level bond yields in EMU and non-EMU Member States set together with the yield of 3-month-maturity Eurobonds. Long-term interest rates co-move with the short-term interest rate, which since 2009 has been driven, to a large extent, by the spill overs from the monetary policy of Federal Reserve Bank. During all periods of Quantitative Easing (QE1 - from Nov '08 to Aug '10, QE2 - from Nov '10 to Sep '11, QE3 - from Sep '12) we can observe sudden declines in interest rates. To capture such effects, which are beyond our explanatory power of included variables, we have used the yield of Eurobonds as an instrument.

The econometric analysis proved the assumption right. Fiscal fundamentals and GDP growth had a very important influence on the cost of public debt in the EU Member States. According to instrumental variables estimation, higher by one percentage point fiscal deficits increase the cost of public debt by 349 basis points in the non-EMU Member States and by 47 basis points in the EMU Member Countries. On the other hand, the cost of sovereign debt for the euro area countries goes up by 215 basis points in response to a one percentage increase in the average EMU fiscal deficit. The cost of debt significantly depends on the GDP growth. One percentage growth of GDP decreases this cost by 317 basis points in EMU Member States and by 52 in the remaining EU countries. If the euro zone experiences an increase in GDP by one percentage point, the cost of newly emitted debt of the EMU Member States will be

Figure 2: Bond yields in EMU and non-EMU economies



lowered by 204 basis points. All estimates are presented in Table 4.

These numbers are very significant for policy-making. They prove the existence of unique circumstances of membership in a currency area. Even though, there are several other reasons why countries may run excessive deficits, an in-variance to the fundamental factor valuation of the cost of government debt creates substantial incentives for profligacy of euro governments.

Our estimation suggests some secondary takeaways. Firstly, we proved the significance of the Net International Investment Position in determining the cost of sovereign debt. As the volatile economic times capital may be withdrawn, countries with low NIIP are in danger of devaluation and fiscal problems. Secondly, according to the assumptions, the economic climate and financial stress are linked with the valuation of the cost of debt. The better the economic climate, the higher the price of public debt. This might be due a growing popularity of more risky assets than government bonds in sound economic times. On the other hand, the interest rate on government bonds is higher, when stock exchange indexes are more volatile. We bear in mind that there are other factors determining the yield of government bonds, which were not fully addressed with the model. We captured these effects by applying the instrument of 3-month-maturity Eurobonds.

Robustness of the estimates was verified in two ways. Firstly, the model was estimated for the EU Member States in the time period 2009-2013. Signs of the estimates were identical with those in the baseline regression. On the other hand, the impact of variables was significantly stronger. In line with our assumptions, markets were

Table 4: Baseline regression estimates

		OLS		IV	
		Coeff.	Std. Error	Coeff.	Std. Error
World Economic Climate	α_1	0.036	0.007 (***)	0.040	0.009 (***)
stocks conditional volatility	α_2	0.058	0.081	0.281	0.109 (***)
NIIP	β_1	-1.316	0.572 (**)	-1.274	0.557 (**)
general government debt	β_2	0.060	0.026 (**)	0.349	0.070 (***)
(own fundamentals)	β_2^{EMU}	-0.005	0.032	-0.302	0.076 (***)
GDP growth	β_3	-0.351	0.030 (***)	-0.317	0.037 (***)
(own fundamentals)	β_3^{EMU}	0.308	0.057 (***)	0.265	0.070 (***)
general government debt	β_2	0.060	0.026 (**)	0.349	0.070 (***)
(EMU fundamentals)	γ_1^{EMU}	0.079	0.037 (**)	0.215	0.057 (**)
GDP growth	β_3	-0.351	0.030 (***)	-0.317	0.037 (***)
(EMU fundamentals)	γ_2^{EMU}	-0.183	0.071 (**)	-0.204	0.088 (**)
yield of 3M Eurobonds	ζ_1	0.637	0.096 (***)	1.000	0.149 (***)
	const	-0.198	0.076 (***)	-0.398	0.109 (***)

Note: (***) denotes significance at the 1 percent level, (**) at the 5 percent level and (*) at the 10 percent level.

overreacting during the period of global financial crisis. We checked the robustness of the model by also eliminating the sample countries that had serious fiscal problems during the crisis, i.e.: Greece, Hungary, Ireland, Portugal, Slovenia and Spain. Estimates proved that the cost of debt of prudent countries also depends on fiscal fundamentals, economic growth, the economic climate and membership in the EMU. As expected, the impact of those factors was more modest than in the entire group of counties. The estimates of two alternative instrumental variables regressions are presented in Table 5.

6 Conclusions

Using cross-country empirical analysis, this paper has verified that the pattern in which fiscal deficits and GDP growth affects the cost of the EMU Member States and remaining EU countries. Results proved that the scheme, in which markets evaluate the fiscal sustainability of countries that belong to currency areas, is based mostly on the entire unions fundamental conditions. The EMU Member States which are backed by common credibility often experience additional incentives for profligacy because they are not penalized by markets. Depending on the model specification, time span and countries covered, the market's penalty for sluggish growth or extensive deficits would be 4 to 7 times stronger for standalone countries. Such a difference in

Table 5: Robustness checks – alternative regression estimates

		IV (2009-2013)		IV (prudent MS)	
		Coeff.	Std. Error	Coeff.	Std. Error
World Economic Climate	α_1	0.029	0.014 (**)	0.039	0.007 (***)
stocks conditional volatility	α_2	0.387	0.152 (**)	0.174	0.080 (**)
NIIP	β_1	-1.281	0.925	-0.767	0.574
general government debt	β_2	0.525	0.129 (***)	0.048	0.039
(own fundamentals)	β_2^{EMU}	-0.466	0.130 (***)	-0.036	0.050
GDP growth	β_3	-0.309	0.049 (***)	-0.333	0.024 (***)
(own fundamentals)	β_3^{EMU}	0.227	0.092 (**)	0.266	0.068 (***)
general government debt	β_2	0.525	0.129 (***)	0.048	0.039
(EMU fundamentals)	γ_1^{EMU}	0.403	0.119 (***)	0.076	0.045 (*)
GDP growth	β_3	-0.309	0.049 (***)	-0.333	0.024 (***)
(EMU fundamentals)	γ_2^{EMU}	-0.149	0.123	-0.079	0.086
yield of 3M Eurobonds	ζ_1	1.497	0.328 (***)	0.368	0.115 (***)
	const	-0.896	0.269 (***)	-0.134	0.095

Note: (***) denotes significance at the 1 percent level, (**) at the 5 percent level and (*) at the 10 percent level.

magnitude of the impact has very important implications. This result complements the existing literature in this field, which omitted the impact of the membership in currency areas.

This paper has also assessed the general impact of the fundamental factors on market interest rates. Even though intangible economic climate and financial stress substantially affect the interest rate, fundamental factors like fiscal deficit, GDP growth and Net International Investment Position are crucial for the valuation of 10-year-maturity government bond yields.

Investigated patterns apply for both prudent and imprudent countries during stable and volatile economic times. The examined effects are robust, statistically significant and important for policy making. They suggest that fiscal policy on a country level with lack of the union's supervision and coordination might not be sustainable. It shall be a concern for EMU authorities who focus on implementing strong and credible incentive mechanisms to keep Member States' fiscal policy in track. As markets believe in potential bailouts, they no longer oversee the economic soundness of the EMU Member States. In line with the direction already taken by strengthening the Stability and Growth Pact in 2011, the coordination of fiscal policies should be further reinforced.

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Appendix I

Table 1: Robustness checks – alternative regression estimates

		coefficient	p-value			coefficient	p-value
	α_0	0.006	0.031		α_0	1.839	0.197
Austria	α_1	-0.098	0.000	**Belgium**	α_1	0.024	0.000
(ATX)	β_0	0.000	0.000	**(BEL20)**	β_0	16.169	0.000
	β_1	0.063	0.000		β_1	0.112	0.000
	β_2	0.935	0.000		β_2	0.877	0.000
	α_0	0.185	0.004		α_0	-48.953	0.100
Bulgaria	α_1	0.133	0.000	**Croatia**	α_1	-0.084	0.000
(SOFIX)	β_0	0.633	0.000	**(CROBEX)**	β_0	0.101	0.000
	β_1	0.251	0.000		β_1	0.341	0.000
	β_2	0.738	0.000		β_2	-0.025	0.394
	α_0	-0.235	0.660		α_0	0.584	0.000
Cyprus	α_1	0.178	0.000	**Czech Rep.**	α_1	0.033	0.087
(FTSE	β_0	46.597	0.000	**(PX)**	β_0	0.939	0.000
/CySE20)	β_1	0.227	0.000		β_1	0.128	0.000
	β_2	0.764	0.000		β_2	0.867	0.000
	α_0	4.441	0.000		α_0	3.787	0.012
UK	α_1	0.107	0.000	**Finland**	α_1	0.017	0.202
(FTSE)	β_0	43.166	0.000	**(OMX**	β_0	60.380	0.000
	β_1	0.119	0.0000	**Helsinki)**	β_1	0.051	0.000
	β_2	0.885	0.000		β_2	0.943	0.000
	α_0	2.089	0.010		α_0	3.544	0.01
France	α_1	-0.046	0.017	**Germany**	α_1	-0.020	0.301
(CAC40)	β_0	29.268	0.000	**(DAX)**	β_0	29.643	0.000
	β_1	0.077	0.000		β_1	0.074	0.000
	β_2	0.914	0.000		β_2	0.923	0.000
	α_0	0.659	0.151		α_0	6.824	0.020
Greece	α_1	0.083	0.000	**Hungary**	α_1	0.023	0.223
(Athex20)	β_0	8.900	0.000	**(BUX)**	β_0	123.780	0.003
	β_1	0.092	0.000		β_1	0.088	0.000
	β_2	0.905	0.000		β_2	0.915	0.000

Table 2: Robustness checks – alternative regression estimates

		coefficient	p-value			coefficient	p-value
	α_0	2.672	0.001		α_0	8.123	0.113
Ireland	α_1	0.434	0.019	**Italy**	α_1	-0.030	0.120
(ISEQ20)	β_0	33.570	0.000	**(FTSE MIB)**	β_0	1388.525	0.000
	β_1	0.089	0.000		β_1	0.978	0.000
	β_2	0.905	0.000		β_2	0.912	0.000
	α_0	0.256	0.000		α_0	0.062	0.000
Latvia	α_1	-0.069	0.000	**Lithuania**	α_1	0.141	0.000
(OMX	β_0	0.187	0.000	**(OMX**	β_0	0.005	0.000
Riga)	β_1	0.139	0.000	**Vilnius**)	β_1	0.121	0.000
	β_2	0.869	0.000		β_2	0.899	0.000
	α_0	23.751	0.000		α_0	0.181	0.008
Luxembourg	α_1	-0.178	0.000	**Netherlands**	α_1	—	—
(LUXX)	β_0	0.505	0.000	**(AEX)**	β_0	0.221	0.000
	β_1	-0.073	0.000		β_1	0.086	0.000
	β_2	-0.777	0.000		β_2	0.905	0.000
	α_0	0.831	0.073		α_0	1.512	0.000
Poland	α_1	0.029	0.133	**Romania**	α_1	0.119	0.000
(WIG20)	β_0	3.668	0.002	**(BET-10)**	β_0	3.986	0.000
	β_1	0.054	0.000		β_1	0.235	0.000
	β_2	0.943	0.000		β_2	0.815	0.000
	α_0	0.046	0.272		α_0	-9.197	0.409
Slovakia	α_1	-0.065	0.000	**Slovenia**	α_1	—	—
(SAX)	β_0	0.024	0.000	**(SBI20)**	β_0	271183	0.000
	β_1	0.034	0.000		β_1	0.559	0.000
	β_2	0.966	0.000		β_2	-0.141	0.000
	α_0	5.231	0.005		α_0	0.522	0.002
Spain	α_1	—	—	**Sweden**	α_1	-0.028	0.122
(IBEX35)	β_0	95.716	0.000	**(OMX**	β_0	0.676	0.000
	β_1	0.077	0.000	**Stockholm)**	β_1	0.060	0.000
	β_2	0.920	0.000		β_2	0.937	0.000