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Does the halo effect still hold? Implications for the euro-candidates from the analysis of the EA bond market –the crisis perspective.

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Abstract

The euro area bond yield spreads have largely converged since the beginning of the EMU. However, during the crisis most eurozone members reported dramatic rise in government bond yield differentials to German Bunds due to deteriorating public finance and liquidity conditions as well as increase in investors' risk aversion. This paper provides an empirical analysis of determinants of government bond yield spreads in the euro area in the times of crisis. It indicates the significance of countries' fiscal performance and liquidity risk in explaining the evolution of bond differentials. It also demonstrates the conviction that credit rating is a forward looking variable, which financial markets immediately respond to, was inappropriate. It is proved credit rating is only a derivative factor of fiscal variables, not the fundamental one. Sovereign debt crisis led to change in the perception of EMU sovereign debt market. Nowadays, euro adoption does not automatically imply the lower profitability of new EA members' bonds. There is no more such a thing as "euro area level of interest rate". It seems to be more conditional on countries' macroeconomic policy. However, on the basis of panel estimation, it turned out that in case of almost all euro-candidates the theoretical values of the EMU convergence criterion bond yields (as they were the euro area members) would be significantly lower than the empirical ones. This suggests fiscal benefits from euro adoption might be substantial thus most countries with derogation should reassess their scale.

JEL Classification: C23, E43, F34, H63
Keywords: euro area, sovereign bond yield spreads, convergence criteria, panel data

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1 Introduction

The financial crisis that started in 2007 had a great impact on the government bond market in the euro area. Euro area yield spreads have largely converged since the starting of the Economic and Monetary Union (EMU) and have been relatively close until mid-2008 (see Appendix 1). However, since September 2008 the long-term government bond yield spreads to Germany have widened remarkably in the most euro area countries. In March 2009, spread of the Greek 10-year sovereign bonds to the benchmark German Bund increased from 30 bps to 270 bps.

Most euro area countries reported dramatic rise in government bond yields differentials to Germany as well. Sovereign yield spreads to German bonds widened due to deteriorating public finance and liquidity conditions in international markets, as well as an increase in general investors' risk aversion. This in turn influenced the countries' capacity to meet their future debt obligations and made investors less willing to provide funding on sovereign borrowers.

The evolution of sovereign bond spreads vis-à-vis Germany was widely commented as a reassessment and differentiation of country risks. This is an important issue in the context of the European fiscal framework. Not only did the Stability and Growth Pact indicate the concept of peer pressure, i.e. European countries force some EU members with excessive deficits to correct them, but also stressed the idea of financial markets' pressure on countries with unsustainable fiscal positions. However, the differentiation of country risk across the euro area countries was not considered before the financial crisis. The free rider problem was observed in the euro area.

The economic literature has responded very actively to the euro area sovereign debt crisis but most existing studies do not capture the most recent and intense phase of the eurozone crisis (2009 onwards) and do not analyse the bond profitability during the crisis. The previous empirical studies usually did not take into account all euro area countries and match fiscal variables with credit and liquidity risk or market perception of the country's performance.

The purpose of this study is to identify the determinants of yield spreads in euro area taking into account crisis period and test empirically their influence on government bond yields in the euro area and countries with derogation – NMS-7[1] . Panel estimation will let calculate the theoretical value of these countries' interest rates as if they were the euro area member. This would enable reassess most of fiscal benefits from accessing the common currency area.

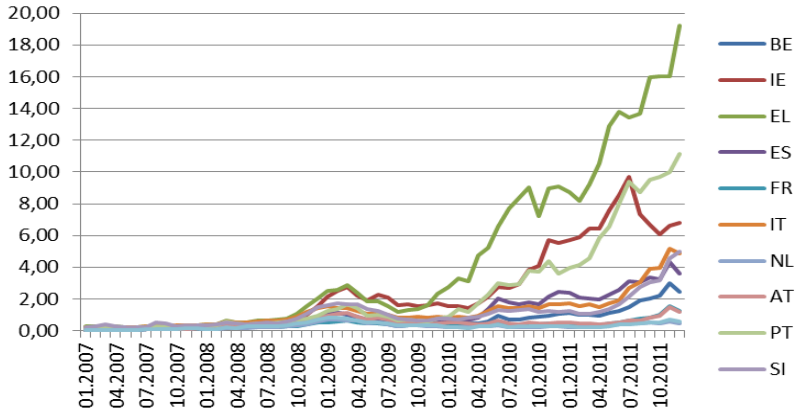
The paper is structured as follows: Section 2 reviews the determinants of yield spreads in the euro area indicated in the economic literature; Section 3 describes the methodology, data and presents the results of empirical study; Section 4 shows the implications for euro-candidates and Section 5 summarizes main findings, discuss the implications of the results and indicates fields for future research.

[1]NMS-7 New Member States: Bulgaria, Lithuania, Poland, The Czech Republic, Latvia, Romania and Hungary

2 Determinants of yield spreads in the euro area - literature review

The beginning of the empirical analysis of government bond yields was in 1984 when Edwards published in the American Economic Review his working paper "LDC Foreign Borrowing and Default Risk: An Empirical Investigation, 1976-80". He related then sovereign spreads to the market perception of countries' default risk. However, the euro area sovereign debt crisis brought forward in the debate the importance of the solvency risk in countries with weak fiscal fundamentals and the risk of contagion among euro area countries' sovereign bond spreads. The figure below presents the range of the government bonds spreads to German Bund in 2007-2011:

Figure 1: Government bonds spreads to German Bund



Source: Dataset/Eurostat

Sovereign bond spreads may be explained by a set of macroeconomic, financial or fiscal variables as well as investors' assessment of a country's creditworthiness. Studies conducted so far analysed both euro area-wide and country-specific characteristics that exert a significant impact on the sovereign bond spreads in the EA. Most researchers indicate similar factors which contribute to fluctuations of bond yield spread to German Bund, which are presented below.

Credit risk. There are three types of credit risk:

- default risk – the probability that the issuer fails to meet the obligations on coupon payments or repayment of principal at maturity,
- credit spread risk – the probability that the market value of the bond will decline more than the value of other comparable quality bonds,

- downgrade risk – the possibility of a downgrade by a credit rating agency.

  As Barrios et al. (2009) point out, the financial crisis has had a significant impact on all three types of credit risks. The deterioration of fiscal position brought about a discussion about the sustainability of public finances. Besides such indicators as government debt and deficit, high current account deficits in some euro area countries intensified markets' perception as these countries were perceived as vulnerable to reversals in international flows of funding. In addition, credit rating agencies downgraded the debt of several euro area sovereign issuers. This might have directly influenced institutional investor portfolio allocation decision due to the managers' limits on investment depending on the credit rating. Moreover, during the crisis governments have taken on large liabilities which are likely to affect their perceived creditworthiness. Credit risk premium depends on each issuer's specific factors, which determine the level of risk. This variable is also determined by the degree of investors' risk aversion and global uncertainty concerning international financial markets. In times of lower risk appetite the global risk premium tends to increase. This contributes to an increase in the yield spreads of countries which are assessed as having a higher default risk in comparison to lower risk countries. In case of the deterioration of a country's default risk, the increase in the global risk premium also consolidates the impact of this deterioration on spreads. Credit risk may be influenced by large current account deficits in some EA countries. The financial crisis intensified the risk for these countries to report prolonged periods of low economic growth and sudden stops in external financing. Countries with higher current account deficits have experienced sharper increases in bond yield spreads versus Germany.

Liquidity risk. National bond markets in the euro area are different in terms of liquidity. The factors that determine liquidity include the issuing volume, the national issuing policy and the existence of sufficiently liquid futures markets that offer hedging possibilities to investors. Liquidity risk and credit risk are interconnected. On the one hand, an increased supply of government bonds, as observed in 2009, should put downward pressure on liquidity premia. On the other hand, high supply is also associated with increased public deficit and debt and thus a higher credit risk premium. The return demanded by investors is expected to be lower for bonds that can be traded quickly, at low cost and without major price changes. Barbosa and Costa (2010) concluded that in times of increased macroeconomic uncertainty and greater volatility in financial markets, there is a higher likelihood of the need to unwind an investment position quickly. This should increase the demand for assets that can be traded at low cost. In these periods, higher liquidity risk contributes to an increase in liquidity premiums, suggesting the existence of a positive correlation between liquidity and credit risk premiums.

General investors' risk aversion. In times of financial uncertainty, investors rebalance their portfolio and prefer to invest in less risky securities as their risk aversion increases. In principle, all government bonds should benefit from it because they are considered as less risky than other assets. However, among euro-area sovereign issuers the German Bund is perceived to be the "safest haven" both in terms of credit quality ("default-free") and liquidity. Therefore, in times of high risk aversion, the "flight-to-safety" and "flight-to-liquidity" flows to the German government bond market are more pronounced than for other sovereign bonds. According to Bernoth and Erdogan (2010), in periods of high global risk aversion, the interest rate differentials of EMU countries versus Germany rose. Two years before the fall of Lehman Brothers, the impact of the global risk factor on euro area yield differentials increased continuously and became significant again. Thus, financial markets started worrying about the countries' creditworthiness long before the outbreak of the financial crisis.

Higher likelihood of default risk, and deterioration in market liquidity. According to Schwarz (2010), determining which component plays the larger role is important for policymakers and investors. If the main component is default risk, only actions to improve the solvency of the issuer are likely to be successful. Whereas if the main driver is market liquidity, measures to improve market functioning are most appropriate. Fiscal rules. Fiscal rules do not have a significant explanatory role regarding sovereign bond yields as such. However, as Iara and Wolff (2010) underline, they are highly relevant when investors become risk averse. When global risk aversion increases, countries with better fiscal rules witness lower increases of sovereign bond yields relative to Germany. Better fiscal rules can thus effectively reduce sovereign bond spreads in times of turbulences in international markets. Stronger fiscal rules turn out to be of great importance to contain sovereign bond spreads in times of elevated market uncertainty in particular. Under extreme circumstances, better fiscal rules can reduce sovereign bond spreads between euro area member states and Germany. There is a proxy variable for fiscal rules compiled by the European Commission which is a compilation of statutory base of the rule, room for revising objectives, mechanisms of monitoring compliance with the enforcement of the rule, existence of pre-defined enforcement mechanisms and media visibility of the rule.

High persistence and regime switching effects. Georgoutsos and Migiakis (2010) point out that the regime switching formulation enables the reflection of the different effects exercised by the credit conditions on the spreads of European sovereign bond yields with the yields of the Bund. Specifically, the spread of yields of the European corporate bonds with an AAA rating against the Bund exercises, in the majority of the cases, negative and significant effects on the European sovereign bond spreads under the high volatility regime and positive under the low volatility one. On the other hand, the spread between BBB European corporate bonds and

the Bund exercise positive effects, in most cases, under the high volatility specification and positive under the low volatility one. This indicates that under high volatility conditions, most of the European sovereign and high credit quality corporate bonds are seen as substitutes while a deterioration of credit conditions reflected in corporate bond yields of the lower bound of the investment category leads to increases in European sovereign bond yields as well. However, the limited significance of these effects under low volatility conditions indicates that corporate credit conditions are not always a determinant of sovereign bond yields' movements.

Deterioration of the fiscal position (in terms of debt and deficit). Before the financial crisis, financial markets paid no attention to government deficit ratios, while they almost continuously monitored the (projected) debt to GDP ratio of the individual countries, which is also the more relevant variable to assess fiscal sustainability. Fiscal development is also taken into consideration while assessing growth prospects of an economy and the government's commitment to repay (De Santis, 2012).

Country's financial sector soundness and its price competitiveness. As Dötz and Fischer (2010) indicate, the combined effect of both variables has proved important for spread developments during the crisis. This suggests that price competitiveness moved into investors' focus as financial sector soundness weakened. Effect of country's financial sector soundness and its price competitiveness is expressed by country rating.

3 Empirical study

3.1 Methodology

Estimation is conducted via cross-sectional time-series regression model with first-order autoregressive disturbance. It offers a GLS estimator for random-effects model:

$$y_{it} = \alpha + \chi_{it}\beta + \nu_i + \varepsilon_{it} \qquad \text{i =1, ..., N; t=1, ..., T}_\text{i}$$

where $\varepsilon_{it} = \rho_{i,t-1} + \eta_{it}$; $\mid \rho \mid < 1$; η_{it} is independent and identically distributed (i.i.d.) with mean 0 and variance σ_n^2 and ν_i is assumed to be realizations of an i.i.d. process with mean 0 and variance σ_ν^2 and independent of the χ_{it}.

3.2 Data description

The dependent variable is 10-year EMU convergence criterion bond yields published by the Eurostat. The most commonly used indicators of a country's fiscal position are the general government debt and deficit ratio to GDP. The deterioration of fiscal position informs investors about increasing risk of sustainability of a country's fiscal policy. The expected sign of these variables is positive, i.e. increasing deficit/debt should raise the bond yields.

5-year CDS spreads relative to Germany, published by Bloomberg, were applied to measure credit risk. However, movements in sovereign CDS premiums may not only reflect changes in the assessment of the credit quality but also changes in global risk perception. As credit risk may be influenced by large current account deficits in some EA countries, the current account balance relative to GDP was also included in the analysis.

As a measure of price competitiveness log of the real effective exchange rate deflated by consumer price indices was applied in the estimation.

To assess liquidity risk, 10-year bid-ask spreads of treasury bonds (published by Reuters) were included according to the literature. Bid-ask spreads are better indicators for gauging liquidity conditions in bond markets than traded volume because volume data may be affected by multiple operations between bank's affiliates to meet balance sheet requirements. Thus, big variations in traded volumes might have little bearing on actual liquidity.

In this analysis, ratings reported by Standard&Poors, Moody's and Fitch were expressed as numbers (in line with each agency's scale – Appendix 4) and then transformed into one indicator – an arithmetic mean of three ratings because of m-collinearity. This indicator is both a proxy of country's financial sector soundness and sovereign credit risk.

The additional variable is fiscal rule index (European Commission's forecast for 2010 and 2011). This index has been constructed by the fiscal policy unit of the European Commission's Directorate-General for Economic and Financial Affairs on the basis of information on fiscal governance obtained from the EU member states via the Economic Policy Committee of the Ecofin Council of the EU. An improvement of the index is achieved by strengthening one or several existing numerical fiscal rules either by introducing new numerical fiscal rules or by extending the coverage of general government rules. The methodology of the fiscal rule index caluculations is presented in Table 1.

3.3 Estimation results

The base (benchmark) model covered 12 euro area countries (balanced panel). Estonia, Cyprus, Malta and Slovakia were excluded as they were not the EMU members through the whole period 2007-2011 and Luxembourg was not analysed due to widely developed financial sector which disturbed the estimation. The results of estimation are presented in Table 2.

Looking at the results, debt (as fiscal variable) proved to be a significant determinant in explaining bond yields evolution. The positive sign of the coefficient suggests an increase in bond yield spreads in case of rising general government debt. It is worth underlining that before the crisis, financial markets paid no attention to government deficit ratios, while they almost continuously monitored the (projected) debt to GDP ratio of the individual countries. In this analysis, covering the crisis period, the influence of the deficit ratio turned out to be of less importance.

The results also reveal an important role of credit risk in driving yield spreads up. An increase of 1 basis point in the CDS spread (i.e. a relative rise

Table 1: Characteristics of fiscal rules by 5 dimensions

From information on characteristics of fiscal rules, a composite Fiscal Rule Index is obtained as follows. First, a Fiscal Rule Strength Index (FRSI) is calculated taking into account five criteria:
Criterion 1: Statutory/legal base of the rule
4 constitutional base
3 the rule is based on a legal act (e.g. Public finance Act, Fiscal Responsibility Law)
2 the rule is based on a coalition agreement or an agreement reached by different general government tiers (and not enshrined in a legal act)
1 political commitment by a given authority (central/local government, minister of finance)
Criterion 2: Room for setting or revising objectives
3 there is no margin for adjusting objectives 2 there is some but constrained margin in setting or adjusting objectives
1 there is complete freedom in setting objectives (the statutory base of the rule merely contains broad principles or the obligation for the government or the relevant authority to set targets)
Criterion 3: Nature of the body in charge of monitoring respect and enforcement of the rule The score of this criterion index is constructed as a simple average of the two elements below:
Nature of the body in charge of monitoring respect of the rule
3 monitoring by an independent authority (Fiscal Council, Court of Auditors or any other Court) or the national Parliament
2 monitoring by the ministry of finance or any other government body
1 no regular public monitoring of the rule (there is no report systematically assessing compliance)
Nature of the body in charge of enforcement of the rule
3 enforcement by an independent authority (Fiscal Council or any Court) or the national Parliament
2 enforcement by the ministry of finance or any other government body
1 no specific body in charge of enforcement
Criterion 4: Enforcement mechanisms of the rule
4 there are automatic correction and sanction mechanisms in case of non-compliance
3 there is an automatic correction mechanism in case of non-compliance and the possibility of imposing sanctions
2 the authority responsible is obliged to take corrective measures in case of non-compliance or is obliged to present corrective proposals to Parliament or the relevant authority
1 there is no ex-ante defined actions in case of non-compliance
Criterion 5: Media visibility of the rule
3 observance of the rule is closely monitored by the media; non-compliance is likely to trigger public debate
2 high media interest in rule compliance, but non-compliance is unlikely to invoke public debate
1 no or modest interest of the media

Source: European Commission

Table 2: Results of panel estimation

```
RE GLS regression with AR(1) disturbances       Number of obs      =       720
Group variable: id                              Number of groups   =        12

R-sq:  within  = 0.5739                         Obs per group: min =        60
       between = 0.7295                                        avg =      60.0
       overall = 0.5789                                        max =        60

                                                Wald chi2(5)       =    287.54
corr(u_i, Xb)      = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
 emu_in_rate |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        debt |   1.278266   .5231853     2.44   0.015     .2528418     2.30369
         cds |   .0009569   .0000959     9.98   0.000      .000769    .0011448
   bidask_10 |   .1622186   .0962155     1.69   0.092    -.0263603    .3507975
 fiscal_rule |  -.6930837   .2303919    -3.01   0.003    -1.144644   -.2415238
       _cons |   3.631826    .443237     8.19   0.000     2.763097    4.500554
-------------+----------------------------------------------------------------
      rho_ar |    .967686   (estimated autocorrelation coefficient)
     sigma_u |  .28937583
     sigma_e |  .32663682
     rho_fov |  .43973312   (fraction of variance due to u_i)
       theta |  .11411913
------------------------------------------------------------------------------
```

Source: Author's estimations based on Stata 11

on the insurance costs of 1,000 euro per 10 million euro of government debt compared to Germany) leads to an increase of 0.001 basis points in the 10-year government bond yield spread.

Liquidity seems to play a meaningful role in explaining the evolution of yield spreads. The positive coefficient means that an increase in the bid-ask spread, which means that the market is less liquid, leads to an increase in the yield spread.

In line with the literature, the estimation results indicate that better fiscal rules reduce sovereign bond spreads in times of turbulences in international markets.

It is worth mentioning that during model estimation it turned out that in cases when credit rating is applied in the model such variables as general government (g.g.) debt and fiscal rule index become insignificant. This suggests that credit rating absorbs the effects of debt and fiscal rules. The addition of credit rating to the estimation also increases artificially the value of R-sq statistics to about 0.84 while the between indicator comes to 0.92 (see Appendix 2).

However, this does not imply that government balances do not play an important role during the crisis. As Roberto A. De Santis (2012) points out, the euro area countries with the largest government deficits-debt combination and therefore with the highest credit risk were subject to numerous credit rating changes and mostly affected by the crisis. Credit ratings published by the credit agencies are a key determinant of the euro area sovereign yield spreads because they are based on the assessments which consider past, current and future fiscal performance. Besides, rating agencies take into account prospects of an economy and the government's commitment to repay. All these factors made credit ratings a forward looking variable which financial markets immediately

respond to. However, this analysis indicates that credit ratings did not predict the market perception of the country in the crisis. Moreover, it is only a derivative factor (of fiscal performance) not the fundamental one which describes the current financial standing of a given country.

To ensure that the findings are solid, there was another model estimated (unbalanced panel) which considered all 17 euro area members (see Appendix 3). The results of both models remain broadly invariant and it suggests that the base model is static and robust. The static model is necessary to estimate the theoretical value of sovereign bond yield spreads for countries with derogation, inter alia Poland.

The analysis confirms the importance of countries' fiscal performance not only in the crisis but also after this period. Besides, this paper supports the 'convergence trade' hypothesis for the pre-crisis period, described by Arghyrou and Kontonikas (2010), according to which before the credit crunch markets took into consideration only the best-case scenario of full convergence to German fundamentals, even in case of countries displaying a deterioration of their macro-fundamentals. Neither poor macro-fundamentals nor the very low risk factor were priced. This approach has changed dramatically during and after the crisis period – currently markets are pricing both the international risk factor and individual fiscal performance on a country-by-country basis. The previous behaviour could be explained by three factors:

- stable global liquidity over the major part of the last decade,
- expectations that euro adoption would result in growth-inducing reforms in periphery countries,
- lack of a mechanism establishing credibility for the "no-bail-out" clause of the Maastricht Treaty.

It seems that markets were functioning with the certainty that there was very little default risk associated with investment in EMU sovereign bonds. In addition, the lack of a proper EU mechanism of monitoring imposing reforms relaxed market pressure on EMU governments to improve macro-fundamentals. This, in turn, resulted in further real divergence within the euro area. In effect, despite the fact that normalization of the global economic outlook may narrow EMU spreads, bond yield spreads are to remain in high levels as long as intra-EMU imbalances maintain.

Moreover, the persistence of spreads proves that the EMU countries have experienced contagion from Greece. The Greek bond yield has become the EMU risk factor. The difference in spread values were observed between Greece and other periphery EMU countries with different economic performance. Neither this nor the escalation of the Greek debt crisis can be explained by the double regime-shift. In November 2009 Greece was transformed from a regime of fully credible commitment to future EMU participation under the perception of fully guaranteed fiscal liabilities into a regime of non-fully credible EMU commitment without fiscal guarantees. In brief, the Greek crisis has turned into the EMU-wide problem.

The crisis has exposed the necessity of institutional reforms at the union level in two directions. On the one hand, the eurozone must improve mechanisms of fiscal governance and policy coordination. On the other hand, it is essential to be able to prevent the EMU countries from debt crisis contagion, if any occurs among the euro area members. In order to achieve these goals, it is important to create a permanent mechanism of emergency financing and reassuring investors that there is no default risk associated with the EMU sovereign bonds.

4 Implications for euro-candidates

The euro adoption is associated with significant changes that the joining country faces. First of all, the nominal exchange rate adjustment against other countries are no longer possible. Secondly, the monetary policy is set by the European Central Bank and it may not be optimal for all member states. Moreover, participating in the monetary union may imply adoption of fiscal stringent measures such as Fiscal Compact. Having that in mind, it is necessary for the euro area candidates countries to estimate costs and benefits from monetary integration, i.e. fiscal benefits from euro adoption, when deciding on the timing of euro adoption.

Szczerbak et al. (2009) estimate influence of euro adoption's influence on public debt management. First, lower interest rates in the euro area lead to decrease in debt service costs. Savings stem from the convergence of the market interest rates, measured by swap values, and an increase in the issuer's creditworthiness. Second, the national financial market will become a part of a much bigger and more liquid euro market. The access to this market will dramatically decrease the risk of demand barrier and let the debt manager create the risk profile without restraint. The limited issuer's influence on the market prices and the direct competition of other government issuers belong to the supply factors. Third, the strategy of debt management costs minimization in the long term will take place in new external conditions so it will be necessary to adjust the institutional structure of debt management to challenges and opportunities the euro market offers. Last but not least, the euro adoption will be followed by converting public debt and other benefits from zloty to euro which requires adjustments of clearing and deposit infrastructure on the national market.

In order to estimate the influence of euro adoption on the long-term interest rate level, theoretical values of the EMU convergence criterion bond yields were calculated. They were assessed on the basis of the estimations results (see previous section) with the assumption of unchanged fundamental factors. The disparity between the empirical and theoretical values results from a different appraisal of debt instruments by the financial markets, when a given country is a EA Member State. Thus, the benefits from euro adoption are assessed in the pessimistic scenario, which does not cover the positive changes in other factors implied in this analysis, i.e. lower general government debt. The results of this calculations are presented in Table 3 (the German level of the interest rate is given as a benchmark).

Table 3: Theoretical values of the EMU convergence criterion bond yields

	theoretical value	empirical value
Bulgaria	3.07	5.23
Lithuania	3.52	5.75
Poland	3.65	5.84
Czech Republic	4.11	3.7
Latvia	4.66	5.93
Romania	4.88	7.39
Hungary	5.05	8.97
Germany	-	1.93

Source: Author's calculations

In case of most euro-candidates the theoretical values are lower than the empirical ones (published by Eurostat). The Czech Republic is the exception. It is not surprising because this country used to have "the safe haven status" in this part of Europe due to positive investors' assessments of creditworthiness regardless of its fiscal conditions. Besides, it is not eager to be the EMU member in the close future. Lower interest rates resulting from the euro area membership besides unchanged fundamentals would lead among others to a significant decrease of the cost of public debt service. Such results confirming that there is still some "hallo effect" suggest that fiscal benefits from euro adoption should be reassessed in case of most countries with derogation.

5 Conclusions

The euro area sovereign debt crisis brought forward in the debate the importance of the safe assets, the sovereign solvency risk in countries with weak fiscal fundamentals and the risk of contagion among euro area countries' sovereign bond spreads.

Among the Maastricht convergence criterion, the long-term interest rate is a measure of the durability and sustainability of a country's convergence process and a reflection of the market perception of the macro-fundamentals sustainability, in particular regarding the fiscal balance and risk premia.

The panel estimation, analyzing the determinants of the sovereign bond yield spreads, indicate the significance of fiscal variables, credit and liquidity risks in explaining movements in yield differentials. However, after applying credit rating as an independent variable in the estimation g.g. debt and fiscal rule index become insignificant. This suggests that credit rating absorbs the effects of debt and fiscal rules. However, this does not imply that government balances do not play an important role during the crisis. As Roberto A. De Santis (2012) points out, the euro area countries with the largest government deficits-debt combination and therefore with the highest credit risk were subject

to numerous credit rating changes and mostly affected by the crisis.

Theoretical values of the EMU convergence criterion bond yields calculated on the basis of the panel estimation are lower than the empirical ones in most cases of euro-candidates which means that the euro area membership may lead to among others lower costs of public debt service. This suggests fiscal benefits from euro adoption should be reassessed in case of most countries with derogation.

The market must take into consideration the future EA enlargement. So it formulates expectations concerning the date of euro adoption by new countries (euro-day). However, it turned out that the assumptions of euro-day estimations are no longer up-to-date. It is mainly due to the fact there is no more such a thing as "euro area level of interest rate". In future work it is planned to expand the analysis by indicating the new assumptions for euro-day estimation. From the perspective of countries with derogation it is necessary to create new fundamentals of euro-day estimations because fiscal benefits from euro adoption and the market conviction of the certain date of this event are meaningful for the strategy of general government debt management.

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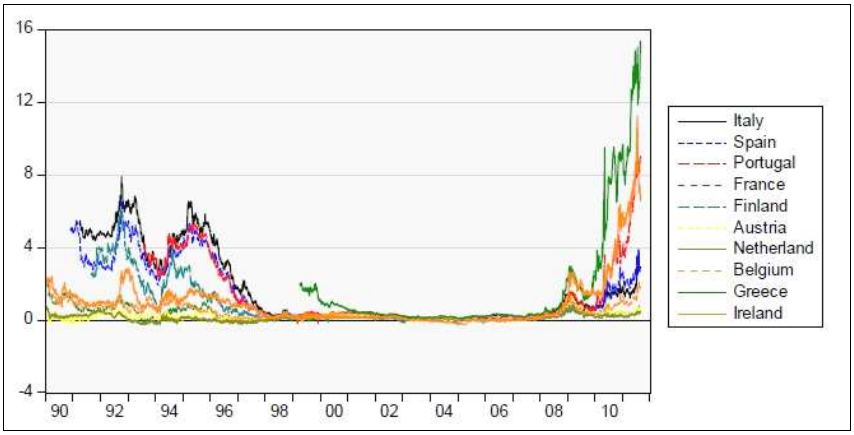
Appendix 1 Government bonds spreads to German Bund before and after the EMU creation



Source: Favero, Missale (2011)

Appendix 2 Results of balanced panel estimation (added rating variable)

```
RE GLS regression with AR(1) disturbances       Number of obs      =       720
Group variable: id                              Number of groups   =        12

R-sq:  within  = 0.8244                         Obs per group: min =        60
       between = 0.9193                                        avg =      60.0
       overall = 0.8380                                        max =        60

                                                Wald chi2(4)       =    680.99
corr(u_i, Xb)      = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
 emu_in_rate |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         cds |   .0008365   .0000927     9.02   0.000     .0006548    .0010182
   bidask_10 |   .1770315   .0942967     1.88   0.060    -.0077865    .3618496
      rating |  -9.764723   .6440556   -15.16   0.000    -11.02705   -8.502397
       _cons |    13.3905   .6049209    22.14   0.000     12.20488    14.57612
-------------+----------------------------------------------------------------
      rho_ar |  .92417529   (estimated autocorrelation coefficient)
     sigma_u |  .13495717
     sigma_e |  .31688791
     rho_fov |  .15352967   (fraction of variance due to u_i)
       theta |  .08310066
------------------------------------------------------------------------------
```

Source: Author's estimation based on Stata 11

Appendix 3 Results of unbalanced panel estimations (17 euro area members)

```
RE GLS regression with AR(1) disturbances       Number of obs      =       606
Group variable: id                              Number of groups   =        12

R-sq:  within  = 0.6156                         Obs per group: min =        24
       between = 0.7219                                        avg =      50.5
       overall = 0.6060                                        max =        60

                                                Wald chi2(5)       =    253.12
corr(u_i, Xb)      = 0 (assumed)                Prob > chi2        =    0.0000

------------------- theta --------------------
   min       5%       median        95%       max
0.1101    0.1134     0.1396     0.1396    0.1396

------------------------------------------------------------------------------
 emu_in_rate |      Coef.   Std. Err.       z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        debt |   1.454636   .6276478     2.32   0.020      .224469    2.684803
         cds |   .0009376   .0001105     8.49   0.000     .0007211    .0011541
   bidask_10 |   .1822236   .1198235     1.52   0.128    -.0526261    .4170734
 fiscal_rule |  -.7077384   .2678978    -2.64   0.008    -1.232809   -.1826683
       _cons |   3.479871     .54364     6.40   0.000     2.414357    4.545386
-------------+----------------------------------------------------------------
      rho_ar |  .96710392   (estimated autocorrelation coefficient)
     sigma_u |  .34262829
     sigma_e |  .34614447
     rho_fov |  .49489514   (fraction of variance due to u_i)
```

Source: Author's estimation based on Stata 11

Appendix 4 The rating scales used by specific rating agencies

Standard&Poor's		Fitch		Moody's	
AAA	1.00	AAA	1.00	Aaa	1.00
AA+	0.96	AA+	0.95	Aa1	0.95
AA	0.91	AA	0.9	Aa2	0.90
AA-	0.87	AA-	0.85	Aa3	0.85
A+	0.83	A+	0.80	A1	0.8
A	0.78	A	0.75	A2	0.75
A-	0.74	A-	0.65	A3	0.70
BBB+	0.70	BBB+	0.60	Baa1	0.65
BBB	0.65	BBB	0.55	Baa2	0.60
BBB-	0.61	BBB-	0.50	Baa3	0.55
BB+	0.57	BB+	0.45	Ba1	0.50
BB	0.52	BB	0.40	Ba2	0.45
BB-	0.48	BB-	0.35	Ba3	0.40
B+	0.43	B+	0.30	B1	0.35
B	0.39	B	0.25	B2	0.30
B-	0.35	B-	0.20	B3	0.25
CCC	0.30	CCC	0.15	Caa1	0.20
CC	0.26	CC	0.10	Caa2	0.15
C	0.22	C		Caa3	0.10
CI	0.17			Ca	0.05
R	0.13			C	0.00
SD	0.09				
D	0.04	D	0.05		
NR	0.00	NR	0.00		

Source: The Ministry of Finance in Poland, based on information from the rating agencies.