

MICHAŁ BRZozowski\*  
JOANNA SIWIŃSKA-GORZELAK\*\*

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## **Fiscal Imbalances, Fiscal Rules and Sovereign Bond Yields<sup>1</sup>**

### **Introduction**

The impact of fiscal imbalances on sovereign bond yields is an issue that has received considerable attention from both researchers and policymakers. Starting from the seminal work by Edwards (1984), it has been acknowledged that bigger fiscal imbalances tend to increase bond yields, as – among other factors – they increase the default risk. On the other hand, some studies have reported that the impact of deteriorating fiscal imbalances is quantitatively small, causing the “interest rate punishment to fiscal indiscipline [to be] highly uncertain” (Faini, 2006) and have noted that “there does not appear to have been any marked increases in higher interest expenditures [despite the rising debt burdens], arguably the most effective feedback policymakers often have to contend with for higher deficits and debt, arguably the most effective feedback policymakers often have to contend with for higher deficits and debt (Hauner and Kumar, 2006). With the recent surge in the level of public indebtedness, the issues related to possible impact of fiscal deficit and public debt on sovereign bond yields seem to be more relevant than ever. However, as many studies have shown, fiscal outcomes are shaped by institutional surrounding of fiscal policy, including fiscal rules (see, for example Bohn and Inman, 1996; Debrun and Kumar, 2007; Larch and Turrini, 2008). Therefore, similar fiscal outcomes could have different impact on bond yields, depending on the presence and the quality of fiscal rules, as they shape investors expectations regarding possible future fiscal consolidations and future fiscal imbalances.

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\* Dr Michał Brzozowski, Wydział Nauk Ekonomicznych, Uniwersytet Warszawski; e-mail: brzozowski@wne.uw.edu.pl

\*\* Dr Joanna Siwińska-Gorzelał, Wydział Nauk Ekonomicznych, Uniwersytet Warszawski, e-mail: siwinska@wne.uw.edu.pl

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The goal of this paper is to shed more light on the impact of fiscal imbalances and fiscal rules on sovereign bond yields in developed countries. The idea that the institutional framework that surrounds fiscal policymakers, including fiscal rules, has an impact on yields is not new; for example it has been shown by Poterba and Rueben (2001) that budget rules have an impact on US states' bond yields. However, systematic research on fiscal rules and yields in international context has up to now been constrained by the lack of reliable and comparable international data. We use the newly released IMF database on fiscal rules to systematically verify their impact. To the best of our knowledge, the impact of fiscal rules on bond yields in an international setting has not been so far systematically tested. Our paper is an attempt to close this gap and to bring attention to the relevance of fiscal rules in shaping sovereign bond spreads.

## 1. Fiscal imbalances and bond yields

### 2.1. Theoretical considerations

As Gruber and Kamin (2010) state, there is a number of reasons, why fiscal imbalances might affect bond yields, including the textbook crowding out effect, the portfolio balance effect that calls for higher interest rates if investors are to increase the share of government debt held in their portfolios and increased default risk associated with worsening fiscal positions.

Focusing just on the last channel, it seems obvious that interest rates are positively correlated with default probability. As shown e.g. Akitoby and Stratmann (2006), in equilibrium interest rates are shaped in the following way:

$$(1 + r^*) = pd \cdot w + (1 - pd) \cdot (1 + r) \quad (1)$$

where  $r$  – the lending rate,

$r^*$  – the risk-free interest rate,

$pd$  – the probability of default,

$w$  – the payment made to the lender in case of default.

Hence, higher probability of default pulls interest rates up. Consequently, higher probability of sovereign default implies higher bond yields and higher costs of servicing the debt.

Obviously, there are many factors that contribute to increased sovereign default, yet the level of fiscal deficit and public debt both have prominent positions among them. Intuitively, this relationship is obvious, yet a basic debt sustainability condition helps to enlighten in a more formal way the relation between fiscal stance and government's solvency and consequently perceived default probability. The requirement that the government is solvent, i.e. that it will be able to meet its debt obligations is usually defined in terms of the debt-to-GDP ratio. It is derived from the government budget constraint:

$$b_{t+1} = \frac{1+R}{(1+\pi)(1+g)} b_t - d_t \quad (2)$$

where  $b$  stands for the debt and  $d$  for the primary surplus, both in proportion to GDP,  $\pi$  denotes inflation,  $R$  is the nominal interest rate and  $g$  is the rate of growth of real GDP. This equation is often simplified to:

$$b_{t+1} = (r-g)b_t - d_t \quad (3)$$

where  $r$  – the real interest rate.

Equations (2) and (3) are difference equations, which are stable if the rate of growth of nominal (real) GDP is larger than the nominal (real) interest rate. When this condition is met, the debt-to-GDP ratio will remain finite regardless of the current and future values of the primary surpluses. Most countries, however, incur high borrowing costs and the nominal rate of interest is larger than the nominal GDP growth rate. As a result, the equation that describes the evolution of government debt is unstable. To ensure fiscal sustainability, the government's current and future primary surpluses must evolve according to

$$b_t \leq \frac{1}{1+R} \sum_{n=0}^{\infty} \frac{(1+\pi)(1+g)^n}{1+R} d_{t+n}. \quad (4)$$

Inequality (4) states that the present value of current and future primary surpluses must be sufficient to allow current debt to be paid off (see eg. Bohn 2005).

Sustainability of fiscal policy is usually assessed by testing the stationarity and/or cointegration of the time series of real debt and real fiscal balances. In a persuasive critique of this approach, Bohn argues (1995;1997) that fiscal sustainability can be more realistically gauged by estimating a fiscal reaction function, which models the path of fiscal balance (net lending) as this allows to assess the likely future developments of primary surpluses and the likelihood of future default. Following this proposition, Ghosh et al. (2011) estimate a fiscal reaction function for industrial countries and report that budget balance of these countries indeed follows a predictable pattern, where the level of fiscal deficit is a function of – among others – the level of debt. They observe that net lending improves in response to increasing public debt, but at a slowing pace, leading to a phenomenon, which they call “fiscal fatigue”. Such behaviour implies that when the public debt exceeds some threshold value, primary surpluses fall short of the growth – interest rate differential, hence debt becomes explosive and default becomes highly probable. Therefore higher values of public debt and fiscal deficits, particularly if merged together with uncertainties about the future GDP growth prospect, make it more likely that the threshold value of debt will be surpassed, hence increasing the default probability.

## 2.2. Brief review of the literature

The empirical literature on the impact of fiscal imbalances on sovereign bond yields is substantial. A number of authors have provided extensive overviews of this literature; therefore in this paper we provide just a very brief summary of the more recent works. Most of them confirm that fiscal imbalances do indeed lead to higher interest rates.

An excellent overview of mostly US experience is the paper by Gale and Orszag (2003), which reports that conclusions from different studies are mixed. Yet these authors stress that majority of papers that incorporate measures of expected future deficits report a significant, positive association between deficits and long-term interest rates, while papers that use current values of deficit report mixed results. This leads the authors to conclude that the empirical evidence in the literature is supportive of the notion that expected future deficits raise long term interest rates, with a sustained increase in the deficit of one percent of GDP raising interest rates by 20 to 60 basis points. In line with this conclusion, Gale and Orszag (2004) regress projected fiscal deficits on real forward long-term interest rate to confirm this result by concluding that interest rates increase by 29 to 45 basis points.

Another comprehensive review of the empirical literature relating to mostly US experience can be found in Engen and Hubbard (2004). These authors review papers from the 1980's 1990's and the beginning of 2000's and also conclude that the evidence on the impact of fiscal deficit and debt levels on sovereign bond yields is mixed: some studies fail to find a significant impact of debt on interest rates, others – on the contrary – find that long-term interest rates are related to current and/or projected fiscal imbalances. Authors also stress that studies differ widely with regard to data – using both projected and current data on fiscal imbalances and yields and econometric methodology, making comparisons difficult. In their own empirical research, they aim to systematically compare the different approaches and estimate the impact of both projected and current value of federal debt on both forward-looking and current real interest rates, using both reduced-form regressions and VAR. They conclude that projected values of government debt have a statistically significant effect on both current and projected long run bond yields – in line with the conclusions of Gale and Orszag (2003), while current values of debt do not have a statistically significant impact and that both reduced form regression and VAR deliver similar results.

In a more recent paper, Laubach (2009) using US data also studies the correlation between long-term forward rates and future projected federal government deficits and debt and finds that the relationship is statistically significant and robust; a percentage point increase in the projected deficit/GDP ratio increases interest rates by about 25 basis points, while the percentage point increase in the debt/GDP ratio increases yields by 3 to 4 basis points. He also stresses the problem of endogeneity of current (as opposed to projected) fiscal variables, which might lead to spurious results, if not properly addressed.

Among international studies, Kinoshita (2006) models the relationship between fiscal imbalances and real 10-year government bond yields, using panel data for 19 industrial countries for years 1971–2004, taking 5-year averages. The results indicate that current government debt increases bond yields, with one percentage point increase in government debt raising long-term interest rates by 2–5 basis points. He also reports that bond yields rise in response to an increase in government consumption spending.

Ardagna (2009), using annual data for 16 OECD countries from 1960 to 2002, concentrates on the impact of large fiscal expansions and contractions on bond yields and concludes that they change bond yields; the paper also shows that the compositions of expansions/adjustments matter, with cuts/increases in primary government spending and transfers inserting a bigger impact on yields

Gruber and Kamin (2012), using annual data for OECD countries for years 1988–2007 and measures of projected fiscal deficits and debts, report a robust association between these measures and long-term interest rates. A one percentage point rise in the ratio of the structural fiscal deficit to GDP increases bond yields by 15 basis points, and a one percentage point rise in the net debt ratio boosts yields by 2 basis points. They also stress the problem of endogeneity of fiscal outcomes and interest rates.

Akitoby and Stratman (2006), using yearly data from developing countries, find a positive impact of debt levels on sovereign bond yields. They also report a positive and significant effect of the level of government current spending on yields.

Baldacci and Kumar (2010), using annual panel data for developing and developed countries for 1980–2008, also confirm that fiscal deficits and public debts raise long-term bond yields, with a one percentage point deterioration in fiscal balance exerting a stronger impact than a one percentage point deterioration in debt. They also focus on possible non-linearities between interest rates and fiscal imbalances. They find that fiscal deterioration in countries with higher initial fiscal imbalances has a stronger impact on bond yields compared to similar change in fiscally prudent countries and that large changes in fiscal balances trigger proportionately stronger reaction of bond yields than small changes. They also show that countries' characteristics, like the rate of domestic savings, population ageing, quality of institutions and the degree of political risk, have an impact on the reaction of bond yields to fiscal changes; international climate – like periods of high financial market distress – is also relevant.

Baldacci, Gupta and Mati (2008) is yet another paper that confirms the relevance of fiscal indicators. Using a sample of developing countries, they find that a change of fiscal balance by one percent changes yields by 30–40 basis points. This impact is stronger in periods of high international financial market volatility and in case of a country previous default.

Jaramillo and Weber (2012) use monthly data from years 2005–2012 for developing countries, and confirm the importance of fiscal variables for bond yields, with an increase in the expected fiscal deficit of 1 percent of GDP boosting nominal bond yields by about 13 to 15 basis points in the whole sample. Using the VIX index of financial market volatility and risk aversion, they divide their sample into

times of high and low global risk aversion. They find that during times of low risk aversion, fiscal variables do not exert a statistically significant impact, but in times of high global risk aversion, fiscal variables play a key role in shaping bond yields.

Focusing on the European experience, Bernoth, von Hagen and Schuknecht (2012) assess the impact of fiscal variables on bond risk premium of the euro member countries between 1991–2002 and also confirm that deterioration in fiscal variables increases yields, however this impact on the interest rates spreads vs. Germany is not strong – an increase in budget deficit relative to Germany by one percent increases the spread by less than 10 basis points. They also report that the impact of fiscal imbalances changes after the euro adoption. The euro has reduced the linear effect of debt and deficits levels on interest rates, yet increased the nonlinear, marginal effect of debt levels (the EMU dummy interacted with debt level and deficit has a negative coefficient, while the EMU dummy interacted with deficit and debt levels squared has a positive coefficient).

Faini (2006), using yearly data for EMU countries for years 1979–2002 and cyclically adjusted primary surplus, also finds a statistically significant impact of deficits, with stronger effect in high-debt countries. An interesting conclusion is that budget deficit changes in one country have an effect on both interest rate spreads and on the overall level of interest rates in the whole EMU area, with a stronger impact at the EMU level.

The paper by Hauner and Kumar (2006) who focus on G-7 countries over 1960–2005 is yet another study that confirms the significance of fiscal balance for bond yields determination; yet it reports insignificance of debt levels in many specifications. It also stresses that expected values of fiscal deficit are more robust determinants of yields than current values.

There are also a number of papers that study the relevance of fiscal institutions. Hallerberg and Wolf (2008) analyze the Eurozone sovereign bond market between 1993–2005 using quarterly data and confirm the relevance of budget deficit and public debt for bond yields. They also stress the role of fiscal institutions – better institutions both lower yields and decrease the impact of fiscal outcomes on yields. They measure the quality of fiscal institutions with several indexes that measure centralization of the budget process, with higher centralization implying better institutions.

Poterba and Rueben (2001), using data for US states for year 1988–1999, investigate the relevance of state balanced budget and debt rules on state bond yields (more precisely, how fiscal rules change the response of bond yields to unexpected deficits and surpluses), and they find that stronger rules significantly weaken the impact of negative shocks on bond yields.

### **3. Empirics: bond yields' determinants**

Our empirical research aims to reassess the impact of fiscal imbalances and fiscal rules on bond yields in industrial countries. The time period is 1985–2010 and data is annual.

The dependent variable is the 10-year government bond yield, taken from IMF International Finance Statistics (IFS) database.

The data on fiscal rules is taken from IMF Fiscal Rules Dataset (2012). As many studies show (see eg. Bohn and Inman 1996), the design of fiscal rules is crucial for the effectiveness, hence an attempt to model not just their presence, but also quality is of utmost importance. To model the design of rules, we construct simple indexes. We focus on two kinds of rules: balance budget rules (BBR) and debt rules (DR), both at the national level. Other rules, like expenditure rules and revenue rules, seem to be of less relevance for our research, as their impact on fiscal imbalances is likely to be weaker<sup>2</sup>. For both types of rules we construct indexes that include 4 characteristics of the each rule: its coverage, legal basis, enforcement and the presence of well-specified escape clauses. The IMF database assigns numerical values to each of these features, with higher values denoting stricter rule, i.e. wider coverage of the rule, its stronger legal basis, stricter enforcement and better-specified escape clauses. Each of these categories has different numerical values attached; with higher values uniformly denoting stricter features. We have normalized these values in such a way, that the highest possible value attached to each category is one. Finally, we also construct a measure of the overall quality of BBR and DR, which is calculated as a simple average from both BBR and DR indexes, denoted as *fiscal rules*.

Among the independent variables we include public debt and primary net lending – both in relation to GDP, output gap (i.e. the difference between actual and potential GDP), all extracted from IMF WEO (April 2011) database, the central bank’s discount rate from IMF IFS (2010) database, and a dummy variable equal to one if a country is a member of the euro zone.

Finally in order to capture the overall investment climate, following eg. Jaramillo and Weber (2012), we include a measure of international financial market volatility and global risk aversion: the Chicago Board Options Exchange Volatility Index – the VIX index<sup>3</sup>, with higher values denoting more volatility and higher risk aversion.

We start by employing the standard fixed and random effects estimators and let the Hausman test discriminate between the two. The Hausman test uniformly points to the validity of a fixed effects estimation. Table 1, columns 1 to 4 displays the results of fixed effects (FE) estimation. All variables are significant and of the expected sign. Net lending is negative indicating that an improvement in budget balance decreases bond yields; more precisely, every additional percentage point of worsening of the primary balance raises yields by about 10 basis points. Debt

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<sup>2</sup> We have estimated regressions including indexes of expenditure and revenue rules and indeed these variables turned out to be insignificant.

<sup>3</sup> Chicago Board Options Exchange Market Volatility Index. It is a “measure of the implied volatility of S&P 500 index options. Often referred to as the *fear index* or the *fear gauge*, it represents one measure of the market’s expectation of stock market volatility over the next 30 day period” (after Wikipedia). See <http://www.cboe.com/micro/VIX/vixintro.aspx>.

turns out to affect yields in a non-linear fashion, indicating that increases in public debt increase yields, and the effect becomes stronger, as debt level becomes higher. The presence and quality of fiscal rules enters with a negative sign, demonstrating that stronger rules attribute to lower yields. This result is very robust across all specifications. Our results have not confirmed that better fiscal rules decrease the magnitude of the impact of fiscal balance on bond yields, as the interaction between the deficit level and fiscal rules index enters with a positive sign, but is not significant.

Including the index of financial market volatility allows drawing interesting conclusions. The impact of financial market volatility turns out to be negative, indicating that an increase in volatility decreases bond yields in industrial countries. It could be possible that investors treat industrial countries as a relatively “safe haven” and in times of financial market distress increase their demand for relatively safer industrial countries’ bonds, pushing yields down. In the same time however, when we interact the volatility index with a dummy variable equal to one when debt exceeds 80% of GDP, this product turns out to be positive, offsetting the former effect. Therefore it seems, that industrial countries with high public debt are not perceived as a “save haven” and their governments cannot hope to benefit from the international markets’ turbulences. This results should be further elaborated using a wider sample of countries – a task which we leave for future research.

To check the robustness of the results, we have estimated several other specifications, for example substituting the GDP growth rate with output gap (column 4) or with unemployment rate and also with several other control variables added (the results are not shown, but are available from the authors). In each specification, the main results were unaltered.

Nevertheless, these conclusions should be viewed with caution. Despite the fact that we insert the output gap among explanatory variables, our results might be contaminated by the endogeneity of the right hand side variables because both fiscal performance and interest rates depend on the business cycle. To avoid spurious positive correlation between the fiscal balance and bond yields, we re-estimate our regressions using the two stage least squares (2SLS) estimators. We instrument primary net lending with its future values and other relevant variables; the Sargan test confirms the validity of our instruments.

The 2SLS results are reported in Table 1, columns 5 and 6; also these estimations uniformly show the significance of fiscal policy imbalances and fiscal rules. All other conclusions also hold. Hence, it seems that our results are robust.

Our results show that sovereign bond yields depend not only on the size of current fiscal imbalances but are also affected by the presence and the quality of fiscal rules. Therefore it seems that strong fiscal rules lessen the fears of government’s default and reduce the costs of borrowing. This result has interesting policy implications – it shows that imposing strict fiscal rules literally pays off – the government imposing such rules will enjoy lower interests payments.



**Table 1**  
**Determinants of 10-year government bonds yields**

	(1)	(2)	(3)	(4)	(5)	(6)
	FE	FE	FE	FE	2SLS	2SLS
Discount rate	0.776*** (0.0224)	0.640*** (0.0242)	0.646*** (0.0239)	0.718*** (0.0256)	0.731*** (0.0263)	0.732*** (0.0262)
Primary net lending	-0.112*** (0.0213)	-0.107*** (0.0218)	-0.0942*** (0.0196)	-0.121*** (0.0186)	-0.0956*** (0.0292)	-0.102*** (0.0290)
GDP growth	-0.0506* (0.0293)	-0.0837*** (0.0265)	-0.0934*** (0.0276)		-0.0545 (0.0373)	-0.0596 (0.0377)
Output gap				-0.00706 (0.0327)		
Debt	0.0435*** (0.0105)	0.0264*** (0.00960)	0.0364*** (0.00998)	0.0304*** (0.0111)	0.0180 (0.0109)	0.0281** (0.0114)
Debt <sup>2</sup>	-0.000246*** (4.67e-05)	-0.000201*** (4.22e-05)	-0.000217*** (4.19e-05)	-0.000184*** (4.47e-05)	-0.000185*** (5.12e-05)	-0.000201*** (5.11e-05)
Euro dummy		-1.873*** (0.210)	-1.771*** (0.207)	-1.446*** (0.213)	-1.724*** (0.210)	-1.673*** (0.209)
Fiscal rules		-0.559*** (0.140)	-0.541*** (0.139)	-0.462*** (0.151)	-0.468*** (0.161)	-0.435*** (0.160)
Fiscal rules*net lending		0.0415 (0.0331)				
Financial market volatility			-0.0425*** (0.0133)	-0.0337** (0.0132)		-0.0361*** (0.0137)
Financial market volatility*debt dummy			0.0407*** (0.0129)	0.0422*** (0.0132)		0.0398*** (0.0139)
Constant	0.646 (0.487)	3.139*** (0.502)	2.796*** (0.572)	2.365*** (0.613)		2.802*** (0.642)
Sargan test $\chi^2$					4.625	5.278
P-value					0.2014	0.1525
Observations	430	429	429	367	329	329
R-squared	0.758	0.807	0.812	0.842		
Number of countries	24	24	24	20	19	19

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## 4. Conclusions

This paper has empirically evaluated the impact of fiscal deficit, public debt and fiscal rules on long-term interest rates for industrial countries, over 25 years. We find that fiscal deterioration pushes bond yields up, while fiscal rules have an opposing effect. While the first result is not surprising and in line with the empirical evidence found in the literature, the confirmation of the relevance of fiscal rules in international setting is a result, which to the best of our knowledge is novel; yet it bears significant policy implications – imposing strong fiscal rules “pays off”. Our results also suggest that during times of increased risk aversion, it cannot be ruled out that industrial countries play the role of “save havens”; however, this effect vanishes, when countries are characterized by high public debt.

Overall, this paper provides evidence that the bond market rewards countries running sound fiscal policies and having strong fiscal rules.

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## **NIERÓWNOWAGA BUDŻETOWA, REGUŁY FISKALNE I RENTOWNOŚĆ OBLIGACJI PAŃSTWOWYCH**

### **Streszczenie**

Wpływ deficytów budżetowych na rentowność obligacji państwowych to problem, który przyciąga uwagę zarówno badaczy, jak i polityków. Chociaż wyniki różnych badań na ten temat są zróżnicowane, większość ostatnich analiz wskazuje, że rosnące deficyty budżetowe zwiększają rentowność obligacji. Kwestią, której poświęcono mniej uwagi jest wpływ nierównowagi budżetowej na rentowność obligacji w sytuacji, gdy istnieją określone zasady regulujące wielkość deficytu budżetowego i długu publicznego. Głównym celem artykułu jest empiryczne zbadanie wpływu deficytów budżetowych oraz reguł fiskalnych na rentowność obligacji państwowych. Wpływ reguł fiskalnych na rentowność obligacji w układzie międzynarodowym nie był dotąd systematycznie badany. Ten artykuł jest próbą wypełnienia tej luki. W związku ze wzrostem w ostatnich latach zadłużenia także w krajach wysoko rozwiniętych problem ten nabrał szczególnego znaczenia.

**Słowa kluczowe:** deficyt budżetowy ♦ reguły fiskalne ♦ rentowność obligacji państwowych

## **БЮДЖЕТНОЕ НЕРАВНОВЕСИЕ, ФИСКАЛЬНЫЕ ПРАВИЛА И РЕНТАБЕЛЬНОСТЬ ГОСУДАРСТВЕННЫХ ОБЛИГАЦИЙ**

### **Резюме**

Влияние бюджетных дефицитов на рентабельность государственных облигаций - это та проблема, которая привлекает внимание как исследователей, так и политиков. Результаты исследований на эту тему отличаются друг от друга, но в большинстве работ

последних лет указывается, что растущие бюджетные дефициты увеличивают рентабельность облигаций. Вопросом, которому уделяется меньше внимания, является вопрос влияния бюджетного неравновесия на рентабельность облигаций тогда, когда существуют определенные принципы, регулирующие размер бюджетного дефицита и публичного долга. Главной целью статьи является эмпирическое исследование влияния бюджетных дефицитов и фискальных правил на рентабельность государственных облигаций. Влияние фискальных правил на рентабельность облигаций в международном плане до сих пор систематически не изучалось. Настоящая статья представляет собой попытку заполнения этого пробела. Эта проблема приобрела особое значение в связи с ростом в последние годы уровня задолженности во многих странах, не исключая высокоразвитых.

**Ключевые слова:** бюджетный дефицит ♦ фискальные правила ♦ рентабельность государственных облигаций