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Article

Public debt and borrowing: Are governments disciplined by financial markets?

Cogent Economics & Finance

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Suggested Citation: Afflatet, Nicolas (2016) : Public debt and borrowing: Are governments disciplined by financial markets?, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 4, Iss. 1, pp. 1-14,
<https://doi.org/10.1080/23322039.2016.1225346>

This Version is available at:

<https://hdl.handle.net/10419/194626>

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Received: 20 April 2016
Accepted: 13 August 2016
Published: 15 September 2016

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Public debt and borrowing: Are governments disciplined by financial markets?

Nicolas Afflatet^{1*}

Abstract: With the announcement to intervene on financial markets to restore the monetary transmission mechanism, the ECB has attenuated the pressure of the markets on the endangered peripheral countries of the Eurozone. Critics argue that by eliminating the markets' disciplining interest mechanism, governments in the crisis countries will not carry out reforms and consolidate their budgets. This kind of interplay between public deficit policy and financial markets is commonly discussed under the notion of Market Discipline Hypothesis. The hypothesis' second half suggests that governments react to rising interest rates by adjusting their deficit policy. Based on panel data for the European Union, different models are tested to investigate if governments react to rising interest rates. The results indicate that governments do raise their primary surpluses when they perceive the rising interest rates in their budgets. Governments react quite quickly to changing interest rates, although there seems to be some backlash in the medium-run.

Subjects: Econometrics; Executive Politics; Macroeconomics

Keywords: market discipline hypothesis; public deficits; public debt; sovereign bond yields; Eurozone; public debt crisis

Jel classification: H62 Deficit; Surplus H63 debt; Debt Management; Sovereign Debt

1. Introduction

Mario Draghi's announcement to rebuy government bonds on secondary markets and the government bond purchase program of the ECB to restore the monetary transmission mechanism have



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Nicolas Afflatet has studied economics at Universität der Bundeswehr/Helmut-Schmidt-Universität (University of the Federal Armed Forces) in Hamburg, Germany, and Université de Bretagne Sud in Vannes, France. He has received his PhD for a politico-economic analysis about the effectiveness of the German Debt Brake. Since his graduation, he works as a research fellow on public debt, the European Monetary Union and empirical macroeconomics. His actual scope is the ongoing debt crisis.

PUBLIC INTEREST STATEMENT

This article deals with interplay between financial markets and governments' deficit policy. Financial markets usually react to rising debt by adapting their interest claims. However, it is not clear whether governments react to these rising interest rates by adapting their policy and returning to a path of sustainable fiscal policy. The empirical analysis of this article suggests that financial markets seem indeed to have a disciplining effect on governments: They adapt their primary surpluses to changes in interest rates, although there seems to be some backlash in the medium term. These results have important policy implications, e.g. for the government bond purchase programs of central banks which must take into account side effects of their policy.

reopened the question of unintended side effects of such policy measures.¹ Government bond purchase programs on secondary markets are expected to lower bond yields. Via arbitrage channels interest burdens on primary markets can be expected to be lowered, too (Figure 1).

Critics argue that this way an important disciplining mechanism is shut off because rising interest rates would discipline the highly indebted countries. Yet, bond purchase programs work in the opposite direction. Thereby incentives for governments to consolidate their budgets would be reduced by central bank's bond purchase programs (Mayer, 2013; Sinn, 2014, 71ff.). The programs come at a price which could be (among others) the attenuation of the pressure on governments to consolidate their budgets.

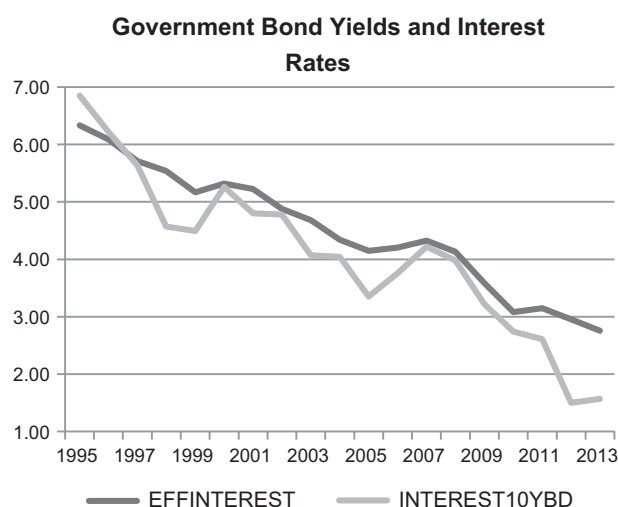
This interplay between financial markets' interest claims and government's deficit policy is discussed under the notion of Market Discipline Hypothesis (MDH). It has been discussed for the first time by Bishop, Damrau, and Miller (1989), Frenkel and Goldstein (1991) and Lane (1993). The MDH consists of two halves: The first half treats the question whether financial markets react to rising public debt and claim higher interest rates while the second half—under the assumption that markets react with rising premiums—treats the question whether governments react to rising interest rates by correcting their fiscal policy.

The existing literature treating the first half of the MDH vastly confirms the hypothesis' argument.² Alesina, de Broeck, Prati, and Tabellini (1992) show that in the OECD the differential between public and private interest rates is positively correlated with the outstanding debt and its growth. In countries with sustainable debt quota this effect cannot be confirmed. On a municipal level, Capeci (1994) finds evidence that markets claim higher premiums when municipal debt rises. Bayoumi, Goldstein, and Woglom (1995) confirm this result for the US federal states level. According to Laubach (2003), long-term interest rates in the US are negatively affected by higher primary deficits in countries with above-average debt. Ardagna, Caselli, and Lane (2007) confirm these results for the OECD countries: In countries with above-average debt levels, a 1% increase in the primary deficit quota leads to a cumulative increase of interest rates of 1.5% after 10 years. Bulut (2012) finally shows that developing countries with high structural deficits have to compensate default risks with higher interest rates.

For the second half of the MDH, there is strikingly little empirical literature and in addition it is contradictory. For a panel of OECD countries Heinemann and Winschel (2001) find asymmetric reactions of governments facing changing sustainability conditions (defined by them as the difference between real interest and real growth rates): While there is a clear reaction of rising primary surpluses in times of deteriorating sustainability conditions, the reaction in times of improving conditions is less pronounced. However, the reaction in case of deteriorating conditions is slow and not

Figure 1. Effective interest rate Germany has to pay on its accumulated debt (dark line) and ten years bond yields on the secondary market (light line).

Source: Annual data from Eurostat and own calculations.



strong enough to achieve a sustainable debt situation. Bulut (2012) confirms the disciplining effect of credit markets on governments of developing countries. Kula (2004) on the other side finds no reaction of public borrowers. The MDH is rejected in regard to US federal states between 1973 and 1998. Still, she admits that there might be a disciplinary effect if governments are in danger of being cut off from credit markets.

This paper takes up the question of the second half of the MDH. Do changing borrowing costs influence government’s fiscal policy? Based on theoretical considerations, an unbalanced panel of all European Union (EU) countries for the years from 1995 to 2013 is used to answer this question empirically.

The results indicate that EU countries have reacted to changing borrowing costs by adapting their primary surpluses although there seems to have been some backlash in the medium term. Overall, it seems as if markets are able to put pressure on governments. Yet, with the ongoing debt crisis, it is obvious that market discipline did not suffice to reach sustainable debt situations. Different arguments shall be put forward to explain this development within the Eurozone.

The article is organized as follows: in the second chapter, theoretical considerations are outlined. The empirical testing and its results are presented in chapter three. Concluding remarks complete the article in chapter four.

2. Theoretical considerations

Starting from the theory of probabilistic voting,³ we can assume that government tries to maximize its expected votes. To reach this goal, it can set the budget structure in order to gain a majority whose utility is higher under the government than it would be under the opposition. If the voters underlie to a certain degree to fiscal illusion, this budget structure can also comprise a deficit element. But if the deficit element persists above a certain level, the accumulated debt rises. If the debt quota ($d = \frac{D}{Y}$, accumulated debt as a share of GDP) rises (as shown for the European countries in Figure 2), sustainability of public finances is not given any more (Blanchard, Chouraqui, Hagemann, & Sartor, 1990; Bohn, 2011).⁴

$$\frac{\delta d_t}{\delta t_t} = (i_t - g_t)d_t - s_t > 0$$

Figure 2. Annual debt quotas in the European Union.

Source: Annual data from Eurostat.

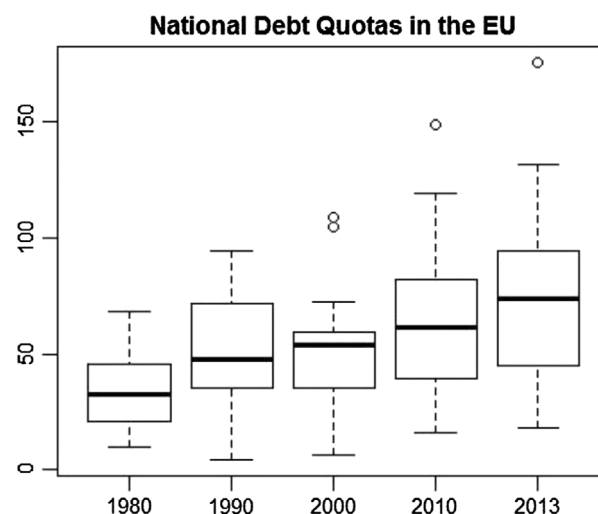
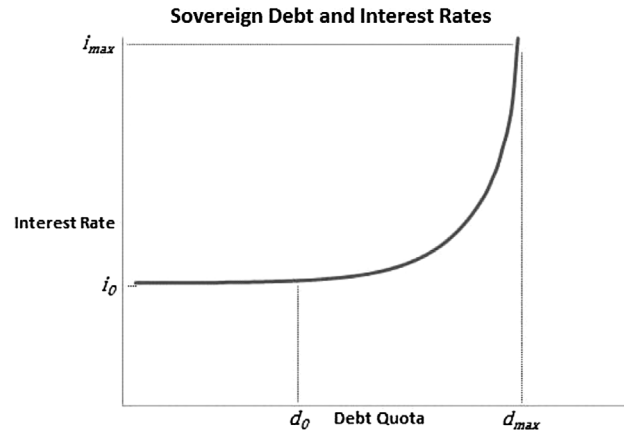


Figure 3. Debt quota and interest rate government has to pay on its outstanding debt.



This can be the case either if interest rates rise ($\frac{\partial i}{\partial t} > 0$), if growth rates ($\frac{\partial g}{\partial t} < 0$) fall or if the primary surplus (public taxes minus expenditures without interest payments, $s = \frac{T-G+i \times D}{Y}$) falls ($\frac{\partial s}{\partial t} < 0$).⁵ Figure 2 shows that this has obviously been the case for EU countries in the last 30 years.

A long-term stable debt quota is not only important in an intergenerational matter of an aging society but also concerning fundability of public debt. If the debt quota rises c. p., interest payments (measured as interest quota $z = \frac{i \times D}{Y}$) will claim a rising share of public budgets. This diminishes government's scope and raises the question whether government will be able to fund its outstanding debt.

It is plausible to assume that risk premiums will rise once a critical threshold is crossed ($d_t > d_0$). Markets will not consider government bonds as safe havens but will claim higher risk premiums ($i_t > i_0$) on the outstanding debt.⁶ This mechanism is illustrated in Figure 3.

In this situation, government has the choice either to adapt its deficit policy and restore long-term sustainability or to continue its path of a non-sustainable debt situation.⁷ One argument for the latter is that governments typically have short time horizons (Lane, 1993, 70ff.) and that they should not have to care about the risk of a fiscal policy leading to a default because they can expect to be out of office by then.

Further speaking against an adaption are its political costs. With the higher taxes and/or lower expenditures government has to hurt electoral groups. As a reaction, government's vote share would diminish. This sinking in votes share can be interpreted as political costs⁸ for the incumbent party. The exact height of political costs of a budget adaption would depend on the degree of consolidation and the degree of the voters' fiscal illusion.⁹

But then again financial markets could react very quickly and force government to pay high interest rates¹⁰ on newly issued bonds which could lead to a default¹¹ even in the short run.¹² As consequence, the national economy would suffer a sharp depression, the primary budget would quickly have to be adapted because government would lose access to financial markets and the re-election probability of the incumbent party would be dropping.¹³

Plausible arguments for a budget adaption as a reaction to changing borrowing costs can be found as well as arguments against it. The question whether governments react to changing borrowing costs imposed by financial markets remains one which has to be answered empirically.

3. Empirical testing

3.1. Data

Concerning the data-set, two different key independent variables are employed to test governments' reaction to changing borrowing costs:¹⁴

- First, the effective (or perceived) interest rates governments have to pay on the outstanding debt.
- Second, the effective interest rates central governments have to pay on the outstanding debt: This variable is of interest because political variables can be tested more specifically (e.g. the influence of national elections on central states' fiscal policy).

As dependent variable the primary surplus is employed. Macroeconomic and political variables and dummies are used as covariates. With these data an unbalanced panel of EU countries between 1995 and 2013 was generated. Table 1 gives an overview over the descriptive statistics of the cardinal variables employed.

3.2. Testing model

To examine government's reaction to changing borrowing costs, two different basic models (both with two variations) are presented. The first model is basically a static panel model. The second one includes lags for the interest variables.

All models are addressed with fixed effects because they are commonly used for panel data models. Random effects estimators might be biased because the assumption $Cov(X_{i,t}, a_i) = 0$, that is the individual specific effects are uncorrelated with the other covariates of the model, does not hold. Yet, the results do not fundamentally change when random effects are used (These results are given in Annex A.3), besides the Hausman test suggests to use random effects (see Section 3.4) instead of fixed effects.

The first model (variations 1 and 2) is formulated as follows:

$$S_{i,t} = \beta_1 \rho_{i,t} + \beta_2 X_{i,t} + \alpha_i + \varepsilon_{i,t}$$

In this equation, $S_{i,t}$ is the primary surplus, $\rho_{i,t}$ represents the different independent interest variables, $X_{i,t}$ the covariates, α_i catches the time-invariant individual effects and $\varepsilon_{i,t}$ is the error term.

The second model (variations 3 and 4) with lags for the independent interest variables is formulated as follows:

$$S_{i,t} = \beta_1 \rho_{i,t} + \beta_2 \rho_{i,t-1} + \beta_3 \rho_{i,t-2} + \beta_4 X_{i,t} + \alpha_i + \varepsilon_{i,t}$$

These lags could be of interest because it can be argued plausibly that governments and bureaucracies commonly react rather slowly to macroeconomic developments. Political processes can be slow and budget imbalances cannot be adjusted ad hoc. Thereby reactions to changing interest rates could only be seen in later years.

A few words must be said about the problem of endogeneity: interest rates do not only influence government's decision about the height of the deficit, it also works the other way round. The problem of endogeneity due to simultaneity might thereby appear.¹⁵ However, effective interest rates are not a result of an annual decision of financial markets on the primary surplus. They rather are the result of the long sovereign's credit history. The influence of the annual primary surplus on the effective interest rate is thereby negligible and with it the problem of endogeneity.

Table 1. Descriptive statistics of the cardinal variables

Variable	Source	Obs.	Mean	Min.	Max.	Std. dev.
Debt quota	Eurostat	386	57.5	6.1	175.1	29.8
Debt quota central state	Eurostat	241	56.9	4.3	181.2	33.9
Primary surplus	Eurostat, own calculations	386	0.0	-27.4	9.8	3.8
Primary surplus central state	Eurostat, own calculations	241	-0.6	-27.0	7.7	3.4
Ten-year government bond yield	Eurostat	386	4.9	1.4	22.5	1.9
Effective interest rate	Eurostat, own calculations	386	4.8	2.1	8.7	1.3
Effective interest rate central state	Eurostat, own calculations	241	4.6	2.0	8.6	1.4
Real growth rate	Eurostat	386	2.2	-17.7	11.3	3.5
Unemployment rate	Eurostat	386	4.1	1.9	27.5	8.5
Real exchange rate (index)	Eurostat	386	102.1	134.9	77.7	7.9
National stock index	Yahoo Finance and Bloomberg	248	7.3	-66.0	117.0	27.4
Consumer prices	Eurostat	248	2.1	-1.7	5.3	1.1

Table 2. Econometric estimation with fixed effects

	Dependent variables			
	1. Primary surplus (public sector)	2. Primary surplus (central state)	3. Primary surplus (public sector)	4. Primary surplus (central state)
Effective interest rate	0.80 (5.46)***	1.11 (5.13)***	1.50 (4.50)***	1.75 (4.85)***
Effective interest rate (Lag 1)			0.19 (0.53)	0.24 (0.64)
Effective interest rate (Lag 2)			-0.56 (-2.01)*	-0.65 (-2.35)*
Real growth rate	0.35 (7.70)***	0.18 (2.99)**	0.33 (6.78)***	0.19 (3.49)***
Unemployment rate	-0.20 (-4.22)***	-0.07 (-1.20)	-0.19 (-3.47)***	-0.08 (1.42)
Real exchange rate	0.06 (3.08)**	0.08 (2.66)**	0.06 (2.22)*	0.10 (3.61)***
Election year	-0.47 (-1.67).	-0.18 (-0.54)	-0.42 (-1.37)	0.01 (0.03)
Stability and growth pact	0.87 (1.97)*	0.00 (0.00)	0.75 (1.43)	0.12 (0.19)
Left government		0.94 (1.58)		0.19 (0.31)
Right government		1.55 (2.63)**		0.70 (1.14)
N	334	241	334	189
R ²	0.42	0.29	0.43	0.39

Notes: Coefficients, *t*-values (in parentheses) and significance level (“.”: 10% level, “*”: 5% level, “***”: 1% level, “****”: 0.1% level) are indicated.

3.3. Econometric results

The testing results presented in Table 2 show that for all four models the macroeconomic variables mostly indicate significance and the algebraic signs point into the expected direction: A positive macroeconomic development leads to an improved fiscal situation because tax revenues rise and public expenditures fall. The unemployment rate however seems not to have a significant impact on the primary surpluses of the central states. It is only significant in the models for the entire public sector.

Table 3. Model diagnostics

	1. Primary surplus (public sector)	2. Primary surplus (central state)	3. Primary surplus (public sector)	4. Primary surplus (central state)
F-test	$F = 9.78$	$F = 6.74$	$F = 8.48$	$F = 5.23$
	$p = 0.00$	$p = 0.00$	$p = 0.00$	$p = 0.00$
Lagrange-Multiplier test (Honda)	Normal = 24.42	Normal = 58.96	Normal = 21.97	Normal = 38.87
	$p = 0.00$	$p = 0.00$	$p = 0.00$	$p = 0.00$
Hausman test	$\chi^2 = 5.62$	$\chi^2 = 13.33$	$\chi^2 = 3.15$	$\chi^2 = 13.83$
	$p = 0.47$	$p = 0.10$	$p = 0.92$	$p = 0.18$

The political variables show the expected algebraic signs, too. But they are not all significant. In election years, surpluses seem to fall somewhat shorter, but the variable is not significant.¹⁶ The situation for the dummy for the breaking of the Stability and Growth Pact (SGP) by France and Germany in 2003 is similar: A fall in primary surpluses after the breaking of the Pact cannot be confirmed. For the variables for the color of the government parties the situation is not clear either. Except for one case (model 2) no hints for a distinguished deficit policy can be found.

The key independent variables, effective interest rates, show significance at the 0.1% level. With the algebraic sign being positive for all four models we can conclude that higher interest rates entail higher primary surpluses in the same year. These results confirm the second half of the MDH: governments seem indeed to react to higher interest rates by raising primary surpluses.

From the analysis of lagged variables (models 3 and 4), it can be concluded that there is a pronounced reaction to rising interest rates in the first year, but a backlash in the second year on. It seems as if governments react quickly to changing interest rates, but in the medium run they could get used to the interest level.

3.4. Model diagnostics

Several diagnostic tests to compare the results of the regressions with other regression models are performed. The results are presented in Table 3.

The *F*-tests comparing pooled to fixed effects models all indicate *p*-values very close to zero. Thus, the test indicates that for all models the individual-specific heterogeneity should be addressed.

As a second test, the Lagrange multiplier test testing whether the variance of the entities is close to zero is performed. Here again, all *p*-values are close to zero. Thus, the random effects should be used instead of a pooled model.

Finally, the Hausman test maintains the null to use random effects. Though, as explained in Section 3.2, fixed effects are more commonly used for panel data estimations. The results do not change when random effects are used instead of fixed effects which can be seen in Annex A.3. Overall, the economic conclusions remain unquestionable no matter which method is chosen to analyze the panel data.

4. Concluding remarks

The result of the empirical testing presented above is that governments seem indeed to react to rising borrowing costs by raising primary surpluses. Governments thereby seem indeed to be disciplined by financial markets.

Yet, the question arises how debt crises generally and more particularly how the Euro crisis could occur if financial markets have a disciplining effect. Several arguments can be found to explain this discrepancy:

- After the introduction of the Euro, most countries benefited from a sharp drop in interest rates even if debt quotas only dropped temporarily. Financial markets might have believed in a bail-out even if this possibility was meant to be excluded with the no-bail-out rule (Feldstein, 2005). This might be a reason why interest rates remained low for a long time although debt quotas rose in several countries. With interest rates remaining low or even falling, there could hardly be a disciplining effect.
- In the last years, central banks contributed to a drop in interest rates and thereby alleviated public borrowing (Gehring & Mayer, 2015).
- Additionally, bail-out programs in the Eurozone helped to keep effective interest rates at moderate levels. The rescue programs in the Eurozone comprised substantially lower interest rates than markets interest rates.
- The Euro crisis can be seen as a “sudden-stop” crisis (Baldwin et al., 2015); the crisis was triggered by a sudden redirection of capital flows which had caused major trade imbalances before. Once they were redirected, slowing growth rates produced high deficits and suddenly rising growing debt quotas. The suddenly appearing crisis left little time to governments to react to the crisis.

One implication of the empirical results shown above is that policy-makers should be aware of the trade-off they face when they intervene on financial markets. All big central banks around the world—the FED, the ECB, the BoE, and the BoJ—started QE. Within these programs, government bonds were purchased and bond yields lowered. The central banks aimed at monetary targets but at the same time they reduced the incentives for budgetary consolidations. Thereby, it is not surprising that all of these monetary areas did not substantially improve their debt situations in the past years. This is especially critical for the Eurozone and Japan which already had heavy public debt burdens before the beginning of the bond purchase programs.

A second implication of these results is that the European government leaders should be careful about steps leading to a fiscal union with joint liability. This would probably solve the ongoing crisis because market interest rates would drop perceptibly. But such a development would very probably reduce the incentive for sound public finances if no other disciplining mechanism is installed (e.g. direct access of the European Commission to national budgets). The introduction of the Euro proves this point: after the announcement to found EMU, interest rates converged to the German level in all peripheral countries. As a consequence, these countries saved big amounts in interest payments. Yet, in several countries—e.g. Greece, Italy, or Portugal—the money was not spent for deficit and debt reduction but for other political purposes. That is why their debts rose again in spite of falling interest quotas. A new drop in interest rates could generate such policy patterns again. The result would be a new, even bigger, debt crisis which is certainly not desirable.

The third policy implication is that other disciplining mechanisms become more important if central banks deem it necessary to intervene on bond markets by lowering bond yields and indirectly refinancing costs. One disciplining mechanism can be fiscal rules which represent a “permanent constraint of fiscal policy” (Kopits & Symansky, 1998). Bird and Mandilaras (2013) argue that fiscal rules might help to reduce the incidence of fiscal crises. Yet, if they aim at certain deficit or debt quotas, they might also be a constraint on the ability of stabilizing economic activity and unemployment which could have in turn a negative impact on tax revenues and public spending. Austerity aiming to achieve a certain deficit quota can thereby in a Keynesian manner lead to greater fiscal stress in the long-run, especially when economic crises are not fiscal crises in their origin. This could especially be true for the ongoing crisis in Europe. The Fiscal Compact which demands structurally balanced budgets might thereby contribute to worsening of (future) crises.¹⁷ Menguy (2014) argues similarly but has a more positive view at the Fiscal Compact. He advocates a structural budgetary

deficit goal as it is set by the Fiscal Compact over a global deficit goal as it was set by the SGP. This way, he argues, economic activity can better be stabilized.

The Fiscal Compact as disciplining mechanism could thereby become particularly important. Taking into account that the SGP had only a very limited disciplining effect (Ioannou & Stracca, 2014), that it has never been fully respected from its beginning (Afflatet, 2016) and that the European Commission shows great neglect concerning sanctioning, there are only few signs that the rules of the Fiscal Compact will discipline European governments effectively in the future.

Funding

The author received no direct funding for this research.

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Citation information

Cite this article as: Public debt and borrowing: Are governments disciplined by financial markets? Nicolas Afflatet, *Cogent Economics & Finance* (2016), 4: 1225346.

Notes

1. With this policy, the ECB officially tries to restore the monetary transaction mechanism and it does not stand alone with it. The FED had started its Quantitative Easing program (QE) long before the ECB, the Bank of Japan (BoJ), and the Bank of England (BoE) had similar programs. These programs were all driven by monetary policy. The difference between the ECB's Outright Monetary Transaction Program (OMT) and the programs of other central banks is that these central banks only bought bonds of the central state's government which does not exist in the Eurozone. Instead, the ECB announced to purchase bonds of countries having to pay an unjustified markup.
2. There are narrative counter examples for the first half of the MDH: UK showed a high debt quota in the 1800s but interest rates remained low: Between 1825 and 1914 they never exceeded 4%. France which had bigger economic resources at the time had to pay considerably higher interest rates. This was a result of its history of defaults (e.g. in 1759 and 1770) but also of more efficient financial and public institutions (Ferguson, 2001, 178ff.). Another striking example is Japan nowadays: Its debt exceeds 243% but interest rates remain low: The 10-year government bond threw off less than 1% in interest. This is supposed to be a result of the high share of domestic bond holders and also of financial repression.
3. See Mueller (2003, 249ff.) for an overview.
4. Hakkio and Rush (1991) show that government revenues and expenditures must form co-integrated time series in order to hold the condition of sustainability. This method cannot be applied here because the time series for the countries are too short. Furthermore, it can be easily shown that with a constant deficit quota, an expenditure quota exceeding the revenue quota and an interest rate above the growth rate, government limits its room for maneuver because the interest quota claims a rising share in government's budget.
5. The primary balance can show a deficit if the nominal growth rate lies above the interest rate ($g > i$).
6. Bohn (2011) suggests that this threshold could be around a debt quota of 55% for the US. Yet, this threshold is certainly not the same for every country. The ability to sustain the actual debt quota depends not only on the government's primary surplus, but also on the economic growth rate, the interest rate government has to pay on its debt and finally the government's ability to efficiently raise taxes or cut spending. Additionally, there are other factors at work, e.g. the central bank's policy. The cases of Japan and Spain show that there is no clearly defined threshold of debt from which on interest rates rise: while Japan has shown a very high debt quota without interest rates rising, Spain had to experience a sharp rise in interest rates during the Euro crisis albeit it had shown a low debt quota for a long time.
7. See Afflatet (2015) for a theoretical model.
8. The assumption of high political costs of consolidation is in line with the literature of budget consolidation which discusses this phenomenon under the keyword "war of attrition" (Alesina & Drazen, 1991; Bliss & Nalebuff, 1984). The empirical literature proves political costs of budget consolidations to be high indeed (Afflatet, 2013; Alesina, Carloni, & Lecce, 2011; Alesina, Perrotti, & Tavares, 1998). Ponticelli and Voth (2010) show based on historical records that expenditure cutbacks are clearly linked with social unrest which is manifested in riots, demonstrations, or assassinations.
9. Voters then have the choice either not to vote at all or to vote for the opposing parties. The opposing parties would underlie the same financial restrictions as government once they are in charge. But if voters underlie to fiscal illusion, the opposition can make promises about future fiscal behavior which would then also lead to the risk of a default. But as long as they are not ruling, myopic voters can take these promises for realistic.
10. This situation resembles one with multiple equilibria and a self-fulfilling prophecy. As long as there is no fear of a default, the original interest level can be held at a "good equilibrium" even once the critical and variable borderline is crossed. But if market participants begin to lose confidence, disturbances can arise which push the bond yields quickly upwards to a "bad equilibrium" which confirms the fear of investors (Baldwin et al., 2015).
11. Sovereign defaults usually simply take place when governments decide not to meet their liabilities any more. After all, they could always cut expenditures for other purposes and redirect it to the bond holders to pay interests and to replace old debts. But at a certain moment, governments do not summon up enough political will any more for an adaption of their budgets. Instead, they prefer to default (Reinhart & Rogoff, 2010, 103ff.).
12. The Greek example is especially striking in this context: After having admitted that deficits were much higher than officially reported, bond yields rose quickly. Not even half a year later, Greece had to beg for assistance from other Eurozone member countries to be saved from a default (Baldwin et al., 2015).

13. In the Eurozone, a sovereign default would also lead to an exit of the affected country from the Eurozone because the ECB could not accept sovereign bonds as securities anymore. The domestic banks would thereby be cut off from the money market. In case of a leaving of the peripheral countries, their new currency would certainly depreciate vis-à-vis the Euro. Yet, the accumulated debt would furthermore have to be served in Euro which would make it more difficult to repay it if there is not a major economic upturn due to the devaluation of a new currency. The incentive to avoid a default thereby multiplies within the Eurozone.
14. It could be argued that changing borrowing costs must not only be considered in a simultaneous and backward looking way, but also in a forward looking way, that is government could anticipate foreseeable rises in interest rates. Yet, this is very improbable. Empirical results suggest that although governments consolidating their budget might not be punished by voters for this policy they mostly shy away from such measures (Alesina et al., 1998, 2011) because of risk aversion or attempts to avoid conflicts with mighty interest groups. A preemptive consolidating strategy would thereby be very risky and improbable even though it might be sane in an economic or intergenerational sense.
15. For a model using bond yields as independent variable, the problem of endogeneity is addressed with a two-stage least-squares regression (2SLS). In this case, endogeneity is obviously a problem. The results of this regression are presented in Annex A.2. They confirm the results presented in Section 3.3.
16. The theory of political business cycles assumes that left governments prefer higher deficits over higher unemployment while right governments prefer the opposite. In the empirical literature this point is not clear. Wagschal (1996) shows for an international environment that left government tend to have lower deficits than right-wing governments. Hahn, Kamlet, and Mowery (1996), however, cannot confirm this result as they find no systematic difference between right and left governments. They are confirmed by Perotti and Kontopoulos (2002) and Volkerink and de Haan (2000) who in turn find that although the color of the government does not systematically affect the height of the deficit, it affects the height of public transfers which are higher in case of left governments. Kollias, Papadamou, and Psarianos (2014) find for the UK that left governments correct fiscal imbalances slower, while right-wing governments are more inclined to operate under a hard budget constraint. The same pattern is true for Germany (Stolder, 1997; Wagschal, 1996).
17. What can be seen here is the same trade-off as with market discipline. Markets might have a disciplining effect of governments as well as fiscal rules. It is yet another question whether such a disciplining mechanism is always desirable. If markets or fiscal rules force governments to reduce deficits, this can have an adverse effect in the long-run because government fails then to stabilize falling private consumption and investment.
18. Sovereigns' ratings play a crucial role on financial markets. The ratings of Fitch were tested in different manners. The only variable characteristic that showed a significant effect on bond yields and interest rates is the dummy that differs between investment and non-investment grades.
19. Concerning the exclusion restriction, we have good reasons to assume that these instrumental variables do not influence directly the endogenous variable, primary surplus, on the second stage: First, member countries of the Eurozone are not expected to have higher or lower deficits than others. Von Hagen and Strauch (2001) showed that a disciplining "Maastricht effect" can only be found for single member countries for a limited time period.

Second, for the period and time sample considered, one cannot speak of solving the debt problem via massive inflation. Inflation rates were low and also the effect would have to be the other way round. As a consequence of debt problems (low primary surpluses) government would try to raise inflation rates.

Third, governments should not care that much about the rating of an agency as long as this does not influence its refinancing costs.

Fourth, the debt quota should not play an immediate role for the primary surplus. If growth rates are high and interest rates are low, very high debt quotas can still be sustainable. Primary surpluses would not have to be exceedingly high. The example of Japan proves this point: The very high debt of more than 243% is still bearable thanks to low interest rates (with the domestic bond holders and the Bank of Japan playing a crucial role). This result is in line with the results found by Papadamou, Sidiropoulos, and Spyromitros (2012) who found that changes in government bond yields multiplied with an index for central bank independence is negatively correlated with the change in stock of government bonds.

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Annex 1

A.1. Figures

Figure A1. Annual government bond yields and primary surpluses in the European Union.

Source: Annual data from Eurostat and based on own calculations.

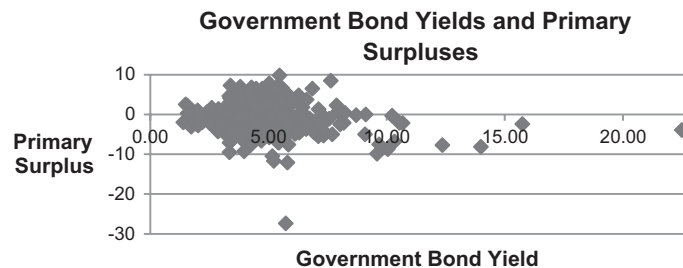
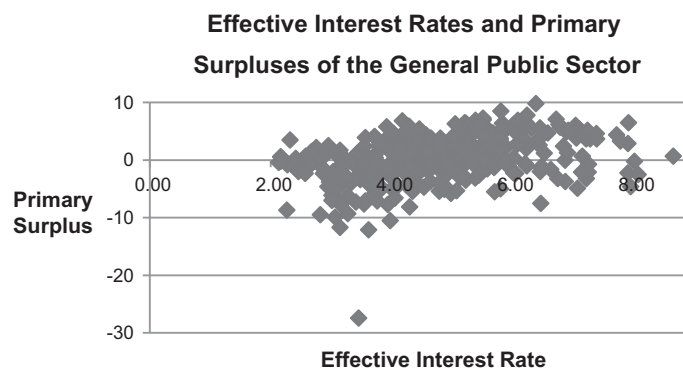


Figure A2. Effective annual interest rates governments have to pay on their outstanding debt and primary surpluses in the European Union.

Source: Annual data from Eurostat and based on own calculations.



A.2. Bond yields and primary surpluses

Besides the tests presented above, an additional test with bond yields on the secondary markets as vital independent variable was run, too. This model was addressed as two-stage least squares regression with fixed effects. This two-stage approach is necessary to take the problem of endogeneity into account (Winker, 2010, 182ff.). This problem appears because it must be assumed, as explained above, that interest variables not only influence primary surpluses but are in turn influenced by the primary surplus. The mutual dependence causes the issue of simultaneity. An ordinary least squares regression would lead to distorted and inconsistent estimated coefficients. A two-stage least squares regression is suitable to solve this problem. This way, the estimated coefficients are corrected. A separate instrumental variables regression taking into account the first stage indicates the correct standard errors, *t*- and *p*-values.

This two-stage regression was formulated as follows on the first stage:

$$Y_{10,t} = \beta Z_{i,t} + \alpha_i + \varepsilon_{i,t}$$

Here, $Y_{10,t}$ is the yield of 10-year government bonds, $Z_{i,t}$ is a vector of instrumental variables, α_i catches the time-invariant individual effects and $\varepsilon_{i,t}$ is the error term. It is crucial that the instrumental variables as subset of the exogenous variables do not influence the primary surplus on the second stage directly but only over their influence on the bond yields (Angrist & Pischke, 2009, 113ff.). The instrumental variables employed here are the annual development of national stock indexes, the bond yields of US bonds, dummies for Euro member countries, for the Fitch investment rating¹⁸ and the public debt crisis, the inflation rate, and the debt quota. For these instruments, we can assume that they are uncorrelated with the error term on the second stage.¹⁹

The fitted values of the government bond yields ($\widehat{Y10}_{i,t}$) obtained on the first stage are then used on the second stage to explain the dependent variable primary surplus:

$$s_{i,t} = \beta_1 \widehat{Y10}_{i,t} + \beta_2 X_{i,t} + \alpha_i + \varepsilon_{i,t}$$

The results of this regression are presented in Table A1. Overall, they confirm the disciplining effect of financial markets. The positive algebraic sign on the second stage for the fitted values of bond yields suggest that governments raise primary surpluses when bond yields rise.²⁰ This means that even before perceived interest rates rise, financial markets have a disciplining effect on governments. This can be explained by the fact that even though bond yields are not perceived immediately in budgets, governments must expect that this effect is perceived sooner or later in effective interest rates. They can thereby be interpreted as a warning sign.

Table A1. Econometric estimation (2SLS)

	First stage fitted values bond yields		Second stage primary surplus
National stock index	-1.11 (-3.47)***	Bond yields	0.74 (5.45)***
US bond yields	0.79 (8.98)***	Real grow rate	0.52 (7.91)***
Debt quota	0.03 (3.96)***	Unemployment	-0.53 (-7.41)***
Consumer prices	0.02 (0.23)	Real exchange rate	0.09 (2.32)*
Debt crisis	0.51 (1.63)	Current account balance	0.27 (3.87)***
Fitch investment rating	-7.55 (-11.40)***	Election year	-0.15 (-0.45)
Euro member country	-0.10 (-0.33)	Stability and growth pact	1.24 (3.10)**
N	248		248
R ²	0.52		0.52

Notes: Coefficients, t-values (in parentheses) and significance level (': 10% level, "": 5% level, "***": 1% level, "****": 0.1% level) are indicated.

A.3. Further econometric results

The following Table A2 presents the results for the panel data estimation presented above with random effects instead of fixed effects. It can clearly be seen that the choice of statistical models does not affect the results of the analysis.

Table A2. Econometric estimation with random effects

	Dependent variables			
	1. Primary surplus (public sector)	2. Primary surplus (central state)	3. Primary surplus (public sector)	4. Primary surplus (public sector)
Intercept	-7.69 (-3.45)***	-12.59 (-4.47)***	-7.23 (-2.66)**	-12.05 (-4.48)***
Effective interest rate	0.74 (5.24)***	1.01 (5.11)***	1.46 (4.46)***	1.55 (4.47)***
Effective interest rate (Lag 1)			0.12 (0.33)	0.18 (0.48)
Effective interest rate (Lag 2)			-0.60 (2.13)*	-0.77 (-2.62)**
Real growth rate	0.33 (7.47)***	0.17 (2.98)**	0.31 (6.64)***	0.19 (3.63)***
Unemployment rate	-0.23 (-5.06)***	-0.12 (-2.30)*	-0.22 (-4.38)***	-0.13 (-2.66)**
Real exchange rate	0.05 (2.58)***	0.07 (2.53)*	0.04 (1.61)	0.08 (3.16)**
Election year	-0.47 (-1.67)*	-0.20 (-0.60)	-0.43 (-1.39)	-0.02 (-0.08)
Stability and growth pact	1.16 (2.73)**	0.30 (0.50)	1.11 (2.25)*	0.71 (1.25)
Left government		0.92 (1.59)		0.23 (0.38)
Right government		1.55 (2.70)**		0.72 (1.23)
N	386	241	334	189
R ²	0.44	0.33	0.44	0.43

Notes: Coefficients, *t*-values (in parentheses) and significance level (': 10% level, "": 5% level, "": 1% level, "": 0.1% level) are indicated.



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