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THE IMPACT OF SOVEREIGN BOND YIELDS ON FISCAL DISCIPLINE

CONTENTS

ABBREVIATIONS

AR(2) – autoregressive model
CAPB – cyclically adjusted primary balance
EA – euro area
EU – European Union
FR – fiscal reaction
GDP – gross domestic product
GMM – Generalised Method of Moments
IBC – intertemporal budget constraint
IMF – International Monetary Fund
IV – instrumental variable
JP – Japan
OECD – Organisation for Economic Co-operation and Development
OLS – ordinary least squares
PB – primary balance
UK – United Kingdom
US – United States of America

ABSTRACT

This paper studies the impact of sovereign bond yields on fiscal discipline against the background of unprecedentedly low interest rates in advanced economies brought about by ultra-expansionary monetary policies of recent years. By employing the panel data econometric approach for a sample of OECD, EU and euro area countries over the period 1980–2014, the study suggests a positive and statistically significant impact of long-term sovereign bond yields on primary balances (PBs), indicating that a decrease in borrowing costs leads to a statistically significant deterioration of fiscal balances. The findings herein also suggest that falling bond yields pass on to fiscal balances through increases in government expenditure rather than revenue reduction. From the economic policy perspective, these findings imply that monetary policy measures resulting in ultra-low interest rates may cause negative side effects for fiscal discipline.

Keywords: fiscal policy, fiscal reaction function, sovereign bond yields, panel data

JEL codes: E62, H62

1. INTRODUCTION

In the aftermath of economic crisis industrialised countries have experienced a considerable slowdown in economic growth and inflation rates well below central bank targets. In order to aid the economic recovery and bring inflation rates closer to their targets, central banks across industrialised countries have recently put to use a set of monetary policy tools (including large-scale purchases of securities) aimed at reducing long-term interest rates.[1] This ultra-expansionary monetary policy brought about a noticeable reduction in government borrowing costs rendering fiscal stimulus more attractive. It has been shown in a number of studies that carefully designed and predictable fiscal stimulus measures may provide significant support to domestic economic activity in the short to medium term (see Cavallari and Romano (2017), Freedman et al. (2009)). However, lower interest rates may also defer the implementation of structural reforms which are crucial for boosting long-term economic potential and restoring sustainable economic growth. Whether lower interest rates result in a looser fiscal policy stance in advanced economies is ultimately an empirical issue, which we aim to address in this study.

There has been a number of research papers focusing on debt sustainability concerns and cyclical reaction of fiscal balances. These papers (see, e.g. Benetrix and Lane (2013), Celasun et al. (2007)) estimate fiscal policy reaction functions capturing the response of fiscal balances to initial fiscal conditions (e.g. accumulated level of public debt) and cyclical conditions (proxied by the level of output gap). Most empirical findings agree that governments are motivated to improve fiscal balances as public debt grows and debt sustainability is questioned. Evidence regarding the effect of business cycles on fiscal discipline is mixed and depends on whether the headline balance or cyclically adjusted balance is employed. Fiscal policy reaction functions have been lately augmented with other macroeconomic, political or financial variables to better understand the effect of political cycles, budget processes and procedures (see Maltritz and Wuste (2015), Tujula and Wolswijk (2004)), or financial market swings (see Tagkalakis (2011)).

However, to the best of our knowledge, the market disciplining effect of borrowing costs has received little attention thus far. For example, Tujula and Wolswijk (2004) investigated the determinants of budget balances in the OECD countries, among them the long-term interest rate. They found that rising interest rates exert a negative and statistically significant effect on nominal budget balances due to an increase in debt servicing costs. This effect, however, may have masked the discretionary government response and, therefore, does not answer the question whether lower interest rates lead to deteriorating fiscal stances. Tagkalakis (2011) augmented the fiscal policy reaction function for a panel of OECD countries with financial variables to investigate the impact of asset price changes (caused by financial crises) on the fiscal policy stance. He included the spread between long-term and short-term interest rates to account for a possible rise in debt servicing costs or future debt sustainability concerns. He reports

[1] The effectiveness of monetary policy measures in determining developments in long-term interest rates has been shown in a number of empirical studies, inter alia, in the most recent paper by Ankram and Li (2017). Monetary policy actions seem to change agents' expectations regarding monetary policy stance and influence long-term rates (see, e.g. Fuhrer (1995)) when these actions are seen as persistent (see Rolley and Sellon (1995)). With respect to unconventional monetary policy measures, evidence exists (see Wu (2014)) that further guidance and the large-scale asset purchasing programme contributed significantly to the decline in long-term interest rates.

a negative effect of the steepening yield curve on current primary expenditure, which might reflect market concerns about the future debt sustainability. Thus, market pressure may induce policy makers to tighten the fiscal policy stance by reducing expenditure. Yang et al. (2015) showed that rising long-term interest rates increase the probability of fiscal adjustment by imposing an additional burden on public debt.

In this study, we try to fill this gap in the literature regarding the impact of interest rates on fiscal discipline. We investigate factors that affect PBs in a panel of OECD countries over the period 1980–2014. In addition, we also use more homogenous sets of EU and euro area countries with a common institutional framework. We estimate FR functions in which developments in fiscal balances are explained by a range of macroeconomic, fiscal and political/institutional explanatory variables. In addition, we include long-term sovereign bond yields to account for the market disciplining effect on fiscal policy[2]. We check robustness of our estimates by varying time spans and specifications. Finally, we also provide evidence for the existence of non-linearities. To address endogeneity concerns inherent in dynamic panel regressions, we employ the GMM estimation approach.

Overall, the results of this study show that declining borrowing costs seem to affect budget behaviour of fiscal policy makers by inducing them to run higher budget deficits. This effect is particularly strong in the euro area countries and appears to work through the expenditure channel. These results are robust across time, and there is evidence in favour of (a) somewhat lower effect of bond yields during the period of economic upswing and (b) a higher effect when interest rates are on the upward trend. Hence, the findings herein imply that monetary policy measures resulting in ultra-low interest rates may have an unintended impact on fical discipline.

The remainder of the paper is structured as follows. Section 2 briefly reviews theoretical rationale for using FR functions and describes the methodology employed in this study to estimate it. Section 3 presents the data and main stylised facts regarding the pattern of sovereign bond yields and budget balances in the largest OECD currency areas. Section 4 provides estimation results of the fiscal policy reaction function with a focus on the impact of sovereign bond yields. Finally, Section 5 concludes.

[2] In this study, the terms "long-term sovereign bond yields" and "interest rates" are used interchangeably.

2. THEORETICAL BACKGROUND AND METHODOLOGY

In this study, we explore the impact of interest rates on budget balances in industrialised countries to uncover the effect of improving (deteriorating) borrowing conditions on fiscal policy decision making. To this end, we estimate FR functions that have mainly been used in the empirical literature to investigate the role of sustainability and motives of economic stabilisation for the conduct of fiscal policies. Recently, FR functions have been increasingly employed for other purposes as well. In this section, we introduce the concept of FR functions and describe the methodology used in this paper to estimate them.

The starting point for the analysis of budget balances is the following basic relationship between public debt and PB[3]:

$$D_t = D_{t-1} + \frac{(r-g)}{(1+g)} D_{t-1} - PB_t \quad (1)$$

where debt-to-GDP ratio (D_t) in period *t* is expressed as a sum of debt-to-GDP ratio at the end of the previous period *t*–1, interest payments on accrued debt (with *r* being real interest rate and *g* representing real GDP growth rate) and PB -to-GDP ratio (PB_t) in period *t* with the opposite sign. Rearranging equation (1) yields PB that ensures unchanged debt-to-GDP ratio:

$$PB_t = \alpha D_{t-1} \quad (2)$$

where coefficient α is equal to $\frac{(r-g)}{(1+g)}$.

This relationship can be further used in the analysis of debt sustainability. Bohn (2008) shows that iterating equation (1) forward in time and imposing transversality or no-Ponzi game condition (whereby the discounted debt-to-GDP ratio converges to zero in limit) yields the so called intertemporal budget constraint (IBC). This condition states that the current public debt ratio is regarded sustainable, if its value is equal to the risk adjusted present value of current and future primary budget surpluses:

$$D_{it} = \sum_{n=0}^{\infty} \beta^{-n} E_t[PB_{t+n}] \quad (3)$$

where $\beta = \frac{1+r}{1+g}$. Thus, the public debt sustainability implies that public debt at any given period must be offset by future primary surpluses. As one's ability to borrow depends on other's willingness to lend, equation (3) is a necessary condition for fiscal sustainability, otherwise rational investors will refuse to buy public debt. This implies that changes in debt, induced by low economic growth or unexpected spending, require a response in PB for equation (3) to hold. To test for debt sustainability, Bohn (2008) advocates using the following extension of equation (2), which represents the general form of FR function:

$$PB_t = \alpha D_{t-1} + e_t \quad (4).$$

For IBC to hold, the estimate of α should be positive, provided that the present value of GDP is finite and e_t (a set of other determinants) as a share of GDP is bounded, and the equation itself is properly specified, i.e. all the relevant PB determinants are

[3] The role of other factors impacting public debt (e.g. exchange rate movements or privatisation) is ignored for simplicity.

included[4]. The estimates of α found in other empirical studies usually vary between 0.01 and 0.10 consistent with the above definition of debt sustainability (see Checherita-Westphal and Zdarek (2016) for a comprehensive review of literature, estimating budget balance sensitivity to changing public debt).

Regarding other explanatory variables, the most commonly used is the output gap, i.e. a variable capturing cyclical conditions. The estimated effect of output gap on PB includes both automatic and discretionary responses. The former is beyond direct control of fiscal authorities (e.g. an automatic increase in tax revenue or reduced expenditure on social benefits during a period of economic upturn). In order to estimate the latter (discretionary response), PB corrected for the automatic effect of business cycles (cyclically adjusted PB or CAPB) is used as a dependent variable in FR functions[5]. There is no consensus in the literature whether discretionary response is largely pro- or counter-cyclical. Results depend on the estimation procedure used, country sample and time period involved as well as on data definition and source (see Plodt and Reicher (2015), Golinelli and Momigliano (2009)).

Besides traditional debt and cyclical variables, FR functions have recently been expanded to include the impact of other factors, in particular the institutional environment, as many countries incorporated some variants of fiscal policy rules. Thus Maltritz and Wuste (2015) provide an extensive analysis on how fiscal rules and fiscal councils affect fiscal balances in Europe and confirm the positive relationship between fiscal rules and fiscal discipline. Also, political environment may play a role. For example, Tujula and Wolswijk (2004) show that in the election years, the fiscal balance tends to be lower than in other years, probably reflecting actions taken by politicians (reduced taxes and increased spending) to increase their chances of staying in the office. As mentioned in the introduction, some of more recent studies include financial market indicators in FR functions (see Tagkalakis (2013)), among them long-term interest rates (see Tagkalakis (2011)). However, the focus on the latter in the literature has thus far been insufficient.

In this study, we estimate the FR function which accounts for debt sustainability concerns, the reaction of fiscal policy to cyclical and political conditions as well as the impact of long-term sovereign bond yields, with the latter being the variable of our interest:

$$G_{it} = \alpha_1 G_{it-1} + \alpha_2 D_{it-1} + \alpha_3 Y_{it} + \alpha_4 \pi_{it} + \alpha_5 R_{it} + \alpha_6 X_{it} + \mu_i + \vartheta_t + \varepsilon_{it} \qquad (5)$$

where index *i* (i=1,…,N) stands for the country and *t* (*t*=1,…,T) indicates the period. *G* is dependent fiscal policy variable, *D* is debt-to-GDP ratio, *Y* denotes output gap, π is the rate of inflation, *R* is long-term sovereign bond yield, *X* denotes political/institutional variables, μ_i and ϑ_t stand for unobserved country and period effects respectively, ε_{it} denotes disturbances that are uncorrelated across countries and time periods. α_1 to α_6 represent marginal effects of explanatory variables in percentage points of the dependent fiscal policy variable.

[4] For the rationale of using equation (4) to test for debt sustainability, see Bohn (1995).

[5] We acknowledge the fact that under certain circumstances fluctuations in CAPB may not be fully explained by discretionary fiscal policy measures. Policy unrelated revenue windfalls (shortfalls) could arise due to a number of factors, e.g. changes in consumption composition, changes in tax compliance, developments in property markets, etc. (see, e.g. Morris et al. (2009)). Despite these caveats, CAPBs are still best available proxies for measuring fiscal policy stance.

It is possible that the institutional arrangement of the EU and euro area influences the interest rate effect on fiscal policy decision making. Hence, in order to take into account possible heterogeneity across different country groupings, we estimate the FR function (5) both for the EU and euro area countries. We are particularly interested how historically low bond yields seen in the euro area affect the incentive of member states to reduce their budget deficits in the context of current policy debates.

To test the sensitivity of baseline estimation results with respect to the choice of the selected sample, we use alternative samples as a robustness check. First, we explore whether estimation results are robust to the selection of the sample period. In 1992, the EU countries signed the Maastricht Treaty which foresaw the creation of the euro area with a common currency. The road to the euro implied that a set of criteria should have been fulfilled (including the fiscal balance and public debt criteria) before an EU member state could introduce the common currency. This may have an impact on the estimates of FR function, hence, we also estimate equation (5) for the period starting from 1992[6].

In addition, we investigate whether the estimated effect of bond yields differs(a) at different levels of public debt, (b) at different levels of bond yields, (c) across periods of growing and shrinking yields, (d) for positive and negative values of output gap, and (e) for periods before and after the onset of the recent economic crisis. We test these hypotheses by including interactive terms to verify whether the difference in the bond yield effect is statistically different from zero.

Finally, we are also interested in channels through which the effect of sovereign bond yields takes place. Thus, we employ the current revenue ratio and primary expenditure ratios (in cyclically adjusted terms) as dependent variables in equation (5).

When estimating equation (5), we make use of the panel econometric technique. Since we include a lagged dependent variable as an explanatory variable, the estimation of equation (5) using conventional OLS fixed effects or instrumental variables (IV) approach would not be feasible and the resulting estimates would be inconsistent. Hence, we employ the GMM-difference estimation technique (see Arellano and Bond (1991)). Following Golinelli and Momigliano (2009) and Celasun et al. (2007), we use the $t-2$ to $t-4$ lags of variables that enter regression[7]. To support the validity of chosen instruments, we carry out the Sargan test of over-identifying restrictions and a test for the absence of second order autocorrelation in the differenced error term.

[6] For example, Benetrix and Lane (2013) showed that in the wake of the Maastricht Treaty there was a significant improvement in counter-cyclicality of fiscal policy, which, however, was reversed in the aftermath of the actual euro adoption.

[7] Where the number of observations is small and does not allow for such an extensive subset of instruments, we use a smaller number of lags. It should be noted, though, that the choice of instrument subsets does not have a large impact on the estimation results.

3. DATA DESCRIPTION

In our baseline specification, we employ an annual unbalanced panel of the current OECD member states[8]. As mentioned, we also narrow our sample to include only the EU and the euro area countries and estimate the FR function for these country samples separately. The dataset in this study comprises fiscal variables (PB, CAPB, cyclically adjusted current revenue and cyclically adjusted primary expenditure), long term (10-year) sovereign bond yield, general government debt-to-GDP ratio, output gap (% of potential GDP), inflation rate, and two political/institutional dummies – one for the election year and the other to account for the presence of fiscal rules aimed at controlling the budget balance. We include country and time dummies to account for country- and time-specific shocks. Finally, we include several specific dummies to capture outliers. These are related to the extraordinary effect of financial and economic crisis in Iceland in 2008–2009, Greece in 2013–2014, and the financial support to ailing banks in Ireland in 2010. Due to restrictions imposed by data availability, we limit our sample to 1980–2014. However, political variables are available only from 1985, therefore, for some FR function specifications the sample spans a shorter period[9]. The data are at annual frequency and collected from various sources, while the bulk of it comes from the November 2015 vintage of OECD Economic Outlook data (see details in Table 1).

[8] In 2016, these were Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, South Korea, Spain, Sweden, Switzerland, Turkey, the UK, and the US. Estonia, Luxembourg and Slovenia are excluded from the sample due to the lack of data on the long-term sovereign bond yields. Latvia is not included in this dataset either, as it joined the OECD only in June 2016. The number of countries employed in a certain specification depends on data availability.

[9] Moreover, it should be noted that the data starting point is different for different countries. In fact, the data for at least four basic variables – PB, public debt, sovereign bond yields and output gap – start from 1980 only in the case of Belgium, Canada, France, Italy, Japan, the Netherlands, Sweden, and the UK. Fiscal variables in cyclically adjusted terms are normally available from year 1986 at the earliest.

Table 1
List of variables used in the study

Variable	Data source	Transformation
General government PB	OECD Economic Outlook No 98 (November 2015), IMF World Economic Outlook database, Eurostat	% of GDP
General Government CAPB	OECD Economic Outlook No 98 (November 2015), IMF World Economic Outlook database, Eurostat	% of potential GDP
General government cyclically adjusted current revenue	OECD Economic Outlook No 98 (November 2015), IMF World Economic Outlook database, Eurostat	% of potential GDP
General government cyclically adjusted primary expenditure	OECD Economic Outlook No 98 (November 2015), Eurostat	% of potential GDP
Long-term 10-year sovereign bond yields	Datastream	%
General government debt	OECD Economic Outlook No 98 (November 2015), IMF World Economic Outlook database	% of GDP
Inflation	OECD Economic Outlook No 98 (November 2015), IMF World Economic Outlook database	%
Output gap	OECD Economic Outlook No 98 (November 2015), IMF World Economic Outlook database	% of potential GDP
Election year	Comparative Political Data Set (http://www.cpds-data.org/)	dummy variable
Fiscal rules to control budget balance	IMF Fiscal Rules Dataset	dummy variable

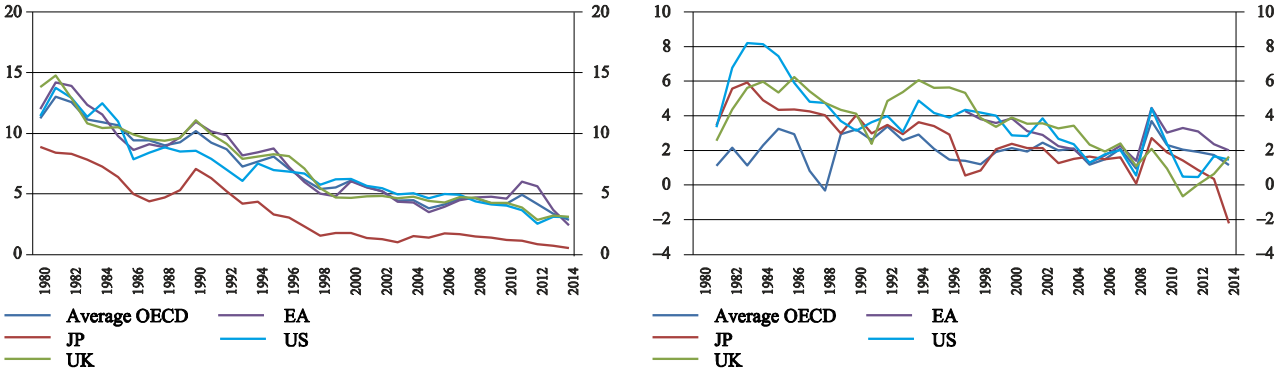
Chart 1 shows the developments in long term sovereign bond yields for the OECD countries on average and for four most important currency areas – the euro area, the US, the UK, and Japan. It reveals a downward trend in sovereign bond yields for the average of the OECD countries as well as for the above four economies with some temporary interruptions in the trend throughout the period. The yields achieved their historical minimum in 2014 due to ultra-expansionary monetary policies implemented by largest central banks, including the ECB[10]. Overall yields have moved broadly in parallel with each other, with yields in Japan being somewhat lower than in the other economies. The idiosyncratic developments in Japanese bond yields largely stem from lower rates of inflation or even deflation observed in the first decade of the 21st century, as Japan's sovereign bond yields were in real terms closer to the yields of other countries.

[10] The downward trend in sovereign bond yields has continued since 2014, with bond yields declining further in 2015 and 2016.

Chart 1

Long-term sovereign bond yields in nominal (Panel A) and real (Panel B) terms in 1980–2014

(%)



Sources: Datastream and OECD.

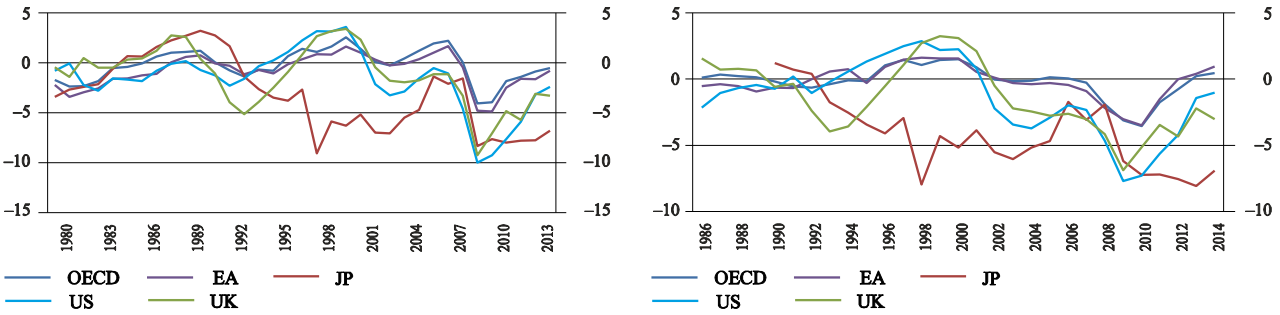
Chart 2 presents general government PBs of the same set of economies in both nominal and cyclically adjusted terms. Until the beginning of the 1990s, PBs in four main currency areas had been improving, with the OECD countries reaching on average a surplus of around 1% of GDP in 1990. The following decade was marked by deterioration in PBs and a subsequent recovery in the late 1990s. The situation in Japan was quite different, with deterioration of PB lasting longer and being more pronounced (with primary budget deficit in 1998 reaching a level above 9% of GDP). Major changes occurred in 2009 when financial crisis caused deterioration of PBs. Since then, balances have been improving in all countries, though at a different pace.

Partly these PB developments were driven by automatic stabilisers smoothening periods of economic booms and recessions, while the changes in cyclically adjusted terms remained more subdued. This difference between the nominal balance and the structural one is particularly visible in some of the OECD economies before the onset of the financial crisis, where PBs improved in nominal terms but stayed on the same level or even deteriorated in cyclically adjusted terms.

Chart 2

General government PB (Panel A) and general government CAPB (Panel B) in 1980–2014

(% of GDP)



Source: OECD.

4. MAIN FINDINGS

4.1 Baseline estimation results

The estimation results for the sample of OECD countries are presented in Table 2 across two alternative dependent variables and employing different specifications. In addition to coefficients and their significance levels, we report the number of observations for each specification, probability of J-test of over-identifying restrictions and probability of AR(2) test for the absence of second order autocorrelation in the differenced error term. The test results confirm that the instruments used in the estimation are valid, and there is no second-order serial correlation in disturbances.

The estimation results suggest that a positive and statistically significant relationship exists between long-term sovereign bond yields and the fiscal balance, indicating that an increase (decrease) in borrowing costs leads to statistically significant improvement (deterioration) in both PB and CAPB. Our estimates show that a decrease of 1 percentage point in bond yields would result in approximately 0.12–0.15 percentage point worsening in PB and 0.17–0.19 percentage point deterioration in CAPB.

Concerning the impact of other explanatory variables, the results are as follows.

– As expected, we find the estimates of lagged debt coefficient to be positive and statistically significant consistent with the Bohn's (2008) definition of public debt sustainability (see Section 2). These estimates (0.04–0.06) are fairly similar to the ones found in other studies which usually range between 0.01 and 0.10 (see, e.g. Afonso and Jalles (2011), Baldi and Staehr (2016), Benetrix and Lane (2013), Celasun et al. (2007), Plodt and Reicher (2015), Tagkalakis (2013), Weichenrieder and Zimmer (2014)).

– We show that an increase (decrease) in output gap causes an improvement (deterioration) in PB. When CAPB is used, our estimates suggest a strong pro-cyclical behaviour, i.e. an increase (decrease) in output gap causes deterioration (improvement) in CAPB. This switch in the sign arises because the changes in CAPB reflect only discretionary fiscal policy response, whereas PB movements also capture the effect of automatic stabilisers. Therefore, the results imply that discretionary actions taken by policy makers are pro-cyclical, confirming the findings of a number of empirical analyses (see, e.g. Lane (2003) and Benetrix and Lane (2013) for the examination of fiscal policy cyclicality in OECD and euro area countries respectively)[11]. We find the difference in coefficients between the two models to be approximately 0.5, which coincides with the estimates of other studies (see, e.g. Bouthevillain et al. (2001), Plodt and Reicher (2015)). As regards the impact of

[11] However, it should be noted that the type of data used in the majority of studies including ours, is ex-post data, i.e. measured after the end of the reported year. When real time data reflecting information available to policymakers at the moment of making decisions are used instead, the response of fiscal policy makers to cyclical developments has been found to be acyclical or counter-cyclical (see, e.g. Beetsma and Giuliodori (2010), Golinelli and Momigliano (2009)) which raises the importance of the data issue.

inflation, it is positive and statistically significant, probably reflecting that government revenue is more sensitive to inflation than government expenditure[12].

– Political and institutional environment appears to be another driver of fiscal balance. The results indicate that budget balances deteriorate in election years (approximately by 0.2 percentage point), possibly reflecting tax cuts or expenditure increases implemented by political incumbents to increase their chances to get re-elected. These findings are in line with previous research (see, e.g. Maltritz and Wuste (2015), Tujula and Wolswijk (2004)). As expected and in line with the literature (see, e.g. Afonso and Guimaraes (2015)), the introduction of fiscal rules exerts a strong positive effect on fiscal balance.

Table 2
Fiscal reaction function in OECD country sample

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	1	2	3	1	2	3
Dependent variable ($t-1$)	0.101 ***	0.108 ***	0.120 ***	0.111 ***	0.052 *	0.077 ***
Debt ($t-1$)	0.058 ***	0.048 ***	0.041 ***	0.052 ***	0.041 ***	0.043 ***
Output gap	0.300 ***	0.222 ***	0.212 ***	–0.209 ***	–0.299 ***	–0.308 ***
Yields	0.122 **	0.136 ***	0.119 **	0.180 ***	0.193 ***	0.132 ***
Inflation			0.166 ***			0.162 ***
Election year dummy		–0.211 ***	–0.142 **		–0.243 ***	–0.212 ***
FR for budget balance		0.835 ***	0.482 *		1.232 ***	0.927 ***
Probability of J-statistic	0.958	0.998	0.998	0.677	0.949	0.963
AR(2) p value	0.803	0.913	0.766	0.643	0.699	0.727
Observations	670	550	549	611	530	530

Notes. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

The estimation results for the EU countries are similar to those for the OECD countries. In particular, falling bond yields appear to provide disincentives for governments to improve their fiscal balances (see Table 3). Furthermore, the coefficient estimates do not differ significantly from those obtained for the OECD countries. Regarding the effect of other explanatory variables, the pro-cyclicality in discretionary actions taken by policy makers seems to be more evident in the EU sample, and the adjustment effect in response to rising debt levels is also more pronounced presumably due to the presence of the public debt threshold imposed by the Maastricht Treaty and higher debt ratios in EU countries on average as compared to non-EU OECD member states[13].

[12] Additionally, we also included GDP growth, housing price and GDP per capita as explanatory macroeconomic variables as well as sovereign bond yields in real rather than nominal terms. We do not report estimation results here for the sake of space but they are available upon request. It should be noted that their inclusion does not change the estimate of the bond yield coefficient significantly. Also, worth mentioning is the large coefficient with which the housing price enters FR functions, which might be attributable to remarkable swings in house price developments.

[13] Even though Japan, the US and Canada have relative high public debt levels, other non-EU OECD countries, in particular Chile, Switzerland, Australia, Korea, Mexico, Turkey, New Zealand, Norway and Iceland fall below the average of EU (on average throughout the sample period).

Table 3
Fiscal reaction function in EU country sample

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	1	2	3	1	2	3
Dependent variable ($t-1$)	0.101 ***	0.108 ***	0.120 ***	0.111 ***	0.052 *	0.077 ***
Debt ($t-1$)	0.058 ***	0.048 ***	0.041 ***	0.052 ***	0.041 ***	0.043 ***
Output gap	0.300 ***	0.222 ***	0.212 ***	–0.209 ***	–0.299 ***	–0.308 ***
Yields	0.122 **	0.136 ***	0.119 **	0.180 ***	0.193 ***	0.132 ***
Inflation			0.166 ***			0.162 ***
Election year dummy		–0.211 ***	–0.142 **		–0.243 ***	-0.212 ***
FR for budget balance		0.835 ***	0.482 *		1.232 ***	0.927 ***
Probability of J-statistic	0.958	0.998	0.998	0.677	0.949	0.963
AR(2) *p* value	0.803	0.913	0.766	0.643	0.699	0.727
Observations	670	550	549	611	530	530

Notes. Estimated by GMM-difference including time fixed effects. The t – 2 *to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

The findings for the euro area countries are also similar to those of the OECD with respect to the sign and statistical significance of estimated coefficients. However, the estimated elasticity of fiscal balance to sovereign bond yields is on average higher, presumably reflecting larger homogeneity among euro area countries.

Table 4
Fiscal reaction function in euro area country sample

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	1	2	3	1	2	3
Dependent variable ($t-1$)	–0.067 ***	–0.012 *	0.015 *	–0.108 ***	–0.112 ***	–0.074 ***
Debt ($t-1$)	0.101 ***	0.081 ***	0.082 ***	0.086 ***	0.084 ***	0.096 ***
Output gap	0.358 ***	0.342 ***	0.297 ***	–0.242 ***	–0.200 ***	–0.249 ***
Yields	0.235 ***	0.280 ***	0.244 ***	0.232 ***	0.318 ***	0.241 ***
Inflation			0.324 ***			0.305 ***
Election year dummy		–0.174 ***	–0.137 ***		–0.168 ***	–0.001
FR for budget balance		1.156 **	1.239 ***		1.146 **	1.194 **
Probability J-statistics	0.996	0.999	0.999	0.999	0.999	0.999
AR(2) p value	0.998	NA	0.680	0.190	0.974	NA
Observations	296	270	269	275	261	261

Notes. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

4.2 Stability of fiscal reaction functions over time

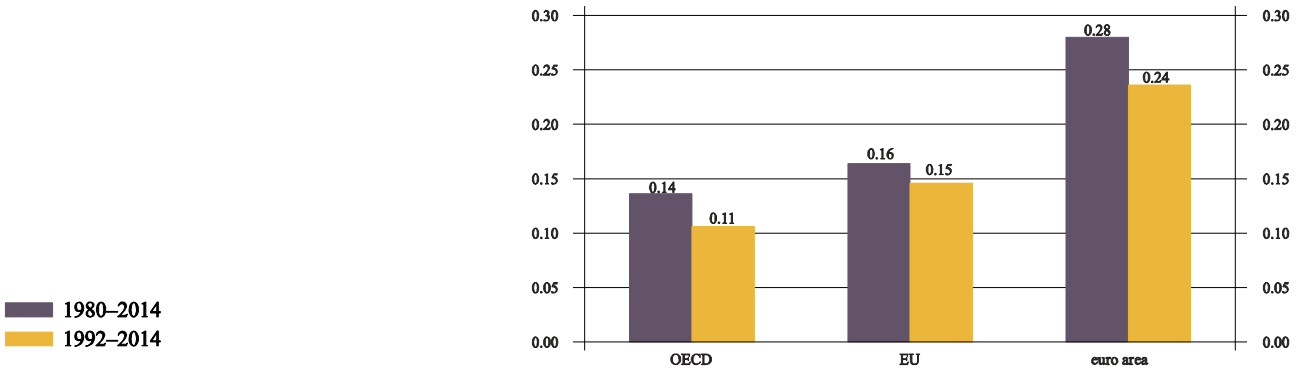
It is usually stressed that the signing of the Maastricht Treaty in 1992 may have changed fiscal policy decision making in the euro area countries as it implied the necessity to comply with the rules of the Stability and Growth Pact (see, e.g. Benetrix and Lane (2013)). Therefore, we estimated FR function using the sub-period starting in 1992. For the sake of comparability, we did it for all three country groupings rather than for the euro area countries alone. Comparing the estimated coefficients (see Tables A1–A3 in Appendix) with those using the full sample confirms their robustness in terms of sign and significance. In particular, it can still be seen that higher (lower) bond yields lead to a significant improvement (deterioration) in both PB and CAPB. However, the value of yields coefficient in the FR function estimated for PBs is somewhat lower in the more recent sample period, i.e. fiscal authorities have become less responsive to changing borrowing costs (see Chart 3). This may be explained by the increased focus of fiscal authorities on the budget deficit's Maastricht criterion of 3% of GDP after the Maastricht Treaty became binding. The response of PB to cyclical fluctuations has also become more subdued, while that of cyclically adjusted PB stayed at a comparable level. This implies that automatic response to business cycle, i.e. the workings of the automatic stabilisers, had somewhat declined over the end-1980s. This may have occurred due to the declining path in income tax rate progressivity that took place in the 1980s alongside the adoption of flatter tax systems in many OECD countries (see Padovano and Galli (2002)).

Additionally, we have checked whether the bond yield coefficient has changed since the onset of the recent economic crisis in 2008. For this purpose, we included an interactive dummy variable for the bond yield coefficient, which is equal to 1 starting from year 2008 and zero otherwise. The estimation results for the OECD and the EU country samples exhibit no change in the way how bond yields affect either PB or CAPB (see Table A4). The estimates for the euro area countries, however, show that after the crisis, the relationship between bond yields and the fiscal position has become

significantly weaker than in the periods before the crisis. These results, however, are not robust in alternative samples; therefore, they should be interpreted with caution.

Chart 3

Estimated elasticity of primary balances with respect to sovereign bond yields



Notes. Estimated by GMM-difference including time fixed effects. The t *– 2 to* t *– 4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. Estimates correspond to FR functions (labelled as (2) in tables throughout this study) that include fiscal variables, output gap and political/institutional variables.*

4.3 Transmission of sovereign bond yield effect

Our estimates of FR function show that fiscal balances are positively related to changes in long-term sovereign bond yields; however, they do not reveal the channels through which higher bond yields translate into better fiscal positions. Higher financing costs may motivate governments to reduce spending and/or to raise taxes. In order to fill this gap and find out what shapes the response of CAPB to changing yields in each of the three country groupings (OECD, EU and euro area), we estimate FR functions for both current revenue ratio and total primary expenditure ratio in cyclically adjusted terms. Tables A5–A7 provide a set of estimation results of these alternative FR functions for the OECD, the EU and the euro area countries respectively. Table 5 summarises these results.

The bond yield transmission channel in the OECD sample is not certain, since both the revenue ratio and the expenditure ratio appear to be unaffected by bond yield fluctuations. This may point to certain heterogeneity of channels. In both the EU and euro area country cases, rising bond yields have a negative effect on primary expenditure[14]. This also means that falling borrowing costs result in deteriorating budget balances through increases in spending. A 1 percentage point drop in bond yields leads to an increase in the primary expenditure-to-GDP ratio by about 0.12–0.21 percentage point in the EU sample and by 0.20–0.33 percentage point in the sample of the euro area member states. Unexpectedly, we find a negative, although not very pronounced, relationship between bond yields and the current revenue, which might indicate that some expenditure cuts induced by rising bond yields may be

[14] These findings are, in a sense, in line with Golinelli and Momigliano (2006) who have shown that fiscal policies tend to be more homogenous in the sample of euro area countries and heterogeneous in the OECD sample.

accompanied by tax cuts. Thus, there is no evidence that rising bond yields induce governments to raise taxes. These results are in a sense comparable to those obtained by Tagkalakis (2011) who showed that the steepening of yield curve caused by fiscal sustainability concerns does not lead to higher revenues but affects primary expenditure negatively. This may be attributed to the fact that expenditure-based fiscal adjustments are usually perceived to be more effective and sustainable in the longer run (from a large set of studies emphasising this phenomenon, see Alesina and Perotti (1996), Alesina and Ardagna (1998), von Hagen et al. (2002), Ahrend et al. (2006)). Also, the governments willing to show their commitment to fiscal targets and calm financial markets rely on expenditure-based corrections.

Regarding the impact of other explanatory variables on the revenue and expenditure ratios, we observe that rising debt levels encourage spending cuts to a somewhat larger extent than tax increases, as the absolute value of the estimated elasticity with respect to public debt ratio is higher for expenditure. Similarly, the pro-cyclical discretionary reaction to changing business cycle conditions is more pronounced on the expenditure side for the sample of the EU countries, while the opposite is true if the focus is solely on the euro area member states. Controlling for political and institutional factors, we verify that in the election years the worsening of CAPBs in the EU countries mainly comes from increased spending, while in the euro area it is spread across both revenue and expenditure sides. Still, in the latter case, however, the reaction is more evident on the expenditure side. Finally, the implementation of budget rules imposes a negative effect on the primary expenditure ratio, whereas the impact of fiscal rules on the current revenue ratio is largely statistically insignificant.

Table 5
Summary of estimated impact of 10-year sovereign bond yields on fiscal variables

Dependent variable	Sample	1	2	3
PB	OECD	0.122**	0.136***	0.119***
	EU	0.124***	0.164***	0.093***
	euro area	0.235***	0.280***	0.244***
CAPB	OECD	0.180***	0.193***	0.132***
	EU	0.143***	0.172***	0.089***
	euro area	0.232***	0.318***	0.241***
Cyclically adjusted current revenue	OECD	0.024	0.050	0.045
	EU	–0.066***	–0.087***	–0.084***
	euro area	–0.033***	–0.030***	–0.026***
Cyclically adjusted primary expenditure	OECD	–0.051	–0.036	0.018
	EU	–0.182***	–0.205***	–0.122***
	euro area	–0.313***	–0.330***	–0.202***

Notes. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

4.4 Non-linear effects of sovereign bond yields

Next, we allow bond yields to affect fiscal balances in a non-linear manner conditional on various circumstances. First, we investigate whether the estimated effect of bond yields varies at different levels of bond yields and public debt; then we test hypothesis of the bond yield asymmetric effect, and finally we verify if their effect on fiscal

balances varies across periods of economic upturn vis-à-vis downturn. In order to assess the relevance of these factors to the effect of bond yields, we re-estimate equation (5) by including four additional interaction terms:
– bond yields themselves,
– public debt ratio,
– a dummy variable, which assumes the value of 1 in periods when yields are growing and is zero otherwise,
– a dummy variable, which is equal to 1 in periods when the value of output gap is positive and is zero otherwise.

Tables A8–A10 provide a set of results. First, it appears that the effect of bond yields on fiscal balances may get only marginally lower at their higher levels. The coefficient estimates imply that a 1 percentage point increase in bond yields brings about a decline in the overall effect on PB by 0.02 percentage point (see Table A8). Furthermore, this type of nonlinearity is evident only in the samples of EU and euro area countries, while it is not statistically significant in the OECD country sample. Second, adding the interaction term capturing the impact of public debt does not result in relevance of government indebtedness to the effect of sovereign bond yields on fiscal position in the OECD sample, while that in the EU and the euro area is negligible (see Table A9). Third, there indeed appears to be some asymmetry in the effect of bond yields, i.e. at least for the EU and the euro area samples, the disciplining effect of rising yields seems to be statistically larger as compared to the loosening effect when these are on the downward trend (see Table A10). Finally, the results reported in Table A11 show that during the periods when GDP is above its potential level, the effect of rising (falling) borrowing costs on CAPBs gets smaller. This may reflect the fact that governments are getting more careless about rising costs in the periods of economic upturn than in the periods of economic downturn. It should be noted that these results are robust to employing different specifications of the FR function.

CONCLUSIONS

In this study, we examine the effect of sovereign bond yields on fiscal balances in advanced economies. Our goal is to find out whether the recent policy of ultra-low interest rates pursued by the majority of large industrialised countries may have negative consequences for fiscal discipline. In order to do that, we estimate the FR function comprising fiscal, macroeconomic and political/institutional variables as well as long-term sovereign bond yields whose effect is the main focus of the study. As a robustness check, we also test whether the effect is stable over time and across different country groupings the OECD, the EU and the euro area. We examine various channels of transmission and non-linearity of the impact of bond yields on fiscal discipline.

The results obtained suggest that the relationship between long-term sovereign bond yields and the fiscal balance is positive and statistically significant, indicating that an increase (decrease) in borrowing costs leads to a significant improvement (deterioration) in both PB and CAPB. It seems that lower borrowing costs, indeed, provide disincentives for governments to stick to fiscal discipline. Our baseline findings are robust to the choice of country sample, as this loosening effect is found in the OECD, the EU and the euro area countries. The coefficient estimates for the euro area countries, however, are somewhat larger than those for the OECD and the EU countries, probably reflecting higher homogeneity among countries included in the sample. Concerning channels through which the loosening effect is transmitted, we find a negative relationship between bond yields and primary expenditure. Hence, the shrinking borrowing costs of recent years appear to pass on the budget balance deterioration by inducing expenditure increases. The results again are more pronounced in the euro area countries. Furthermore, we find evidence of non-linearity, implying that the bond yield effect gets marginally smaller with higher levels of bond yields and during the period of economic uptick. Also, there is evidence of asymmetry, whereby the disciplining effect of rising bond yields is somewhat larger as compared to the loosening effect of falling yields.

Overall these results suggest that unconventional monetary policy that leads to a pronounced decrease in long-term interest rates may have negative side effects on fiscal discipline, thus providing disincentives for structural reform implementation.

APPENDIX

Table A1
Fiscal reaction function in OECD country sample in 1992–2014

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	1	2	3	1	2	3
Dependent variable ($t-1$)	0.162 ***	0.128 ***	0.120 ***	0.114 ***	0.040	0.083 **
Debt ($t-1$)	0.056 ***	0.049 ***	0.046 ***	0.058 ***	0.045 ***	0.048 ***
Output gap	0.264 ***	0.191 ***	0.168 ***	–0.181 ***	–0.296 ***	–0.300 ***
Yields	0.108 *	0.106 **	0.063	0.182 ***	0.176 ***	0.107 **
Inflation			0.241 ***			0.236 ***
Election year dummy		–0.248 ***	–0.155 **		–0.246 ***	–0.217 ***
FR for budget balance		1.064 ***	0.746 ***		1.308 ***	0.905 ***
Probability J-statistics	0.489	0.924	0.857	0.469	0.735	0.792
AR(2) *p* value	0.999	0.796	0.648	0.627	0.735	0.741
Observations	582	486	486	563	486	486

Notes. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A2
Fiscal reaction function in EU country sample in 1992–2014

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	1	2	3	1	2	3
Dependent variable ($t-1$)	0.031	0.070 ***	0.109 ***	–0.057 **	–0.038	0.021
Debt ($t-1$)	0.081 ***	0.067 ***	0.081 ***	0.092 ***	0.075 ***	0.082 ***
Output gap	0.112 ***	0.115 ***	0.079 **	–0.355 ***	–0.369 ***	–0.379 ***
Yields	0.105 **	0.146 ***	0.014	0.127 ***	0.165 ***	0.066 ***
Inflation			0.394 ***			0.353 ***
Election year dummy		–0.325 ***	–0.247 ***		–0.317 ***	–0.250 ***
FR for budget balance		0.846 **	0.773 **		0.775 **	0.775 **
Probability J-statistics	0.918	0.975	0.990	0.929	0.975	0.991
AR(2) *p* value	0.509	0.417	0.449	0.190	0.179	0.241
Observations	360	333	333	360	333	333

Notes. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A3

Fiscal reaction function in euro area country sample in 1992–2014

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	1	2	3	4	5	6
Dependent variable (t –1)	–0.030	–0.013 *	0.011	–0.096 ***	–0.104 ***	–0.065 ***
Debt (t – 1)	0.084 ***	0.078 ***	0.087 ***	0.091 ***	0.089 ***	0.104 ***
Output gap	0.277 ***	0.274 ***	0.248 ***	–0.219 ***	–0.161 ***	–0.224 ***
Yields	0.196 ***	0.236 ***	0.195 ***	0.219 ***	0.327 ***	0.238 ***
Inflation			0.410 ***			0.422 ***
Election year dummy		–0.138 ***	–0.139 ***		–0.177 ***	–0.002
FR for budget balance		1.104 **	1.250 ***		1.359 ***	1.483 ***
Probability J-statistics	0.908	0.999	0.999	0.996	0.999	0.991
AR(2) p value	0.517	NA	0.999	0.239	0.986	NA
Observations	255	241	241	255	241	241

Notes. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A4

Fiscal reaction function in OECD, EU and euro area country samples (crisis effect)

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	OECD	EU	EA	OECD	EU	EA
Dependent variable (t – 1)	0.106 ***	0.066 ***	–0.004	0.050 *	–0.044 **	–0.106 ***
Debt (t – 1)	0.047 ***	0.071 ***	0.088 ***	0.040 ***	0.072 ***	0.090 ***
Output gap	0.227 ***	0.163 ***	0.308 ***	–0.292 ***	–0.373 ***	–0.229 ***
Yields	0.121 *	0.179 ***	0.631 ***	0.158 **	0.159 **	0.618 ***
Yields x crisis dummy	0.031	–0.020	–0.494 ***	0.056	0.033	–0.417 ***
Election year dummy	–0.210 ***	–0.336 ***	–0.177 ***	–0.242 ***	–0.308 ***	–0.176 ***
FR for budget balance	0.839 ***	0.879 **	1.535 ***	1.219 ***	0.791 **	1.433 ***
Probability J-statistics	0.998	0.999	1.000	0.945	0.997	1.000
AR(2) p value	0.922	0.673	NA	0.699	0.210	0.981
Observations	550	368	270	530	357	261

Notes. Crisis dummy variable is equal to 1 starting from 2008 and is 0 otherwise. Results are taken from the baseline specification including political/institutional explanatory variables but excluding inflation; results from other specifications are available upon request. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A5

Fiscal reaction function for revenue and expenditure ratio in OECD country sample

Dependent variable	Cyclically adjusted current revenue (% of potential GDP)			Cyclically adjusted primary expenditure (% of potential GDP)		
Independent variables/specification	1	2	3	1	2	3
Dependent variable (t –1)	0.078 **	0.030	0.031	–0.017	–0.078 **	–0.042
Debt (t – 1)	0.023 ***	0.020 ***	0.021 ***	–0.082 ***	–0.075 ***	–0.078 ***
Output gap	–0.091 ***	–0.077 ***	–0.086 ***	0.067	0.126 ***	0.139 ***
Yields	0.024	0.050	0.045	–0.051	–0.036	0.018
Inflation			0.008			–0.135 ***
Election year dummy		–0.177 ***	–0.148 ***		0.027	–0.037
FR for budget balance		0.058	0.108		–1.217 ***	–0.777 ***
Probability J-statistics	0.664	0.892	0.940	0.150	0.619	0.863
AR(2) p value	0.598	0.890	0.856	0.056	0.059	0.047
Observations	572	524	524	572	524	524

Notes. Estimated by GMM-difference including time fixed effects. The t *– 2 to* t *– 4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A6

Fiscal reaction function for revenue and expenditure ratios in EU country sample

Dependent variable	Cyclically adjusted current revenue (% of potential GDP)			Cyclically adjusted primary expenditure (% of potential GDP)		
Independent variables/specification	1	2	3	1	2	3
Dependent variable (t – 1)	0.032	0.007	0.014	0.075 ***	0.071 ***	0.100 ***
Debt (t – 1)	0.036 ***	0.036 ***	0.035 ***	–0.044 ***	–0.036 ***	–0.042 ***
Output gap	–0.148 ***	–0.142 ***	–0.168 ***	0.184 ***	0.209 ***	0.236 ***
Yields	–0.066 ***	–0.087 ***	–0.084 ***	–0.182 ***	–0.205 ***	–0.122 ***
Inflation			0.052 ***			–0.315 ***
Election year dummy		–0.033	0.019		0.194 ***	0.076 **
FR for budget balance		–0.236	–0.544 ***		–1.156 ***	–0.842 ***
Probability J-statistics	0.994	0.997	0.961	0.999	0.999	0.996
AR(2) p value	0.811	0.846	0.427	0.528	0.530	0.572
Observations	367	354	354	367	354	354

Notes. Estimated by GMM-difference including time fixed effects. The t *– 2 to* t *– 4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A7

Fiscal reaction function for revenue and expenditure ratio in euro area country sample

Dependent variable	Cyclically adjusted current revenue			Cyclically adjusted primary expenditure		
Independent variables/specification	1	2	3	1	2	3
Dependent variable ($t-1$)	0.026 ***	0.031 ***	–0.002	0.013	0.013	0.157 ***
Debt ($t-1$)	0.014 ***	0.013 ***	0.011 ***	–0.069 ***	–0.062 ***	–0.103 ***
Output gap	–0.156 ***	–0.155 ***	–0.154 ***	0.066 ***	0.076 ***	0.031 *
Yields	–0.033 ***	–0.030 ***	–0.026 ***	–0.313 ***	–0.330 ***	–0.202 ***
Inflation			–0.041 **			–0.431 ***
Election year dummy		–0.057 ***	–0.077 ***		0.086 ***	0.096 ***
FR for budget balance		0.039	0.187		–1.050 ***	–0.215
Probability J-statistics	0.996	0.995	0.992	0.994	0.994	0.979
AR(2) *p* value	NA	NA	0.996	NA	0.988	0.995
Observations	258	258	258	258	258	258

Notes. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A8

Fiscal reaction function in OECD, EU and euro area country samples (bond yield quadratic effect)

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	OECD	EU	EA	OECD	EU	EA
Dependent variable ($t-1$)	0.109 ***	0.087 ***	0.007	0.071 **	–0.013	–0.084 ***
Debt ($t-1$)	0.048 ***	0.079 ***	0.088 ***	0.044 ***	0.077 ***	0.090 ***
Output gap	0.221 ***	0.141 ***	0.337 ***	–0.309 ***	–0.391 ***	–0.193 ***
Yields	0.169	0.556 ***	0.676 ***	0.432 ***	0.529 ***	0.691 ***
Yields squared	–0.002	–0.019 ***	–0.017 ***	–0.012 *	–0.017 ***	–0.016 ***
Election year dummy	–0.213 ***	–0.335 ***	–0.166 ***	–0.242 ***	–0.307 ***	–0.161 ***
FR for budget balance	0.829 ***	0.779 **	1.121 **	1.199 ***	0.819 **	1.134 **
Probability J-statistics	0.998	0.999	0.999	0.955 ***	0.997	0.999
AR(2) *p* value	0.929	0.987	NA	0.559	0.371	NA
Observations	550	368	270	530	357	261

Notes. Results are taken from the baseline specification including political/institutional explanatory variables but excluding inflation; results from other specifications are available upon request. Estimated by GMM-difference including time fixed effects. The t – *2 to* t – *4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A9

Fiscal reaction function in OECD, EU and euro area country samples (public debt effect)

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	OECD	EU	EA	OECD	EU	EA
Dependent variable (*t*– 1)	0.107 ***	0.075 ***	–0.005 **	0.051 *	–0.030	–0.101 ***
Debt (*t* – 1)	0.046 ***	0.079 ***	0.091 ***	0.040 ***	0.080 ***	0.091 ***
Output gap	0.230 ***	0.137 ***	0.292 ***	–0.293 ***	–0.395 ***	–0.245 ***
Yields	0.107	0.322 ***	0.528 ***	0.160 **	0.322 ***	0.456 ***
Yields x public debt	0.000	–0.002 ***	–0.002 ***	0.000	–0.001 ***	–0.001 ***
Election year dummy	–0.209 ***	–0.340 ***	–0.173 ***	–0.242 ***	–0.323 ***	–0.184 ***
FR for budget balance	0.830 ***	0.885 **	1.298 ***	1.226 ***	0.777 **	1.564 ***
Probability J-statistics	0.998	0.999	0.999	0.944	0.997	0.999
AR(2) *p* value	0.917	0.635	NA	0.702	0.203	NA
Observations	550	368	270	530	357	261

Notes. Results are taken from the baseline specification including political/institutional explanatory variables but excluding inflation; results from other specifications are available upon request. Estimated by GMM-difference including time fixed effects. The t *– 2 to* t *– 4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level.*

Table A10

Fiscal reaction function in OECD, EU and euro area country samples (asymmetric effect)

Dependent variable	Primary balance (% of GDP)			Cyclically adjusted primary balance (% of potential GDP)		
Independent variables/specification	OECD	EU	EA	OECD	EU	EA
Dependent variable (*t* – 1)	0.105 ***	0.072 ***	–0.004	0.051 *	–0.033	–0.102 ***
Debt (*t* – 1)	0.048 ***	0.071 ***	0.083 ***	0.041 ***	0.073 ***	0.085 ***
Output gap	0.227 ***	0.152 ***	0.325 ***	–0.301 ***	–0.388 ***	–0.212 ***
Yields	0.175 ***	0.114 ***	0.208 ***	0.189 ***	0.104 ***	0.246 ***
Yields x DUMYIELD	–0.022 *	0.030 ***	0.042 ***	0.001	0.040 ***	0.045 ***
Election year dummy	–0.220 ***	–0.331 ***	–0.161 ***	–0.243 ***	–0.313 ***	–0.162 ***
FR for budget balance	0.888 ***	0.938 **	1.274 **	1.232 ***	0.872 **	1.307 ***
Probability J-statistics	0.998	0.999	0.999	0.945	0.997	0.999
AR(2) *p* value	0.907	0.782	NA	0.700	0.283	0.978
Observations	550	368	270	530	357	261

Notes. Results are taken from the baseline specification including political/institutional explanatory variables but excluding inflation; results from other specifications are available upon request. Estimated by GMM-difference including time fixed effects. The t *– 2 to* t *– 4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level. DUMYIELD is a dummy variable, which is equal to 1 when yields are rising and is 0 when they are declining.*

Table A11
Fiscal reaction function in OECD, EU and euro area country samples (output gap effect)

Dependent variable	PB (% of GDP)			CAPB (% of potential GDP)		
Independent variables/specification	OECD	EU	EA	OECD	EU	EA
Dependent variable ($t-1$)	0.110 ***	0.082 ***	0.001	0.056 **	–0.044	–0.113 ***
Debt ($t-1$)	0.049 ***	0.060 ***	0.082 ***	0.042 ***	0.066 ***	0.085 ***
Output gap	0.237 ***	0.188	0.347 ***	–0.265 ***	–0.368 ***	–0.194 ***
Yields	0.137 ***	0.185 **	0.283 ***	0.206 ***	0.182 ***	0.319 ***
Yields x DUMOG	–0.012 *	–0.009	0.016	–0.037 **	–0.038 **	–0.010 **
Election year dummy	–0.214 ***	–0.319 ***	–0.187 ***	–0.255 ***	–0.286 ***	–0.171 ***
FR for budget balance	0.818 ***	1.453 ***	1.646 **	1.155 ***	1.271 *	1.130 **
Probability J-statistics	0.998	0.987	0.999	0.952	0.980	0.999
AR(2) *p* value	0.916	0.723	NA	0.666	0.241	0.944
Observations	550	368	270	530	357	261

Notes. Results are taken from the baseline specification including political/institutional explanatory variables but exluding inflation; results from other specifications are available upon request. Estimated by GMM-difference including time fixed effects. The t *– 2 to* t *– 4 lags of both dependent and explanatory variables are used as instruments. A smaller number of lags are used in some regressions due to limitations in the number of observations. * denotes significance at 10% level, ** denotes significance at 5% level, and *** denotes significance at 1% level. DUMOG is a dummy variable, which is equal to 1 when output gap is positiv, and is 0 when it is negative.*

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