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Optimal Design of New Generation Fiscal Rules: Coping with the Business Cycle and Discretionary Tax Reductions

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Abstract

While business cycles are crucial for determining the dynamics of government budget deficits, it is rare to find an analysis of optimal fiscal rules that are designed to cope with the asymmetric behavior of fiscal variables during the cycle. In this paper I characterize the dynamics of budget deficits along the cycle: i) in recessions marginal propensity to spend is higher than the coefficient of marginal tax revenues, causing an increase of the deficit over GDP; ii) in expansions tax revenues soar allowing for a deficit reduction; however, marginal spending is still high and consequently a full cycle implies an increase in the deficit. Then, I present a model in which fiscal rules are designed to cope with a political bias that is based on two components: the cyclical bias and discretionary tax reductions. According to my analysis, the new generation fiscal rules should be based on a combination of expenditure and revenue rules, which are newer than budget deficit rules and are becoming widespread. According to my empirically calibrated simulation, this combination of rules succeeds on avoiding the political bias and is more cycle-friendly than a budget deficit rule.

Keywords: Cycle; Fiscal policy; Fiscal rules

Introduction

Following the recent global economic crisis and the resulting high budget deficits, countries are adopting and strengthening fiscal rules [1]. The main motive for that policy change is to provide credibility to the fiscal consolidation policy in order to improve the likelihood of transition to lower fiscal deficits. While the literature has studied the importance of the implementation of fiscal rules, and the pattern of fiscal policy during the cycle, it is puzzling to note that there are at most few papers connecting between these two phenomena. So far the papers were focused on checking the impact of fiscal rules on the cycle, and not in the role that the cycle plays for designing an optimal fiscal rule. Since policy-makers are looking today for the next-generation fiscal rules, filling this gap is a crucial task.

Another unexplored issue in the literature is related to discretionary statutory tax reductions. Reducing tax rates can be used by politicians as a tool for gaining popularity, while at the same time the budget balance may be threatened[1]. One of the reasons for the lack of research on this field was the inexistence of data on statutory tax rates. Recently, Vegh and Vuletin [2] have presented a statutory tax rates database for industrial and developing countries. Interestingly, they found that the vast majority of statutory tax changes in industrial countries are actually tax reductions: they constitute 75 percent of personal statutory income tax changes (of a magnitude of 2.8 percent), 67 percent of statutory corporate tax changes (of a magnitude of 2.6 percent) and 13 percent of V.A.T. tax changes (of a magnitude of 1.6 percent)[2].

In recent decades, several OECD countries have gradually adopted budget and expenditure rules; in late years, revenue rules are becoming more widespread. The increase of fiscal rules from fewer than five countries in the 1970s and 1980s to 30 countries after the 1990s [3] may partially be explained by the effectiveness of numerical fiscal rules in curtailing budget deficits in different parts of the world at different levels of government, such as, USA [4-6], Latin America [7] and Switzerland [8][3].

At the same time, both policymakers and researchers are aware of the possible effect of adopting fiscal rules alongside the benefits of budgetary discipline[4]. The main concern, according to the Keynesian view[5], is that rules for balancing budgets are expected to deepen recessions. Nevertheless, based on a sample of American states, Alesina and Bayoumi [6] found that fiscal rules have not increased output volatility. More recently, several papers detect no evidence that fiscal rules amplify economic fluctuations (Gali and Perotti [9], for the EMU countries, Fatas and Mihov [10] for the USA, and Badinger [11] for the OECD countries). Schunk and Woodward (2005) at the states level, and Debrun [12] at the national level, show that Procyclicality can be avoided if rules are originally designed to preserve the operation of automatic stabilizers. These authors show that expenditure rules are more cyclical friendly than budget and debt rules.

A different strand of the literature analyzes the behavior of fiscal policy along the cycle. The picture arising from this literature has been corroborated by different papers and it points out to an asymmetrical pattern along the cycle. Hercowitz and Strawczynski [16] showed that advanced economies run a countercyclical fiscal policy during

[1]Another source for political manipulations is tax exemptions, usually given to firms to avoid corporate taxes. Studying these changes is beyond the scope of the present paper.

[2]Potentially V.A.T. reductions can be more popular than direct tax reductions since consumption is related to all individuals in society. However, a high income or corporate statutory tax reduction is more attractive for politicians than a small statutory V.A.T. reduction, because of two reasons: i) the visibility of the statutory tax reduction; ii) the income and corporate tax reduction can be targeted on the median voter.

[3]See also Guichard et al. [13], who found that both expenditure and budget rules anchor successful fiscal consolidations.

[4]Kopits [14] provides a list of arguments for and against budget rules.

[5]From a neo-classical point of view, balance budget rules may impose costs due to a sub-optimal path of tax rates [15].

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recessions, which is not corrected during expansions; the availability of tax revenues in expansions helps governments reducing the deficit, "hiding" the inherent bias caused by the two phases of the cycle. According to these authors the asymmetric behavior of expenditure in advanced economies, cause a spending bias – which arises after the completion of a full business cycle. This pattern has been confirmed by Balassone, Francese and Zotteri [17] for the budget deficit and the debt. The asymmetry of collecting revenues was confirmed for particular taxes like the corporate tax [18,19].

An important question is how to design budget rules that minimize the cyclical bias, which is related to the interaction between the cycle and political forces that work asymmetrically in the different phases of the cycle. It is important to stress, in this context, that as shown by Von Hagen and Harden [20] one of the main purposes of fiscal rules is to deal with the well-known "common pool problem", which implies that ministers put pressure on increasing spending when tax revenues increase. This phenomenon is clearly related to the business cycle, since tax revenues soar at expansions, which may enhance the potential harm of the common pool problem. Moreover, according to Kim and Watson (1998), the average duration of expansions is 33.3 months, compared to 10 months for recessions – which enhances the probability that political forces can profit expansions for increasing expenditure. Note also that an additional way to be benevolent with potential voters is by implementing tax reductions. Tax reductions maybe implemented in expansions and in recessions; in the latter, because of Keynesian considerations[6].

Consistently with existing empirical findings on the cyclicality of fiscal variables, I analyze the design of fiscal rules based on asymmetric behavior along the cycle: in expansions tax revenues are abundant and the pressure for increasing spending and reducing statutory tax rates materializes[7], while in recessions maintaining the increase in spending or reducing tax rates imply a high deficit, which is problematic since rating agencies may penalize such a policy by reducing country's debt rating.

An important question related to policy is: how should the next generation budget rules look like so as to cope with these issues? What is the right combination of rules?

The paper is organized as follows. In section 2 I describe existing fiscal rules and present a model for analyzing the cyclical pattern of spending and revenues. This model allows me to characterize three types of fiscal rules: budget deficit rule, expenditure rule and revenue rule. In Section 3 I perform an empirical analysis of the expenditure and revenue functions for a sample of OECD countries. The traditional analysis is extended to learn about the role of tax reductions (of V.A.T. and top income tax rates) on government budget deficits, during recessions and expansions. In section 4 I extend the analysis in order to analyze the impact of fiscal rules on government budget deficits. Section 5 summarizes and concludes.

New Generation Fiscal Rules: A Combination of Rules

Review of existing rules

It is well known that the main benefit of fiscal rules is that they allow the Finance Minister to cope with the "common pool problem", which implies that ministers tend to promote their partisan agenda. Fiscal Rules put a cap on these activities, and consequently allow governments to avoid a deficit bias, which is problematic since it raises the government debt.

In the past, the way to cope with this bias was by using only a balanced budget deficit approach – which put a cap on budget deficit. However, as time went by, governments started to understand that since expenditure is at the heart of the common pool problem, it is necessary to put a cap on expenditure. Historically, this development is reflected in the fact that until 1992 there were 16 budget rules that increased to 56 in 2013. Expenditure rules were used since the very beginning, and they substantially increased in the nineties (Figure 1). It is interesting to note that revenue rules were almost inexistent at the beginning of the nineties, and they are becoming widespread as time goes by. This historical development raises the question about the right combination of budget rules: while theoretically expenditure and revenue rules imply an over identification, in practice it seems that governments need a combination of rules. Figure 2 shows the existing combinations by different countries.

From this figure we learn that countries that apply one rule, they use a budget rule (52 countries compared to 5 countries with an expenditure rule and no countries with a revenue rule). When using two rules, the single existing combination includes budget and expenditure rules. Finally, there are 6 countries that use all three rules – which – once countries accept a combination of rules as a right remedy- seems to be an important option that has been increasing along time. In Table 1 I show the list of countries imposing three rules, the time of adoption and a description of the type of rule.

Note that the description of revenue rules remarks two points related to a deficit bias (one of them also related to the cycle): i) if taxes are reduced there should be an alternative revenue source; ii) if

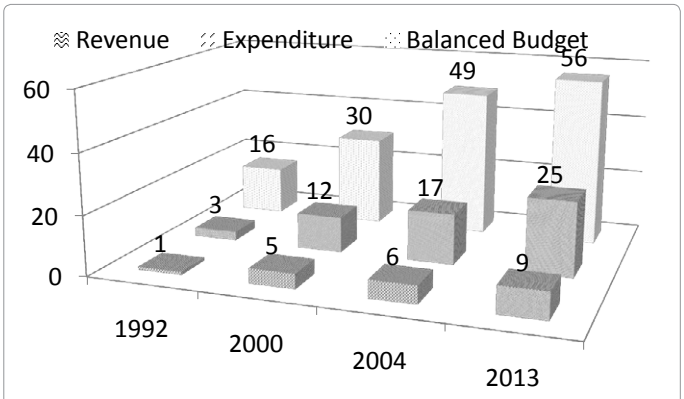

Figure 1: Development of fiscal rules.

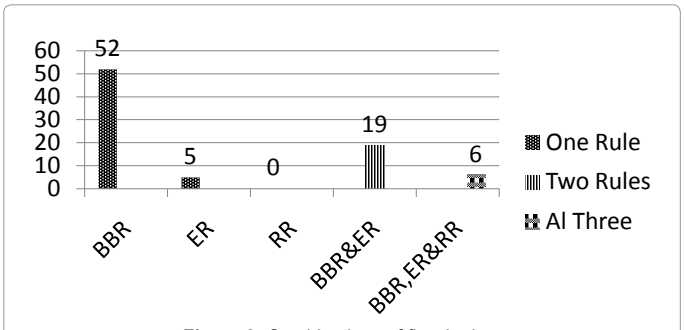

Figure 2: Combinations of fiscal rules.

[6]As in the case of the global crisis; see Spilimbergo et al. (2010).

[7]A paper that is based on this characteristic at the spending side is Talvi and Vegh [21]. For a paper that shows the procyclical behavior of statutory tax rates see Strawczynski [22], who documents this behavior in Israel, and Vegh and Vuletin [2] who document this behavior for developing countries.

Country	BBR implementation	ER implementation	RR implementation	Type of RR
Australia	1985	1985	1985	Not raise tax revenues as a % of GDP
Belgium	1982	1993	1995	Growth of revenues in line with GDP Growth
Denmark	1992	1994	2001	Direct and Indirect taxes cannot be raised
France	1992	1998	2006	Define ex-ante the allocation of revenues higher than expected
Lithuania	2004	2008	2008	Excess revenues must be used to reduce deficit
Netherland	1992	1994	1994	Tax relief must be compensated by a tax increase

Table 1: Countries with three rules.

revenues are higher than expected (i.e., in expansions), they should not be used to increase expenditure[8]. In the next sub-section I present a model that incorporates these issues.

Cyclical bias, tax reductions and fiscal rules

For writing a model of fiscal variables I need the specifications of the tax and expenditure functions as a percent of GDP. The classical approach is to assume that taxes and expenditure are linear functions of GDP, which implies in the long-run that these ratios are constant. However, these simple assumptions are at odd with observed behavior of fiscal variables. Buchanan and Wagner [23] identified a long-run trend of increasing public expenditure as a percent of GDP[9]. Hercowitz and Strawczynski [16] document a similar phenomenon that is related to the cyclical behavior of spending. In fact, a novel way of formalizing this observed pattern was performed by Bertola and Drazen [24] who considered the case in which the spending over GDP ratio is a random walk with an upward drift that is corrected from time to time once it arrives to a trigger point[10]. This approach means that basic fiscal variables as a percent of GDP have an upward trend (corrected from time to time), which can be achieved by using a non-linear relationship between spending and taxation and the GDP.

Following this approach, assume first that the revenue side is given by:

$$T=t(Y)\ Y=(A_i+B_iY)Y\ Y, \text{ where } i=E \text{ (expansions)}, R \text{ (recessions)} \quad (1)$$

Where a small t represents the aggregate tax rate; i.e., the tax rate is progressive[11] through a linear function that has different coefficients A and B in expansions and recessions[12]. This feature characterizes tax functions in advanced economies – and will be corroborated in the empirical analysis.

Note that under this function:

$$\frac{\partial T}{\partial Y} = A_i + 2B_iY \quad (2)$$

Concerning expenditure, assume that the higher the GDP, the higher the political willingness of ministers to spend, and assume that the propensity to do so [represented by g(Y)] is different in expansions and recessions[13]:

$$G=g(Y)\ Y=(C_i+D_iY)\ Y\ ,\ i=E, R \quad (3)$$

Note that:

$$\frac{\partial G}{\partial Y} = C_i + 2D_iY \quad (4)$$

For simplicity assume that there is a uniform probability of 0.5 to be in a recession and 0.5 to be in an expansion, with a fixed variance. We assume that in times of recessions the propensity to spend is higher or equal than the coefficient of marginal tax revenues; while for expansions the coefficient of marginal taxation is higher than the propensity to spend (these assumptions will be tested empirically):

$$D_R \geq B_R, D_E \leq B_E \quad (5)$$

Concerning tax revenues, following Sobel and Hecombe [26] we shall expect that $B_E > B_R$. Concerning expenditure, the relationship between the coefficients in expansions and recessions depends on whether the political bias described by Talvi and Vegh [21] is relevant, a fact that was not yet documented empirically. If the bias exists we shall find that $D_E > D_R$; if it does not, we shall find that $D_E = D_R$. These relationships between the coefficients will be tested empirically in the next section.

We further assume that when the GDP is at its trend value, the budget deficit as a percent of GDP is balanced:

$$\frac{DEF(\bar{Y})}{\bar{Y}} = \frac{G(\bar{Y})}{\bar{Y}} - \frac{T(\bar{Y})}{\bar{Y}} = 0.5\left[(C_E + C_R - A_E - A_R) + (D_E - B_E + D_R - B_R)\bar{Y}\right] = 0 \quad (6)$$

This implies:

$$A_E + A_R - C_E - C_R = (D_E - B_E + D_R - B_R)\bar{Y} \quad (7)$$

This condition means that in times of recessions there is a deficit bias, due to the propensity of ministers to increase spending at the same pace, at the same time that the GDP declines; in expansion the opposite is true: in principle, the deficit bias goes down. The methodology shown here has the advantage of being stable in the long run: opposed to Balassone, Francese and Zotteri [17] where a full cycle implies an explosive deficit, in my model the structure imposes that the bias is balanced in the long run. In the following equations, I will introduce to the model a new feature: politicians tend to reduce taxes at different opportunities that can be "hidden" during expansion times, given the budget surplus. These tax reductions give a role to fiscal rules, which are intended on assuring convergence to budget balance in the long run.

The bias at the different parts of the cycle is represented by:

$$\frac{\partial DEF}{\partial Y} = C_i - A_i + 2Y(D_i - B_i) = \text{def}(Y) \quad (8)$$

Evaluating this expression at the trend value of Y, means that the deficit bias is equal to:

$$\frac{\partial DEF}{\partial}\Big|(Y = \bar{Y}) = (D_E - B_E + D_R - B_R)\bar{Y} \quad (9)$$

Without losing generality, we assume that the parameters are such

[8]A well-known example of a rule designed to avoid using cyclical revenues for spending is Chile's rule related to revenues from the sale of copper [25].

[9]These findings are in line with the well-known hypothesis developed by A. Wagner and by Peacock and Wiseman.

[10]Alesina and Drazen (1990) show that this adjustment usually occurs after a continuous worsening macroeconomic situation.

[11]I assume that in the long run the GDP is finite. Thus, the tax rate converges to$A+BY$, that is a fixed number. Since Y is a large number, this feature means that A is expected to be negative and B to be small. In the regressions shown in Section 4, A is represented by the constant term and by dummies for the different decades – which are expected to be negative.

[12]Sobel and Hocombe [26] document the asymmetry of short run and long run tax revenue elasticities along the cycle for the US at the national level.

[13]Talvi and Vegh [21] assume that political forces require increases in expenditure using a non-linear function.

that if they are measured at the trend value the budget as a percent of GDP is balanced both in expansions and in recessions:

$$A_E - C_E = (D_E - B_E)\bar{Y} \quad (10)$$

$$A_R - C_R = (D_R - B_R)\bar{Y} \quad (11)$$

We can look at the bias in a recession, in which $Y_t > \bar{Y}$:

$$Recession\ Bias = C_R - A_R + 2(Y_t + \bar{Y} - \bar{Y})(D_R - B_R) \quad (12)$$

$$= 2(Y_t - \bar{Y})(D_R - B_R) + \bar{Y}(D_R - B_R) > 0$$

Or in percent of gdp:

$$RB\_Y = (D_R - B_R)\left(2 - \frac{\bar{Y}}{Y_t}\right) > 0 \quad (13)$$

Analytically, the bias is composed by the gap between marginal propensity to consume compared to the marginal coefficient for revenues, mitigated by the fact that actual GDP is lower than trend, which implies that the last term in the second parenthesis of the right hand side is higher than 1.

The expansion bias, in which $Y_t > \bar{Y}$ is:

$$Expansion\ Bias = 2(Y_t - \bar{Y})(D_R - B_R) + \bar{Y}(D_R - B_R) < 0 \quad (14)$$

Or in percent of GDP:

$$Expansion\ Bias = (D_E - B_E)\left(2 - \frac{\bar{Y}}{Y_t}\right) < 0 \quad (15)$$

In this case the gap between the coefficients of spending and revenues is negative, and the second term in the parenthesis is lower than 1 – exacerbating the surplus bias.

Consider now discretionary tax reductions – represented by β; those can be implemented in a recession (because of Keynesian considerations) or in an expansion (political bias); note that if it is implemented in an expansion, tax reductions will be lower than the surplus bias so as to 'hide' the deficit bias; as a consequence of this policy, the expansion bias can be positive or negative, as a function of the extent of tax reductions:

$$RB_{Y\beta} = (D_R - B_R)\left(2 - \frac{\bar{Y}}{Y_t}\right) + \beta > 0 \quad (16)$$

$$EB_{Y\beta} = (D_E - B_E)\left(2 - \frac{\bar{Y}}{Y_t}\right) + \beta \ ? \quad (17)$$

Summarizing (9) and (10), we find that after a full business cycle the bias depends on the relative coefficients of reaction of spending and tax revenues to GDP and on the magnitude of β, the tax reductions:

$$RB_{Y\beta} + EB_{Y\beta} = 2(D_R - B_R + D_E - B_E) - \left(\frac{\bar{Y}}{Y_{tR}}(D_R - B_R) + \frac{\bar{Y}}{Y_{tE}}(D_E - B_E)\right) + 2\beta > 0 \quad (18)$$

Assuming asymmetric cyclical coefficients, equation 18 implies the result presented by Balassone, Francese and Zotteri [17] where a full business cycle brings in a positive deficit bias. However, in this case the bias does not result only from the asymmetric cyclical pattern of expenditure; it arises also from the fact that governments reduce taxes. This last result gives a crucial role to revenue rules, which are becoming an increasingly widespread tool in the new generation of fiscal rules.

Note also that this pattern of the bias implies that countries may be interested on imposing fiscal rules at the different stages of the cycle. In a recession, the spending bias and the tax reductions may drive deficits to levels that are unacceptable from the point of view of the country's rating, a phenomenon that would be penalized by international rating agencies. Thus, the rule will avoid paying the cost of having the rating reduced. In expansions, the possibility of "hiding" tax reductions (since overall the budget maybe even in surplus), and the existence of a political bias, call for imposing fiscal rules.

Finally, note that three kinds of rules are generally used by policy-makers to deal with the political bias and with tax reductions [1]: i) budget deficit rules that constrain the deficit (effective mainly in recessions); ii) expenditure rules that constraint the increase in expenditure both in expansions and in recessions; iii) revenue rules, aimed at preventing unbalanced tax reductions.

I now turn to the design of these rules, assuming that they are intended to deal with the political cyclical bias and with discretional statutory tax reductions[14].

Budget Rules

Budget deficit rule

Since it is not binding, the budget deficit rule is not the right tool for coping with political spending or statutory tax reduction in expansions. The budget deficit rule is designed to alleviate the recession bias:

$$Recession\ Bias\ after\ the\ rule = (D_R - B_R)\left(2 - \frac{\bar{Y}}{Y_t}\right) + \beta - \alpha = 0.$$

Where α is the parameter that represents government willingness of avoiding a high deficit.

Expenditure rule

The expenditure rule is intended to reduce the political bias: $D'_i = \gamma D_i$. This rule means that there is a cap on expenditure increase that is binding in both recessions and expansions. The bias at the different phases of the cycle is:

$$Cyclical\ Bias\ after\ the\ rule = (\gamma D_i - B_i)\left(2 - \frac{\bar{Y}}{Y_t}\right) + \beta$$

Where γ is the coefficient of effectiveness of the expenditure rule, and is lower than 1. After the imposition of this rule the cyclical bias can be positive or negative, depending on the severity of the rule.

Revenue rule

The revenue rule is intended to alleviate discretionary tax reductions (i.e., those that are not implemented with a parallel reduction of expenditure). Under this rule we introduce the parameter δ which represents the percentage of tax reductions that can be implemented under the revenue rule. Consequently, under this rule tax reductions become $\delta\beta$.

Cyclical Bias, Tax Reductions and Fiscal Rules: An Empirical Analysis

The data

I use a panel of 22 OECD countries[15] during the period 1960 to 2010. The source of my data is the OECD[16]. The rates of change of government expenditure and revenues are computed as the logarithmic

[14]I assume that the decisions on binding rules are taken at the period of budget planning, in which governments have information with respect to the phase of the cycle.

change, deflated by GDP prices. The choice of GDP prices as a deflator is in line with Lane [27]: By using GDP prices, I am able to depict the rise in government wages over domestic prices. Since the matter of wages is one of the main potential political economy forces driving the dynamics of expenditure, it is important to allow it to play a role. Budget deficit is measured by the ratio of nominal government net balance to nominal GDP.

Cyclical bias: parameters estimation

In order to run a simulation we estimate first the expenditure and revenue functions presented in equations 1 and 3 (Tables 2 and 3).

In all regressions I control for variables that are candidates for explaining expenditures (Table 2), and I use the same variables for the tax revenues equation (Table 3). These variables include the population under 15 years old and beyond 65 (pop15+pop65), which are characterized by a high demand for public services; the population (population); dummies for decades in which target rules were implemented in a low scale (Decade60s, Decade70s and Decade80s) in which they take the value of 1 at the specified decade and 0 otherwise; a dummy variable for countries that implemented the policy known as "from welfare to work" (fwtw) which takes the value of 1 for countries and years of implementation[17]; unemployment, that controls for transfer payments (u); budget deficit (defy); and past values of expenditure [g(-1)], budget deficit [deficit(-1)] and tax revenues [tax revenues(-1)][18].

Note that the dummy variables are intended to represent the discrete adjustments that are done by governments from time to time; thus, the coefficients of these variables are expected to be negative. Note also that the coefficient of the variable fwtw is also expected to be negative; moreover, it can be interpreted as the modern correction of the increasing pattern of expenditure – and it is relevant for the period that starts in the nineties and continue until the end of the sample.

I run two specifications that are parallel for both log (g) and log (tax revenues), using panel cointegration after correcting for dependence of variables using the methodology suggested by Pesaran [29]. This correction requires adding the average values of the dependent variable and independent variables for the whole panel sample, as explained by Eberhardt and Bond [30]. I report the W statistic of Im, Pesaran and Shin.

Results are consistent with the model, calling for an interpretation of the parameters of the theoretical model. The main coefficient is the one of log (g)^2 and log(tax revenues)^2, which according to equations 1 and 3 are helpful for estimating the cyclical bias. In Tables 4a-4c I summarize the coefficients and their significance.

Results shown in Table 4a are according to my ex-ante expectations: the test for the model shows 1 percent significance, and most variables are significant and with the expected signs.

Table 4b shows the validity of the inequalities shown in equation 5, according to which in recessions the marginal propensity to spend (measured by the coefficient of squared G) is higher than marginal tax revenues (measured as the coefficient of squared T); and in expansions the opposite result holds: marginal tax revenues are higher than the marginal propensity to spend. While in all regressions the magnitude of the coefficients is according to expected inequalities, only the inequality for recessions is significant at 10 percent; in expansions the coefficients of revenues and expenditure tend to be statistically equal. This result is in line with Hercowitz and Strawczynski [16], who showed that the cyclical effect on deficits is relatively high in recessions, and it is not corrected in expansions.

[15]This list includes all OECD countries except Luxembourg, Mexico, Turkey, and the new members (the Slovak Republic, Poland, Hungary, Korea, the Czech Republic, Chile, Israel, and Slovenia).

[16]The data are from the OECD Annual National Accounts database.

[17]Based on Martin and David [28].

[18]The use of cointegration technique implies keeping to a minimum the number of lagged variables.

Variable	(1)	(2)	(3)	(4)
C	-4.2 (3.1)	-5.1 (3.0)*	-2.5 (2.9)	-2.9 (2.8)
Log(y)*recessions	-0.4 (0.03)***	-0.3 (0.03)***		
Log(y)^2*recessions	0.032 (0.002)***	0.0262 (0.002)***		
Log(y)*expansions			-0.5 (0.03)***	-0.4 (0.03)***
Log(y)^2*expansions			0.0359 (0.002)***	0.0317 (0.002)***
Log(pop15+pop65)	-1.5 (0.7)**	-0.6 (0.6)	0.9 (0.6)	1.0 (0.6)*
Decade60s	-1.1 (0.4)***	-1.3 (0.4)***	-1.2 (0.3)***	-1.4 (0.3)***
Decade70s	-1.2 (0.3)***	-1.4 (0.3)***	-1.3 (0.3)***	-1.0 (0.2)***
Decade80s	-0.8 (0.2) ***	-1.0 (0.2)***	-0.9 (0.2)***	-1.0 (0.2)***
Fwtw	-1.2 (0.2)***	-1.3 (0.2)***	-1.1 (0.2)***	-1.2 (0.2)***
U	-0.1 (0.01)***	-0.1 (0.01)***	-0.1 (0.01)***	-0.1 (0.01)***
Log(population)	2.0 (0.7)***	1.1 (0.6)*	-0.4 (0.6)	-0.6 (0.6)
Tax Revenues(-1)	0.01 (0.003)***	0.06 (0.001)***	0.04 (0.002)***	-0.05 (0.001)***
Average (X)	0.00 (0.00)	-0.03 (0.004)***	0.001 (0.0002)***	-0.001 (0.0005)*
Average (Y)	0.7 (0.2)***	0.9 (0.2)***	0.8 (0.2)***	0.9 (0.2)***
Deficit_y(-1)	0.03 (0.01)***		0.04 (0.001)***	
G(-1)		0.02 (0.004)***		0.001 (0.0003)***
Deficit_y		0.04 (0.008)***		0.04 (0.008)***
Exp_Pct_y		-0.005 (0.002)**		-0.003 (0.002)
Adj. R Squared	0.72	0.74	0.76	0.78
Im, Pesaran and Shin W	-5.2***	-5.4***	-6.3***	-6.9***
Number of observations	918	916	918	916

Table 2: Expenditure functions (Dependent variable: log (g)).

Variable	(1)	(2)	(3)	(4)
C	-32.3 (3.8)***	-32.7 (3.7)***	-29.8 (3.5)***	-30.0 (3.4)***
Log(y)*recessions	-0.3 (0.04)***	-0.3 (0.04)***		
Log(y)^2*recessions	0.027 (0.003)***	0.0248 (0.003)***		
Log(y)*expansions			-0.5 (0.03)***	-0.5 (0.03)***
Log(y)^2*expansions			0.0373 (0.002)***	0.0346 (0.002)***
Log(pop15+pop65)	-4.4 (0.8)***	-3.4 (0.8)***	-1.9 (0.8)**	-1.7 (0.7)**
Decade60s	-2.0 (0.5)***	-2.4 (0.4)***	-2.1 (0.4)***	-2.5 (0.4)***
Decade70s	-2.2 (0.3)***	-3.7 (0.3)***	-2.3 (0.3)***	-2.5 (0.3)***
Decade80s	-1.4 (0.3) ***	-2.5 (0.3)***	-1.5 (0.2)***	-1.7 (0.2)***
Fwtw	-1.8 (0.2)***	-2.1 (0.2)***	-1.7 (0.2)***	-1.9 (0.3)***
U	-0.06 (0.02)***	-0.05 (0.01)***	-0.04 (0.01)***	-0.05 (0.01)***
Log(population)	5.0 (0.8)***	4.0 (0.8)***	2.5 (0.7)***	2.3 (0.7)***
Tax Revenues(-1)	0.004 (0.002)	-0.002 (0.0005)***	0.007 (0.002)***	-0.0008 (0.0005)*
Average (X)	1.9 (0.3)***	2.0 (0.3)***	2.0 (0.3)***	1.9 (0.3)***
Average (Y)		-0.008 (0.001)***		-0.8 (0.1)***
Deficit_y(-1)	0.08 (0.01)***		0.09 (0.01)***	
G(-1)	0.001 (0.0003)***	0.003 (0.0004)***	0.003 (0.0002)***	0.8 (0.1)***
Deficit_y		0.08 (0.01)***		0.1 (0.01)***
Exp_Pct_y		0.008 (0.002)***		0.01 (0.003)***
Adj. R Squared	0.75	0.77	0.79	0.80
Im, Pesaran and Shin W	-3.4***	-3.1***	-4.3***	-4.7***
Number of observations	918	916	918	916

Table 3: Tax revenue functions (Dependent variable: log (tax revenues)).

Equation	(1)		(2)		(3)		(4)	
	B_R	D_R	B_R	D_R	B_E	D_E	B_E	D_E
Coefficient	0.027	0.032	0.0248	0.0262	0.0373	0.0359	0.0346	0.0317

Table 4a: Summary of the coefficients.

Test	B_R- D_R =0		B_E- D_E =0	
Equations	(1)	(2)	(3)	(4)
Probability	0.06*	0.55	0.47	0.13

Table 4b: Wald Test for the Cyclical Coefficients.

Test	D_E-D_R=0		B_E-B_R=0	
Equations	(3)-(1)	(4)-(2)	(3)-(1)	(4)-(2)
Probability	0.04**	0.004***	0.000***	0.000***

Table 4c: Wald Test for the cyclical coefficients.

In Table 4c the Wald test certifies that the coefficient for marginal taxation in expansions is high compared to the one of recessions. This finding was confirmed empirically in the literature, and it is corroborated by the test with a high level of significance (lower than 1 percent). Concerning marginal propensity of spending, results are as expected but with lower significance: while for one specification the coefficient in expansions is higher than in recessions at 1 percent significance, confirming the political bias, in the other specification the significance is found only at a 5 percent level. Thus, the political bias result is weakly confirmed. In terms of the model, the existence of the revenue asymmetry calls for paying special attention to revenues – which may imply using revenue rules.

Note that the constant and all the dummies representing decades, and FWTW, have a negative coefficient (as expected). I also included lagged values of spending and tax revenues so as to control for levels. In the next section I check the behavior of tax reductions, in order to check whether it is a relevant issue.

Tax reductions

One of the most comprehensive studies of the interaction between fiscal rules and cyclicality has been performed by Debrun [12]. These authors consider also revenue rules, and note that they can be cycle-friendly if they avoid using windfalls in expansions, or procyclical if they target a minimum or maximum amount of tax revenues. However, these authors did not consider the possible impact of discretionary tax reductions: if revenue rules are efficient on avoiding discretionary tax reductions in expansions, that would be a positive outcome both from the point of view of cyclical friendliness and avoidance of a structural deficit.

In general statutory tax data is not available, which makes difficult the task of assessing discretionary tax reductions. Recently Vegh and Vuletin [2] studied the behavior of statutory tax rates in a sample of both developed and developing economies, and found that it is acyclical in the first group and procyclical in the second. These authors based their study on the changes in VAT, corporate taxes and the top marginal tax rates of individuals, and did not differentiate among tax increases and reductions[19].

In this sub-section I use the reductions in these three items in order to learn on the cyclical behavior of tax reductions. In order to check the propensity to reduce taxes during the cycle I run a regression where the dependent variable is the group of different sources of tax reductions, and the independent variables are the different phases of the cycle, using cyclical control variables. Since tax reductions are prone to be implemented simultaneously, I use cross-section SUR estimates[20]. The purpose of my analysis is to identify discretionary tax reductions. Thus, I need an identifying strategy. I will consider tax reductions that are parallel to expenditure reductions as "ideological": since they are budgetary balanced, these reductions are a legitimate choice of

[19]Strawczynski [31] used a broader set of taxes for the case of Israel and found that indirect taxation is procyclical, while direct taxation is acyclical.

[20]The SUR technique was used also by Balassone, Zotteri and Francese [17].

politicians and consequently shall not be considered as discretionary; thus, they shall not be a matter to be treated by fiscal rules. Consistently, the dependent variable will include only tax reductions that were not implemented with a parallel reduction of expenditure – which will be considered as discretionary. For this purpose I will check sensitivity by using two definitions: i) DISCR_TAX_RED1 is based on tax reductions that were implemented with no parallel reduction of real expenditure; ii) DISCR_TAX_RED2 is based on tax reductions that were implemented with no parallel reduction of per-capita real expenditure.

In Table 5 I show the results for discretionary tax reductions adding two combinations of fiscal rules: revenue rules and the combination of the three types of rule. Interestingly, the existence of the three kinds of rule moderates discretionary tax reductions, with a coefficient of 0.4 for the first definition (i.e., no parallel real expenditure reduction) and of 0.3 for the second definition (i.e., no parallel per-capita real expenditure reduction) – which will be adopted as a benchmark in the simulation below.

Simulation of fiscal rules

The simulation is performed assuming a symmetric shock and using the coefficients shown in the previous sub-section. I assume that the shock equals to 5 percent of GDP.

Table 6a shows the impact of the shock and the performance of the deficit bias under different rules (Table 6a).

According to the basic setup, and as a consequence of the cycle, there is a political deficit bias, exacerbated by tax reductions. Applying the coefficients of the squared variables for G and T to the benchmark values of G, T and Y, I obtain a recession bias of 1.2 of GDP that is corrected in expansions by 0.6 percent of GDP. Concerning discretionary tax reductions, I estimated them by looking at the reductions of income taxation, corporate taxation and V.A.T. that were implemented with no parallel reduction of per-capita real government expenditure. The average reduction in corporate taxes was 3.6, and in income taxation it was 2.9 (there were no discretionary V.A.T. reductions). Using these estimates and the share of these taxes in tax revenues, I obtained that discretionary tax reductions stand at 0.5 percent of GDP. Consistently with my results in Table 5 and results by Vegh and Vuletin [2], I assume that tax reductions are implemented equally in expansions and recessions. Accordingly, the deficit stands at 3.4 percent of GDP in recessions and 1.5 percent in expansions. Note that while the tax reduction increases the deficit in both phases of the cycle, it becomes visible at recessions, in which the GDP growth is negative.

Imposing a deficit rule means that it will be binding in recessions; in the simulation I use the cap imposed at Maastricht Treaty, which stands at 3 percent of GDP. Thus, the deficit bias in recessions is reduced by 0.4 percent, while in expansions it is not binding and thus it does not affect the deficit bias.

In order to compare between the deficit and expenditure rules, I assume that the expenditure rule is designed ex-ante so as to neutralize the cyclical bias – as estimated in the regressions. Results show that the impact of this rule on the deficit is slightly smaller in recessions (while the whole adjustment comes from the expenditure side) but, as opposed to budget deficit rule, it exists in expansions. In average the deficit is lower, due to the fact that the expenditure rule is designed to cope with the political cyclical bias. Another remarkable aspect is that the expenditure rule is more cycle-friendly than the deficit rule. This result is in line with Debrun [12].

The most notable impact is achieved when imposing a combination of expenditure and revenue rules: since the revenue rule constraints discretionary tax reductions, the deficit bias in recessions is related to the cyclical bias and to the portion of effective discretionary tax reductions under the combination of the rules, which according to the results in Table 5 stands at 30 percent. Under this combination of rules, the deficit bias stands at 2.9 and 1.1 percent of GDP in recessions and expansions, respectively. These figures mean that the combination of rules is efficient on neutralizing the political bias, and that it is binding

Variable/Regression	(1)	(2)	(3)	(4)
Dependent Variable	DISCR_TAX_RED1	DISCR_TAX_RED2	DISCR_TAX_RED1	DISCR_TAX_RED2
C	0.1 (0.05)**	0.14 (0.05)***	0.1 (0.05)**	0.1 (0.05)**
Recessions	0.02 (0.02)**	0.03 (0.02)*	0.02 (0.002)	0.04 (0.002)*
Recessions (-1)	-0.01 (0.02)	-0.02 (0.02)	-0.01 (0.002)***	-0.03 (0.002)
Dlog(exports)	-0.5 (0.2)**	-0.5 (0.2)***	-0.5 (0.2)***	-0.5 (0.3)***
Dlog(unemployment)	-0.01 (0.01)	-0.02 (0.01)	-0.02 (0.02)	-0.02 (0.02)
Output gap	0.08 (0.02)***	0.07 (0.02)***	0.08 (0.00)***	0.07 (0.02)***
Dlog(population)	4.5 (1.8)**	2.5 (1.6)	4.5 (1.8)***	3.2 (1.6)**
Parlament	0.08 (0.04)**		0.08 (0.04)**	0.06 (0.04)*
Rtarget	0.06 (0.04)	0.04 (0.04)		
Rtarget*Btarget*Etarget			0.4 (0.07)***	0.3 (0.06)***
Adj. R Squared	0.03	0.04	0.06	0.06
Durbin Watson	1.9	1.6	1.9	1.9
Sample Period	1975-2010	1975-2010	1975-2010	1975-2010

Table 5: Tax reductions (Cross section SUR regressions).

	Recession	Expansion
Cyclical Bias	3.4	1.5
Deficit Rule	3.0	1.5
Expenditure rule	3.1	1.2
Expenditure and Revenue Rule	2.9	1.1

Table 6a: A simulation of fiscal rules along the cycle simulated deficit bias as a percent of GDP (Chosen parameters: $\alpha = 0.4; \gamma = 0.994; \delta = 0.3$). Assumption: tax reductions are equal in size to the cyclical bias; structural deficit equals the average deficit over the sample.

	A=1, B=1, C=1	A=2, B=0.5, C=0.5	A=0.5, B=2, C=0.5	A=0.5, B=0.5, C=2
Deficit Rule	0.8	0.3	1	1
Expenditure rule	0.7	0.5	0.7	0.75
Expenditure and Revenue Rule	0.4	0.1	0.2	0.89

Table 6b: Social loss under different weights.

in expansions. The ability of coping with the political bias in expansions is an optimal way to react, since it is cycle-friendly. Debrun [12] analyze the different rules according to their characteristics concerning the ability for curtailing the deficit, and the extent of cycle-friendliness.

One of the most well-known formulations for a macroeconomic loss function by a benevolent policy-maker was proposed by Barro and Gordon [32]. It is desired to avoid the deviation of actual unemployment from its natural rate. In the present context, we shall add to the loss function a term that represents the loss of reputation caused by a high debt[21]. Thus, the government would choose the fiscal rules that bring to a minimum the following loss function:

$$Min\, L = K*(DEBT_t - \overline{DEBT}) + H*(u_t - u_N)$$

Where DEBT represents the ratio of general government gross debt to GDP, $\overline{DEBT}$ is the debt target, u_t represents unemployment at time t and u_N is the natural rate of unemployment. In the present case the loss of reputation is represented by the increase of deficits over the cap (which occur during recessions), and by the increase of the structural deficit that is caused by the political bias. The deviations from the natural rate of unemployment are critical in recessions, since at that time unemployment goes up. Thus, the reduced form of equation 19 in the present framework takes the following form:

(1) L=A × (excess deficit over cap)+B × (increase of structural deficit)+C × (cuts in recession)

Where A, B and C are, respectively, the weights given to the different terms. Using different combinations I analyze the strength of the different rules. It turned out that in most cases the combination of expenditure and revenue rules dominates the other options; another clear result is that the budget deficit rule is dominated by the other two options (Table 6b).

Empirical Evidence on Fiscal Rules along the Cycle

Following Kumar [34] I define a fiscal rule here as a numerical target that binds and controls budget deficits and expenditure in annual budgeting—e.g., a budget-balancing rule, expenditure ceilings and caps, revenue rules ("IMF Definition")[22]. According to IMF definition, a target qualifies as a fiscal rule only if it is specified for at least three years (or more); note also that the IMF definition does not include pay-as-you-go targets as a fiscal rule.

Fiscal rules are represented by dummy variables that take the value of 1 during the period beginning at the adoption date of the rule and lasting until the rule is abandoned (otherwise it continues until the end of the sample), and 0 otherwise. The data is freely available at the internet and was facilitated to researchers by the authors.

I considered three different definitions for fiscal rules at the federal level[23]: i) budget balancing rules adopted at the national level (BTARGET); ii) expenditure rules adopted at the national level (ETARGET); iii) revenue rules (RTARGET), which typically require increasing another taxation source when taxes are reduced. The use of this last type of rule is less common, but it has been increasing in recent years. Kumar [34] and Budina [1] stress that the complexity of fiscal finances in modern times imply that the coexistence of the different types of rules is desirable.

Note that these definitions focus on different variables. Budget balancing rules usually affect a deficit by setting a balanced budget target or gradually lowering it, and by cutting expenditure or increasing taxes. Expenditure rules target the rate of increase of government spending; thus, they are more likely to restrain expenditure growth if they are binding[24]. Revenues rules put restrictions on tax reductions, and are intended to strengthen the revenue side of the budget. The choice of these three different definitions allows for testing the efficacy of the different degrees of rules. Moreover, by using interaction variables (defined as the multiplication of the different dummy variables representing the rules), I can test the effectiveness of a combined application of rules. For example, until the end of the period to which the data relates, Netherland implemented all three types of rules, Iceland did not adopt any, and the USA was the only country to abolish an existing budget rule without adopting another.

I performed General Method of Moments (GMM) estimations using year and country fixed effects. Ilzetzki and Vegh [35] emphasize the need to account for potential endogeneity between government expenditure and GDP when studying fiscal policy. To cope with this issue I use exports growth as an instrumental variable for GDP growth. I report robust standard deviations, using White cross-section corrected standard errors.

I used the following control variables to reflect higher sources of demand for government expenditure (public services such as education, child allowances, and old-age pensions, respectively): population growth (DlogPOP) to account for the demand for public services, GDP growth (DlogY) to represent resources, and the growth of the population under 15 years of age (DlogPOP15) and over 65 years of age (DlogPOP65) [36-38].

Dependent Variable:	**DEFY**			
Period:	**1963-2010**			
Number of observations	**977**	**977**	**977**	**977**
C	1.519	1.306	1.305	1.409
	(3.56)***	(2.43)**	(2.44)**	(2.65)***
DlogY	-34.560	-35.541	-35.617	-36.731
	(-3.54)***	(-3.52)***	(-3.53)***	(-3.62)***
DlogPOP	-29.806	24.265	24.925	28.450
	(-0.77)	(0.38)	(0.39)	(0.45)
DlogPOP15+DlogPOP65	15.628	4.786	4.625	3.699
	(1.73)*	(0.40)	(0.39)	(0.32)
DEFY(-1)	-0.185	-0.174	-0.174	-0.179
	(-5.05)***	(-4.24)***	(-4.25)***	(-4.38)***
RTARGET	-0.466			
	(-1.96)**			
ETARGET* BTARGET* RTARGET		-0.719		
		(-1.85)*		
ETARGET* BTARGET* RTARGET(1-YBOOM)			-0.695	
			(-2.10)**	
BTARGET(1-YBOOM)				-0.553
				(-2.01)**
Adj. R2	0.34	0.34	0.33	0.34
Durbin-Watson	2.09	2.08	2.08	2.08

Table 7: The new generation fiscal rule: adding a revenue rule.

[21]A model that solves optimal fiscal policy under the existence of a penalty for the loss of reputation when the debt to gdp ratio is higher than the target is shown by Hercowitz and Strawczynski [33].

[22]For an analysis of different definitions of fiscal rules see Dahan and Strawczynski [22].

[23]Another important dimension is federal vs. state rules. For example, European rules apply to all levels of government. However, learning about the effectiveness of state rules is beyond the scope of the present paper.

[24]Dothan and Thompson (2009) analyze a transparent spending rule governing maximum sustainable rate of spending growth, treating the revenue as given.

Table 7 shows the impact of fiscal rules on budget deficit. Introducing revenue rules reduces the deficit by 0.5 percent. This effect become larger when applied in combination with the other two types of rule: balanced budget and expenditure. Finally, I obtained that the effect of the fiscal rules combination is notable at recessions: the coefficient for these periods is significant. Note that in the ex-ante analysis the tax reduction could be performed in expansions ("hiding") or in recessions (countercyclical policy) [39,40]. This result means that revenue rules, in combination with the other two types of rules, may avoid increasing the deficit in recessions; note that in these periods governments are interested to avoid a high deficit (beyond the automatic stabilizers). The sizable coefficient raises the question of the cycle-friendliness of revenue rules – a question that merits further research (Table 7).

Summary and Conclusions

In recessions the GDP slows down, tax revenues are reduced and the budget deficit goes up. In expansions tax revenues soar and the abundant 'common pool of revenues' stimulates ministers to spend; thus, the correction of the deficit in expansions is not enough to avoid an increase in the deficit after a full business cycle. Fiscal rules, which were created in order to deal with the political bias of the common pool problem, should take into account the impact of the economic cycle on fiscal variables, and be designed so as to cope with the political bias. Note that the political bias does not always show up in real time. A good illustration of this type of phenomenon is the reduction of statutory tax rates: if those are performed in expansions, the exogenous increase in GDP that is characteristic to expansions, compensates for the reduction of tax revenues, and thus it hides the increase of the structural deficit. The right rules to be applied as a reaction to the political bias are the ones that fight it at source: spending and revenue rules. Paradoxically, those are actually less widespread than budget deficit rules (although becoming popular in late years).

In this paper I check whether the pattern of spending and revenues is related to the cycle. Concerning revenues, and in consistence with empirical findings, we shall expect that in good times they rise more than in recessions. The reason for this result is related to progressive taxation: in good times high income individuals advance to subsequent brackets, which implies higher personal income marginal tax rates. Concerning spending, the prevailing hypothesis is that in good times the common pool problem is at place, causing a higher spending compared to recessions. Using a sample of OECD countries between 1963 and 2010, I found very strong support (at 1 percent significance) for the first result and a weaker support (at 5 percent significance) for the second. I also found that in recessions marginal spending is higher than marginal tax revenues, while in expansions they tend to be similar – a result that is in line with Hercowitz and Strawczynski [16].

My next step is to model these facts in order to analyze the possible bias that may arise as a consequence of the interaction of the cycle and the political forces. An additional possible source for a deficit bias is the implementation of discretionary tax reductions, which are defined as those reductions that are implemented without a parallel reduction in expenditure. Discretionary tax reductions can be implemented in recessions as a countercyclical reaction, or in expansions, given the feasibility of hiding the impact of statutory tax reductions on tax revenues in real time. By using V.A.T., corporate and top marginal income tax rates, I show that in OECD countries discretionary tax reductions were implemented mainly in recessions. An examination of the impact of revenue rules on tax reductions show that while these rules limit tax reductions, they allow their implementation in recessions – which in the terminology of Debrun [12] means that they are cycle-friendly.

Fiscal rules can deal with the deficit bias by putting a cap on deficit (balanced budget rules), by putting a limit on spending (expenditure rules) or by limiting discretionary tax reductions (revenue rules). Budina et al. [1] have shown that the combinations of rules are becoming widespread, in order to deal with the source of possible political bias. I run a simulation using the parameters found in the empirical regressions, and found that revenue rules are crucial for limiting the deficit bias caused by discretionary tax reductions. According to the simulation, the addition of a revenue rule is effective on reducing the budget deficit. Moreover, a combination of expenditure and revenue rules is effective for both curtailing the budget deficit and for doing it in a cycle-friendly way[25]. A loss function that combines the political bias and the cycle-friendliness of rules in recessions shows that the combination of expenditure and revenue rules implies a lower loss than the application of a single rule - deficit or expenditure.

Finally, I performed regressions for the general government budget deficit as a function of its main explaining variables, with the addition of fiscal rules. As in previous papers, I found that deficit rules and expenditure rules help for reducing the budget deficit. A new finding is that revenue rules have an additional contribution for reducing the deficit, which becomes more substantial under a combination of the three types of rules.

[25]The friendliness of revenue rules was checked in my paper. The friendliness of expenditure rules was checked and corroborated by Debrun [12].

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