Ricardian fiscal regimes in the European Union

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Abstract The prevalence of different fiscal regimes is important both for practical policy reasons and to assess fiscal sustainability, notably for European Union countries. The purpose of this article is to assess, with a panel data set, the empirical evidence concerning the existence of Ricardian fiscal regimes in EU-15 countries. The results give support to the Ricardian fiscal regime hypothesis throughout the sample period, and for sub-samples accounting for the dates of the Maastricht Treaty and for the setting-up of the Stability and Growth Pact. Furthermore, electoral budget cycles also seem to play a relevant role in fiscal behaviour.

Keywords Fiscal regimes · European Union · Panel data models

JEL Classifications C23 · E62 · H62

1 Introduction

The distinction between Ricardian and non-Ricardian fiscal regimes can be traced back to Aiyagari and Gertler (1985) who maintained that in a non-Ricardian regime, the Treasury would not commit itself in the future to match completely new

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government debt with future taxes, since some part of the new debt is to be financed through money. In a Ricardian regime, the opposite would be true, with future fiscal revenues being expected to pay for current outstanding government liabilities. In other words, in a Ricardian fiscal regime, primary budget balances are expected to react to government debt, in order to ensure fiscal solvency. On the other hand, in a non-Ricardian regime the government would determine primary balances independently of the level of government debt. Moreover, in the context of assessing the sustainability of public finances, satisfying the intertemporal budget constraint or being in a Ricardian fiscal regime is a necessary, but not sufficient, condition for sustainability.

The existence of different fiscal regimes is relevant for practical policy reasons. Indeed, this closely relates to the commitment of the European fiscal authorities to keep government liabilities within bounds, in the spirit of the Maastricht Treaty and of the Stability and Growth Pact (SGP). Nevertheless, applied work on the topic is far from abundant, and even less for countries of the European Union.

This paper adds to the literature by assessing the empirical evidence concerning the existence of Ricardian or non-Ricardian fiscal regimes in the EU-15 countries, using an annual panel data set for the period 1970–2003. Given the institutional changes that occurred in the EU-15 in the 1990s, alternative sub-sample periods are considered in the analysis to assess the possibility of fiscal regime shifts. Therefore, the analysis takes into account the ratification of the European Union Treaty in Maastricht on February 1992, with the setting up of the convergence criteria, as well as the adoption of the SGP framework in December 1996 in the European Council of Dublin, afterwards ratified in June 1997 in Amsterdam. The results reported in the paper give support to the Ricardian fiscal regime hypothesis throughout the sample period. Additionally, electoral budget cycles also seem to play a role in fiscal behaviour since the adherence to a Ricardian fiscal regime is more mitigated in election times.

The remainder of the paper is organised as follows. Section 2 addresses the relevance of fiscal regimes, and reviews some of the related existing evidence. Section 3 discusses the specifications. Section 4 presents the empirical analysis of fiscal regimes in the EU-15 countries. Finally, Sect. 5 contains concluding remarks.

2 Fiscal regimes

2.1 The relevance of different fiscal regimes

The classification of a fiscal regime as “Ricardian,” is inspired by the idea of a “well behaved” or “disciplined” government. Tax cuts financed by increased government borrowing should be matched by tax increases (or spending cuts) in the future in order to keep the present value of tax liabilities constant. This is essentially the implicit assumption of a Ricardian fiscal regime, pursued by a “well behaved” government.1

1 Following Sargent and Wallace (1981), a Ricardian regime is a “regime of monetary predominance” if money demand and supply determine the price level. In a non-Ricardian regime, “a regime of fiscal predominance,” prices would be endogenously determined by the government budget constraint.
In a Ricardian regime where the monetary authorities are “active”, the government has to attain primary budget surpluses in order that the budget constraint is consistent with repayment of the initial stock of debt at the price level resulting from the money demand equation. According to Leeper’s (1991) terminology, the Treasury has a “passive” strategy and the monetary authority has an “active” behaviour. If the government chooses an active fiscal policy, that is, the budget surpluses are not adjusted endogenously in order for the budget constraint to satisfy the price level implicit in the money demand function then a non-Ricardian fiscal regime could be in place.\footnote{The proponents of the fiscal theory of the price level argue along these lines, see Woodford (1994), Sims (1994), Cochrane (1999), and Gordon and Leeper (2006) while Buiter (2002) offers a critical view.}

Within the theoretical framework of a regime of fiscal predominance, where consumers are non-Ricardian, wealth effects should show up through nominal government debt, with the government budget constraint being used to determine a unique price level. More generally, in a nutshell the price level, $P$, could be determined by the intertemporal government budget constraint,

$$\frac{B_t}{P_t} = \sum_{s=0}^{\infty} \frac{s_{t+s}}{(1 + r)^{s+1}}.$$  \(1\)

$B_t$ stands for the government nominal liabilities in period $t$, including the stock of public debt (for simplicity, one year securities) and the monetary base; $s_t$ is the primary budget government balance in period $t$, including seigniorage revenues, in real terms; and $r$ is the real interest rate, assumed constant, also considering the usual transversality condition, which needs to be met by a solvent government.

In the framework of Sargent and Wallace, the intertemporal budget constraint would imply that the inflation tax is the residual that adjusts to meet the fiscal shortfalls. Under a Ricardian fiscal regime fiscal policy models would need a fiscal rule, for instance, making the primary surplus a function of outstanding government liabilities. This underlying rational is useful for the testable specifications of fiscal regimes proposed ahead in Sect. 3 of the paper.

2.2 Previous related evidence on Ricardian fiscal regimes

Regarding the empirical validation of the existence of Ricardian fiscal regimes Canzoneri et al. (2001) use a bivariate VAR to test for the existence of a Ricardian regime in the US. They assess if the primary budget surplus as a percentage of GDP negatively influences the government liabilities, also as a ratio of GDP. They conclude for the existence of Ricardian regime, with the Treasury assuming a passive strategy and the Central Bank assuming an active strategy.

Debrun and Wyplosz (1999) and Méliéz (2000) provide some additional empirical work. They estimate reaction functions respectively for the UE-12 and OECD countries, in order to evaluate if the primary budget surplus responds positively to the level of government debt. According to their results, there seems to be a statistically significant positive response of the primary budget balance to government debt. Consequently, governments do seem to take into account their
respective intertemporal budget constraints. In other words, fiscal policy might have been implemented according to a Ricardian regime. Additionally, another possible reading of the results presented by these authors might in terms of the sustainability of public finances.3

Using a different approach for somehow related research, Favero (2002) jointly models the effects of monetary and fiscal policies on macroeconomic variables in structural models for France, Germany, Italy and Spain, and reports that fiscal policy reacts to increases in debt. Additionally, for the US, Favero and Monacelli (2003) and Sala (2004), report the existence of Ricardian fiscal regimes after the end (beginning) of the 1980s (1990s), while Sala concludes for the existence of non-Ricardian regime in the 1960s and 1970s. A Ricardian regime is also reported by Rocha and da Silva (2004) for Brazil, a country where past high inflation and fiscal problems would have seem to be a good ground for fiscal predominance.4

2.3 Empirical specifications

The idea of implementing causality tests between the primary balances and government debt, which is implied in the VAR models mentioned in Sect. 2, is not without pitfalls. In fact, both these variables are part of the present value borrowing constraint, a constraint that in the end holds true in any fiscal regime, whether Ricardian or non-Ricardian. Since I am specifically concerned with the EU-15 countries, another strategy is to pool the data and use panel models along with some plausible testable assumptions. One of the advantages of using a pooled sample is that it allows the use of more observations and gives more degrees of freedom. Indeed, since for some countries the length of the time span could be a problem, country-specific regressions might offer imprecise estimates. Another advantage of a panel approach may be the reduction of multicollinearity among variables.

When thinking about government debt and fiscal balances, it seems pertinent to expect governments to attain primary surpluses if they want to downsize the stock of public debt. The underlying idea being that if fiscal authorities are motivated by debt stabilization and sustainability motives, a positive response of budget balances to the stock of debt should be expected. A fiscal policy rule where the primary balance reacts to the debt variable would be a possible avenue for such analysis.

Therefore, the following linear dynamic model, closely connected to the fiscal budget account identity, could give a testable specification for the primary budget balance with the debt ratio as an exogenous variable and a lagged dependent variable,

\[ s_{it} = \beta_i + \delta s_{i,t-1} + \theta b_{i,t-1} + u_{it}. \]  

In (2) the index \( i = 1, \ldots, N \) denotes the country, the index \( t = 1, \ldots, T \) indicates the period and \( \beta_i \) stands for the individual effects to be estimated for each country \( i \). \( s_{it} \) is the primary balance as a percentage of GDP for country \( i \) in period \( t \).

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3 Afonso (2005a) reports results regarding the lack of fiscal sustainability for the European Union.

is the observation on the same series for the same country \(i\) in the previous period, and \(b_{it-1}\) is the debt-to-GDP ratio in period \(t-1\) for country \(i\). Additionally, it is assumed that the disturbances \(u_{it}\) are independent across countries.

The use of primary rather than total balances is justified by the fact that the intertemporal government budget constraint relates to the primary surplus. Moreover, the use of the primary balance is logical since primary expenditure is more easily under the discretionary control of the government. Under such a fiscal policy rule, one assumes that the primary balance of period \(t\) is dependent on last year’s primary balance. Indeed, it is not easy for the governments to implement enough measures in a single year to dramatically change the fiscal policy stance. For instance, the more relevant budgetary spending items as the compensation of employees or social transfers are essentially little unchanged in the short-term. Therefore, the use of the primary balance lagged explanatory variable seems reasonable. Hence, making the primary balance a function of government debt, allows testing the following hypotheses:

(i) If \(\theta = 0\), the primary balance does not react to the level of public debt, a non-Ricardian fiscal regime.

(ii) If \(\theta > 0\), the government tries to increase the primary balance in order to react to the existing stock of public debt, which could be seen as a sign of a Ricardian fiscal regime.

Moreover, sustainability of public finances would require not only that \(\theta\) is positive but also that such coefficient be sufficiently positive.

Besides the previous simple fiscal rule for the primary balances, one may try to estimate also the following specification for the government debt ratio,

\[
b_{it} = \alpha_i + \gamma s_{it-1} + \phi b_{it-1} + \nu_{it}, \quad (3)
\]

where \(s\) and \(b\) are defined as before and now \(\alpha_i\) stands for the individual effects to be estimated for each country \(i\), assuming also that the disturbances \(\nu_{it}\) are independent across countries. Such a specification is essentially compatible with the standard budget deficit and debt dynamics formulation, even if we do not dwell here on that issue. This allows putting forward the following testable ideas:

(i) The hypothesis of a Ricardian fiscal regime is not rejected when \(\gamma < 0\), as most likely the government is using budget surpluses to reduce outstanding government debt.

(ii) With \(\gamma \geq 0\), there may be a non-Ricardian regime, i.e. a regime of fiscal dominance.

It is possible to see that (3) is almost an accounting identity departing from such equality for two reasons. First the lagged debt coefficient varies over time being approximated by the difference between the interest rate and the economic growth rate. Second, deficit-debt adjustment related factors indeed disturb the linkage between deficit and debt, and they should then be part of the residual.

Specifications (2) and (3) are standard fixed effects models, essentially linear regression models in which the intercept terms vary over the individual cross section.
The existence of differences between the several countries should then be taken into account by the autonomous term that may change from country-to-country, in each cross section sample, in order to capture individual country characteristics.

In the previous specifications, there is nevertheless an implicit assumption that the underlying model is homogeneous, i.e. the coefficients are the same for all countries. As a matter of fact, one of the problems with panel data estimations, as, for example, mentioned by Haque et al. (2000), is the possibility that the real model might be heterogeneous, with different coefficients for the explanatory variables in the cross section dimension. Assuming the same coefficients for all the countries, with the exception of the intercept, may give rise to non-linearity in the estimations, even if the relation between the variables is linear. An alternative estimator proposed by Pesaran and Smith (1995), the mean group estimator, is based on the separate estimation of the coefficients for each cross section unit, through the least squares method, and then computing the arithmetic mean of those coefficients. Still, this alternative procedure does not allow for the hypothesis that some of the coefficients may indeed be similar for several countries.

Alongside the problem mentioned above, and to circumvent the potential non-stationarity problem arising from the time-series dimension of the data, empirical models in the literature are usually estimated with the first differences of the variables. Even so, in most cases this procedure does not fully solve the problem. The alternative of using variables in first differences also might not take into account the fact that there is a level relation between the government budget balance and the stock of outstanding public debt, through the present value borrowing constraint.

Moreover, in an autoregressive panel data model with exogenous variables with a fixed $T$ dimension, estimation inconsistency might be a problem and the bias should not be ignored. To address such inconsistency problems an instrumental variables approach is adequate where the first differences of the variables are employed as their own instruments. This can be used both for the lagged dependent variable and also for the exogenous variables. However, in doing so, we give up any potential efficiency gains if an exogenous variable actually helps explaining the lagged endogenous variable.

First-difference versions of Eqs. 2 and 3 can be written as follows, respectively for the primary balance, and for the government debt,

\[
\Delta s_{it} = \delta \Delta s_{it-1} + \theta \Delta b_{it-1} + \Delta u_{it},
\]

\[
\Delta b_{it} = \gamma \Delta s_{it-1} + \phi \Delta b_{it-1} + \Delta v_{it},
\]

where one now has, for instance, $\Delta s_{it} = s_{it} - s_{it-1}$.

First differencing directly eliminates the individual effects ($b_{it}$ and $s_{it}$) from the models. However, differencing introduces a correlation between the differenced lagged dependent variable and the differenced error term, and the use of instruments is then required. For the previous two specifications, consistent estimates can be obtained using Two-Stage Least Squares (2SLS) with instrumental variables correlated with $\Delta s_{it-1}$ ($\Delta b_{it-1}$) and orthogonal to $\Delta u_{it} (\Delta v_{it})$. Indeed, the lagged
values \( s_{it-2} \) and \( b_{it-2} \), will be uncorrelated respectively with \( \Delta u_{it} \) and \( \Delta v_{it} \), and can therefore be used as instrumental variables for the first differenced equations in (4) and (5).\(^5\) One should notice that specifications (4) and (5) would imply a slightly different interpretation of parameters \( \theta \) and \( \gamma \). For instance, a positive \( \theta \) would point to an increasing speed in the change of the primary balance ratio when the speed of change in the debt-to-GDP ratio increases.

Additionally, and in order to account for the effects of the business cycle, the output gap can also be included in the specifications as follows:

\[
\Delta s_{it} = \delta \Delta s_{it-1} + \theta \Delta b_{it-1} + \lambda_s \Delta z_{it-1} + \Delta u_{it}, \quad (4')
\]

\[
\Delta b_{it} = \gamma \Delta s_{it-1} + \varphi \Delta b_{it-1} + \lambda_b \Delta z_{it-1} + \Delta v_{it}, \quad (5')
\]

where \( z \) is the output gap computed as the difference between actual GDP and potential GDP as a percentage of potential GDP.

### 3 Empirical analysis

#### 3.1 Data

In order to assess the possibility of Ricardian fiscal regimes for the EU-15, I use annual data spanning the years 1970–2003 for the primary budget balance as a percentage of GDP (excluding UMTS effects), and for the debt-to-GDP ratio. This gives a maximum of 34 years of annual observations for 15 countries. Of the 15 countries in the panel data set, 12 are currently in EMU—Austria, Belgium, Germany, Finland, France, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal and Spain—and 3 others have not adopted the euro—Denmark, Sweden and United Kingdom. The source of the data is the European Commission AMECO database. Table 1 presents summary descriptive statistics for the full sample.

A first assessment of the data can be made in order to check the magnitude of the existing negative correlation between the primary budget balance ratio and the changes in the debt ratio. For instance, such correlation is around \(-0.8\) for Belgium, Spain, and the UK, and around \(-0.5\) for Germany, Portugal, and Italy. On the one hand, this hints at the possibility of Ricardian fiscal regimes in the EU-15, on the other hand it reveals different degrees of adherence to such a fiscal regime within the country sample.

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<table>
<thead>
<tr>
<th>Table 1 Descriptive Statistics (full sample): 1970–2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Primary balance ratio (%)</td>
</tr>
<tr>
<td>Debt ratio (%)</td>
</tr>
<tr>
<td>Output gap (%)</td>
</tr>
</tbody>
</table>

Note: IR—Ireland; DK—Denmark; LU—Luxembourg; BE—Belgium; FI—Finland; PT—Portugal
For a casual inspection of the underlying time series, Fig. 1 plots the changes in the debt-to-GDP ratio and primary balance ratios for a set of selected countries. Interestingly, the scatter diagrams, where I draw a second order polynomial regression between the two variables, indicate the existence of a negative relationship.

3.2 Unit root tests

The motivation behind panel data unit root tests is to increase the power of unit root tests by increasing the span of the data while minimising the risk of encountering
structural breaks due to regime shifts. Two alternative panel unit root tests are performed for the government debt and primary budget balance series. Levin et al. (2002) proposed a test based on heterogeneous panels with fixed effects where the null hypothesis assumes that there is a common unit root process. The basic augmented Dickey-Fuller (ADF) equation is

$$\Delta y_{it} = a y_{it}/C_{0} + \sum_{j=1}^{k} \beta_{ij} \Delta y_{it-j} + \delta X_{it} + \epsilon_{it}. \quad (6)$$

The null hypothesis of a unit root to be tested is then $H_0: a = 0$, against the alternative $H_1: a < 0$.\(^6\)

Instead, Im et al. (2003) proposed a test that allows for individual unit root processes so that $\alpha_i$ in (6) may vary across cross sections, hence relaxing the assumption that $\alpha_1 = \alpha_2 = \ldots = \alpha_N$. The null hypothesis may in this case be written as $H_0: \alpha_i = 0$, for all $i$. The alternative hypothesis is now given by

$$H_1 = \left\{ \begin{array}{ll}
\alpha_i = 0, & \text{for } i = 1, 2, \ldots, N_1 \\
\alpha_i \neq 0, & \text{for } i = N_1 + 1, N_2 + 2, \ldots, N_0
\end{array} \right.$$  

implying that some fraction of the individual processes are stationary.\(^7\)

\(^6\) Levin et al. (2002) mention that this type of test is particularly useful for panels of moderate size, between 10 and 250 cross sections and 25–250 time series observations per cross section, which fits our data sample.

\(^7\) Phillips and Moon (2000) and Arellano and Honoré (2001) provide further discussions on panel unit root tests.

### Table 2  Panel unit root results

<table>
<thead>
<tr>
<th>Series</th>
<th>Sample</th>
<th>Common unit root (LLC)</th>
<th>Individual unit root (IPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Statistic</td>
<td>Probability</td>
</tr>
<tr>
<td>Debt ratio</td>
<td>1970–2003</td>
<td>−2.11</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td>1970–1991</td>
<td>−1.05</td>
<td>0.148</td>
</tr>
<tr>
<td></td>
<td>1992–2003</td>
<td>−5.74</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>1970–1996</td>
<td>0.81</td>
<td>0.792</td>
</tr>
<tr>
<td></td>
<td>1997–2003</td>
<td>−3.00</td>
<td>0.001</td>
</tr>
<tr>
<td>Primary balance ratio</td>
<td>1970–2003</td>
<td>−1.41</td>
<td>0.080</td>
</tr>
<tr>
<td></td>
<td>1970–1991</td>
<td>−2.72</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>1992–2003</td>
<td>−3.45</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>1997–2003</td>
<td>−1.34</td>
<td>0.091</td>
</tr>
<tr>
<td></td>
<td>1970–2003</td>
<td>−3.30</td>
<td>0.001</td>
</tr>
<tr>
<td>Output gap</td>
<td>1970–2003</td>
<td>−3.98</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>1970–1991</td>
<td>−5.02</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>1992–2003</td>
<td>−6.36</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>1997–2003</td>
<td>−2.98</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>1970–2003</td>
<td>−6.46</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: LLC—Levin, Lin and Chu. IPS—Im, Pesaran, and Shin
Table 2 reports the results of the aforementioned unit root tests for the debt-to-GDP and primary budget balance ratio to GDP and for the output gap series. For the entire sample period it is possible to see that the tests reject the existence of a unit root at least at the 10% significance level for the primary balance ratio. On the other hand, for the debt ratio series, while the common unit root test also allows the rejection of the null hypothesis, the individual unit root test does not reject the unit root hypothesis.

Additionally, for the primary balance, the null hypothesis of a unit root is also rejected, by both tests, for the sub-periods limited by the European Union Treaty (1970–1991 and 1992–2003). For the sub-periods before and after the adoption of the SGP (1970–1996 and 1997–2003), the unit root hypothesis is also mostly rejected even if one has to be aware of the more limited number of observations for the post-SGP period. Regarding the debt ratio series, it seems interesting to notice that the unit root hypothesis is never rejected for the sub-periods 1970–1991 and 1970–1996, but that it is mostly rejected for the post-Maastricht and post-SGP periods, respectively, 1992–2003 and 1997–2003. Finally, the existence of a unit root is also always rejected for the output gap for all sub-periods.

3.3 Estimation results

The fixed effects model is a typical choice for macroeconomists and is generally more adequate than the random effects model. For instance, if the individual effects are somehow a substitute for non-specified variables, it is probable that each country-specific effect is correlated with the other independent variables. Moreover, and since the country sample includes all the relevant countries, and not a random sample from a bigger set of countries the fixed effects model is a more obvious choice.

Additionally, as noted namely by Judson and Owen (1997), when the individual observation sample (countries in our case) is picked from a larger population (for instance all the developed countries), it might be suitable to consider the specific constant terms as randomly distributed through the cross section units. However, and even if the present country sample includes a small number of countries, it is sensible to admit that the EU-15 countries have similar specific characteristics, not shared by the other countries in the world. This is particularly true if one considers the fiscal rule-based framework underlying the SGP, which has been progressively implemented since the late 1990s in the EU-15 countries. In this case, it would seem adequate to choose the fixed effects formalisation, even if it were not correct to generalise the results afterwards to the entire population, which is also not the purpose of the paper.

Table 3 reports estimation results for the core specifications for the primary balance and for the debt ratios for the full sample period and all 15 countries. Alternative estimators are presented for Eqs. 4 and 5, using 2SLS estimations with lagged values as instruments, on the full cross-sectional sample. The first three columns of reported estimated coefficients relate to the specification where the dependent variable is the primary balance, and the last three columns report estimated coefficients for the case when debt is the dependent variable.
The hypothesis that primary balances react positively to government debt, i.e. $\theta > 0$, should not be rejected since the estimated coefficient is statistically different from zero and positive. In other words, the EU-15 governments seem to act in accordance with the existing stock of government debt, by increasing the primary budget surplus as a result of increases in the outstanding stock of government debt. This is consistent with the prevalence of a Ricardian fiscal regime, where fiscal policy adjusts to the intertemporal budget constraint, and the fiscal authorities respond in a “stabilising” manner by increasing primary balances when the debt ratio increases.\(^8\) Interestingly there is a counter-cyclical response of fiscal policy given the positive effects on the primary balance of increases in the output gap.

Additionally, and also according to the results of Table 3, when the government debt is the dependent variable, EU-15 governments seem to use primary budget surpluses to reduce the debt-to-GDP ratio. This can be seen from the fact that we obtain a negative and statistically significant $\gamma$ coefficient for the primary balance in the debt regressions.

Since the institutional changes that occurred in the EU-15 in the 1990s may have had an effect on the prevalence of the fiscal regimes, alternative sub-sample periods are considered to take into account first, the signing of the European Union Treaty on 7 February 1992 in Maastricht, with the setting up of the convergence criteria, and secondly, the adoption of the SGP framework on 13–14 December 1996 at the European Council in Dublin (adopted when the Amsterdam Treaty was signed on June 1997).

Therefore, I split the study period into the pre- and post-Maastricht, using 1992 as the first year of the new EU fiscal framework, and then into the pre- and post-SGP periods using 1997 as the splitting date, and re-estimated the specifications for the

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\(^8\) However, measurement issues and stock-flow adjustments might blur such expected relationships as reported, for instance, by von Hagen and Wolff (2004).

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**Table 3** 2SLS estimators for primary balance and debt ratios: 1970–2003

<table>
<thead>
<tr>
<th>Method</th>
<th>Dependent variable: primary balance</th>
<th>Dependent variable: debt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled</td>
<td>Fixed effects</td>
</tr>
<tr>
<td>Constant</td>
<td>$-0.094$</td>
<td>$-0.442$***</td>
</tr>
<tr>
<td></td>
<td>($-1.22$)</td>
<td>(2.85)</td>
</tr>
<tr>
<td>Primary balance</td>
<td>$0.159$***</td>
<td>$0.160$***</td>
</tr>
<tr>
<td></td>
<td>(2.63)</td>
<td>(2.61)</td>
</tr>
<tr>
<td>Debt</td>
<td>$0.094$***</td>
<td>$0.097$***</td>
</tr>
<tr>
<td></td>
<td>(4.11)</td>
<td>(4.07)</td>
</tr>
<tr>
<td>Output gap</td>
<td>$0.255$***</td>
<td>$0.189$</td>
</tr>
<tr>
<td>Observations</td>
<td>460</td>
<td>460</td>
</tr>
</tbody>
</table>

**Note:** The $t$ statistics are in parentheses. *, **, *** Statistically significant at the 10, 5, and 1 percent level, respectively.
resulting four time intervals. This might be a way of controlling for common changes in fiscal regimes as response to common problems as, for instance, the need to make additional efforts in order to comply with the convergence criteria. Table 4 reports estimation results for the sub-periods before and after the signing of the Maastricht Treaty, respectively, 1970–1991 and 1992–2003.

The responsiveness of primary balances to government debt remains positive and statistically significant, both for the pre- and post-Maastricht period. Moreover, the increase in primary balances still impact negatively on government debt in the two above-mentioned sub-periods. Again, this can be read as evidence of the existence of an overall Ricardian fiscal regime in the EU-15 throughout the full sample period. Interestingly, one may notice the increase in the magnitude of the estimated coefficients in the post-Maastricht period, vis-à-vis the pre-Maastricht period.

9 The sample breakdown for the Maastricht period might have different meanings for each country. Indeed, the dates of referendum approval varied among countries: 1992 for Belgium, France, Italy, Luxemburg, Netherlands, Ireland, Greece, Spain and Portugal; 1993 for Denmark, United Kingdom and Germany; 1994 for Austria, Finland and Sweden.
implying somehow a stronger impact of primary balances on government debt. This could be read as a sign of increased efforts from the national governments in the second sub-period in order to comply with the European Union fiscal convergence criteria. In this second sub-period higher output gaps also contribute to reduce the debt ratio. Table 5 reports estimation results for the sub-periods before and after the drafting of the SGP, respectively, 1970–1996 and 1997–2003.

The results reported in Table 5 can be summarised as follows. The introduction of the SGP framework did not seem to change substantially the overall fiscal regime in the EU-15, which seems to have remained a Ricardian one. In other words, both in the pre- and in the post-SGP sub-periods, improvements in primary balances were used to reduce government indebtedness ($\gamma < 0$), and primary balances increased in order to react to the existing stock of government debt ($\theta > 0$). The estimated $\gamma$ coefficients have broadly the same magnitude before and after the SGP implementation, synonym of a similar impact of primary balances on debt. On the other hand, primary balances do seem to react more to government debt in the post-SGP period, as indicated by the higher magnitude of the estimated ($\theta$) coefficients for the debt variable in the primary balance regressions.

### Table 5

<table>
<thead>
<tr>
<th>Method</th>
<th>Dependent variable: primary balance</th>
<th>Dependent variable: debt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled Fixed effects</td>
<td>Pooled Fixed effects</td>
</tr>
<tr>
<td>1970–1996</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>$-0.146$ ($-1.50$)</td>
<td>$0.914^{***}$</td>
</tr>
<tr>
<td>Primary balance</td>
<td>$0.131^*$ ($1.88$)</td>
<td>$-0.287^{**}$ ($-2.40$)</td>
</tr>
<tr>
<td>Debt</td>
<td>$0.099^{***}$ ($3.73$)</td>
<td>$0.472^{***}$ ($6.69$)</td>
</tr>
<tr>
<td>Output gap</td>
<td>$0.245^{***}$ ($4.78$)</td>
<td>$-0.197$ ($-1.34$)</td>
</tr>
<tr>
<td>Observations</td>
<td>355 355 322</td>
<td>356 356 323</td>
</tr>
<tr>
<td>1997–2003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>$0.178$ ($1.37$)</td>
<td>$-0.834^{***}$</td>
</tr>
<tr>
<td>Primary balance</td>
<td>$0.293^{***}$ ($2.76$)</td>
<td>$-0.247^*$ ($-1.69$)</td>
</tr>
<tr>
<td>Debt</td>
<td>$0.121^{**}$ ($2.43$)</td>
<td>$0.493^{***}$ ($4.89$)</td>
</tr>
<tr>
<td>Output gap</td>
<td>$0.458^{***}$ ($3.13$)</td>
<td>$-0.565^{***}$ ($-2.71$)</td>
</tr>
<tr>
<td>Observations</td>
<td>120 120 105</td>
<td>120 120 105</td>
</tr>
</tbody>
</table>

*Note: The $t$ statistics are in parentheses. *, **, *** Statistically significant at the 10, 5, and 1 percent level, respectively*
4 Alternative specifications

4.1 Specific EMU and SGP dummies

In order to further test the possibility of a shift in the fiscal regimes, and to avoid breaking up the data sample, I used specific dummy variables to signal the EMU and SPG sub-periods, respectively $D_{it}^{emu}$ and $D_{it}^{sgp}$. The dummy variable $D_{it}^{emu}$ takes the value one in the years of and after the approval of the Maastricht Treaty, and zero elsewhere (see footnote 10 for specific dates). The dummy variable $D_{it}^{sgp}$ takes the value one in the euro area countries in 1997, and zero otherwise. Therefore, the two dummy variables are formulated as follows:

$$D_{it}^{emu} = \begin{cases} 1, & \text{if } t \geq \text{year of Maastricht referendum} \\ 0, & \text{if } t < \text{year of Maastricht referendum} \end{cases}$$  \hspace{1cm} (7)

$$D_{it}^{sgp} = \begin{cases} 1, & \text{if } t \geq 1997 \text{ and if } i \in \text{euro area} \\ 0, & \text{otherwise} \end{cases}$$  \hspace{1cm} (8)

Using the first difference versions of equations (2) and (3), the alternative testable specifications including an interaction term between $b$, $s$, and, for instance, the dummy variable for the pre- and post-EMU sub-periods, are

$$\Delta s_{it} = a_0 + \delta \Delta s_{it-1} + \theta_1 D_{it-1}^{emu} \Delta b_{it-1} + \theta_2 (1 - D_{it-1}^{emu}) \Delta b_{it-1} + \lambda s \Delta z_{it-1} + \Delta u_{it},$$  \hspace{1cm} (9)

$$\Delta b_{it} = c_0 + \phi \Delta b_{it-1} + \gamma_1 D_{it-1}^{emu} \Delta s_{it-1} + \gamma_2 (1 - D_{it-1}^{emu}) \Delta s_{it-1} + \lambda b \Delta z_{it-1} + \Delta v_{it}.$$  \hspace{1cm} (10)

Similar specifications were also estimated for the SGP sub-periods, replacing then $D_{it}^{emu}$ by $D_{it}^{sgp}$ in (9) and in (10). Table 6 reports the relevant results.

It is possible to see that these alternatives specifications essentially confirm the results of the previous sub-section about the existence of Ricardian fiscal regimes in the EU. Indeed, primary balance improvements are used to reduce government indebtedness, as depicted by the respective negative estimated coefficients in the debt regressions. However, the primary balance coefficients in those regressions are only statistically significant for the post-EMU and post-SGP periods, which might signal some increased efforts by the governments to improve the respective fiscal positions after EMU and after the setting up of the SGP.

Moreover, the overall prevalence of fiscal Ricardian regimes cannot be discarded from the estimation results of the primary balance equations. Primary balances react positively and in a statistically significant way to government debt in the pre- and post-EMU period. On the other hand, only the estimated coefficient for debt in the post-SGP sub-period is statistically significant in the primary balance regressions that do not include the output gap.

One can also summarise the findings regarding the estimated $\theta$ coefficients, intended to model the response of primary balances to government debt, and where a positive value is a requirement for fiscal sustainability. The magnitude of such
Table 6  Estimators for primary balance and debt ratios with EMU and SGP dummies, 1970–2003

<table>
<thead>
<tr>
<th>Method</th>
<th>Dependent variable: primary balance</th>
<th>Dependent variable: debt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled Fixed effects</td>
<td>Pooled Fixed effects</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EMU dummy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>−0.083 (−1.05)</td>
<td>0.428*** (2.78)</td>
</tr>
<tr>
<td>Primary balance</td>
<td>0.156*** (2.62)</td>
<td>0.156*** (1.57)</td>
</tr>
<tr>
<td>Pre-EMU</td>
<td>−0.117 (−0.75)</td>
<td>−0.140 (−0.94)</td>
</tr>
<tr>
<td>Post-EMU</td>
<td>−0.330*** (−2.66)</td>
<td>−0.355*** (−2.87)</td>
</tr>
<tr>
<td>Debt</td>
<td>0.537*** (8.50)</td>
<td>0.508*** (7.84)</td>
</tr>
<tr>
<td>Pre-EMU</td>
<td>0.106*** (3.08)</td>
<td>0.131*** (3.45)</td>
</tr>
<tr>
<td>Post-EMU</td>
<td>0.086*** (2.81)</td>
<td>0.126*** (3.59)</td>
</tr>
<tr>
<td>Output gap</td>
<td>0.255*** (5.33)</td>
<td>−0.189 (−1.43)</td>
</tr>
<tr>
<td>Observations</td>
<td>460 460 427 461 461 428</td>
<td></td>
</tr>
<tr>
<td><strong>SGP dummy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>−0.100 (−1.20)</td>
<td>0.442*** (2.84)</td>
</tr>
<tr>
<td>Primary balance</td>
<td>0.159*** (2.63)</td>
<td>0.101* (1.62)</td>
</tr>
<tr>
<td>Pre-SGP</td>
<td>−0.187 (−0.92)</td>
<td>−0.222 (−1.09)</td>
</tr>
<tr>
<td>Post-SGP</td>
<td>−0.285*** (−2.56)</td>
<td>−0.308*** (−2.80)</td>
</tr>
<tr>
<td>Debt</td>
<td>0.537*** (8.47)</td>
<td>0.508*** (7.80)</td>
</tr>
<tr>
<td>Pre-SGP</td>
<td>0.080 (1.26)</td>
<td>0.129*** (4.46)</td>
</tr>
<tr>
<td>Post-SGP</td>
<td>0.095*** (3.81)</td>
<td>0.125** (3.69)</td>
</tr>
<tr>
<td>Output gap</td>
<td>0.254*** (5.34)</td>
<td>−0.190 (0.153)</td>
</tr>
<tr>
<td>Observations</td>
<td>460 460 427 461 461 428</td>
<td></td>
</tr>
</tbody>
</table>

Note: The t statistics are in parentheses. *, **, *** Statistically significant at the 10, 5, and 1 percent level, respectively
coefficient ranges from 0.08 in the pre-SGP period, in the model with a specific SGP dummy variable and without cross effects, to 0.26 in the period 1997–2003, in the model with fixed effects. For the 24 above reported estimations for the $\theta$ coefficients, in Tables 4–6, the simple average value for $\theta$ is 0.12, being statistically significant in 22 of the 24 cases.

4.2 The relevance of government indebtedness

To assess how different levels of government indebtedness may impinge on the government’s responses within a Ricardian fiscal regime, I considered several thresholds (DTH) for the debt ratio by using the dummy variable $D_{it}^{\text{DTH}}$, defined as follows:

$$D_{it}^{\text{DTH}} = \begin{cases} 1, & \text{debt ratio} > \text{DTH} \\ 0, & \text{otherwise} \end{cases}$$

Therefore, the fiscal rule used before for the primary balance can now be rewritten to include an interaction term between $b$ and the dummy variable for the debt ratio threshold, as follows:

$$\Delta s_{it} = a_0 + \delta \Delta s_{it-1} + w_1 D_{it-1}^{\text{DTH}} \Delta b_{it-1} + w_2 (1 - D_{it-1}^{\text{DTH}}) \Delta b_{it-1} + \lambda_z \Delta z_{it-1} + \Delta u_{it}. \quad (12)$$

I used several limit values for DTH, notably 50%, 60%, 65%, and 70%. The estimation results with those thresholds for model (12) are reported in Table 7. Additionally, the results of using the average debt ratio of each country, instead of an overall limit, are also presented.

From Table 7 it is possible to conclude that the authorities seem to respond in a more Ricardian way when the debt ratio is above the selected thresholds. Indeed, the estimated coefficient for the debt variable is always higher in such circumstances. On the other hand, that coefficient is also higher for say a debt ratio of 70% than when the 50% or 60% thresholds are used. The estimation results with the country averages for the debt ratio thresholds point again to a more Ricardian response of the governments in a situation of higher public indebtedness.

Still from Table 7, one could mention for the 70% threshold case, that for instance, an acceleration of the change in the debt ratio of five percentage points would imply and acceleration in the improvement of the primary balance ratio between 0.615 and 0.745 percentage points of GDP if the debt ratio was already above 70%, or between 0.395 and 0.565 percentage points of GDP otherwise. This implies that governments on average seem to respond in a more significant manner via primary surpluses when faced with higher indebtedness levels.

4.3 Electoral budget cycles

An additional test can be made to see whether the responsiveness of primary budget balances to changes in the debt is hindered by the political cycle. In other words, it might be relevant to see whether the electoral budget cycle diminishes the
<table>
<thead>
<tr>
<th>Dth</th>
<th>50%</th>
<th>60%</th>
<th>65%</th>
<th>70%</th>
<th>Country average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary balance</td>
<td>0.153**</td>
<td>0.098</td>
<td>0.156***</td>
<td>0.099</td>
<td>0.151***</td>
</tr>
<tr>
<td></td>
<td>(3.22)</td>
<td>(1.55)</td>
<td>(3.24)</td>
<td>(1.58)</td>
<td>(3.01)</td>
</tr>
<tr>
<td>Debt ratio &gt; dth</td>
<td>0.108***</td>
<td>0.136***</td>
<td>0.103***</td>
<td>0.113***</td>
<td>0.140***</td>
</tr>
<tr>
<td></td>
<td>(4.81)</td>
<td>(4.44)</td>
<td>(3.99)</td>
<td>(3.63)</td>
<td>(3.92)</td>
</tr>
<tr>
<td>Debt ratio ≤ dth</td>
<td>0.064*</td>
<td>0.103**</td>
<td>0.089***</td>
<td>0.123***</td>
<td>0.083***</td>
</tr>
<tr>
<td></td>
<td>(1.76)</td>
<td>(2.68)</td>
<td>(3.07)</td>
<td>(3.63)</td>
<td>(3.14)</td>
</tr>
<tr>
<td>Output gap</td>
<td>0.251***</td>
<td>0.254***</td>
<td>0.253***</td>
<td>0.252***</td>
<td>0.253***</td>
</tr>
<tr>
<td></td>
<td>(5.20)</td>
<td>(5.32)</td>
<td>(5.26)</td>
<td>(5.26)</td>
<td>(5.23)</td>
</tr>
<tr>
<td>N</td>
<td>460</td>
<td>427</td>
<td>460</td>
<td>427</td>
<td>460</td>
</tr>
</tbody>
</table>

Note: The t statistics are in parentheses. *, **, *** Statistically significant at the 10, 5, and 1 percent level, respectively.
government adherence to a Ricardian fiscal regime. Indeed, faced with elections, governments might be less willing to deliver primary surpluses, which could be used to redeem debt, and more prompt to incur in more expansionary fiscal policies. Additionally, in an environment of quick government turnover, the authorities may be tempted to spend more before elections leaving a higher government indebtedness level for the new government since it probably does not share its spending priorities.

The differences in government’s behaviour, which take into account the electoral cycle, are predicted and discussed by the literature on the relations between elections and fiscal performance, which can be traced back to Nordhaus (1975) and Hibbs (1977), respectively regarding opportunistic and partisan cycles. According to several studies, pre-electoral expansionary fiscal policies seem to be reported by the available data, with governments embarking sometimes in short sighted policies, characterised, for instance, by tax cuts before elections.

In the context of this paper, the study of an eventual influence of the electoral cycle on the existence of Ricardian fiscal regimes can be studied by using the dummy variable \( D_{it}^{EL} \), defined as

\[
D_{it}^{EL} = \begin{cases} 
1, & \text{if in country } i \text{ there were elections for the parliament in } t \\
0, & \text{otherwise}
\end{cases}
\]

In order to test the relevance of the electoral cycle, the simple fiscal rule used before for the primary balance can now be amended to include an interaction term between \( b \) and the dummy variable for the elections,

\[
\Delta s_{it} = a_0 + \delta \Delta s_{it-1} + w_1 D_{it}^{EL} \Delta b_{it-1} + w_2 (1 - D_{it}^{EL}) \Delta b_{it-1} + \lambda \Delta z_{it-1} + \Delta u_{it}. \tag{13}
\]

The hypothesis to be tested is whether, faced with an election in the next period, \( t \), governments choose to deliver in the pre-electoral period, \( t - 1 \), a more expansionary fiscal policy, therefore allowing for a more mitigated response of the primary balance to recent increases in the government debt. In other words, if electoral budget cycles play a role in the government’s fiscal decisions, one would expect \( w_1 \) to be smaller than \( w_2 \), or eventually not even statistically significant, signalling then a less Ricardian fiscal regime under those circumstances.

Data on parliamentary elections were collected for all the EU countries for the period 1970–2003. One has to bear in mind that for Portugal and Spain no democratic elections took place before 1975 and 1977, respectively, and therefore the election dummy assumes the value zero for all the previous years for these two countries. Additionally, for France I used the dates of the parliamentary elections instead of the presidential ones, since the latter followed in the past a longer political cycle resulting in a smaller number of observations. Table 8 reports the results of the estimation of (13) for the full sample period.

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10 Rogoff and Sibert (1988), Alesina and Roubini (1992), and Alesina et al. (1997) provide subsequent related work.

11 The electoral dummy assumes a value of one when there is a parliamentary election (see Afonso 2005b for the data). The data on election dates were obtained from the following sources: http://www.idea.int/vt/total_number_of_elections.cfm and http://www.electionresources.org/
From the results reported with the election interaction dummy, it is possible to see that primary balances react positively and in a statistically significant way to government debt, when there are no parliamentary elections in the next period, but this is not the overall case if there are elections. Indeed, the estimated coefficient for debt in the no-elections sub-sample is statistically more significant in the primary balance regressions (having also a higher magnitude). This could imply that authorities’ adherence a Ricardian fiscal regime depends in some way on the electoral cycle.

Therefore, more expansionary fiscal policies are somehow related to political elections, a result also mentioned, for instance, by Buti and van den Noord (2003) for the euro area in the period 1999–2002. Interestingly, Tujula and Wolswijk (2004) also report that for the EU-15 countries fiscal balances deteriorated in general elections years during the period 1970–2002.

Additionally, the results for the EMU and SGP sub-samples, allowing for the interaction of the election dummy, are presented in Table 9.

Again, and after taking into account the EMU and SGP sub-samples, it is possible to observe that when an election takes place governments’ reactions seem to be less in line with a fiscal Ricardian regime. Notice that in such cases, none of the estimated coefficients for the interaction between the election dummy and the debt variable are generally less statistically significant.

### 5 Conclusion

Whether fiscal authorities adhere to a Ricardian or to a non-Ricardian fiscal regime might have practical implications notably as to additional challenges posed, for
instance, to the monetary authorities, and in terms of the sustainability of public finances. All in all, the theoretical assumptions required for the existence of non-Ricardian regimes, where fiscal policy could actively determine the price level seem rather problematic to agree with, being the possibility of Ricardian fiscal regimes more consensual in the literature.

In this paper I used a panel data set to test the existence of Ricardian fiscal regimes in the EU-15 countries. The results for the period 1970–2003 show that the EU-15 governments do have a tendency to use the primary budget surplus to reduce the debt-to-GDP ratio, synonym of a fiscal Ricardian regime. This response seems to be higher the higher is the level of government indebtedness. On the other hand,
governments also seem to improve the primary budget balance as a result of increases in the outstanding stock of government debt, and fiscal policies have a counter-cyclical response. This new set of results for the EU-15 is consistent with the sparse already available related empirical evidence.

The above-mentioned overall results reported in the paper, in line with the prevalence of Ricardian fiscal regimes, also hold for four different sub-periods: pre- and post-Maastricht, and pre- and post-SGP period. Some changes in the magnitude of the estimated coefficients are also found for the post-SGP period. These results seem to be robust to alternative specifications, either by breaking up the sample or by using specific EMU and SGP dummy variables. Moreover, one may also mention that simple correlation analysis hints at the possibility that the degree of responsiveness of fiscal authorities to fiscal problems varies across countries and across the aforementioned data sample sub-periods.

Additionally, when allowing for the interaction between fiscal developments and the electoral budget cycle the evidence seems to confirm that the adherence to a Ricardian fiscal regime is more mitigated in election times. Indeed, in the simple fiscal rule used for the primary balance, this variable reacts less to government debt when an election occurs. In other words, one cannot discard the idea that governments try somehow to use fiscal policy in order to increase their chances for a positive electoral outcome. This seems to be true both in the EMU and in the SGP sub-samples.

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