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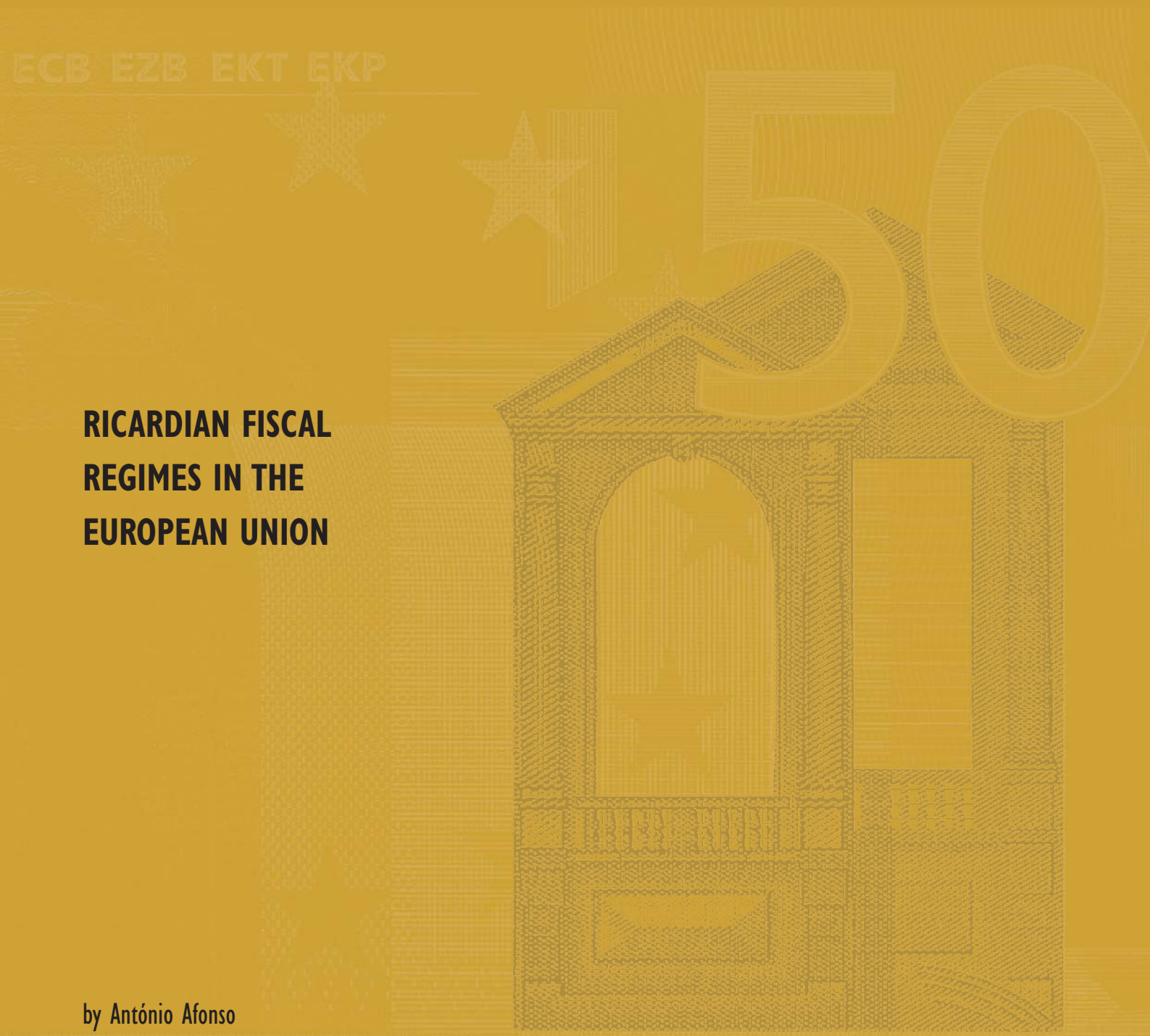

RICARDIAN FISCAL REGIMES IN THE EUROPEAN UNION

by António Afonso

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Abstract

The prevalence of either Ricardian or non-Ricardian fiscal regimes is important both for practical policy reasons and to assess fiscal sustainability, and this is of particular relevance for European Union countries. The purpose of this paper 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. Additionally, electoral budget cycles also seem to play a role in fiscal behaviour.

JEL classification: C23, E62, H62

Keywords: fiscal regimes, European Union, panel data models

Non-technical summary

The prevalence of either Ricardian or non-Ricardian fiscal regimes is important to assess fiscal sustainability, and this is of particular relevance for European Union countries. In a non-Ricardian regime, the Treasury would not commit itself in the future to match completely new 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.

The existence of either a Ricardian or a non-Ricardian fiscal regime is also 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 this topic is far from abundant, and even less for countries of the European Union. Therefore, the purpose of this paper is to assess, with a panel data set, the empirical evidence concerning the existence of Ricardian fiscal regimes in the fifteen "older" members of the European Union (EU-15), 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, since 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. This new set of results for the EU-15 is consistent with the sparse already available related empirical evidence.

The results 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 fiscal responses 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 European Monetary Union (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.

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 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.[1]

The existence of either a Ricardian or a non-Ricardian fiscal regime is also 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

[1] For a discussion of fiscal sustainability tests and review of empirical evidence see, for instance, Chalk and Hemming (2000) and Afonso (2005).

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.

The remainder of the paper is organised as follows. Section two addresses the discussion regarding fiscal regimes, and reviews some of the sparse related existing empirical evidence. Section three discusses the empirical specifications. Section four presents the empirical analysis of fiscal regimes in the EU-15 countries. Finally, section five contains my 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.

Under the terminology used by Sargent and Wallace (1981), a Ricardian regime can be labelled as a "regime of monetary predominance," since money demand and supply determine in this case the price level.[2] In addition, the non-Ricardian regime is labelled "a regime of fiscal predominance," as prices would then be endogenously determined from 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

[2] Sargent and Wallace (1981) assessed the effectiveness of monetary policy under a regime where the treasury sets budget deficits throughout time. Under certain circumstances, their simulations indicate that sufficient seigniorage cannot be generated to finance the continuous issuing of new debt if deficits are too big and persistent, and that "monetary predominance" in the present may lead to higher inflation in the future.

"passive" strategy and the monetary authority has an "active" behaviour.[3] 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.[4]

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 then used to determine a unique price level. More generally, the price level, P, could be determined by the intertemporal government budget constraint,

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

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.

On the other hand, under such Ricardian fiscal regimes, and as Buiter (2002) recalls, the intertemporal government budget constraint would not be seen as a constraint but rather as a value equation. In that case, 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 section three of the paper.

[3] Davig and Leeper (2005) mention that "passive fiscal policy" occurs when the response of taxes to debt exceeds the real interest rate and "active fiscal policy" occurs when taxes do not respond sufficiently to debt to cover real interest payments.

[4] The proponents of the fiscal theory of the price level argue along these lines. See, for instance, Woodford (1994), Sims (1994), and Cochrane (1999)

2.2. Overview of previous evidence on Ricardian fiscal regimes

Regarding the empirical validation of the existence of Ricardian fiscal regimes, some work has been attempted, predominantly based on univariate tests. Canzoneri, Cumby and Diba (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. The government liabilities include both the public debt and the monetary base. In a Ricardian regime, the positive changes in the budget surplus should be used to pay back some of the outstanding public debt. One would then expect to see an inverse relationship between the primary budget surplus and government liabilities. They conclude in favour of the existence of Ricardian regime, with the Treasury assuming a passive strategy and the Central Bank assuming an active strategy.

Cochrane (1999) also uses a VAR model with the following variables: public debt as a percentage of private consumption, the budget surplus-private consumption ratio, the consumption rate growth and the real interest rate implicit in the stock of public debt. With annual data for the US he concludes that positive changes in the budget surplus reduce the stock of public debt. Woodford (1999) reaches the same conclusions as Cochrane (1999), with the same data and variables, with the exception that the real interest rate is discarded on the basis that it should be implicit in the evolution of the other three variables (Woodford (1999)).

Debrun and Wyplosz (1999) and Mélitz (2000) provide additional empirical work related to this discussion. 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 the results presented by these authors, there seems to be a statistically significant positive response of the primary budget balance to government debt. Consequently, they conclude that governments do take into account their respective intertemporal budget constraints. In other words, fiscal policy might have been implemented according to a Ricardian regime.

Creel and Sterdyniak (2001) also adopt an approach similar to the one implemented by Mélitz (2000). With panel data and reaction function estimations, they mention that

fiscal policy could be characterised by a Ricardian regime in Germany and in the US, and by a non-Ricardian regime in France. Additionally, another possible reading of the results presented by these two authors might be the conclusion that fiscal policy may have been, in the past, sustainable in Germany and not sustainable in France.[5]

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 Silva (2004) for Brazil, a country where past high inflation and fiscal problems would have seem to be a good ground for fiscal predominance.

Table 1 summarises a broader list of the main findings on empirical related evidence directly or indirectly regarding the existence of Ricardian fiscal regimes.

[5] Afonso (2005) also reports fiscal policy sustainability results along this line.

Table 1 – Empirical evidence on Ricardian fiscal regimes

Reference	Data	Methodology	Results
Bohn (1998)	US, 1916-1995	VAR	Positive reaction of primary surplus to (initial) debt ratio. Ricardian regime.
Cochrane (1999), Woodford (1999)	US, 1960-1996	VAR	Positive changes in the budget surplus reduce the stock of public debt: Ricardian regime.
Debrun and Wyplosz (1999)	EU-12	Reaction functions	Primary budget surplus responds positively to the level of government debt: Ricardian regime.
Mélitz (2000)	19 OECD countries, 1976-1995	Pooled 2SLS and 3SLS	Primary budget surplus responds positively to the level of government debt: Ricardian regime.
Creel and Sterdyniak (2001)	US, France, Germany, UK, 1970-1999	Panel data, reaction functions	The increase of government debt has a positive effect on the primary balances: Ricardian regime.
Canzoneri, Cumby and Diba (2001)	US, 1951-1995	VAR	Positive shocks in the primary budget surplus decrease the real value of the stock of public debt: Ricardian regime.
von Hagen, Hughes Hallet, and Strauch (2001)	20 OECD countries, 1973-1998	3SLS	The fiscal surplus reacts positively to an increase in the debt ratio. Ricardian regime.
Favero (2002)	France, Germany, Italy, Spain, 1960-2000	SUR	Fiscal policy reacts to debt increases. Ricardian regime.
Galí and Perotti (2003)	EU-14, Norway, Japan, Australia, Canada, US, 1980-2002	Panel estimations	Cyclically primary deficits decrease with increase in debt. Ricardian regime.
Favero and Monacelli (2003)	US, 1960:4-2000:4	Markov switching regime, VAR	Ricardian regime after 1986:3.
Rocha and Silva (2004)	Brazil, 1966-2000	VAR	Debt reacts negatively to primary budget surplus. Ricardian regime.
Sala (2004)	US, 1960-2001	VAR	Non-Ricardian regime in 1960-1979; Ricardian regime in 1990-2001.
EC (2004)	EU-11, 1970-2003	Panel data, instrumental variables	Primary and cyclically adjusted primary balances react positively to debt. Ricardian regime.
Ballabriga and Martinez-Mongay (2005)	14 EU countries, US and Japan, 1977-2002	NLLS	Primary surplus reacts positively to debt. Ricardian regime.
Bohn (2005)	US, 1792-2003	OLS	Positive response of primary surplus to initial debt. Ricardian regime.

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 sub-section 2.3, 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 set of 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 (see namely Hsiao (2002)).

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,

$$s_{it} = \beta_i + \delta s_{it-1} + \theta b_{it-1} + u_{it} \,. \qquad (2)$$

In (2) the index i (i=1,…,N) denotes the country, the index t (t=1,…,T) indicates the period and β_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, s_{it-1} 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 and comply with the budget constraint, which could be seen as a sign of a Ricardian fiscal regime.

Moreover, sustainability of public finances would require not only that θ 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,

$$b_{it} = \alpha_i + \gamma s_{it-1} + \varphi b_{it-1} + v_{it}\,, \qquad (3)$$

where s and b are defined as before and now α_i stands for the individual effects to be estimated for each country i, assuming also that the disturbances v_{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 (see, for instance, Afonso (2005)). 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 might 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. Firstly the lagged debt coefficient varies over time being approximated by the difference between the interest rate and the economic growth rate. Secondly, 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 units. 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, Pesaran and Sharma (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 equations (2) and (3) can be written as follows, respectively for the primary balance,

$$\Delta s_{it} = \delta \Delta s_{it-1} + \theta \Delta b_{it-1} + \Delta u_{it}, \qquad (4)$$

and for the government debt,

$$\Delta b_{it} = \gamma \Delta s_{it-1} + \varphi \Delta b_{it-1} + \Delta v_{it}, \qquad (5)$$

where one now has $\Delta s_{it}=s_{it}-s_{it-1}$, $\Delta s_{it-1}=s_{it-1}-s_{it-2}$, $\Delta b_{it}=b_{it}-b_{it-1}$, and $\Delta b_{it-1}=b_{it-1}-b_{it-2}$.

The above first differencing directly eliminates the individual effects (β_i and α_i) from the models. However, differencing introduces a correlation between the differenced lagged dependent variable (primary balance, and debt in this case) 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 Δs_{it-1} (Δb_{it-1}) and orthogonal to Δu_{it} (Δv_{it}). Indeed, the lagged values s_{it-2} and $b_{it-2,}$ will be uncorrelated respectively with Δu_{it} and Δv_{it}, and can therefore be used as instrumental variables for the first differenced equations in (4) and (5).[6]

One should notice that specifications (4) and (5) would imply a slightly different interpretation of parameters θ and γ. For instance, a positive θ would point to an

[6] See, for instance, Bond (2002) and Verbeek (2003).

increasing speed in the change of the primary balance ratio when the speed of change in the debt-to-GDP ratio increases.

4. Empirical analysis

4.1. 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 2 presents summary descriptive statistics for the full sample (cross-sectional statistics are reported in the Appendix 1). For the sample period the debt-to-GDP ratio ranged from 4.6% for Luxembourg in 1991 to 137.9% for Belgium in 1993. On the other hand, the primary balance ratio ranged from -7.4% for Ireland in 1975 to 11.8% for Denmark in 1986.

Table 2 – Descriptive statistics (full sample): 1970-2003

	Mean	Std dev	Min	Max	Observations
Primary balance ratio (%)	1.5	3.3	-7.4 (IR, 1975)	11.8 (DK, 1986)	507
Debt ratio (%)	52.4	30.3	4.6 (LU, 1991)	137.9 (BE, 1993)	492

Note: IR – Ireland; DK – Denmark; LU – Luxembourg; BE – Belgium.

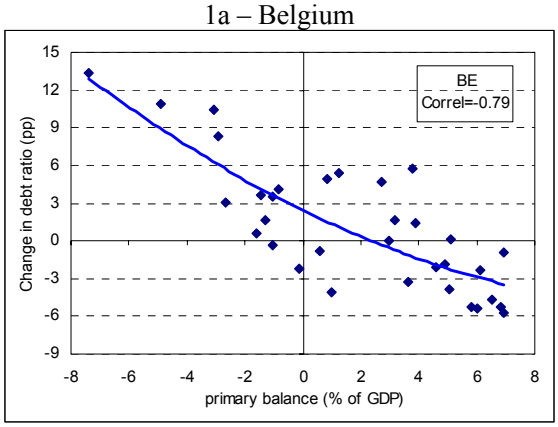
4.2. Debt and primary balance stylised evidence

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, and according to the data, that correlation is around -0.80 for Belgium, Spain, and the UK, and around -0.50 for Germany, Portugal, and Italy. On

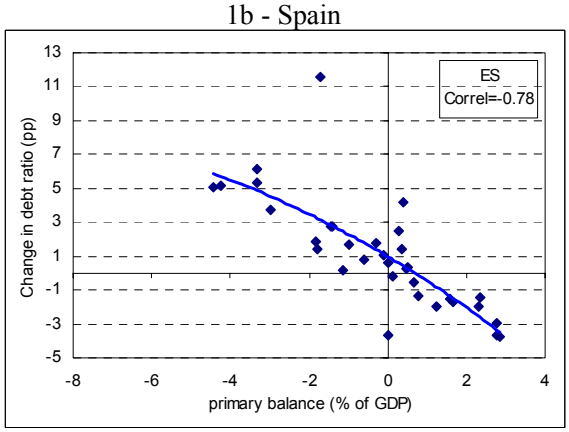
the one hand, this hints at the possibility of Ricardian fiscal regimes in the EU-15, on the other hand it reveals different degrees of adherence to such a fiscal regime within the country sample.

Figure 1 – Primary balance ratio and change in debt-to-GDP ratio (1971-2003)

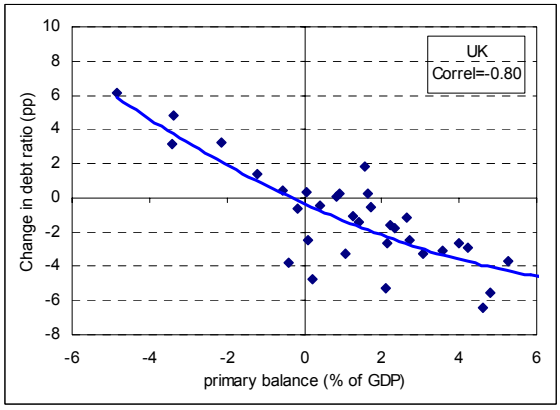
1a – Belgium



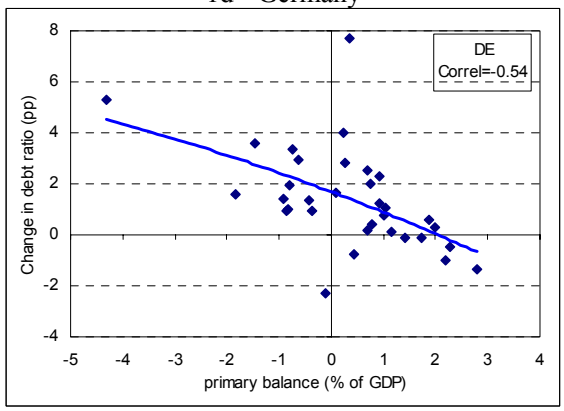
1b - Spain



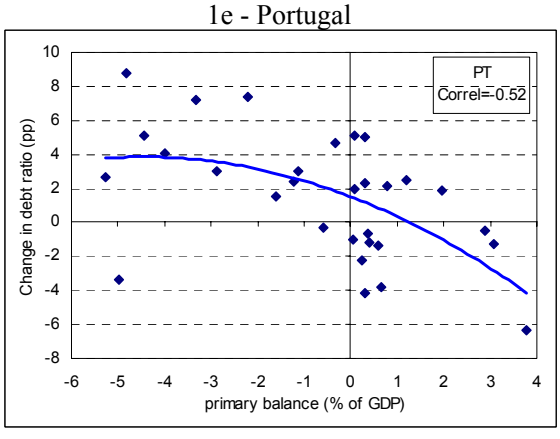
1c - UK



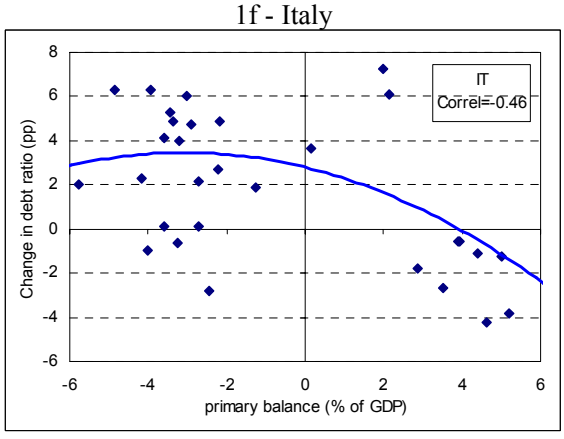
1d - Germany



1e - Portugal



1f - Italy



Note: In the scatter diagrams I draw the fitted values of a 2nd order polynomial regression of the changes in the debt ratio on the primary balance ratio.

For a casual inspection of the underlying time series and to convey a visual impression of the correlation in the data, Figure 1 plots the changes in the debt-to-GDP ratio and primary balance ratios for a set of selected countries. Interestingly, a look at the scatter diagrams, where I draw a second order polynomial regression between the two variables, confirms the existence of a negative relationship.

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 (formally adopted when the Amsterdam Treaty was signed on June 1997).[7]

The starting of the European and Monetary Union (EMU) on 1 January 1999, with the conversion of the national currencies into the euro, was also considered, as an additional illustration, given the limited availability of observations in this new regime. Moreover, this date also signals the moment when the implementation of the SGP – the fiscal pillar of EMU – actually started in practice. Table 3 reports the correlations for the aforementioned sub-samples for all the countries.

[7] One has to be aware that the data 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.

Table 3 – Correlation between the primary budget balance ratio and the change in the debt ratio

	Full period	European Union Treaty (Maastricht)		Adoption of SGP (Dublin, Amsterdam)		EMU
	1971-03	1971-91	1992-03	1971-96	1997-03	1999-03
Austria	-0.77	-0.86	-0.63	-0.84	-0.11	-0.38
Belgium	-0.79	-0.70	-0.73	-0.70	0.19	0.20
Denmark	-0.72	-0.84	-0.33	-0.71	-0.59	-0.71
Finland	-0.70	-0.69	-0.72	-0.74	-0.06	-0.72
France	-0.88	-0.71	-0.93	-0.86	-0.96	-0.99
Germany	-0.54	-0.75	-0.52	-0.49	-0.75	-0.76
Greece	-0.50	-0.66	-0.74	-0.35	0.15	0.58
Ireland	-0.70	-0.66	-0.32	-0.66	-0.73	-0.88
Italy	-0.46	-0.20	-0.71	0.02	-0.29	-0.15
Luxembourg	-0.30	-0.34	-0.31	-0.41	0.45	0.44
Netherlands	-0.77	-0.42	-0.80	-0.55	-0.93	-0.94
Portugal	-0.52	-0.41	-0.72	-0.51	-0.58	-0.44
Spain	-0.78	-0.87	-0.86	-0.65	-0.70	-0.94
Sweden	-0.80	-0.89	-0.82	-0.81	-0.67	-0.73
UK	-0.80	-0.45	-0.98	-0.79	-0.96	-0.96

Notes: Denmark, 1971-2003; France, 1977-2003; Luxembourg, 1970-1987, 1990-2003; Netherlands, 1975-2003; Portugal, 1973-2003.

Even if these are simple correlations, one can nevertheless spot for the after-Maastricht period, for instance, some cases were the negative correlation between primary balances and debt changes was stronger (France, Greece, Italy, Netherlands, Portugal, and UK), cases where the correlation broadly remained high (Belgium, Finland, Spain, and Sweden) and other cases where there was a weakening of the relationship (Denmark, Germany, Ireland, and Austria).

4.3. Unit root tests

This sub-section tests the relevant series for unit roots. 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.

Supposing that the stochastic process, y_{it}, is generated by the first-order autoregressive process described below in (6) for a panel sample,

$$y_{it} = \rho_i y_{it-1} + \delta X_{it} + \varepsilon_{it}, \quad i = 1,...,N, \quad t = 1,...,T, \tag{6}$$

where N is the total number of cross-sectional units observed over T time periods, i denotes the country, t indicates the period, X_{it} includes the exogenous variables, and the error process ε_{it} is distributed independently across sections. The null hypothesis of unit root is ρ_i=1 for all i. Moreover, if one assumes the existence of a common persistence coefficient across cross-sections, countries in this case, then the autoregressive coefficient is such that $\rho_i=\rho$ for all i. On the other hand, one can allow ρ_i to vary across cross-sections.

Several tests for unit roots within panel data have been proposed to address dynamic heterogeneous panels. Two alternative panel unit root tests are performed for our data sample in order to assess the existence of unit roots for the government debt and primary budget balance series. In the first category of tests, for instance, Levin, Lin, and Chu (2002) proposed a test based on heterogeneous panels with fixed effects where the null hypothesis assumes that there is a common unit root process and that ρ_i is identical across cross-sections. The basic augmented Dickey-Fuller (ADF) equation is

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{k_i} \beta_{ij} \Delta y_{it-j} + \delta X_{it} + \varepsilon_{it} \ , \qquad (7)$$

assuming $\alpha=\rho$-1. The null hypothesis of a unit root to be tested is then H_0: $\alpha=0$, against the alternative H_1: $a<0$.[8]

Instead, Im, Pesaran, and Shin (2003) proposed a test that allows for individual unit root processes so that ρ_i in (7) may vary across cross-sections, hence relaxing the assumption that $\rho_1=\rho_2=\ldots=\rho_N$. The null hypothesis may in this case be written as H_0: $\alpha=0$, for all i. The alternative hypothesis is now

given by $H_1 = \begin{cases} \alpha_i = 0, \text{for } i = 1, 2, ..., N_1 \\ \alpha_i \langle 0, \text{for } i = N_1 + 1, N_2 + 2, ..., N \end{cases}$, implying that some fraction of the individual processes are stationary.[9]

[8] Levin, Lin and Chu (2002) mention that this type of test is particularly useful for panels of moderate size, between 10-250 cross-sections and 25-250 time series observations per cross section, therefore a category where this paper's data sample fits.

[9] For instance, Phillips and Moon (2000) and Arellano and Honoré (2001) provide further discussions on panel unit root tests in panel data models.

Table 4 reports the results of the aforementioned unit root tests for the debt-to-GDP and primary budget balance ratio to GDP series.

Table 4 – Panel unit root results

Series	Sample	Common unit root (LLC)			Individual unit root (IPS)		
		Statistic	Probability	N	Statistic	Probability	N
Debt ratio	1970-2003	-2.11	0.018	463	0.19	0.574	463
	1970-1991	-1.05	0.148	292	3.01	1.000	292
	1992-2003	-5.74	0.000	180	-2.81	0.000	180
	1970-1996	0.81	0.792	354	4.24	1.000	354
	1997-2003	-3.00	0.001	105	-0.43	0.335	105
Primary balance ratio	1970-2003	-1.41	0.080	479	-3.32	0.000	479
	1970-1991	-2.72	0.003	308	-3.09	0.000	308
	1992-2003	-3.45	0.000	180	-1.62	0.053	180
	1970-1996	-1.34	0.091	374	-2.62	0.000	374
	1997-2003	-3.30	0.001	105	-0.31	0.371	105

Notes: LLC – Levin, Lin and Chu. IPS – Im, Pesaran, and Shin.

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 per cent significance level for the primary balance ratio. On the other hand, for the debt ratio series, while the common unit root test 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.

4.4. 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 Greene (1997) and 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 Stability and Growth Pact, 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 5 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 equations (4) and (5), using 2SLS estimations with lagged values as instruments, on the full cross-sectional sample. The first two columns of reported estimated coefficients relate to the specification where the dependent variable is the primary balance, and the last two columns report estimated coefficients for the case when debt is the dependent variable.

Table 5 – 2SLS estimators for primary balance and debt ratios: 1970-2003

	Dependent variable: primary balance		Dependent variable: debt	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	-0.094		0.442 ***	
	(-1.22)	-	(2.85)	-
Primary balance	0.159 ***	0.160 ***	-0.275 ***	-0.300 ***
	(2.63)	(2.61)	(-2.66)	(-2.92)
Debt	0.094 ***	0.097 ***	0.537 ***	0.508 ***
	(4.11)	(4.07)	(8.48)	(7.81)
Observations	460	460	461	461

Notes: The t statistics are in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 percent level respectively.

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.[10]

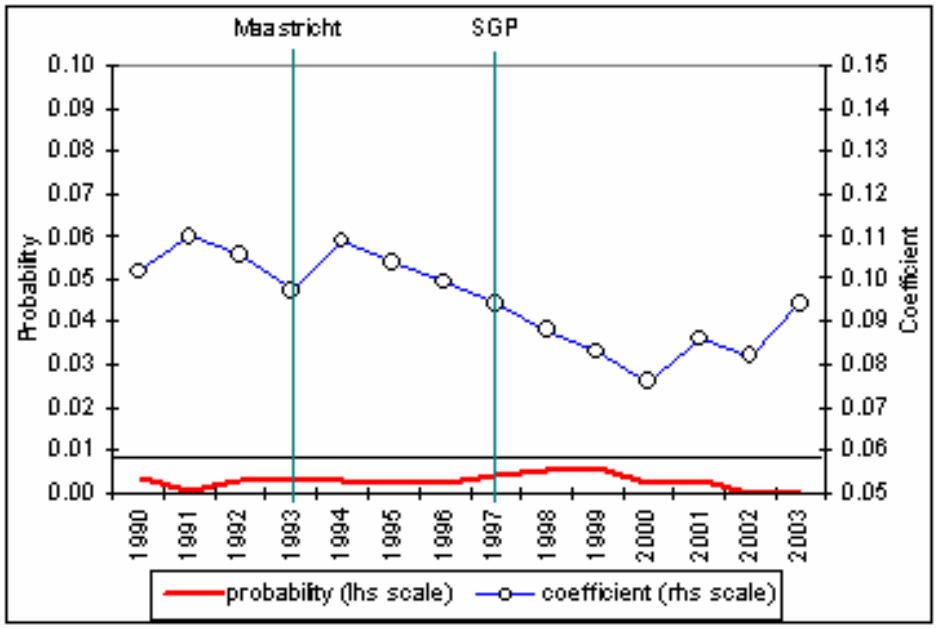
Additionally, and also according to the results of Table 5, when government debt is the dependent variable, EU-15 governments seem to use primary budget surpluses to reduce the debt-to-GDP ratio. This can be seen from the fact that we obtain a negative and statistically significant γ coefficient for the primary balance in the debt regressions.

I estimated also the simple fiscal rule given by (4) by adding successively new yearly data from 1990 onwards, in order to assess the different magnitudes of the θ parameter through time. In other words, to see how the responsiveness of primary budget surplus to increases in the outstanding stock of government debt developed. The relevant pooled 2SLS estimated coefficients (the fixed effects results were very similar), plotted in Figure 2, along with the respective probabilities, seem to indicate that the magnitude of

[10] However, one should be aware that, for instance, measurement issues, and sizeable stock-flow adjustments, which can account for a relevant part of government debt accumulation, might blur such expected relationships as reported, for instance, by von Hagen and Wolff (2004).

primary surplus response was stable even if somewhat declining in the second half of the 1990s.

Figure 2 – Magnitude and statistical significance of θ: responsiveness of primary budget surplus to debt (pooled 2SLS)



Note: the horizontal bar denotes the 1% significance level.

Next 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 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 6 reports estimation results for the sub-periods before and after the signing of the Maastricht Treaty, respectively 1970-1991 and 1992-2003.

Table 6 – 2SLS estimators for primary balance and debt ratios, pre- and post-Maastricht: 1970-1991 and 1992-2003

1970-1991	Dependent variable: primary balance		Dependent variable: debt	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	-0.186 *		0.742 ***	
	(-1.70)	-	(3.87)	-
Primary balance	0.057	0.058	-0.230 **	-0.274 **
	(0.78)	(0.76)	(-2.08)	(-2.44)
Debt	0.118 ***	0.129 ***	0.582 ***	0.496 ***
	(3.41)	(3.42)	(10.24)	(7.64)
Observations	280	280	281	281
1992-2003	Dependent variable: primary balance		Dependent variable: debt	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	-0.006		-0.118	
	(-0.05)	-	(-0.397)	-
Primary balance	0.315 ***	0.326 ***	-0.382 *	-0.547 ***
	(3.32)	(3.35)	(-1.80)	(-2.63)
Debt	0.086 ***	0.097 ***	0.454 ***	0.323 ***
	(2.86)	(2.87)	(4.24)	(2.69)
Observations	180	180	180	180

Notes: The t statistics are in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 percent level respectively.

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 γ coefficients in the post-Maastricht period, vis-à-vis the pre-Maastricht period, 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.

Table 7 reports estimation results for the sub-periods before and after the drafting of the SGP, respectively 1970-1996 and 1997-2003.

Table 7 – 2SLS estimators for primary balance and debt ratios, pre- and post-SGP: 1970-1996 and 1997-2003

1970-1996	Dependent variable: primary balance		Dependent variable: Debt	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	-0.146		0.914 ***	
	(-1.50)	-	(4.66)	-
Primary balance	0.131 *	0.131 *	-0.287 **	-0.335 ***
	(1.88)	(1.84)	(-2.40)	(-2.83)
Debt	0.099 ***	0.104 ***	0.472 ***	0.418 ***
	(3.73)	(3.68)	(6.69)	(5.74)
Observations	355	355	356	356
1997-2003	Dependent variable: primary balance		Dependent variable: debt	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	0.178		-0.834 ***	
	(1.37)	-	(-4.12)	-
Primary balance	0.293 ***	0.294 **	-0.247 *	-0.339 **
	(2.76)	(2.46)	(-1.69)	(-2.49)
Debt	0.121 **	0.200 ***	0.493 ***	0.223 *
	(2.43)	(3.21)	(4.89)	(1.87)
Observations	120	120	120	120

Notes: The t statistics are in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 percent level respectively.

The results reported in Table 7 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 (γ<0), and primary balances increased in order to react to the existing stock of government debt (θ>0). The estimated γ 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 (θ) coefficients for the debt variable in the primary balance regressions.

4.5. Alternative specifications

4.5.1. 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 7 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:

$$D_{it}^{emu} = \begin{cases} 1, \text{if } t \geq \text{year of Maastricht referendum} \\ 0, \text{if } t < \text{year of Maastricht referendum} \end{cases}, \quad (8)$$

$$D_{it}^{sgp} = \begin{cases} 1, \text{if } t \geq 1997 \text{ and if } i \in \text{euro area} \\ 0, \text{otherwise} \end{cases}. \quad (9)$$

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

$$\Delta s_{it} = a_0 + \delta \Delta s_{it-1} + \theta_1 D_{it-1}^{emu} \Delta b_{it-1} + \theta_2 (1 - D_{it-1}^{emu}) \Delta b_{it-1} + \Delta u_{it}, \quad (10)$$

and

$$\Delta b_{it} = c_0 + \varphi \Delta b_{it-1} + \gamma_1 D_{it-1}^{emu} \Delta s_{it-1} + \gamma_2 (1 - D_{it-1}^{emu}) \Delta s_{it-1} + \Delta v_{it}. \quad (11)$$

Similar specifications were also estimated for the SGP sub-periods, replacing then D_{it-1}^{emu} by D_{it-1}^{sgp} in (10) and in (11). Table 8 reports the relevant results.

Table 8 – 2SLS estimators for primary balance and debt ratios: full sample with EMU and SGP dummies

1970-2003 EMU dummy	Dependent variable: primary balance		Dependent variable: Debt	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	-0.083		0.428 ***	
	(-1.05)	-	(2.78)	-
Primary balance	0.156 ***	0.156 ***		
	(2.62)	(1.57)		
Pre-EMU			-0.117	-0.140
			(-0.75)	(-0.94)
Post-EMU			-0.330 ***	-0.355 ***
			(-2.66)	(-2.87)
Debt			0.537 ***	0.508 ***
			(8.50)	(7.84)
Pre-EMU	0.106 ***	0.113 ***		
	(3.08)	(3.15)		
Post-EMU	0.086 ***	0.086 ***		
	(2.81)	(2.71)		
Observations	460	460	461	461

1970-2003 SGP dummy	Dependent variable: primary balance		Dependent variable: debt	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	-0.100		0.442 ***	
	(-1.20)	-	(2.84)	-
Primary balance	0.159 ***	0.160 ***		
	(2.63)	(2.60)		
Pre-SGP			-0.187	-0.222
			(-0.92)	(-1.09)
Post-SGP			-0.285 ***	-0.308 ***
			(-2.56)	(-2.80)
Debt			0.537 ***	0.508 ***
			(8.47)	(7.80)
Pre-SGP	0.080	0.094		
	(1.26)	(1.40)		
Post-SGP	0.095 ***	0.097 ***		
	(3.81)	(3.69)		
Observations	460	460	461	461

Notes: The t statistics are in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 percent level respectively.

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.

One can also summarise the findings regarding the estimated θ 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 coefficient ranges from 0.08 in the pre-SGP period, in the model with a specific SGP dummy variable and without cross effects, to 0.20 in the period 1997–2003, in the model with fixed effects. For the 18 above reported estimations, in Tables 5 to 8, the simple average value for θ is 0.11, being statistically significant in 16 of the 18 cases.

4.5.2. The relevance of the 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}^{DTH}, defined as follows:

$$D_{it}^{DTH} = \begin{cases} 1, \text{debt ratio} \rangle \text{DTH} \\ 0, \text{otherwise} \end{cases} . \qquad (12)$$

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:

$$\Delta s_{it} = a_0 + \delta \Delta s_{it-1} + w_1 D_{it-1}^{DTH} \Delta b_{it-1} + w_2 (1 - D_{it-1}^{DTH}) \Delta b_{it-1} + \Delta u_{it} \quad .(13)$$

I used several limit values for *DTH*, notably 50%, 60%, 65% and 70%. The estimation results with those thresholds for model (13) are reported in Table 9. Additionally, the results of using the average debt ratio of each country, instead of an overall limit, are also presented.

Table 9 – IV fixed-effects panel estimations for primary balance, 1970-2003: alternative debt ratio thresholds

	Debt ratio threshold (*dth*)				
	50%	60%	65%	70%	Country average
Primary balance	0.153 **	0.156 ***	0.151 ***	0.149 ***	0.156 ***
	(3.22)	(3.24)	(3.01)	(3.10)	(3.27)
Debt ratio > *dth*	0.108 ***	0.103 ***	0.113 ***	0.123 ***	0.106 ***
	(4.81)	(3.99)	(3.92)	(4.03)	(4.60)
Debt ratio ≤ *dth*	0.064 *	0.089 ***	0.083 ***	0.079 ***	0.075 **
	(1.76)	(3.07)	(3.14)	(3.13)	(2.24)
Observations	460	460	460	460	460

Notes: The t statistics are in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 percent level respectively.

From Table 9 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.

Again from Table 9, one could mention for the case of the 70% threshold, that for instance, an acceleration of the change in the debt ratio of 5 percentage points would imply and acceleration in the improvement of the primary balance ratio of 0.615 percentage points of GDP if the debt ratio was already above 70% or 0.395 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.

4.6. 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 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 (1997), respectively regarding opportunistic and partisan cycles.[11] 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

$$D_{it}^{EL} = \begin{cases} 1, \text{if in country } i \text{ there were elections for the parliament in } t \\ 0, \text{otherwise} \end{cases} . \quad (14)$$

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,

[11] For instance, Rogoff and Sibert (1988), Alesina and Roubini (1992), and Alesina, Roubini and Cohen (1997) provide subsequent related work.

$$\Delta s_{it} = a_0 + \delta \Delta s_{it-1} + w_1 D_{it}^{EL} \Delta b_{it-1} + w_2 (1 - D_{it}^{EL}) \Delta b_{it-1} + \Delta u_{it} \ . \quad (15)$$

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 (see Appendix 2). 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 10 reports the results of the estimation of (14) for the full sample period.

Table 10 – 2SLS estimators for primary balance: full sample and elections dummy

1970-2003	Dependent variable: primary balance	
Method	Pooled	Fixed effects
Constant	-0.089	
	(-1.05)	-
Primary	0.161 ***	0.163 ***
balance	(2.65)	(2.63)
Debt		
Elections	0.054	0.055
	(1.35)	(1.35)
No-elections	0.107 ***	0.111 ***
	(3.96)	(2.63)
Observations	460	460

Notes: The t statistics are in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 percent level respectively.

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 case if there are elections. Indeed, only the estimated coefficient for debt in the no-elections sub-sample is statistically 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 11.

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 statistically significant.

Table 11 – 2SLS estimators for primary balance: election dummy and EMU and SGP sub-samples

EMU sub-samples	1970-1991		1992-2003	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	-0.188 *		-0.003	
	(-1.70)	-	(-0.03)	-
Primary balance	0.060	0.061	0.317 ***	0.328 ***
	(0.81)	(0.78)	(3.31)	(3.37)
Debt				
Elections	0.056	0.062	0.066	0.076
	(0.99)	(1.09)	(1.22)	(1.27)
No-elections	0.148 ***	0.162 ***	0.090 ***	0.101 ***
	(3.56)	(3.51)	(2.61)	(2.63)
Observations	280	280	180	180

SGP sub-samples	1970-1996		1997-2003	
Method	Pooled	Fixed effects	Pooled	Fixed effects
Constant	-0.139		0.035	
	(-1.42)	-	(0.23)	-
Primary balance	0.134 *	0.133 *	0.300 ***	0.306 **
	(1.89)	(1.85)	(2.86)	(2.60)
Debt				
Elections	0.059	0.060	0.076	0.148
	(1.29)	(1.27)	(1.22)	(1.59)
No-elections	0.112 ***	0.117 ***	0.114	0.174 **
	(3.64)	(3.62)	(1.56)	(2.60)
Observations	355	355	105	105

Notes: The t statistics are in parentheses. *, **, *** - statistically significant at the 10, 5, and 1 percent level respectively.

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. 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.

Appendix 1 – Cross-sectional descriptive statistics

Table A2.1 – Primary balance ratio (1970-2003)

	Mean	Std dev	Min	Max	Observations
Austria	0.9	1.4	-2.0	3.7	34
Belgium	1.8	3.8	-7.4	6.9	34
Denmark	4.8	3.1	-2.6	11.8	33
Finland	4.5	3.0	-3.0	10.0	34
France	0.2	1.1	-2.5	1.9	34
Germany	0.3	1.4	-4.3	2.8	34
Greece	-0.1	4.0	-6.7	6.6	34
Ireland	0.6	3.9	-7.4	6.4	34
Italy	-0.7	3.7	-6.9	6.7	34
Luxembourg	3.2	2.0	-1.9	7.2	32
Netherlands	1.9	1.6	-1.0	5.3	34
Portugal	-0.3	2.5	-5.3	3.8	34
Spain	-0.2	2.0	-4.4	2.9	34
Sweden	4.1	3.8	-5.6	10.4	34
UK	1.3	2.5	-4.8	6.7	34
Full sample	1.5	3.3	-7.4	11.8	507

Source: EC AMECO database.

Table A2.2 – Debt ratio (1970-2003)

	Mean	Std dev	Min	Max	Observations
Austria	47.6	18.3	17.0	69.2	34
Belgium	102.8	28.8	57.9	137.9	34
Denmark	47.0	22.9	5.8	78.0	33
Finland	25.7	18.6	6.2	58.0	34
France	39.9	15.0	19.8	63.3	27
Germany	40.6	14.8	18.0	64.2	34
Greece	62.5	36.8	17.5	111.3	34
Ireland	70.6	24.7	32.3	114.2	34
Italy	84.9	27.8	37.9	124.8	34
Luxembourg	10.4	5.1	4.6	23.2	34
Netherlands	62.4	13.8	40.0	79.3	29
Portugal	48.6	14.9	15.0	64.3	31
Spain	37.7	20.0	12.1	68.1	34
Sweden	49.4	16.5	24.6	73.9	34
UK	51.5	11.0	34.0	78.7	34
Full sample	52.4	30.3	4.6	137.9	492

Source: EC AMECO database.

Appendix 2 – Parliamentary election dates

	BE	DK	DE	GR	ES	FR	IR	IT	LU	NL	AU	PT	FI	SW	UK
1970	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1
1971	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0
1972	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0
1973	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0
1974	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1
1975	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0
1976	0	0	1	0	0	0	0	1	0	0	0	1	0	1	0
1977	1	1	0	1	1	0	1	0	0	1	0	0	0	0	0
1978	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
1979	0	1	0	0	1	0	0	1	1	0	1	1	1	1	1
1980	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
1981	1	1	0	1	0	1	1	0	0	1	0	0	0	0	0
1982	0	0	0	0	1	0	1	0	0	1	0	0	0	1	0
1983	0	0	1	0	0	0	0	1	0	0	1	1	1	0	1
1984	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
1985	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0
1986	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0
1987	1	1	1	0	0	0	1	1	0	0	0	1	1	0	1
1988	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0
1989	0	0	0	1	1	0	1	0	1	1	0	0	0	0	0
1990	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1991	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0
1992	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1
1993	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
1994	0	1	1	0	0	0	0	1	1	1	1	0	0	1	0
1995	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0
1996	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0
1997	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1
1998	0	1	1	0	0	0	0	0	0	1	0	0	0	1	0
1999	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0
2000	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
2001	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1
2002	0	0	1	0	0	1	1	0	0	1	1	1	0	1	0
2003	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0

Notes: the electoral dummy variable assumes a value of one when there is a parliamentary election. The data on election dates was obtained from the following two sources: http://www.idea.int/vt/total_number_of_elections.cfm and http://electionresources.org/.

BE – Belgium; DK – Denmark; DE – Germany; GR – Greece; ES – Spain; FR – France; IR – Ireland; IT – Italy; LU – Luxembourg; NL – Netherlands; AU – Austria; PT – Portugal; FI –Finland; SW – Sweden; UK – United Kingdom.

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