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Government debt forecast errors and the net expenditure rule in EU countries

David Cronin and Kieran McQuinn*

*The views expressed here are those of the authors and do not necessarily reflect those of the Central Bank of Ireland, European System of Central Banks or the Economic and Social Research Institute. Contact details: dave.cronin@centralbank.ie (corresponding author); kieran.mcquinn@esri.ie

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Abstract

Against a backdrop of debt ratio targets being central to recent proposed changes to the EU fiscal rules, we examine errors in official forecasts of the General Government debt ratios and their determinants in 26 member states from 2012 to 2019 when the "six pack" rules applied. We find debt ratio outturns exceeding projected values with forecast errors increasing over a four-year horizon. Larger errors arise where the initial debt ratio exceeds the Maastricht Treaty threshold of 60 per cent. In modelling the forecast errors of the debt ratio, we find that most of the variation is explained by forecast errors in the output growth rate and in the structural budget balance, as well as previous errors in projecting the debt ratio. During the sample period, member states who had not met their medium-term objective of a balanced structural budget were expected to adhere to a net expenditure rule. For countries subject to this requirement, we find undue optimism arising in forecasting the deficit ratio, a determinant of the debt ratio.

Keywords: EU fiscal rules, government debt, forecast errors

JEL codes: H30, H63, H 68

1. Introduction

The European Commission published initial proposals for a revised set of rules governing fiscal behaviour in European Union (EU) countries in November 2022. These were clarified further by the Commission in April 2023.[1] An objective of the proposed reforms of the Stability and Growth Pact is to simplify what had become, following reforms to the original Pact (1998) in 2005 and the early 2010s, an involved set of rules. The revisions would curtail the use of the structural budget balance and the output gap in assessing budgetary performance and remove the requirement for high-debt member states to reduce their debt ratio by one-twentieth each year. Instead, renewed emphasis would be placed on member states meeting the 3 per cent government deficit and 60 per cent (gross) government debt ratios (to GDP) that formed the basis of the Maastricht Treaty (1992) fiscal rules.

A greater focus on the 60 per cent debt ratio threshold would occur within the revised rules. In that respect, countries would be classified according to whether their debt ratio is less than 60 per cent of GDP (low debt), between 60 per cent and 90 per cent (moderate debt), or greater than 90 per cent (substantial debt). Those countries in the latter two categories would be required to follow a multi-annual net expenditure path that constrained spending growth in the expectation that doing so would lead the debt ratio to decline to 60 per cent over time. The debt ratio should then be on a downward adjustment path within three to four years, the typical forecasting horizon for EU member states in their annual Stability and Convergence Programmes (SCPs), with the ratio being lower at the end of the forecast period than at the start. A debt-based excessive deficit procedure would be activated when a member state with a debt ratio greater than 60 per cent deviates from the agreed expenditure path.

Against this background of the debt ratio likely becoming more prominent in the EU fiscal rules and the forward-looking nature of official assessments of countries' compliance with those rules, this paper studies the forecasting performance of domestic policymakers in relation to the debt ratio projections contained in member states' SCPs between 2012 and 2019. The starting year of 2012 is when the last major revision of the EU fiscal rules took effect. Those rule changes were made through the "six pack" reforms of 2011, with that reform of the Pact entering into force on 13 December 2011 (European Commission, 2012). The end-sample year of 2019 is the year before enforcement of the Pact was suspended in 2020 when the Covid-

[1] See https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_2394.

19 pandemic struck. Forecasting performance is assessed through comparing debt ratio with realised, or outturn, values and the projection horizon examined is from the current year to three years hence. The analysis also sheds light on the form and principal causes of the forecasted errors for the debt ratios. This may flag potential issues that could hamper the proposed new rules.

A feature of the period from 2012 to 2019 was that, under the "six pack" rules, a net expenditure requirement arose for member states who had not attained their medium-term objective (MTO) of achieving a structural budget balance of close to balance or in surplus. The requirement of such countries was that net spending should grow at a lower rate than that of medium-term potential growth with the aim of improving budgetary performance. While the spending rule applied differently between 2012 and 2019 than would occur under the recent European Commission proposals, the analysis here of the "six pack" era may indicate whether it holds the promise, or otherwise, of being effective in reducing high debt ratios towards 60 per cent in the proposed fiscal rules regime.[2]

The salient findings of our study are that the expected outturns for the debt ratio across the 26 EU country sample are subject to an optimism bias, with forecasts not being rational across the four-year projection horizon. Subsequent analysis shows the forecast error in the debt ratio being largely determined, in an economically intuitive manner, by errors in forecasting the output growth rate and the structural budget balance ratio, as well as by prior errors in projecting the debt ratio. In relation to the net expenditure rule, in general, member states that had not met their MTO have an optimism bias to their forecasts of the budget balance ratio. This suggests that requiring member states to adhere to a net expenditure rule imparts a forecasting bias that is not conducive to meeting rule targets. On a more encouraging note, the econometric analysis indicates that such bias did not arise in the budget balance ratio forecasts of countries with debt ratios in excess of 60 per cent.

The paper proceeds as follows: in the next section, after a brief literature review, we outline the data considered and its statistical properties, including tests of the rationality of SCP forecasts of the debt ratio, the budget balance ratio, the structural budget balance ratio and the real GDP growth rate. In section 3, we provide an econometric model of the determinants of

[2] Estefania-Flores *et al.* (2023) is a recent study of public debt forecast errors in 174 countries between 1995 and 2020. While our study shares some of the same focus as theirs, such as explaining debt forecast errors by errors in variables such as the real GDP growth rate, our assessment has a narrower focus on debt ratio forecasting and performance within the EU and in a period when a particular set of EU-wide fiscal rules was in place.

the forecast error of the debt ratio over a four-years-ahead horizon. In section 4, we assess the impact that a member state being required to follow the net expenditure rule has on budgetary outcomes. Section 5 concludes by discussing the implications of our statistical and econometric analysis for policymakers, in particular those with responsibility for preparing fiscal forecasts.

2. Data and statistical analysis

(i) Overview and literature review

Member states provide detailed fiscal forecasts in the SCPs that they submit to the European Commission each April. Those sets of forecasts contain initial outturns for the previous year ($t-1$) and calendar-year forecasts from the current year (t) to, at least, three years ahead (i.e., year $t+3$). The debt ratio (denoted as d below) is among the variables that attract the most attention of the Commission and other interested parties (including other member states), along with the budget balance ratio (b), the real GDP growth rate (g) and the solely policy-determined component of the budget balance ratio, that is, the structural budget balance ratio (sbb). These variables are related to one another, including in the determination of the end-year debt ratios reported in SCPs. In relation to the debt ratio, its value at the end of any year $t+i$ will depend on its value at the end of the previous year (year $t+i-1$) and the budget balance ratio in year $t+i$. The latter variable, in turn, has a structural budget balance component (also of year $t+i$) and a cyclical component, which is dependent on the rate of output growth (again, in year $t+i$) .

The forecasts contained in SCPs have been the subject of academic scrutiny for almost as long as monetary union and its associated fiscal requirements of member states took effect in 1999, with most studies focussing on output and budget balance variables. Strauch *et al.* (2004) found member states not using the information available to them efficiently in making forecasts with those projections also being sensitive to where economies were in the economic cycle. Jonung and Larch (2006) show official output growth forecasts to be overly optimistic, on average, in the four largest EU countries. Marinheiro (2011) provides similar evidence. An output growth bias of this form will see, all else being equal, the realised cyclical component of the budget balance being poorer than expected, owing mainly to lower tax revenue arising than was projected. Consequently, the budget balance ratio will be less favourable and the debt ratio higher than forecast, all else being equal.

The EU fiscal rules themselves may have been a source of this forecasting behaviour as member states being required to meet budgetary targets can be more easily achieved *ex ante* through providing a more optimistic economic outlook rather than changing fiscal policy (Frankel, 2011). Notwithstanding this output forecasting bias, Beetsma *et al.* (2009) find the fiscal adjustments that occurred in the years prior to 2008 being smaller than planned. Gilbert and de Jong (2017) find an upward bias in official forecasts occurring when member states expect the EU fiscal rules to be binding.

Partly in response to the forecasting difficulties that arose in the first decade of monetary union, and those issues calling into question the credibility of budgetary processes, the fiscal rules reforms of the early 2010s placed an emphasis on forecasting that was either independent of government or involved external endorsement of member states' official forecasts by another national authority. An improvement in the oversight and preparation of forecasts occurred with the European Commission (2014) reporting that all bar three countries were involving independent fiscal institutes in such processes. Nevertheless, deficiencies in official forecasts continue to arise with Cronin and McQuinn (2021a) finding member state output growth forecasts to be unduly pessimistic, irrational and influenced by recent economic activity in the period from 2013 to 2018. Cronin and McInerney (2023) also report biases of a pessimistic form arising in SCP forecasts of the output growth rate and budget balance variables during this time.

In comparison to the budget balance ratio and output growth rate, the forecasting performance of member states in relation to the debt ratio has received scant consideration in the literature. This may have occurred for two reasons. First, the debt ratio, and in particular year-to-year changes in that variable, are largely dependent on output growth and the fiscal policy stance with academic and policy interest then gravitating more towards those variables. Secondly, and perhaps related to that dependence, the debt ratio has had less prominent a role heretofore in revisions of the EU fiscal rules, which have tended to focus on the structural budget positions of member states. The new rules touted in November 2022 represent a change in that regard with the debt ratio coming to the fore in assessing member states' fiscal performance. This serves as a motivation for studying recent official forecasting performance in respect of the debt ratio.

A broader issue arises as well relating to fiscal sustainability, summarised by Estefania-Flores *et al.* (2023, p. 685) as "accurate forecasts are an essential foundation for robust fiscal strategies consistent with debt sustainability … and robustness is even more important when debt is already very high, as is the case today." As Kose *et al.* (2021) show, there was a sharp rise in debt, both public and private, on a global basis, both before and during the Covid-19 pandemic, with the government debt ratio reaching, on average, 123 per cent of GDP in advanced economies in 2020, the highest ratio value since 1970. Estefania-Flores *et al.* (2023) assess debt forecasting for an unbalanced panel of 174 countries between 1995 and 2020. They find, on average, realised debt ratios to be larger than forecasted values; forecast errors increasing with the horizon; and positive errors being only partly explained by optimism about output growth and the budget balance.

(ii) Data

For the analysis here, the SCP forecasts of the aforementioned four variables (the debt ratio, the budget balance ratio, the real GDP growth rate, and the structural budget balance ratio) were collected from tables in the European Commission's annual overview of SCPs, published in its *Occasional Paper* series. The series collected cover 26 EU member states and the years 2012 to 2019, rendering 201 observations.[3] Where gaps in those tables arose, missing observations were collected from member states' programmes. The dataset includes, for each variable, the estimate of the outturn for the previous year, $t-1$, and forecasts for the current year and following three years (i.e., t, $t+1$, $t+2$, $t+3$). Outturn data for the variables were collected from the European Commission's AMECO database.

In section 4, variables are used in the regression analysis that are based on the difference between a member state's medium-term objective (MTO) and its structural budget balance in year $t-1$. Under the "six pack" rules, the MTO is the country-specific numerical target towards which the structural budget balance is required to be adjusting over the medium term if its value is less than that numerical target. Those MTO targets are sourced from both the Commission's annual SCP overviews and in the *Vade Mecum on the Stability and Growth*

[3] Those member states are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Portugal, The Netherlands, Poland, Romania, Slovakia, Slovenia, Spain and Sweden.

Data for Croatia are available from 2014 to 2019, reflecting when it joined the EU. No data for 2012 are available for Portugal and the Netherlands. Likewise, there are no data for Cyprus for the years 2013 to 2015. Accordingly, there are 201 observations for the variables at each of the years from $t-1$ to $t+3$ with the exceptions of Germany 2014 when no growth rate for years $t+2$ and $t+3$ are in its SCP and for the same variable at year $t+3$ in Portugal's 2014 SCP.

Pact, also published by the European Commission in its *Institutional Paper* series. There are 122 observations where the MTO had not been met in year $t-1$.

(iii) Statistical analysis

We define the forecast error of a variable as its realised (outturn) value less its forecasted value. In Table 1, we provide statistics in relation to the forecast errors of the debt ratio over the sample period. As arises with subsequent tables, we consider full sample properties (201 observations) and those of two subsets, where observations are sub-divided between those where, as reported in the SCP, the debt ratio in year $t-1$ is less than 60 per cent of GDP (100 observations) and those where it exceeds 60 per cent (101 observations). For convenience, we refer to the former observations as "low debt" and the latter as "high debt".

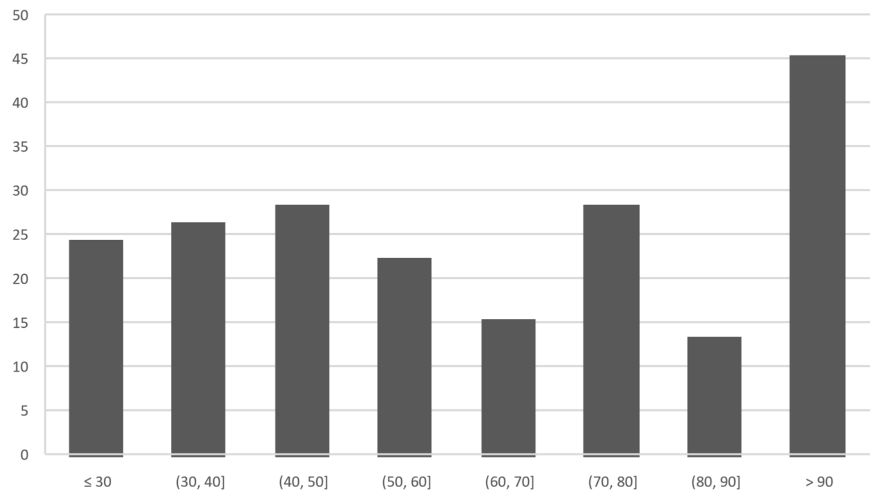
The year $t-1$ entries in rows (i) and (ii) of Table 1 indicate little difference between mean outturn and mean forecast, respectively, for the three categories covered. The full-sample average debt ratio in the SCPs is 64.3 per cent. There is a substantial difference in the average, initial (year $t-1$) debt ratio values between the low debt (38 per cent) and high debt (90.3 per cent) observations reported in SCPs. Figure 1 shows that this reflects a large number of initial debt ratios being above 90 per cent. Those 45 observations, constituting almost one quarter of the full sample, raise the average, initial ratio for the high-debt category well above the 60 per cent benchmark. For the low-debt category, there is a relatively low number of observations (24) below 30 per cent and a more even spread of debt ratios across the four sub-60-per-cent categorisations.

Across all three classifications of the debt ratio, row (ii) of Table 1 shows the mean forecasts of the SCP debt ratios falling between year $t-1$ and year $t+3$. The projected decline was greater where the initial debt ratio exceeded 60 per cent with the mean debt ratio expected to decrease 6.9 per cent from 90.3 per cent to 83.4 per cent, while a 2.3 per cent fall, from 38 to 35.7 per cent, was projected for the less-than-60-per-cent group. Much of the decline in debt ratios was projected to occur in years $t+2$ and, in particular, $t+3$.

The mean outturn values in row (i) of Table 1 show a more modest decline occurring in the debt ratio than was forecast for the full sample and for the high-debt countries. The realised mean debt ratio at the end of the four-year horizon (i.e. year $t+3$) proves higher for the less-than-60-per-cent category than its initial value, rising from 37.8 per cent of GDP to 39.3 per cent. The realised debt ratio declining over time for the high-debt ratio category may give some comfort to proponents of the November 2022 reforms, although the decline is modest, at 2.4 per cent of GDP compared to the initial mean debt ratio of just over 90 per cent.

Rows (iii) and (iv) of Table 1 illustrate that while most projections over the forecast horizon expected the debt ratio to decline, the realised debt ratios in year $t+3$ were more likely not to be less than year $t-1$ values (as reported in the SCPs). So, for example, of the 201 observations in the full sample, the debt ratio was forecast to decline over the forecast horizon in 155 cases but only 98 cases of a fall in the debt ratio were actually observed. Of the 101 high-debt observations, 88 foresaw a decline in the debt ratio but only 49 realised such a reduction. This feature of the data strikes a note of caution to the ambition of the November 2022 proposals to see high debt ratios declining over the medium term.

Figure 1. Histogram of initial debt ratios in SCPs



Note: the horizontal axis shows debt ratio ranges (as percentages of GDP) in year t-1 and the vertical axis the number of observations in each category. **Source:** Stability and Convergence Programmes; authors' calculations

Rows (v) and (vi) of Table 1 show the mean forecast errors and tests of the significance of those errors, respectively. Forecast errors at year t have a negative sign (outturns are less than projections) at values of between -0.465 per cent of GDP for the low-debt sub-sample (significant at the five per cent level) and -0.719 of the high-debt group (insignificant). Errors at longer horizons are positive in value and are statistically significant at the five per cent level in years $t+2$ and $t+3$. The forecast error at year $t+3$ is 4.630 per cent for high-debt countries and 3.613 per cent for low-debt countries. As noted in Cronin and McQuinn (2021a), the significance of the forecast error points to the presence of bias in the forecast; we formally test for this in the next sub-section.

The “Maximum” and “Minimum” entries in rows (vii) and (viii) show there to be a large range of forecast errors, with the range rising over the forecast horizon. Rows (ix) to (xi) provide a breakdown between those forecast errors that are greater than, less than or equal to zero. Negative forecast errors are more numerous at year t, while there are a greater number of positive errors at years $t + 2$ and $t + 3$. In such circumstances, and in particular where there are large outliers, the median error should be considered alongside the mean error. The median errors are shown in row (xii). The year t errors have a negative sign and the test statistics in rows (xiii) to (xvi) indicate them being significant for year t for the full-sample and low-debt categories but not for the high-debt group. Median errors are insignificant in year $t + 1$, while the tests of significance are mixed for year $t + 2$. The median errors for year $t + 3$ are positive and substantial in size (4.1 per cent for low-debt countries and 7.3 per cent for high-debt countries). The summary assessment of the mean and median forecast errors then is that, while they are often insignificant at shorter horizons, large positive errors arise at years $t + 2$ and $t + 3$.

In the next two sections, we consider economic and policy developments as determinants of the forecast errors of the debt and budget balance ratios. Consequently, in Table 2, the summary statistics of the budget balance ratio (b), the real GDP growth rate (g) and structural budget balance ratio (sbb) are provided. Rows (iii) and (iv) show that at longer horizons, the forecast error of the budget balance ratio is negative, i.e. the outturn ratio is poorer than that of the forecast. The mean forecast errors of the real GDP growth rate are insignificant at years $t + 2$ and $t + 3$, while those errors are mixed between being insignificant and significant at years t and $t + 1$ (see rows (vii) and (viii). The final rows ((xi) and (xii)) of the table show the mean forecast errors of the structural budget balance being predominantly negative in value, indicating that the policy stance was weaker than intended in the SCPs.

(iv) *Tests of rationality*

Having examined the summary statistics and significance of the forecast errors of the debt ratio and the other variables, and noting the significant forecast errors that arise, the rationality of the forecasts of these variables is considered for years t to $t + 3$. The methodology to do so follows that of Cronin and McQuinn (2021a), who, in turn, acknowledged the approaches of Croushore and Van Norden (2018), Campbell and Dufour (1991) and Campbell and Ghysels (1995). Panel data models are estimated where the realised variable value for each year t to $t + 3$ is regressed on the SCP forecast of the same variable and country-specific fixed effects.

Table 1. Statistical properties of the forecast errors of the debt ratio (d)

		All observations (201)					Observations where $d_{i,t-1}$<60% (100)					Observations where $d_{i,t-1}$>60% (101)				
	Year	t-1	t	t+1	t+2	t+3	t-1	t	t+1	t+2	t+3	t-1	t	t+1	t+2	t+3
(i)	Mean outturn (%)	64.2	63.6	64.2	64.3	63.8	37.8	37.7	38.6	39.2	39.3	90.4	89.3	89.6	89.1	88.0
(ii)	Mean forecast (%)	64.3	64.2	63.2	61.7	59.7	38.0	38.2	37.7	37.0	35.7	90.3	90.0	88.5	86.1	83.4
(iii)	Projected decline over forecast horizon*			155					67					88		
(iv)	Realised decline over forecast horizon**			98					49					49		
(v)	Mean error (%)	-0.116	-0.592	1.029	2.596	4.124	-0.264	-0.465	0.944	2.254	3.613	0.030	-0.719	1.111	2.934	4.630
(vi)	(Test of mean = 0)	0.567	0.051	0.082	0.007	0.000	0.027	0.039	0.079	0.003	0.000	0.939	0.201	0.291	0.029	0.002
(vii)	Maximum	13	12.1	33.5	41	41.4	6.0	8.2	17.4	27.7	31.7	13	12.1	33.5	41	41.4
(viii)	Minimum	-17.1	-28.3	-43.3	-41.6	-44.4	-3.6	-8.1	-8.8	-11.5	-15.3	-17.1	-28.3	-43.3	-41.6	-44.4
(ix)	Ob.s > 0 (number)	79	76	100	112	130	34	32	48	53	63	45	44	52	59	67
(x)	Ob.s < 0 (number)	117	119	100	86	70	62	63	52	45	36	55	56	48	41	34
(xi)	Ob.s = 0 (number)	5	6	1	3	1	4	5	0	2	1	1	1	1	1	0
(xii)	Median error (%)	-0.400	-0.600	0.000	1.200	5.100	-0.400	-0.500	-0.500	0.600	4.100	-0.100	-0.600	0.200	2.500	7.300
	(Tests of median = 0)															
(xiii)	Sign (exact binomial)	0.008	0.003	1.000	0.075	0.000	0.006	0.002	0.764	0.480	0.009	0.368	0.271	0.764	0.089	0.000
(xiv)	Sign (normal approxn.)	0.008	0.003	0.944	0.076	0.000	0.006	0.002	0.764	0.480	0.009	0.368	0.271	0.764	0.089	0.002
(xv)	Wilcoxian signed rank	0.039	0.013	0.295	0.006	0.000	0.005	0.004	0.559	0.013	0.000	0.917	0.287	0.394	0.014	0.000
(xvi)	Normal scores	0.113	0.026	0.147	0.000	0.000	0.001	0.008	0.242	0.004	0.000	0.945	0.285	0.305	0.016	0.002

Note: Entries in rows (vi) and (xiii)-(xvi) are probability values. *debt ratio entry in SCP for year $t-1$ compared to SCP entry for year $t+3$. ** debt ratio entry in SCP for year $t-1$ compared to outturn for year $t+3$. **Source:** Stability and Convergence Programmes; EU AMECO; authors' calculations.

__Table 2. Statistical properties of the forecast errors of the other variables__

		All observations (201)*					Ob.s where d_{t-1}^{i}<60% (100)					Ob.s where d_{t-1}^{i}>60% (101)**				
	Year	t-1	t	t+1	t+2	t+3	t-1	t	t+1	t+2	t+3	t-1	t	t+1	t+2	t+3
				b					b					b		
(i)	Mean outturn (%)	-2.00	-1.49	-1.87	-2.00	-2.04	-1.12	-0.86	-1.37	-1.48	-1.61	-2.87	-2.11	-2.36	-2.51	-2.47
(ii)	Mean forecast (%)	-1.89	-1.65	-1.22	-0.75	-0.33	-1.10	-1.22	-0.96	-0.65	-0.29	-2.66	-2.08	-1.47	-0.84	-0.36
(iii)	Mean error (%)	-0.115	0.165	-0.651	-1.252	-1.720	-0.022	0.366	-0.413	-0.831	-1.318	-0.207	-0.034	-0.887	-1.669	-2.111
(iv)	(Test of mean = 0)	0.076	0.114	0.001	0.000	0.000	0.714	0.031	0.146	0.007	0.000	0.071	0.785	0.002	0.000	0.000
				g					g					g		
(v)	Mean outturn (%)	2.45	2.56	1.89	2.55	2.71	2.73	2.67	2.01	2.65	2.74	2.17	2.44	1.77	2.46	2.68
(vi)	Mean forecast (%)	2.20	2.14	2.48	2.58	2.59	2.72	2.55	2.97	3.09	3.10	1.69	1.73	2.00	2.06	2.07
(vii)	Mean error (%)	0.253	0.418	-0.596	-0.020	0.132	0.013	0.121	-0.958	-0.448	-0.357	0.490	0.713	-0.238	0.408	0.625
(viii)	(Test of mean = 0)	0.015	0.003	0.018	0.942	0.628	0.906	0.425	0.000	0.136	0.210	0.005	0.002	0.566	0.374	0.179
				sbb					sbb					sbb		
(ix)	Mean outturn (%)	-1.33	-1.09	-1.34	-1.57	-1.88	-0.76	-0.67	-1.04	-1.23	-1.51	-1.90	-1.51	-1.64	-1.91	-2.26
(x)	Mean forecast (%)	-1.30	-1.27	-0.95	-0.67	-0.44	-0.80	-0.95	-0.69	-0.53	-0.36	-1.79	-1.59	-1.21	-0.82	-0.52
(xi)	Mean error (%)	-0.035	0.180	-0.394	-0.896	-1.444	0.038	0.283	-0.355	-0.702	-1.150	-0.106	0.077	-0.433	-1.089	-1.735
(xii)	(Test of mean = 0)	0.589	0.034	0.003	0.000	0.000	0.589	0.037	0.087	0.003	0.000	0.324	0.449	0.012	0.000	0.000

Note: Entries in rows (iv), (viii), (xii) are probability values. *number of g_{t+2} ob.s: 200; number of g_{t+3} observations: 199; **number of g_{t+2} ob.s: 100; number of g_{t+3} observations: 99. **Source:** Stability and Convergence Programmes; EU AMECO; authors' calculations.

The fixed-effects panel-data regression model used to test for rationality is of the form:

$$I^R_{i,t+j} = \gamma_1 I^F_{i,t+j} + \sum_{i=1}^{26} \gamma_{1+i} CD_i + \varepsilon_{i,t+j} \qquad (1)$$

Where I is a vector consisting (in turn) of the four variables, d, b, g, sbb; the superscript R denotes the realised value of the variable with the superscript F denoting the forecast; i refers to a specific country; j has a value of zero for the current year, one for the following year, and so forth. For each variable, four sets of regressions are then estimated for the years t, $t+1$, $t+2$, and $t+3$. CD_i are country-specific dummies, γ_i are the parameters to be estimated, and ε is the error term.

Following Cronin and McQuinn (2021a), Döpke *et al.* (2018), and Audretsch and Stadtmann (2005), the null hypothesis of a rational forecast can be rejected in a panel regression if the coefficient on the contemporaneous/one-year-ahead forecast is not equal to one and/or the individual country dummies are not jointly equal to zero. In panel (i) of Table 3, which considers the debt ratio, the coefficient on the forecast variable for each year is statistically different from one and the F-tests on the inclusion of the fixed effects (as reported at the bottom of each table) reject the null hypothesis that the country dummies are not different from zero. Accordingly, the SCP forecasts of the debt ratio are not rational.

The other three panels of the table consider the same test applied to, in turn, the budget balance ratio, the real growth rate and the structural budget balance ratio. For years $t+1$ to $t+3$, the same qualitative results arise in panels (ii), (iii) and (iv) as occur for the debt ratio with the coefficient on the forecast variable being different from one and the null hypothesis that the country dummies are not different from zero being rejected. For year t, the regressor coefficient is not different from one in all three panels but the null hypothesis concerning the country dummies is rejected.

Consequently, the null hypothesis of rational expectations in the forecasting processes of the member states for the four variables can, in all cases, be rejected at each yearly horizon. The results indicate that the forecasts of the debt ratio are subject to the same biases that forecasts of output growth are susceptible to, as was found in Cronin and McQuinn (2021a).

Table 3. Tests of rationality based on panel data models (unbalanced panel)

	(i) d				(ii) b				(iii) g				(iv) sbb			
Year	t	t+1	t+2	t+3	t	t+1	t+2	t+3	t	t+1	t+2	t+3	t	t+1	t+2	t+3
Coefficient (γ_1) (Forecast)	0.822	0.448	0.175	0.093	0.950	0.134	-0.725	-0.989	0.923	-0.152	-1.13	-0.228	0.875	0.290	-0.046	-0.366
T-Stat (Different from 1)	5.73	9.90	14.84	17.29	0.769	5.154	8.63	9.08	0.700	3.41	4.701	2.291	1.420	4.76	5.715	7.761
F-Test (Country dummies different from 0)	7.100	8.213	17.29	26.28	2.689	2.88	7.038	9.09	1.822	1.38	2.049	1.31	1.963	2.684	5.095	9.75
P-Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.012	0.113	0.003	0.15	0.005	0.00	0.00	0.00

Note: All models are estimated for 26 countries over the period 2012 and 2019. Unbalanced panel, 7 observations skipped out of a usable 201. **Source:** Authors' estimations.

3. Determinants of debt ratio forecast errors

In this section, we consider the determinants of the debt ratio forecast errors. Bachleitner and Prammer (2023) use a standard accounting decomposition to assess the determinants of the debt forecast errors in SCPs, including that proportion arising from stock-flow adjustments. Our approach is similar to that of Estefania-Flores *et al.* (2023) whereby we regress the forecast error of the debt ratio on the forecast errors of other variables.[4] Here, we consider those factors that would systematically affect the debt ratio on a year-to-year basis, namely the debt ratio at the end of the previous year, the real growth rate and the policy stance, as measured by the structural budget balance.[5] Consequently, we regress the forecast error in the debt ratio on the forecast errors of these three variables:

$$FE(d)_{i,t+j} = B_1 FE(d)_{i,t+j-1} + B_2 FE(g)_{i,t+j} + B_3 FE(sbb)_{i,t+j} + \sum_{i=1}^{26} B_{3+i} CD_i + \varepsilon_{i,t+j} \quad (2)$$

Where FE represents the forecast error; d, g, and sbb are defined, as previously; i is the country; j has a value of zero for the current year, 1 for the following year, etc.; the B terms indicate the coefficients to be estimated; CD_i are country-specific dummies, and ε is an error term.

The equation is motivated by the debt ratio error in the year specified (for example, year $t+3$), owing, in part, to the error in forecasting the debt ratio in the previous year (in this case, year $t+2$).[6] The other two variables in the regression equation are the effects of forecast errors in the output growth rate and structural budget balance ratio in the specific year under

[4] Ours is a more parsimonious representation than Estefania-Flores *at al* but which still reports high R-squared values. In our view, including several lags of each variable in a regression would pose some difficulties. First, there would be a double-counting of influences on the regressand. For example, the last lag of the debt ratio error will encapsulate the effects of all previous debt errors as well as prior errors in the growth rate and structural budget balance ratio. The inclusion of more than one lag of a variable can also induce serial correlation in the regression residuals.

[5] Accordingly, we do not consider the effects of financial transactions and interest rate and exchange rate movements. Bachleitner and Prammer (2023) find such factors to have a significant role in SCP forecast errors of the debt ratio. We did consider in our preliminary estimations, as is usual in the fiscal forecasting literature (see, for example, Bruck and Stephan, 2006), as to whether the timing of general elections had an impact on forecast errors of the debt ratio (and the budget balance ratio) but found them to be insignificant. In the classification of Auerbach (1995), we are then considering the impact of policy errors (through the structural budget balance error) and economic errors (via the real growth rate error), but not behavioural errors, on the forecast error of the debt ratio.

[6] In turn, the debt ratio forecast error in year $t+2$ is owing to that which occurred in the years prior to it. Consequently, it is necessary only to include the debt ratio error in the year before that under consideration.

consideration. Forecast errors in the budget balance, and accordingly the debt ratio, in any year are endogenous to errors in projecting output growth rate for that year. Consequently, real GDP forecast errors are included as a regressor in equations explaining fiscal errors by Pina and Vines (211), Beetsma *et al.* (2013), Giuriato *et al.* (2016), and Cronin and McInerney (2023). Likewise, the realised structural budget balance ratio being different from the forecast value in a particular year will affect both the headline budget balance ratio and the debt ratio outturns compared to those projected.

The estimations of (2) for the full sample are reported in columns (i) to (iv) of Table 4, with the forecast horizon under consideration indicated in the subscripts of the "Dependent variable" row. These parsimonious regressions have a high goodness of fit with adjusted R-squared values ranging from 0.784 to 0.940, with values increasing at longer forecast horizons. The coefficients on the lagged debt ratio forecast error are statistically insignificantly different from one in these columns, pointing to a full pass-through of the debt ratio error accumulated in previous years to the year under consideration. The coefficient on the real GDP growth rate is negative and, in absolute terms, in excess of a value of one. This is an intuitive and economically plausible coefficient value as a better (worse) output growth rate than projected will be expected to cause, ceteris paribus, the debt ratio to be lower (higher) than expected. A better-than-expected growth rate will act to improve the budget balance, through a higher net tax take, and result in a higher GDP value, which is the denominator of the debt ratio.

The coefficient on the forecast error of the structural budget balance is significant and negative in columns (i) to (iv) of Table 4. Again, this is an intuitive coefficient sign: if the policy stance proves to be tighter (looser) than expected then the debt ratio will fall (rise). The coefficient values are in the range of -0.538 to -0.836 so that the structural budget balance being one percent of GDP higher (lower) causes the debt ratio to be about 0.5 to 0.8 per cent of GDP lower (higher) than projected.

The results of repeating these estimations for the less-than-60-per-cent and greater-than-60-per-cent sub-samples are reported in columns (v) to (viii) and (ix) to (xii) of Table 4, respectively. The signs on the debt ratio and structural budget balance variables are broadly the same as occur in the first four columns of Table 4. The most notable difference between both sets of columns is that the coefficients on the growth rate errors are substantially larger, in absolute terms, in the high-debt country columns than in the low-debt country columns.

Table 4. Determinants of forecast errors in the debt ratio (unbalanced panel)

	All observations (201)				Ob.s where d_{t-1}^{i}<60% (100)				Ob.s where d_{t-1}^{i}>60% (101)			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)
Dependent variable	$FE(b)_{i,t}$	$FE(b)_{i,t+1}$	$FE(b)_{i,t+2}$	$FE(b)_{i,t+3}$	$FE(b)_{i,t}$	$FE(b)_{i,t+1}$	$FE(b)_{i,t+2}$	$FE(b)_{i,t+3}$	$FE(b)_{i,t}$	$FE(b)_{i,t+1}$	$FE(b)_{i,t+2}$	$FE(b)_{i,t+3}$
$FE(b)_{i,t-1}$	0.917				0.602				0.931			
	(14.243)				(3.122)				(13.118)			
$FE(g)_{i,t}$	-1.035				-0.440				-1.305			
	(-12.81)				(-3.689)				(-12.45)			
$FE(sbb)_{i,t}$	-0.538				-0.528				-0.524			
	(-4.056)				(-3.540)				(-2.068)			
$FE(b)_{i,t}$		1.008				0.764				1.057		
		(15.740)				(5.443)				(16.146)		
$FE(g)_{i,t+1}$		-1.360				-0.997				-1.596		
		(-17.76)				(-8.231)				(-18.32)		
$FE(sbb)_{i,t+1}$		-0.634				-0.623				-0.862		
		(-4.326)				(-3.456)				(-4.077)		
$FE(b)_{i,t+1}$			0.993				1.010				0.976	
			(28.545)				(15.224)				(24.041)	
$FE(g)_{i,t+2}$			-1.256				-0.873				-1.450	
			(-18.93)				(-8.789)				(-17.85)	
$FE(sbb)_{i,t+2}$			-0.836				-0.934				-1.031	
			(-6.726)				(-5.894)				(-5.795)	
$FE(b)_{i,t+2}$				0.953				0.875				0.992
				(31.181)				(17.266)				(24.211)
$FE(g)_{i,t+3}$				-1.285				-0.811				-1.534
				(-18.62)				(-7.512)				(-17.40)
$FE(sbb)_{i,t+3}$				-0.728				-0.781				-0.837
				(-6.350)				(-5.549)				(-4.586)
Adj. R-squared	0.784	0.876	0.922	0.940	0.460	0.798	0.886	0.895	0.865	0.934	0.951	0.964
Test of fixed effects (probability value)	0.014	0.000	0.022	0.222	0.047	0.006	0.235	0.735	0.033	0.000	0.006	0.039

Note: Country fixed effects are not reported; entries in brackets are t-ratios; there are 200 observations for the estimation in column (iii), 199 observations in column (iv), 100 observations in column (xi), 99 observations in column (xii). **Source:** Authors' estimations.

4. Impact of the net expenditure rule on budgetary outcomes

The expenditure benchmark was introduced in the 2011 "six pack" reforms of the Pact and took effect in 2012. It was conceived as a means by which member states could reach or remain at their medium-term objective of a structural budget balance close to zero. The requirement was that the relevant net expenditure heading would grow by less than the potential output growth rate when the MTO had not yet been achieved. Although the expenditure rule, or limit, does not apply once the MTO is achieved, such spending would then be expected to grow in line with the potential growth rate once the objective had been met.[7] The November 2022 proposals for revised EU fiscal rules envisage a continued role for the expenditure benchmark. On this occasion, the rule would be followed by member states with debt ratios above 60 per cent in the expectation that compliance with it would see the debt ratio decline towards the Maastricht Treaty's 60 per cent level over time.

While the expenditure rule would now apply in a different manner under the November 2022 proposals, it is worth considering whether its application during the "six pack" era had an effect on the forecast errors of the headline budget numbers, i.e. the budget balance and debt ratios. Such an assessment might be instructive as to the expenditure rule's possible impact under the new rules. To undertake such an analysis, we make use of the size of the gap that arises between the medium-term objective (MTO) and the structural budget balance ratio in year $t-1$, with the latter subtracted from the former. From this calculation, we create two variables. The first includes those observations where the gap is positive, i.e. the medium-term objective was not met in year $t-1$, and all other entries for that variable are given a value of zero; of the 201 observations, there are 122 where a positive gap arises, with the largest gap observation being 7.4 per cent. This gap variable is denoted as $MTOPOS_{i,t-1}$. A variable denoted as $MTONEG_{i,t-1}$ has a negative gap value for the 79 other observations, and zero otherwise, with the largest gap, in absolute terms, being 3.5 per cent. It represents those instances where the structural budget balance equated with or exceeded the medium-term objective in year $t-1$.[8]

[7] As well as being intended to steer member states' structural budget balance towards their medium-term objective, the net expenditure rule was also intended to have a damping effect on government spending over the cycle. Against a general finding of pro-cyclical expenditure arising in EU member states in the 2010s, Cronin and McQuinn (2021b) find a member state not having met its medium-term objective being associated with a less pro-cyclical government spending policy. Likewise, Belu Manescu and Bova (2020) find pro-cyclical fiscal policy in the EU being tempered by expenditure rules.

[8] These gap variables were also employed by Cronin (2020) in an assessment of member states' compliance with the EU fiscal rules during the 'six pack' era.

Exploratory regressions indicated these two variables to be insignificant in the regressions where the forecast error in the debt ratio is the left-hand-side variable; hence, they were excluded in the estimations reported in the previous section. The budget balance ratio is the principal fiscal determinant of the debt ratio and both $MTOPOS_{i,t-1}$ and $MTONEG_{i,t-1}$ were found to have explanatory power in regressions of the following form:

$$FE(b)_{i,t+j} = B_1 FE(g)_{i,t+j-1} + B_2 FE(sbb)_{i,t+j} + \delta_1 MTOPOS_{i,t-1} + \delta_2 MTONEG_{i,t-1} + \sum_{i=1}^{26} B_{3+i} CD_i + \varepsilon_{i,t+j} \qquad (3)$$

Where FE represents the forecast error for the variable in question; b, g, sbb are defined as previously; i is the country; j has a value of zero for the current year, one for the following year, etc.; the B terms are coefficients to be estimated; CD_i are country-specific dummies and ε is an error term.[9]

The estimations of (3) for years t to $t+3$ are reported in Table 5, with full-sample, low-debt and high-debt samples used once again. In eleven of the twelve columns, the coefficients on the forecast error in the real growth rate are significant at the five per cent level, in a range of 0.134 to 0.332. The positive coefficient is the expected sign as the outturn growth rate being higher (lower) than forecast will boost (reduce) the cyclical component of the budget balance relative to that projected. The coefficients on the forecast error of the structural budget balance ratio also have a significant, positive sign throughout the columns. They have lower values in the columns where forecast errors for year t are under consideration (in a range of 0.322 to 0.808) and then have a value of close to one in all other columns. The sign indicates that the realised structural budget balance proving to be higher (lower) than forecast has a similar effect on the budget balance, as would be expected *a priori*. Coefficient values being insignificantly different from one point to a more-or-less full pass-through of an error in forecasting the structural budget balance ratio to the headline budget ratio.

Turning to the MTO variables, the coefficient on the $MTOPOS_{i,t-1}$ variable is significant and negative in three of the (i) to (iv) columns of Table 5, in a range of -0.172 to -0.235. Similar qualitative coefficient values arise on this variable in the less-than-60-per-cent regressions (columns (v) to (viii)). The negative sign indicates that, for those member states not to have

[9] A dummy variable with had a value of one if the MTO had not been met and zero otherwise was considered in exploratory estimations explaining forecast errors in the debt ratio and in the budget balance ratio. It was insignificant in all such regressions and, thus, was excluded in the final estimations reported here.

met their MTO, a budget balance ratio poorer than that forecast arises. This points to member states who were expected to follow the net expenditure rule realising a budget balance ratio that is worse than forecast. The larger the gap between the structural budget balance in year $t-1$ and the MTO then the bigger this negative impact on the budget balance forecast error is, all else being equal. For example, the coefficient value of -0.172 in column (i) indicates that a member state whose structural budget balance was, say, 0 per cent in year $t-1$ and whose MTO was 1 per cent made a forecast error of its budget balance ratio of close to (minus) one-fifth of one per cent of GDP in year t, all else being equal.[10] The coefficients on the $MTONEG_{i,t-1}$variable are insignificant in all columns of Table 5. An insignificant coefficient indicates that a member state having met its MTO, and thus not being subject to the net expenditure rule, of itself induces no bias to the forecast of the budget balance ratio.

The most notable feature of Table 5 is that the coefficients on the $MTOPOS_{i,t-1}$ variable are insignificant in three of the columns (ix) to (xii), which are those columns where the debt ratio in year $t-1$ exceeded 60 per cent. The exception is column (xii) where the coefficient of -0.258 and the attendant t-ratio is -2.253. The insignificant coefficient values mean that where a high debt (greater-than-60 per cent debt ratio) member state has a structural budget balance less than its MTO (which arises for 75 of the 101 high debt observations) that situation does not, in general, explain the forecast error in the budget balance ratio. This can be interpreted as reflecting favourably on such countries as it indicates no inclination on their part to provide a biased forecast of the budget balance ratio even though they have not met their MTO.

[10] To give another example, in column (iii), the significant coefficient value on $MTOPOS_{i,t-1}$ is -0.235. In this case, the same member state would have made a forecast error in the budget balance ratio for year $t-2$ of just under (minus) one-quarter of one per cent of GDP.

Table 5. Determinants of forecast errors in the budget balance ratio (unbalanced panel)

	All observations (201)				Ob.s where d_{t-1}^{i}<60% (100)				Ob.s where d_{t-1}^{i}>60% (101)			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)
Dependent variable	$FE(d)_t$	$FE(d)_{t+1}$	$FE(d)_{t+2}$	$FE(d)_{t+3}$	$FE(d)_t$	$FE(d)_{t+1}$	$FE(d)_{t+2}$	$FE(d)_{t+3}$	$FE(d)_t$	$FE(d)_{t+1}$	$FE(d)_{t+2}$	$FE(d)_{t+3}$
Constant	0.169 (1.119)	-0.048 (-0.330)	0.092 (0.514)	0.191 (1.252)	0.250 (1.241)	0.189 (1.248)	0.320 (2.449)	0.148 (1.347)	0.182 (0.822)	-0.368 (-1.401)	-0.236 (-0.624)	0.413 (1.213)
$FE(g)_{i,t}$	0.134 (2.955)				0.192 (2.256)				0.094 (1.772)			
$FE(sbb)_{i,t}$	0.631 (8.573)				0.808 (7.790)				0.322 (2.533)			
$FE(g)_{i,t+1}$		0.310 (10.900)				0.319 (7.153)				0.332 (8.226)		
$FE(sbb)_{i,t+1}$		0.964 (19.506)				0.936 (14.115)				0.913 (9.123)		
$FE(g)_{i,t+2}$			0.243 (9.101)				0.185 (6.707)				0.267 (6.370)	
$FE(sbb)_{i,t+2}$			1.129 (20.579)				1.114 (25.657)				1.130 (11.090)	
$FE(g)_{i,t+3}$				0.232 (10.87)				0.215 (9.052)				0.236 (7.261)
$FE(sbb)_{i,t+3}$				1.131 (26.252)				1.043 (28.462)				1.251 (15.467)
$MTOPOS_{i,t-1}$	-0.172 (-2.393)	-0.084 (-1.184)	-0.235 (-2.699)	-0.190 (-2.644)	-0.322 (-2.265)	-0.003 (-0.034)	-0.221 (-2.347)	-0.132 (-1.682)	-0.149 (-1.766)	-0.057 (-0.563)	-0.214 (-1.531)	-0.258 (-2.253)
$MTONEG_{i,t-1}$	-0.093 (-0.611)	-0.157 (-1.025)	0.096 (0.498)	0.163 (1.028)	-0.170 (-0.861)	-0.069 (-0.464)	0.191 (1.383)	0.169 (1.402)	0.176 (0.611)	-0.201 (-0.566)	-0.212 (0.466)	0.153 (0.411)
Adj. R-squared	0.443	0.848	0.825	0.888	0.541	0.905	0.938	0.961	0.297	0.795	0.726	0.826
Test of fixed effects (probability value)	0.007	0.000	0.000	0.003	0.466	0.000	0.000	0.000	0.012	0.003	0.002	0.030

Note: Country fixed effects are not reported; entries in brackets are t-ratios; there are 200 observations for the estimation in column (iii), 199 observations in column (iv), 100 observations in column (xi), 99 observations in column (xii). **Source:** Authors' estimations

5. Conclusion

This paper has focussed on debt ratio forecasting performance in EU member states over the period 2012 to 2019 with a view to assessing the challenges that may face policymakers if, as proposed by the European Commission, the debt ratio becomes central to the EU fiscal rules in the years ahead. The main finding is that member states were irrational and overly optimistic in their forecasts of the debt ratio, in the sense that released debt ratios proved higher than projections, during that time. While most SCPs set out a reduction in debt ratios over the forecast horizon, an observed fall in ratios occurred in less than half the sample, including among those member states that had high debt ratios. It is also established that member states provided biased forecasts of other critical variables in their SCPs, namely, the budget balance ratio, the real GDP growth rate and the structural budget balance ratio. In the econometric analysis, debt ratio errors are explained, inter alia, by errors in forecasting the real output growth rate and the structural budget balance ratio. Where forecasts of those variables are unduly optimistic, they will contribute to higher-than-expected debt ratios arising *ex-post*.

Were these tendencies in forecasting output growth and the policy stance to continue under the new fiscal regime then realised debt ratios will also be greater than initially projected. There is also the danger that were the debt ratio to become the primary focus of the EU fiscal rules then that could itself induce an additional source of bias to forecasts, perhaps peculiar to that variable alone. It is worth noting too that revisions to the EU fiscal rules, including those of 2011, had a focus on improved forecasting by member states. This is not supported by the empirical analysis here, which shows issues of bias occurring and of a tendency for projected declines of already high debt ratio not to be realised. Such deficiencies can reflect strategic and political factors having a bearing on budgetary processes. In summary, the evidence provided here supports the central contention of Leal *et al.* (2008) that the EU fiscal rules placing a strong emphasis on fiscal forecasting makes for a challenging setting for practitioners in the area to undertake their work.

The new fiscal rules envisage a prominent rule for limits on net expenditure growth where debt ratios exceed 60 per cent. A similar stipulation was initiated in the "six pack" rules of 2011 for member states who had yet to meet their medium-term objective. The full-sample evidence presented here is that member states who had not met their MTO during the 2012 to 2019 sample period provided unduly optimistic forecasts of the budget balance ratio in their SCPs. All else being equal, this would also have resulted in debt ratios being higher than projected. While the target of the imposition of a net expenditure rule differs between the "six pack" and the November 2022 rules proposals, the estimations here suggest some scepticism being warranted in relation to it achieving its goal in a new fiscal policy regime.

Against that, the continued emphasis on an expenditure rule may provide general support for budgetary discipline in EU countries. Belu Manescu and Bova (2021) note that the introduction of the expenditure benchmark into the EU fiscal rules in 2012 was a major catalyst to spending rules being included in national frameworks. As mentioned above, such rules also appear to have tempered the pro-cyclicality of fiscal policy during the 2010s. A difficulty, however, may be that the expenditure benchmark will be effectively ignored by those countries to whom it is supposed to apply at the time budgetary policy is being formulated and passed through parliament. There is also the issue of the expenditure benchmark currently employed within the EU fiscal rules being a complex indicator and relying on data that may not be available to domestic authorities at the time budgetary policy is being formulated (Marinheiro, 2021). These features indicate that the high-level targets of the current fiscal rules proposals of focussing on the debt ratio and a complementary expenditure rule must occur alongside a clear and straightforward implementation framework.

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