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Is the Road to Hell Paved with Good Intentions? An Empirical Analysis of Budgetary Follow-up in the EU¹

¹ We thank an anonymous referee for very helpful comments on an earlier version of this paper.

By Roel Beetsma,² Matthias Busse,³ Lorenzo Germinetti,⁴ Massimo Giuliadori⁵ and Martin Larch⁶

Abstract

We study the one-year-ahead budgetary projections from the Stability and Convergence Programmes (SCPs) of EU Member States since the start of the Economic and Monetary Union (EMU) until the start of the coronavirus crisis. First, we consider errors of the general government's headline budget-balance, which we then split into expenditure and revenue errors. Next, we split the latter two into "base", "growth" and "denominator" effects. We find that the most important explanatory variable is the GDP growth error: more optimism in GDP growth projections produces more optimistic budgetary projections. This effect goes beyond a mechanical denominator effect on spending and revenues as shares of GDP; it also works through the numerator of these ratios. Our findings may call for delegating the construction of output projections to adequately equipped national independent fiscal institutions. Finally, we explore how independent fiscal institutions shape projection errors. Those with high media impact producing or assessing the macroeconomic forecast appear to lead to actual budgetary improvement relative to projections.

Date: March 2023

Keywords: budgetary follow-up, projection, first-release error, general government headline budget balance, revenues, expenditures.

JEL codes: G11, G12, G18, E62.

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Abstract

We study the one-year-ahead budgetary projections from the Stability and Convergence Programmes (SCPs) of EU Member States since the start of the Economic and Monetary Union (EMU) until the start of the coronavirus crisis. First, we consider errors of the general government's headline budget-balance, which we then split into expenditure and revenue errors. Next, we split the latter two into "base", "growth" and "denominator" effects. We find that the most important explanatory variable is the GDP growth error: more optimism in GDP growth projections produces more optimistic budgetary projections. This effect goes beyond a mechanical denominator effect on spending and revenues as shares of GDP; it also works through the numerator of these ratios. Our findings may call for delegating the construction of output projections to adequately equipped national independent fiscal institutions. Finally, we explore how independent fiscal institutions shape projection errors. Those with high media impact producing or assessing the macroeconomic forecast appear to lead to actual budgetary improvement relative to projections.

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1. Introduction

Accurate macroeconomic and budgetary projections are crucial for the fiscal instrument settings by the government and for the confidence of the private sector (in particular the financial markets) in a country's public finances. Using the Stability and Convergence Programmes (SCPs) of 27 European Union (EU) countries since 1999, we explore the errors in national budgetary projections and their driving factors.¹ The main contributions of this paper are the following: (1) we deploy the largest comprehensive dataset used so far for the purpose of exploring budgetary follow-up in the EU, covering the full available set of EU countries over the period since the start of the Economic and Monetary Union (EMU) until just before the coronavirus crisis; (2) this allows us to also consider sub-sample periods; (3) we analyse the driving factors of the components of the general governments' headline budget balance forecast errors, namely the errors in revenues and expenditures, which we then decompose further into "base", "growth" and "denominator" effects. This decomposition gives a clearer perspective on the sources of the projection errors.

In our analysis we focus on the so-called "first-release errors", i.e. the difference between the observation one year before and one year after the reference period. These need to be distinguished from the "ex-post errors", the latest vintage's value minus that in the year preceding the reference period. An advantage of using the first-release instead of *ex-post* errors is that the former compare values after and before the reference year that are better comparable in terms of methodology than the values making up the *ex-post* errors, as methodological changes may gradually cumulate over time. Another advantage is that first-release errors form the basis for the real-time monitoring by the fiscal authorities and financial markets.

We find that the most important explanatory variable of the first-release budget error, as well as its components, is the first-release (real) GDP growth error. The result can be explained by the fact that budgetary projections are based on projections of economic growth and, the more optimistic (pessimistic) economic growth projections are, the more optimistic (pessimistic) budgetary projections can be. Further, we find that the first-release errors are quite persistent. However, the persistence is substantially larger during the first phase in the sample than during the second phase, potentially a result of improved scrutiny of the forecasts over last decade. The fact that over the second part of our sample SCPs were already submitted in April (instead of in the fall) may have contributed to better scrutiny. In line with the intention of the European Semester, the earlier submission may have put pressure on governments to prepare for policies that are later validated through the formal budget for the coming year. Finally, we explore how the institutional setting affects the first-release budget error. The presence of an independent fiscal institution (IFI) with high media impact producing or assessing the macroeconomic forecast appears to lead to actual budgetary improvement relative to projections.

The role of the first-release GDP growth error may yield some important policy lessons. Our results demonstrate that institutional settings generating more accurate GDP growth projections should also generate more accurate budgetary projections. More accurate GDP growth projections will lead to budgets subject to fewer corrections during implementation, hence more budgetary stability, which should be conducive in terms of efficient allocation of public and private resources. More accurate budgeting also benefits a government's standing in the financial markets, which dislike erratic fluctuations in budgetary implementation.

How can GDP growth projections potentially be improved? In euro area countries, the 2013 "two-pack" reform of the Stability and Growth Pact (SGP) requires these projections to be produced by an independent institution or to be endorsed by such an institution. While only a few countries use it, the former is preferable for various reasons. First, the IFI may be reluctant to not endorse the projections underpinning the budget because forecasts are inherently uncertain and because the European Commission may come to a different conclusion. In fact, most IFIs use rather circumspect language

¹ Given the period covered, the EU 27 contains all current EU Member States with the exception of Croatia, but still including the United Kingdom.

when characterising the governments projections. As a result, governments may exploit the IFIs' reluctance by predicating their budgets on unrealistic forecasts. Second, based on the information it has, a truly independent fiscal institution is likely to provide an unbiased projection of GDP growth. Obviously, growth will generally turn out to differ from its projection, but on average the projection will be roughly correct. Third, mandating an IFI with the construction of the macro-projections, it will acquire the necessary analytical capacity, which will also benefit its other work.

This paper links to other papers studying the quality of macro and budgetary forecasts, many of them focusing on the EU or the euro area. Examples are Strauch *et al.* (2004), Brück and Stephan (2006), Jonung and Larch (2006), Beetsma *et al.* (2009), Frankel (2011), Pina and Neves (2011), Cimadomo (2012), Beetsma *et al.* (2013a,b), De Castro *et al.* (2013), Frankel and Schreger (2013), Gupta *et al.* (2017) and Flores *et al.* (2021). Merola and Pérez (2013) compare fiscal forecasting of governments and international institutions, and indicate that the information disadvantage of the latter inhibits their forecasting performance. This leads them and other studies mentioned above to suggest national IFIs as the natural candidate for fiscal forecasting.² Several contributions investigate how fiscal frameworks influence the quality of the fiscal projections. Debrun *et al.* (2008) explore the role of national fiscal rules in EU countries. Gilbert and De Jong (2017) obtain evidence of budgetary over-optimism for euro area countries whose budget deficits risk to exceed the 3% reference value, while no such effect is found for non-euro area countries. Debrun and Kinda (2017) find that well-designed IFIs are associated with more accurate macroeconomic and budgetary forecasts. Beetsma *et al.* (2019) find evidence for the EU that in the presence of an IFI fiscal forecasts are more accurate and potentially less optimistic. Gootjes and De Haan (2022) show that, although fiscal plans are a-cyclical, their realizations are pro-cyclical. Fiscal rules reduce such pro-cyclicality (see also Larch *et al.*, 2021). We extend the existing literature by using a more comprehensive dataset and decomposing the revenue and expenditure errors into their components, allowing to account for the mechanical (“denominator”) effects of GDP growth errors on budget forecast errors.

The remainder of this paper is organized as follows. Section 2 presents the dataset, of which a descriptive analysis is provided in Section 3. Section 4 conducts the econometric analysis on the general governments' headline budget balance forecast errors, while Section 5 analyses the decomposition of the latter into their components. Section 6 turns to the role of the IFIs. Finally, Section 7 concludes the paper. The Appendix contains material that is not for publication.

2. The Data

The core of our data are the SCPs of 27 EU countries over the period 1998-2020. Each country submits a Stability Programme if it is a member of the euro area and a Convergence Programme if it is not a member of the euro area. In the past, these programmes had to be submitted in the fall of the year. Since 2011, as part of the European Semester, they are submitted between mid and end April. This change was meant to strengthen multilateral fiscal surveillance at the EU level by asking member states to share budgetary plans earlier in the year and to allow the Commission and the Ecofin Council to put pressure on governments to correct policies that go astray.

The SCPs contain information on the headline budget balance, public expenditures, public revenues, public debt and interest payments of the general government, as well as nominal and real GDP and inflation. Reported are last-year values (first-release), current-year values (nowcast) and projections for at least the first three years into the future. The advantage of using the SCPs for the current study is their broad coverage and the fact that the figures are comparable across countries, because the reporting requirements are the same and the figures are vetted by Eurostat.

² For an overview of the IFIs in the different EU member states and the role they have played in their early years of operation, see Jankovics and Sherwood (2017). See also Horvath (2018). Beetsma *et al.* (2022) analyse how IFIs can enhance fiscal transparency.

Besides the SCPs, we obtain *ex-post* (i.e. latest available) figures from the European Commission's AMECO database. These *ex-post* figures may for various reasons differ substantially from the earlier real-time figures. In particular, new information may become available after publication of the latter, which may lead to an adjustment of the original real-time figures. Figures may also be subject to revision because of changes in the methodology to construct them (Beetsma *et al.*, 2013a).

Further, we gather data on national fiscal frameworks. First, we obtain the Fiscal Rule Index from the European Commission (2020). It is an index of national fiscal rules and its construction is described in e.g. Debrun *et al.* (2008). It combines both the strength and the coverage of all rules in existence, which could apply to different government sectors or levels. Strength is based on (1) the statutory or legal base of the rule (the highest score being for a constitutional one); (2) the body that monitors the rule (an independent authority or the national parliament achieves the highest score); (3) the body that enforces the rule (again, an independent authority or the national parliament achieves the highest score); (4) the enforcement mechanism (automatic corrections and sanctions for non-compliance achieve the highest score); and (5) visibility in the media. Then strength is weighted by the share of general government finances covered by the rule and, finally, the resulting weighted scores are aggregated over all rules present. In case multiple rules apply to the same general government sub-sector their weights, except for that of the strongest, are halved. Second, from the IMF Fiscal Council Dataset (2016) we obtain time-varying information on key features of existing fiscal councils, including on whether they produce or assess the macroeconomic forecasts used in the budgetary process, on their media impact, and on formal guarantees for their independence. Third, we collect World Bank Worldwide Governance Indicators for Voice and Accountability and Government Effectiveness.

Finally, we obtain data on political variables from Armingeon *et al.* (2020), a widely used and regularly updated comprehensive dataset containing a large number of political variables. The dataset allows us to obtain information on changes in government,³ government fragmentation, the political leaning of the government and changes in the government's ideological composition.

For fiscal measures and GDP growth measures published in different vintages, we can extract the following variables from the available data (where the subscript is the year to which the variable applies and the superscript is the vintage, i.e. the year in which the variable is published):

x_t^t : the *nowcast* is the (preliminary) value of x in t reported in vintage t .

x_t^{t+1} : the *first-release* value of x in t reported in vintage $t + 1$.

$x_t^{t-\tau}$: the projection of x in t reported in the vintage τ years prior (i.e., the τ -years ahead forecast).

x_t^f : the *final* or *ex-post* value of x in t reported in the latest available vintage of the data.

$x_t^{t+1} - x_t^{t-1}$: first-release forecast error.

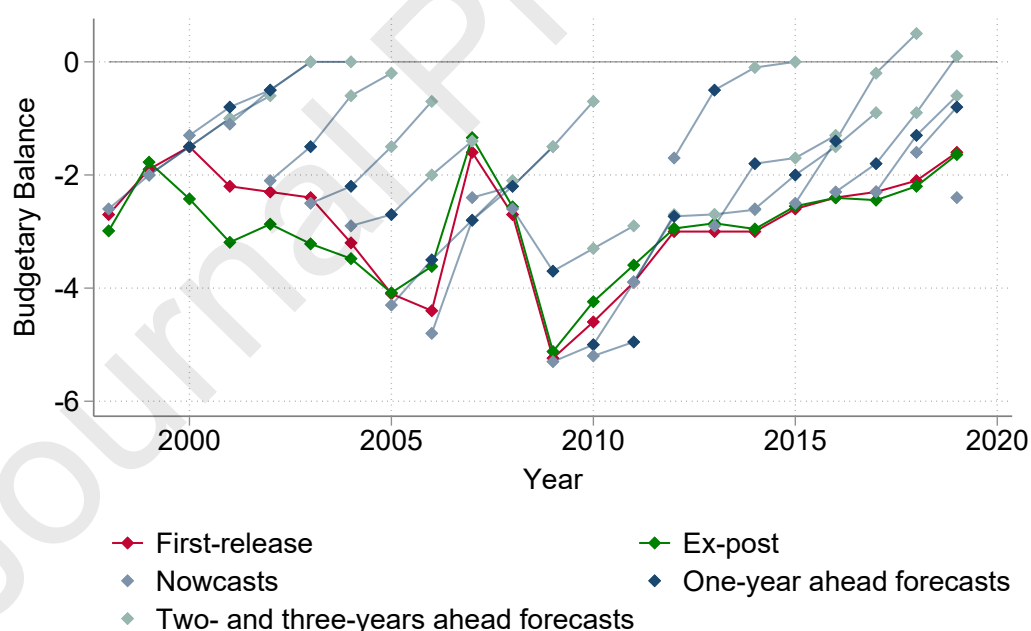
Fiscal variables are presented in percent of GDP, unless noted otherwise.

³ We use government changes instead of elections, as early testing indicates that the same results are obtained when using either elections or government changes.

3. Descriptive analysis

This section provides a descriptive analysis of the EU projection errors. Figure 1a depicts for Italy for each sample year t in blue the nowcast bb_t^t and the one-, two- and three-years ahead forecasts (bb_{t+1}^t , bb_{t+2}^t and bb_{t+3}^t) all taken from the SCP vintage year t , and in red the first-release value of the budget balance, bb_{t+1}^{t+1} , taken from the SCP vintage year $t+1$. Here, bb refers to the general government's headline budget balance, i.e. including interest expenditure.⁴ In the remainder of this paper we will refer to this specific budgetary aggregate as the 'budget balance'. The vertical difference between the red diamond and the dark blue diamond is the first-release forecast error in the budget balance. The figure clearly shows the good intentions embedded in the SCPs. Typically, the projected path of the budget balance exhibits an upward trend, indicating that the government becomes more ambitious about the budget balance the further out in time. This confirms an observation already made in earlier work (Beetsma *et al.*, 2009). Comparing the budget balance projections into the future with their first-release values in the different years, the figure shows that the latter systematically fall below the earlier projections for the same year, indicating that the government's reported ambitions are not fulfilled. This is also the case when the comparison is made with the *ex-post* figures, which are depicted in green. Comparable figures conveying the same message can be constructed, for example, for Belgium and Portugal (see Appendix A). While the pattern seen for Italy is less pronounced for the EU members on average, especially in recent years, we still see a systematic pattern of budget balance projections increasing with the projection horizon (see Figure 1b, which depicts the averages across the series for the individual Member States). We also see that the ambitions are often missed in a negative direction.

Figure 1a: Projections, first releases and *ex-post* values of the budget balance for Italy

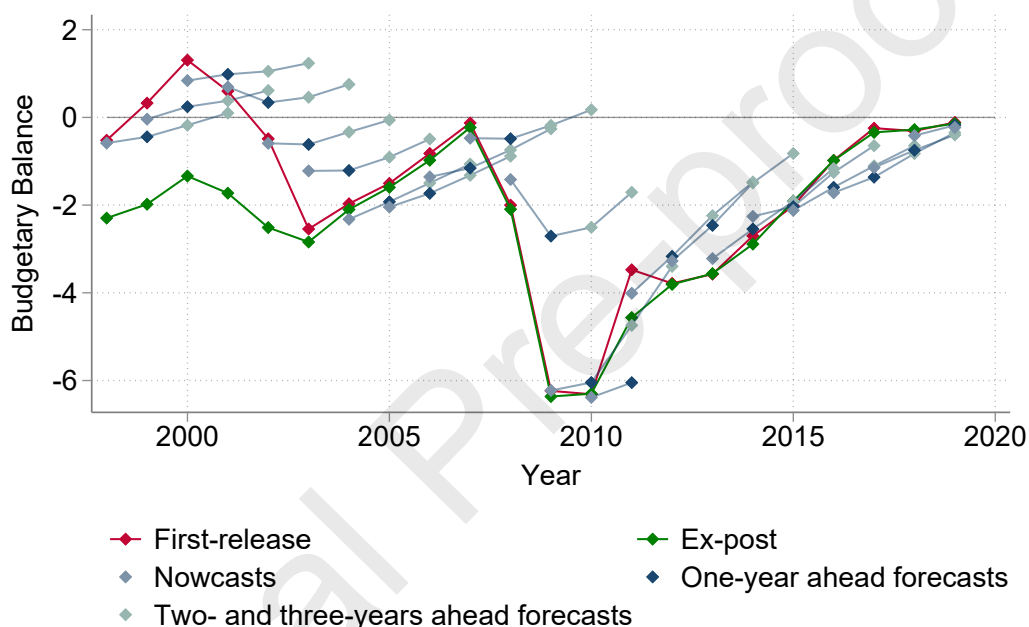


Notes: nowcasts are the figures reported in the reference year, first-release figures are reported in the year after the reference year, one-year (two-year, three-year) ahead forecasts are constructed in the year (two years, three years) preceding the reference year and *ex-post* figures are the figures reported for the reference year in the most recent data vintage used.

⁴ We focus on the headline balance of the general government as opposed (i) the primary balance, and (ii) the central government, because the EU's SGP is built around that aggregate variable.

In the sequel we will work with first-release instead of *ex-post* figures. One reason is that in terms of methodology first-release date are closer to the original projections than are *ex-post* values. Another is that under EU fiscal surveillance any decision involving possible procedural steps is typically taken on the basis of first-release data. Finally, we observe that with the exception of the first few years of our sample, first-release values are very close to *ex-post* figures. Hence, in the sequel errors are always taken to be first-release errors.

Figure 1b: Projections, first releases and *ex-post* values of the budget balance for EU countries



Notes: see Notes to Figure 1a.

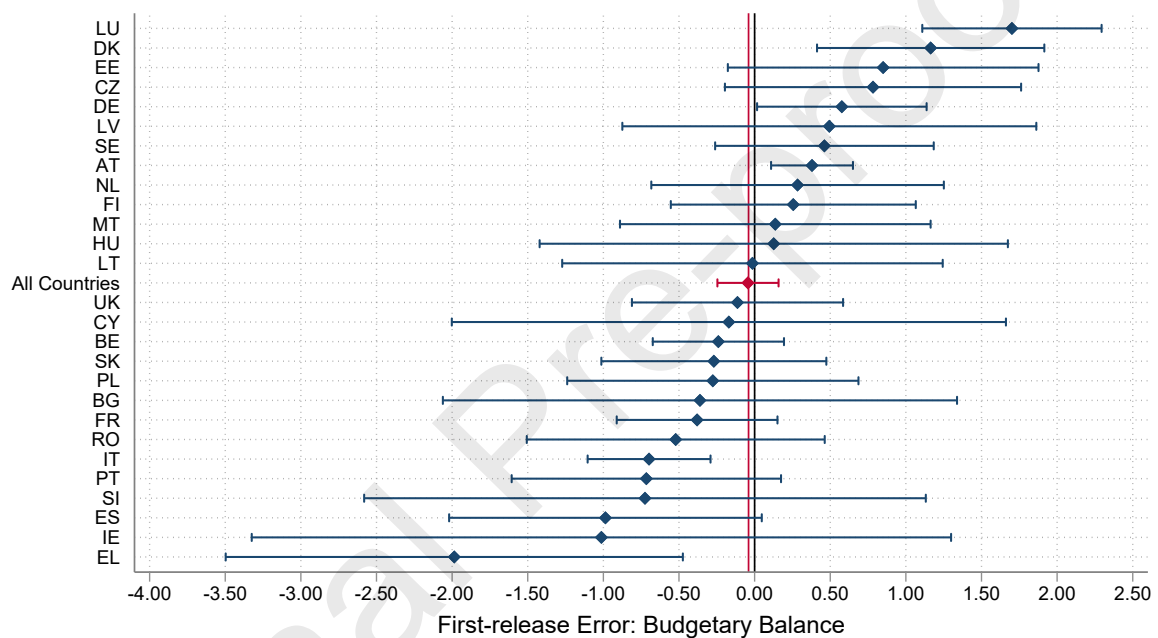
To offer some further perspective on potential biases in the projections of the budget balance, Figure 2a depicts by country the averages, and the 95% confidence intervals around these averages, of the forecast errors for the budget balance, defined as $bb_t^{t+1} - bb_t^{t-1}$, over the full sample period. Note that an over-optimistic forecast will result in a negative forecast error, as the first-release value of the budget balance will be lower than the one-year ahead forecast (and *vice versa* for an over-pessimistic forecast). It is interesting to see that the average error across all the countries is very close to zero. Hence, in contrast to a somewhat widely held view, we find in the aggregate no over-optimism bias for EU countries.⁵ However, it is true that at the level of individual countries there may be systematic over-optimism or over-pessimism. Most systematically over-pessimistic is Luxemburg, which is too gloomy

⁵ This result does not mean forecast errors are irrelevant from the EU perspective – recall the initial gross underestimation of the 2009 Greek budget deficit, which marked the start of the unrest in the euro area sovereign debt market, eventually resulting in the euro area debt crisis. Budgetary policy remains a prerogative of member states where systematic policy mistakes may spill over to other countries and affect the stability of the economic union as a whole.

by on average 1.75% of GDP. Most systematically over-optimistic is Greece, which is over-optimistic by 2% of GDP on average. It should be noted though that not many of these averages are significant, due to the rather wide confidence intervals around the averages.⁶

Splitting the sample period into the two sub-periods 1999-2008 and 2009-2019, we observe that the first sub-period is characterized by an average degree of over-optimism, while the second sub-period is characterized by an average degree of over-pessimism. Both averages are quite small, though. Figure 2b plots by country the average forecast error in the second sub-period against that in the first sub-period. There is a positive relationship between the two sub-periods, but it is far from perfect. A diehard in terms of conservatism is Luxemburg, while Greece is a diehard in terms of over-optimism.

Fig. 2a: Average forecast errors of the budget balances (1999-2019)



Notes: (1) AT = Austria, BE = Belgium, BG = Bulgaria, CY = Cyprus, CZ = Czech Republic, DE = Germany, DK = Denmark, EE = Estonia, EL = Greece, ES = Spain, FI = Finland, FR = France, HU = Hungary, IE = Ireland, IT = Italy, LT = Lithuania, LU = Luxembourg, LV = Latvia, MT = Malta, NL = the Netherlands, PL = Poland, PT = Portugal, RO = Romania, SE = Sweden, SI = Slovenia, SK = Slovakia, UK = United Kingdom; (2) the horizontal line corresponds to the 95% confidence intervals based on plus/minus 1.96 standard errors around the mean.

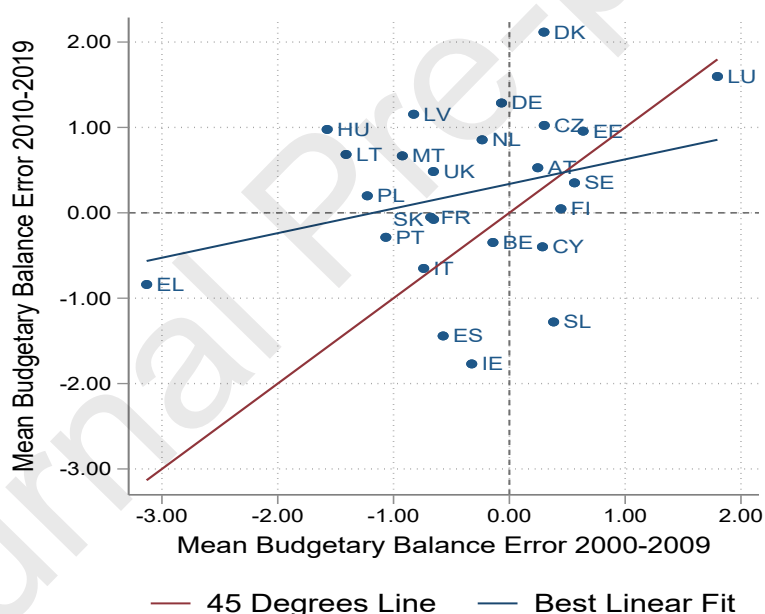
An obvious question is to what extent systematic biases in budget balance projections may be explained by systematic biases in GDP growth projections: the logic is that governments plan their taxes and expenditures on the basis of projected GDP growth. If the growth projection is over-optimistic, then realized tax revenues will on average fall short of projected revenues, leading to a negative budget balance forecast error. However, even if GDP growth projections are unbiased, budgetary forecast errors could be systematically biased if the government uses a systematically too high revenue elasticity.

⁶ One might wonder to what extent the pattern in Figure 2a is driven by the crisis years 2009 – 2012. Large, negative forecast errors are observed in particular in 2009, while in 2011 the average error is positive and quite large. However, leaving out these years results in a pattern that is still similar to that in Figure 2a (see Appendix B).

A projected increase in GDP growth would then result in an exaggerated projected increase in revenues.⁷ Figure 3(a) shows a scatter plot of the relationship between the budget balance forecast error and the real GDP growth error. As expected, the two errors are positively correlated. Figure 3(b) depicts the corresponding figure with nominal GDP growth, which exhibits a similar pattern. Hence, the conclusion is that budgetary and GDP growth errors are closely connected, a result that will emerge also from our econometric analysis below.

A priori, differences in the average size of the forecast error of the budget balance could also reflect the degree of control the central government effectively exercises over lower levels of governments. Specifically, federal states may find it more difficult to implement budgetary plans across all levels of government and hence display higher forecast errors. However, Figure 2a does not support this assumption: of the four EU member states that are generally classified as federal states - Belgium, Spain, Germany and Austria - two display on average over-optimistic forecasts (Belgium and Spain), the other two over-pessimistic forecasts. One likely explanation is that federal states rely on different institutional arrangements for planning and implementing budgetary policies supporting diverging outcomes. In particular, the design of national fiscal frameworks, rules and IFIs can play an important role and are included in the inferential statistical analysis in Section 4 below.

Fig. 2b: Averages of forecast errors budget balances



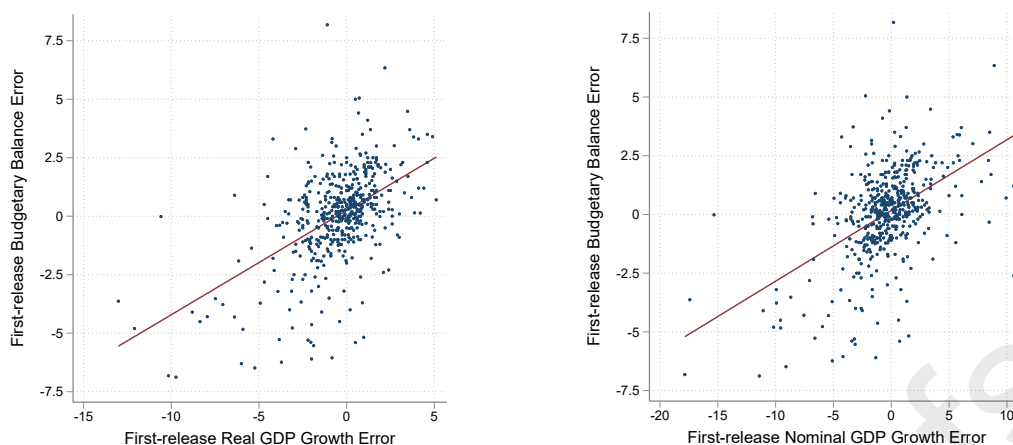
Notes: see Notes to Figure 2a.

Figure 3: Scatter plots of errors in the budget balances and in GDP growth

(a) Real GDP growth

(b) Nominal GDP growth

⁷ Use of a too high revenue elasticity raises the average absolute value of the budget balance forecast error, not the average value itself when projections of GDP growth are unbiased. Above-average growth then produces a too high revenue forecast, while below-average growth produces a too low forecast.



Notes: the figure excludes three data points, namely Greece in 2009, Ireland in 2010 and Slovenia in 2013. In these instances, the countries recorded an error in the budget balance of respectively -9.8%, -20.8% and -12.2%.

In the sequel, we will also analyse the decomposition of budget balance forecast errors into revenues and spending errors. Hence, Table 1 reports the variance-covariance matrix of the error in the budget balance, the error in revenues, $rev_{i,t}^{t+1} - rev_{i,t}^{t-1}$, and the negative of the error in expenditures, $exp_{i,t}^{t-1} - exp_{i,t}^{t+1}$. The variance of the first-release spending errors is higher than that of the budget balance, which in turn is higher than that of revenues. The positive covariance between the budget balance and the revenues error indicates that when actual revenues exceed their projection this contributes to the budget balance exceeding its projection. Similarly, the positive covariance between the budget balance and the negative of the spending error indicates that when actual spending falls short of its projection, this also contributes to the budget balance exceeding its projection. Spending errors contribute most to the budget balance forecast errors, which is clear from its co-variance with the budget balance forecast error being about four times higher in absolute magnitude than the covariance of the budget balance and the revenues error. A plausible explanation for this larger role of spending errors is that spending is relatively insensitive to unforeseen changes in the business cycle (see Larch and Salto, 2005). Most spending growth is pre-determined through benefit programs and other commitments and will not react, at least not in the short run, to an unexpected change in GDP growth. Hence, a slowdown in growth, or even negative growth, will lead to an increase in the spending ratio of GDP and, because revenues are strongly correlated with growth, produce a deterioration of the budget balance as a share GDP. Indeed, the higher covariance of the spending error with the budget balance forecast error is a reflection of the role of the automatic stabilizers.

Finally, the negative entry in the table indicates a positive covariance between the revenues and the spending errors. Hence, if actual spending exceeds its projection, then actual revenues tend to exceed their projection, and *vice versa*. The mechanism could run from spending towards revenues: actual spending exceeding its projection would lead revenues to be raised above their projection. *Vice versa*, deviations of actual revenue from their projection could drive spending adjustments. First, by cutting expenditure governments may try to make up for a budgetary shortfall caused by a revenue shortfall. Second, windfall revenues may not be used for building buffers, but for extra spending. We find that the covariance between the errors in revenues and expenditures is -3.71 when the forecast error in the budget balance is positive and -2.97 when the error is negative or equal to zero. The larger absolute size of the covariance when the budget balance forecast error is positive suggests that revenues might be a

stronger driver of spending when the former exceed their forecast than when they fall short of their forecast.⁸

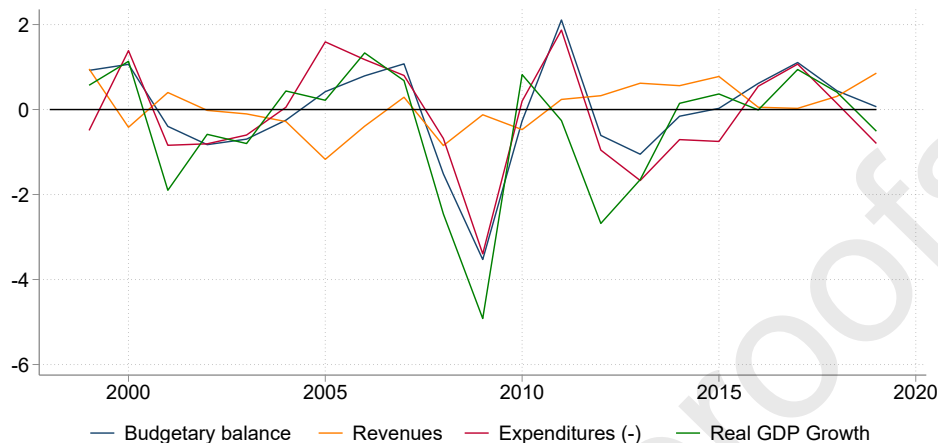
Table 1: Variance-covariance matrix of the errors

First-release error	<i>Budget balance</i>	<i>Revenues</i>	<i>Minus expenditures</i>
<i>budget balance</i>	5.18	1.12	4.05
<i>Revenues</i>		4.13	- 3.01
<i>Expenditures</i>			7.04

To close this section, Figure 4 depicts the average errors in the budget balance, revenues, minus expenditures and real GDP growth over time. The average error in the budget balance is closely tracked by the average error in minus spending, but less closely by that in revenues, in line with the much higher covariance between the budget balance forecast error and the error in minus spending than between the budget balance forecast error and the revenues error. The strong relationship between the budget balance forecast error and the error in minus spending is particularly striking during the global finance crisis (GFC) in 2009. As already pointed out, it illustrates the operation of the automatic stabilizers, rather than a mistake in planning: when GDP falls sharply compared to its forecast, spending plans are not adjusted or are adjusted with a delay, while revenues decline broadly in line with actual GDP. We can also observe a positive correlation between the budget balance forecast error and real GDP growth error. The commonality between the two is particularly strong during the GFC in 2009.

⁸ Leaving out the crisis years 2009 – 2012 yields a qualitatively similar variance-covariance matrix, but the variance of the budget balance forecast error is smaller now and so are (in absolute terms) the covariances between the budget balance error and the expenditures error and between the budget balance forecast error and the revenues error. However, the contribution to the variance in the budget balance forecast error is still dominated by the covariance between the budget balance error and the expenditures error (see Appendix F).

Figure 4: Average errors in the budget balances, revenues, minus expenditures and real GDP growth over time



Notes: The figure displays the evolution over time of the average errors across all countries. The error in expenditures is multiplied by (-1), so that all data points below zero indicate that on average the forecasts in question were over-optimistic (as the first-release values of revenues and expenditures were respectively below or above the forecast values).

4. Econometric analysis of the forecast errors of the budget balance

In this section we turn to our econometric analysis of the forecast errors of the budget balance. We are interested in what determines their potential over-optimism as well as their potential over-pessimism. As Figure 2a suggested, both may be present on a systematic basis, and it is important to uncover what causes one to occur versus the other. Since over-optimism is generally considered more undesirable than over-pessimism, we are interested what institutional arrangements can reduce over-optimism.⁹ Hence, we estimate models of the general format:

$$bb_{i,t}^{t+1} - bb_{i,t}^{t-1} = \alpha_i + \beta_t + \delta_1(bb_{i,t-1}^t - bb_{i,t-1}^{t-2}) + \delta_2(bb_{i,t-1}^{t-1} - bb_{i,t-1}^{t-1}) + \delta_3(y_{i,t}^{t+1} - y_{i,t}^{t-1}) + \delta_4 d_{i,t-1}^{t-1} + \mu_1 inst_{it} + \lambda_1 pol_{i,t} + \varepsilon_{it}, \quad (1)$$

in which the error of the budget balance is regressed on a country-specific constant α_i , a year-fixed effect β_t , the lag of the error, $bb_{i,t-1}^t - bb_{i,t-1}^{t-2}$, the lagged projection of the change in the budget

⁹ The ensuing econometric analysis is conceptually different from an analysis of the predictive accuracy of budgetary projections (e.g. Clark and West, 2007), which would at least be partially determined by the technical capabilities of the bodies making these projections and the quality of the data production. In fact, we find that the predictive accuracy of budgetary projections is to a substantial extent driven by that of GDP projections.

balance, $bb_{i,t}^{t-1} - bb_{i,t-1}^{t-1}$, the error in real GDP growth, $y_{i,t}^{t+1} - y_{i,t}^{t-1}$, the debt-to-GDP ratio $d_{i,t-1}^{t-1}$ at the moment the budgetary projection was made, a set of institutional variables $inst_{i,t}$ and a set of political variables $pol_{i,t}$. For now, $inst_{i,t}$ comprises the European Commission's fiscal rule index $fri_{i,t-1}$, that is at the moment the budgetary projection was made. We include the fiscal rule index, because *a priori* one would expect that tighter fiscal rules would go along with tighter monitoring of budgetary policy, reducing opportunities for deviations from budgetary plans. Political variables $pol_{i,t}$ include the number of government changes, $govchan_{i,t}$, and the government type, $govtype_{i,t-1}$. This latter variable increases in government fragmentation, from 1 (single-party majority), to 5 (multi-party minority) and then to 7 (technocratic government).¹⁰ Changes in government increase the likelihood of a break with existing commitments. Similarly, increased government fragmentation gives rise to stronger incentives to deviate from existing commitments by giving in to demands from dissident factions in order to keep them inside the government. We experimented with a much broader set of political variables. However, other political variables turned out not to play any role and, hence, in the following we do not include them in the analysis – see also below.¹¹

We include country-fixed effects to control for all the time-invariant differences in institutions across the countries that could systematically affect the potential degree of over-optimism or over-pessimism and because the country-fixed effects are jointly statistically significant, which justifies their inclusion from an econometric perspective. Year-fixed effects are included to control for common factors that may affect the budget balance errors, for instance business cycle developments, financial market developments and institutional changes at the EU level that affect all countries (e.g. EU-wide changes in budgetary monitoring or the calculation of macroeconomic aggregate, etc.). As they are jointly statistically significant, also from an econometric perspective their inclusion is warranted.

Table 2 reports the estimates for specific variants of (1). Estimation is via OLS or instrumental variables (IV), in order to instrument the real GDP growth error, with standard errors clustered at the country level. The most parsimonious variants, reported in Columns (1) and (2), leave out the political variables. Column (1) is based on OLS, and Column (2) on IV, because a feedback from the budget balance forecast error onto the real GDP growth error cannot be excluded: an unanticipated fiscal expansion could lead to an unanticipated increase in real growth. In the case of IV, following Beetsma et al. (2013a), we instrument the forecasting error in real GDP growth for a given country with the average forecasting error in real GDP growth in all the other countries (j) in the sample in the same year (i.e., the variable $\bar{y}_{j,t}^{t+1,t-1}$). Standard tests indicate that the instrument is valid.¹² In addition, the exclusion restriction for this instrument is valid as long as there is no feedback from the budget balance forecast error of a given country onto the real GDP growth error of *other* countries. Therefore, we assume that the budget balance forecast errors of a given country do not contemporaneously spill over onto the average growth rates of the other countries included in the sample. The differences in the estimates between the two columns are extremely small.

The lagged dependent variable is highly significant with a coefficient of 0.14, a value sufficiently low to suggest that the standard dynamic-panel bias from including the lagged dependent

¹⁰ One may raise the question whether a technocratic government represents the highest degree of fragmentation. However, a technocratic government does not represent a specific party or parties, while in a democratic system it would need to have the support from Parliament to implement its plans.

¹¹ We also investigated whether the threat to be subject to the Excessive Deficit Procedure (EDP) affects the governments' forecast errors by including different measures of the distance between the budget balance and a plausible threshold level used for the EDP (while the reference level for the deficit is 3% of GDP, in practice some margin may have been allowed before an EDP was started). There is some suggestive evidence that small transgressions of the 3% of GDP reference value for the deficit leads governments to make an unplanned additional effort to raise revenues.

¹² The Kleibergen-Paap rk Wald F-statistic for our instrument is well above the commonly used threshold level of 10. In addition, the Kleibergen-Paap rk LM statistic for the under-identification test allows us to conclude that the instrument is relevant.

variable is rather small.¹³ Notice that the significance of the coefficient is as such not an indication of a systematic forecasting bias. In fact, under rational expectations we expect $bb_{i,t}^{t+1} - bb_{i,t}^{t-1}$ and its lag to be correlated, because both are partially driven by new information becoming available in period t .¹⁴ The error in real GDP growth enters with a coefficient of around 0.26, which is highly significantly different from zero. An improvement of real growth relative to its projection in $t-1$ by 1% - point improves the budget balance by more than a quarter of a percentage point relative to its projection. An increase in the debt-to-GDP ratio by 1% - point improves the error by 2.3 basis points, a highly significant, though not very large, effect. Column (3) replaces the error in real GDP growth with that in nominal GDP growth, $yn_{i,t}^{t+1} - yn_{i,t}^{t-1}$. The coefficient estimates on the retained variables remain almost equal. The coefficient on the error in nominal GDP growth is highly significantly different from zero, though in size about two-thirds of that on the error in real GDP growth.

Columns (4) and (5) add the fiscal rule index and the political variables to the baseline specification in Columns (1) and (2).¹⁵ The data used in these specifications is restricted to the time period 2000-2018, as the variable $govchan_{i,t}$ is available only up to 2018 (Armingeon *et al.*, 2020). Again, OLS and IV yield very similar estimates. In addition, the coefficient estimates remain close to those reported in Columns (1) and (2). An increase in the fiscal rule index lowers the budget balance forecast error. This may be slightly surprising. However, an increase in the fiscal rule index could also lead to a reduction of over-pessimism in those cases in which forecasts are too pessimistic otherwise. A change in the government between periods $t-1$ and t also results into a worsening in the first-release budget balance relative to its projection, possibly because once elected a new government immediately takes policy actions leading to a deviation from the previous government's plans. In particular, the new government may want to honour spending promises to its constituency. A more fragmented government (a higher value of $govtype_{i,t-1}$) produces a deterioration of the error. Plausibly, a more fragmented government makes more demands on the public budget to keep all factions satisfied, resulting into an over-optimism bias to generate the necessary budgetary room.

In view of the fact that IV gives results very similar to OLS, while IV is more defensible because of the risk of feedback effects, in the following we continue our estimations with IV only.

Finally, Column (6) reruns the regression in Column (2) on the sub-sample of the first fifteen EU member countries. The new estimates are generally close to those in Column (2). The negative coefficient on $bb_{i,t}^{t-1} - bb_{i,t-1}^{t-1}$ increases a bit in absolute magnitude, but becomes statistically less significantly different from zero.

Next, we turn to the sub-sample periods. We split the full sample into the sub-periods 2000 – 2009 and 2010 – 2019. The former is the period preceding the GFC and the period of the severe downturn caused by the GFC. The second sub-period contains the recovery from the GFC, the euro area debt crisis and the revisions of the EU fiscal framework with the “two-pack” and the “six-pack”. The second sub-period ends just before the corona crisis. We consider both the full set of 27 sample countries

¹³ In order to formally test the potential relevance of the Nickell bias for our dynamic panel specification, we also implemented the bias-corrected estimates suggested by Bruno (2005), who derives the Nickell bias approximation formulas to accommodate unbalanced panels. The resulting estimates of the above-specified models for the budget balance and real GDP growth forecast errors are very similar to the baseline results we document in this section.

¹⁴ We also estimated a version of the baseline regression in Column (2) of Table 2 in which we replaced the lag of $bb_{i,t}^{t+1} - bb_{i,t}^{t-1}$ on the right-hand side by its second lag. The second lag was not significant. The estimates of the other coefficients were very close to those reported in Column (2) of Table 2.

¹⁵ The Armingeon *et al.* (2020) database contains a wide range of political variables. In addition to the variables for which we present the results here, we also tried specifications with elections in periods $t-1$ and $t+1$, a dummy equal to one in the case of a new government with a different ideological composition than the previous incumbent government (to capture the idea that a government of a different political leaning could be less keen on sticking to the fiscal plans of the incumbent government), and an index for the government political color (left-right). We added one-by-one the candidate political variables to the baseline model for the budget balance forecast error and retained in the regressions reported in Table 2 only the variables for which the coefficients were statistically significant or close to statistical significance.

and the subset of the first 15 EU member states. There are some interesting differences between the two sub-periods. First, the lagged dependent variable is positive and (highly) significant during the first sub-period and insignificant during the second sub-period. Second, the projected improvement in the budget balance $bb_{i,t}^{t-1} - bb_{i,t-1}^{t-1}$ exerts a significantly negative effect only during the second sub-period when considering all 27 countries. Overall, the comparison between the two sub-periods suggests that the budget forecast errors have a somewhat less systematic character during the second period than during the first period. Appendix C depicts in more detail the evolution over time of the coefficient estimates for a rolling estimation window of 10 years. There is a gradual decline in the importance of the lagged budget balance forecast error and a somewhat steep reduction in the coefficient of the projected improvement in the budget balance early on. The coefficient on the real output growth error is very stable over time, which emphasizes the role of this error for the budget balance forecast error. The coefficient on the debt ratio starts as positively significantly different from zero, then declines and after that increases to stay positive and significantly different from zero. The confidence interval around its coefficient tightens sharply during the second part of the sample.¹⁶ The fiscal rule index is insignificant in both sub-periods, while a change in government produces more budgetary over-optimism in the first period and has no effect on budgetary over-optimism in the second sub-period. Finally, a more fragmented government encourages over-optimism, but its coefficient is only significant for the second sub-period for the full country sample and for the first sub-period for the fifteen-countries sub-sample.

Table 2: Budget balance forecast error, $bb_{i,t}^{t+1} - bb_{i,t}^{t-1}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$bb_{i,t-1}^t - bb_{i,t}^{t-1}$	0.143* **	0.142* **	0.146* **	0.122* **	0.121* **	0.168* **	0.259* **	0.004	0.353* **	-0.043
	(0.031)	(0.031)	(0.031)	(0.036)	(0.036)	(0.032)	(0.097)	(0.041)	(0.087)	(0.039)
$y_{i,t}^{t+1} - y_{i,t}^{t-1}$	0.259* **	0.265* **		0.265* **	0.274* **	0.313* *	0.290* **	0.252* *	0.403* **	0.378*
	(0.065)	(0.067)		(0.071)	(0.074)	(0.133)	(0.045)	(0.091)	(0.078)	(0.213)
$yn_{i,t}^{t+1} - yn_{i,t}^t$			0.162* **							
			(0.039)							
$bb_{i,t}^{t-1} - bb_{i,t}^t$	- 0.203* **	- 0.203* **	- 0.200* **	- 0.233* **	- 0.233* **	-0.275* **	0.170	- 0.163* *	0.031	-0.099

¹⁶ We note here that, in addition to investigating how our main results change when focusing on different sub-periods, we have also checked whether the parameter estimates of interest change when excluding observations with the largest forecast errors. In particular, addressing potential concerns that the obtained estimates are driven by the outcomes of a few countries during the GFC or the Euro Area debt crisis, we find that the estimates barely change when excluding the observations with the largest errors. Details are available upon request.

	(0.075)	(0.075)	(0.076)	(0.083)	(0.083)	(0.164)	(0.244)	(0.067)	(0.204)	(0.122)
$d_{i,t-1}^{t-1}$	0.023* **	0.023* **	0.022* **	0.026* **	0.026* **	0.021* **	0.066* *	0.058* *	0.041*	0.058* *
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.028)	(0.024)	(0.024)	(0.027)
$fri_{i,t-1}$				-0.340* (0.205)	-0.343* (0.205)		0.033 (0.372)	-0.344 (0.269)	-0.168 (0.351)	-0.258 (0.265)
$govchan_{i,t}$				-0.464* *	-0.464* *		-0.493* **	-0.333	-0.542* **	-0.314
				(0.186)	(0.186)		(0.172)	(0.285)	(0.146)	(0.382)
$govtype_{i,t-1}$				-0.124* *	-0.124* *		-0.188	-0.170* *	-0.332* *	-0.213
				(0.056)	(0.056)		(0.134)	(0.073)	(0.147)	(0.138)
N	458	458	457	432	432	296	189	243	147	135
R2	0.472	0.472	0.487	0.496	0.496	0.500	0.735	0.420	0.771	0.421
Adjusted R2	0.407	0.407	0.418	0.429	0.429	0.420	0.658	0.302	0.711	0.261
N. of countries	27	27	27	27	27	15	27	27	15	15
Time period	2000-2019	2000-2019	2000-2019	2000-2018	2000-2018	2000-2019	2000-2009	2010-2019	2000-2009	2010-2019
Estimation method	OLS	IV	IV	OLS	IV	IV	IV	IV	IV	IV

Notes: Standard errors are clustered at the country level. * p<0.10, ** p<0.05, *** p<0.01. Year- and country-fixed effects are included in all specifications (although the estimates are not reported), N = number of

observations, N . of countries = number of countries. For IV we use as instrument the average forecast error in real GDP growth in all other countries in the same year, $\bar{y}_{j,t}^{t+1,t-1}$.

An important determinant of the budget balance forecast error is the real GDP growth error. Because of the relevance of this variable, it is useful to get a handle on what could drive it, and for this purpose we use similar controls as in the model for the budget balance forecast errors. Table 3 reports the estimates of variants of the following regression framework:

$$y_{i,t}^{t+1} - y_{i,t}^{t-1} = \alpha_i + \beta_t + \delta_1(y_{i,t-1}^t - y_{i,t-1}^{t-2}) + \delta_2 y_{i,t-1}^{t-1} + \delta_4 d_{i,t-1}^{t-1} + \delta_5 fri_{i,t-1} + \delta_6 govchan_{i,t} + \delta_7 govtype_{i,t-1} + \varepsilon_{it}. \quad (2)$$

The first lag always exerts a highly significant positive effect, hence there is substantial persistence in the error of real GDP growth. The persistence is higher than that for the error of the budget balance. The real GDP growth rate at the moment the projection is made, $y_{i,t-1}^t$, is always significantly negative, suggesting that higher growth at the moment the forecast is made leads to more over-optimism in the forecast, possibly because the forecasters extrapolate current good or bad performance of the economy. For the full sample, an increase in the fiscal rule index is found to be associated with less over-optimism, while the debt ratio is found to play no role in the forecast error in real GDP growth (see Columns (2), (3) and (5)). Also, a change in government and the government type play no role. This suggests that the coefficients of these variables reported in Table 2 capture their full effect on the budget balance forecast errors.

Splitting the sample into two sub-periods (see Columns (6) and (7)), we observe that in the second sub-period the persistence in the growth forecast error is lower and the extrapolation of the state captured by $y_{i,t-1}^t$ weaker, suggesting that forecasting becomes “better”. The fiscal rule index is insignificant in the first sub-period and significant at the 5% level in the second sub-period, possibly a sign of the wider prevalence and variation of the index during that sub-period. Quite remarkably, while the debt ratio is insignificant for the full period, it is significantly positive for each of the two sub-periods.¹⁷ The change in government variable is insignificant during the first sub-period and significant at the 10% during the second sub-period, suggesting that a change in government increases over-optimism.

¹⁷ The finding that the coefficient estimate on $d_{i,t-1}^{t-1}$ is close to zero for the full sample, while it is positive and highly significant for each of the two sub-samples, may seem puzzling. Expanding the first sub-sample with the year 2010 we find that coefficient estimate drops to almost zero. The same is the case if we expand the second sub-sample with the year 2009. This pattern suggests that the Global Financial Crisis that started in 2008 and that resulted in bounce-back growth in 2010 has made the relationship between debt levels and growth forecast errors (after controlling for the other variables) unstable.

Table 3: Forecast error in real GDP growth ($y_t^{t+1} - y_t^{t-1}$)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$y_{t-1}^t - y_{t-1}^{t-2}$	0.522***	0.515***	0.520***	0.521***	0.514***	0.741***	0.248***
	(0.116)	(0.120)	(0.122)	(0.119)	(0.129)	(0.216)	(0.052)
y_{t-1}^{t-1}	-0.328***	-0.323***	-0.321***	-0.330***	-0.320***	-0.391**	-0.180***
	(0.103)	(0.106)	(0.111)	(0.103)	(0.114)	(0.175)	(0.069)
$fri_{i,t-1}$		0.187*			0.236**	0.085	0.332**
		(0.111)			(0.107)	(0.516)	(0.166)
$d_{i,t-1}^{t-1}$			0.001		-0.002	0.051***	0.048***
			(0.007)		(0.008)	(0.018)	(0.009)
$govchan_{i,t}$				-0.051	-0.043	0.335	-0.136*
				(0.126)	(0.124)	(0.206)	(0.082)
$govtype_{i,t-1}$				0.113	0.116	0.156	0.102
				(0.084)	(0.083)	(0.108)	(0.098)
N	460	460	458	434	432	189	243
Adjusted R2	0.585	0.586	0.583	0.589	0.635	0.691	0.619
N. of countries	27	27	27	27	27	27	27
Period	2000-2019	2000-2019	2000-2019	2000-2018	2000-2018	2000-2009	2010-2019

Notes: Estimates are obtained with OLS, with standard errors clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Year- and country-fixed effects are included in all specifications (although the estimates are not reported), N . of countries = number of countries.

5. Decomposing the budget balance forecast errors

In this section we explore further the driving factors behind the components of the budget balance forecast errors. We do this in two steps. First, we split the budget balance forecast errors into revenues and spending errors. Next, we investigate the components of these errors.

5.1 First-release errors in revenues and spending

We can write the budget balance forecast error as the difference between the revenues and the spending errors, i.e. $bb_{i,t}^{t+1} - bb_{i,t}^{t-1} = (rev_{i,t}^{t+1} - rev_{i,t}^{t-1}) - (exp_{i,t}^{t+1} - exp_{i,t}^{t-1})$, each of which we can then analyse separately. Here, $rev_{i,t}^t$ is the revenues – GDP ratio and $exp_{i,t}^t$ the spending – GDP ratio. The format of the regressions is the similar to that of equation (1), replacing $bb_{i,t}^{t+1} - bb_{i,t}^{t-1}$ as outcome variable by $rev_{i,t}^{t+1} - rev_{i,t}^{t-1}$ or $exp_{i,t}^{t+1} - exp_{i,t}^{t-1}$, and analogously splitting the budget balance variables on the right-hand side into the corresponding ones in revenues and expenditures.

Table 4 reports the estimates for revenues and spending errors, respectively. Columns (1) and (4) find that both errors are persistent with coefficients that are roughly equal. The lagged error in revenues (spending) helps to explain the error in revenues (spending). However, there are no “cross effects” from spending to revenues and *vice versa*. The coefficient estimates of the GDP error for the spending error are about twice the size of those for the revenues error. This explains why the variable was positive and significant in the regression for the budget balance forecast error. In the following subsection we will delve deeper into the role of the GDP growth error. On both the first-release in revenues and spending equation, the projected increase in revenues in $t-1$ exerts a significant and negative effect, while the projected increase in spending has no effect. These findings suggest that only part of the projected increase in revenues is realised, implying over-optimism at the projection stage. Spending, in turn, may be suppressed because the underlying revenues increase fails to materialise. The debt ratio now exerts no effect on the revenues error and a significantly negative effect on the spending error: higher indebtedness lowers first-release spending relative to its projection, along this channel improving the budget balance relative to its projection. Turning to Columns (2) and (5), the fiscal rule index and the number of government changes are not significant. The type of government exerts a significantly (at the 5% level) negative effect on the revenues error and no effect on the spending error. The estimates of the coefficients on the other variables are essentially unchanged. Finally, replacing the real GDP growth error with the nominal GDP growth error in Columns (3) and (6) leaves the estimates essentially unchanged. Only the $t-1$ projected increase in spending now exerts a significant positive effect on the revenue error.

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Table 4: Errors in revenues and expenditures

Dependent →	$rev_{i,t}^{t+1} - rev_{i,t}^{t-1}$			$exp_{i,t}^{t+1} - exp_{i,t}^{t-1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$rev_{i,t-1}^t - rev_{i,t}^{t-1}$	0.212***	0.206***	0.212***	0.058	0.071	0.082
	(0.066)	(0.068)	(0.070)	(0.081)	(0.088)	(0.093)
$exp_{i,t-1}^t - exp_{i,t}^{t-1}$	0.055	0.057	0.060*	0.190***	0.172***	0.184***
	(0.036)	(0.036)	(0.034)	(0.038)	(0.044)	(0.043)
$y_{i,t}^{t+1} - y_{i,t}^{t-1}$	-0.234***	-0.225***		-0.500***	-0.501***	
	(0.086)	(0.084)		(0.083)	(0.087)	
$yn_{i,t}^{t+1} - yn_{i,t}^{t-1}$			-0.177***			-0.348***
			(0.052)			(0.054)
$rev_{i,t}^{t-1} - rev_{i,t-1}^t$	-0.559***	-0.565***	-0.565***	-0.360***	-0.347***	-0.341**
	(0.149)	(0.154)	(0.158)	(0.126)	(0.127)	(0.139)
$exp_{i,t}^{t-1} - exp_{i,t-1}^t$	0.176	0.179	0.222*	-0.003	-0.047	0.020
	(0.114)	(0.116)	(0.118)	(0.131)	(0.127)	(0.133)
$d_{i,t-1}^{t-1}$	0.007	0.008	0.009	-0.016**	-0.018**	-0.015***
	(0.009)	(0.012)	(0.011)	(0.007)	(0.007)	(0.005)

$fri_{i,t-1}$		-0.071	-0.087		0.293	0.241
		(0.185)	(0.188)		(0.226)	(0.230)
$govchan_{i,t}$		-0.097	-0.127		0.360	0.293
		(0.141)	(0.141)		(0.226)	(0.239)
$govtype_{i,t-1}$		-0.152**	-0.139**		-0.030	-0.009
		(0.072)	(0.068)		(0.092)	(0.094)
N	452	426	425	452	426	425
R2	0.387	0.39	0.399	0.496	0.502	0.505
Adjusted R2	0.309	0.303	0.313	0.432	0.431	0.434
N. of countries	27	27	27	27	27	27
Time period	2000-2019	2000-2018	2000-2018	2000-2019	2000-2018	2000-2018
Estimation method	IV	IV	IV	IV	IV	IV

Notes: Standard errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Year- and country-fixed effects are included in all specifications (although the estimates are not reported), N. of countries = number of countries. We use as instrument the average forecast error in real GDP growth in all other countries in the same year, $\bar{y}_{j,t}^{t+1,t-1}$.

5.2 Decomposition into “base”, “growth” and “denominator” effects

In this sub-section we delve deeper into the driving forces behind the revenues and spending errors. The reason is that the forecast errors are all defined in terms of ratios to GDP. Hence, any change in GDP will have a mechanical effect on these ratios. With the decomposition of the errors below we can purge this mechanical “denominator” effect and see if GDP growth errors also affect other components of the budget balance forecast error that are more closely under the influence of the fiscal authorities. The errors can be decomposed as follows (see Beetsma *et al.*, 2013, or Appendix D):

$$\begin{aligned}
 x_t^{t+1} - x_t^{t-1} &= \frac{1 + g_{x,t}^{t-1}}{1 + yn_t^{t-1}}(x_{t-1}^{t+1} - x_{t-1}^{t-1}) + \frac{x_{t-1}^{t+1}}{(1 + yn_t^{t+1})(1 + yn_t^{t-1})}(g_{x,t}^{t+1} - g_{x,t}^{t-1}) \\
 &- \frac{x_{t-1}^{t+1}}{(1 + yn_t^{t+1})(1 + yn_t^{t-1})}(yn_t^{t+1} - yn_t^{t-1}) - \frac{x_{t-1}^{t+1}}{(1 + yn_t^{t+1})(1 + yn_t^{t-1})}(g_{x,t}^{t+1}yn_t^{t-1} - g_{x,t}^{t-1}yn_t^{t+1}) \quad (3)
 \end{aligned}$$

where $x = rev$ or $x = exp$. The first term on the right-hand is the so-called “base” effect, which captures the update of the value of a variable pertaining to a given year as time passes by. Updating could take place as a result of new information coming in or because of changes in construction methodology. Hence, the base effect would mostly be the result of “mechanical” adjustment, rather than deliberate policy choices. The second term is the so-called “growth” effect, which includes $g_{x,t}^{t+1} - g_{x,t}^{t-1}$, the difference between the first-release nominal growth rate in revenues or spending (in euros) and the projected nominal growth rate in revenues or spending (*in euros*), and a weighting factor composed of the fraction of revenues or spending of GDP, x_{t-1}^{t+1} , divided by the product of the projected and first-release gross nominal GDP growth rates, yn_t^{t-1} and yn_t^{t+1} . We are particularly interested in whether and how GDP growth errors affect this growth effect in revenues or spending, which we would *a priori* expect to be under the government’s control. The third term (*including* the minus sign) is the “denominator” effect, with the error in the nominal GDP growth rate, $yn_t^{t+1} - yn_t^{t-1}$. This term features the same weighting factor as the growth effect. When first-release nominal GDP growth exceeds its projection, the denominators of the revenues and spending ratios are higher than projected, thereby resulting into a mechanical negative effect on the errors on the left-hand side. The final term in (3) is a residual term that is generally small, as it is the difference between two products of growth rates.

Table 5 reports the averages over all observations for the headline balance, revenues and spending of the overall error, and the base, growth and denominator effects. All three components (base, growth and denominator effects) play on average a role of a roughly comparable order of magnitude in explaining the forecast errors in revenues and spending. However, the denominator effect hardly plays any role driving the budget balance forecast error. This is due to the fact that this effect exerts a similarly-sized but opposing effect on both the revenues and spending errors. Hence, because the denominator effects of revenues and spending essentially cancel against each other, overall the denominator effect plays only a minor role in the budget balance forecast error.¹⁸ The table shows that the growth effect is negative for revenues, and positive for spending, indicating that the growth of revenues in euros is over-projected and the growth of spending in euros is under-projected.

¹⁸ The denominator effect is the result of the GDP growth error. The preceding conclusion may appear counterintuitive in view of the results reported in Table 5. However, the denominator effect is a mechanical effect of the GDP growth error, while the latter also affects the spending and revenues levels directly – see below.

Table 5: Averages of the forecast errors and their components

	Budget balance	Revenues	Expenditures
Overall error	-0.06	0.07	0.14
Base effect	0.12	-0.09	-0.21
Growth effect	-0.14	-0.06	0.08
Denominator effect	0.02	-0.22	-0.24

Notes: The denominator effect needs to be subtracted from the sum of the other two effects to arrive at the overall error. A difference may result because of rounding errors.

The regression framework remains analogous to that before, deploying the same right-hand side specifications. The coefficient estimates can then immediately be interpreted in terms of the contribution to the budget balance forecast error. Hence, the regression equations will take the format:

$$z_{i,t+1} = \alpha_i + \beta_t + \delta_1(bb_{i,t-1}^t - bb_{i,t-1}^{t-2}) + \delta_2(bb_{i,t-1}^{t-1} - bb_{i,t-1}^{t-2}) + \delta_3(y_{i,t}^{t+1} - y_{i,t}^{t-1}) + \delta_4 d_{i,t-1}^{t-1} + \delta_5 fri_{i,t-1} + \delta_6 govchan_{i,t} + \delta_7 govtype_{i,t-1} + \varepsilon_{it}, \quad (4)$$

for $z_{i,t+1} \in \{expbe_{i,t+1}, revbe_{i,t+1}, revge_{i,t+1}, expge_{i,t+1}\}$, where $expbe_{i,t+1} = \frac{1 + g_{exp,t}^{t-1}}{1 + yn_{i,t-1}^{t-1}}$ ($exp_{i,t}^{t+1} - exp_{i,t}^{t-1}$) and $revbe_{i,t+1} = \frac{1 + g_{rev,t}^{t-1}}{1 + yn_{i,t-1}^{t-1}}(rev_{i,t}^{t+1} - rev_{i,t}^{t-1})$ are the base effects and $revge_{i,t+1} = \frac{rev_{i,t}^{t+1}}{(1 + yn_{i,t+1}^{t+1})(1 + yn_{i,t-1}^{t-1})}(g_{rev,t}^{t+1} - g_{rev,t}^{t-1})$ and $expge_{i,t+1} = \frac{exp_{i,t}^{t+1}}{(1 + yn_{i,t+1}^{t+1})(1 + yn_{i,t-1}^{t-1})}(g_{exp,t}^{t+1} - g_{exp,t}^{t-1})$ are the growth effects, respectively. The base and growth effects of the budget balance are just the difference between the corresponding ones for revenues and spending. Since the denominator effect is a mechanical consequence resulting from the nominal GDP growth forecast error that we already discussed above, we will not discuss it further below. The crucial question of the current exercise is whether there are factors beyond the mechanical denominator effect driving the forecasting errors. We will also not discuss the base effect as it follows from statistical updating and as such is less driven by policy decisions. The estimates for the base effect are found in Appendix E.

Table 6 reports the results for the regressions for the growth effect in revenues. Columns (1) and (2) show that the larger is (nominal or real) GDP growth relative to its projection, the more revenues turn out to grow relative to their projection. This is not surprising as GDP growth generally leads to more revenue growth. We observe that the revenues growth effect is negatively related to the projected increase in the revenue ratio, $rev_{i,t}^{t-1} - rev_{i,t-1}^{t-1}$ and positively related to the projected increase in the

spending ratio, $exp_{i,t}^{t-1} - exp_{i,t-1}^{t-1}$. A more fragmented government leads to a more negative growth effect in revenues, possibly because the government finds it harder to implement projected unpleasant measures, viz. the projected growth in revenues. Column (3) drops the weighting factor in front of $g_{rev,t}^{t+1} - g_{rev,t}^{t-1}$, so it puts the error in the forecast of the nominal growth rate of revenues on the left-hand side of the regression equation. Hence, the regression in this column repeats that in the previous column, except for the change in the dependent variable. The estimates show that a one-percentage point error in nominal GDP growth produces a 0.7 percentage point improvement in the error in the forecast of the nominal growth rate of revenues.

Turning to the growth effect of expenditures in Columns (4) and (5), we find that a higher-than-anticipated spending ratio in period $t - 1$ produces a lower spending growth effect in period t , possibly because the government wants to correct the previous period's excess spending. This in turn may be driven by the desire to remain within the correction horizon allowed by the SGP. By contrast, a higher-than-anticipated revenue ratio in period $t - 1$ has the opposite effect; it induces the government to spend part of the unanticipated room. Likewise, higher (real or nominal) GDP growth in period t creates more room to spend, having a positive effect on the growth effect in spending, possibly due to political pressure to spend more. A period $t - 1$ projected increase in the spending ratio between periods $t - 1$ and t exerts a negative influence on the growth effect. A larger projected increase in the expenditure ratio $exp_{i,t}^{t-1} - exp_{i,t-1}^{t-1}$ goes together with more over-optimism about spending, hence a larger shortfall of spending growth from its projection. A higher debt ratio in period $t - 1$ implies a lower growth effect in spending, hence induces the government to correct spending growth relative to the projection in period $t - 1$. Column (6) puts the error in the nominal GDP growth rate on the left-hand side of the regression. The estimates show that a one-percentage point error in nominal GDP growth produces a 0.4 percentage point deterioration in the nominal growth rate of expenditures.

Table 6: Estimates for the growth effects

	<i>revge_{i,t}</i>		$g_{rev,t}^{t+1} - g_{rev,t}^{t-1}$	<i>expge_{i,t}</i>		$g_{exp,t}^{t+1} - g_{exp,t}^{t-1}$
	(1)	(2)	(3)	(4)	(5)	(6)
$rev_{i,t-1}^t - rev_{i,t-1}^{t-1}$	-0.099	-0.110*	-0.282*	0.335**	0.328**	0.567**
	(0.065)	(0.061)	(0.158)	(0.131)	(0.131)	(0.230)
$exp_{i,t-1}^t - exp_{i,t-1}^{t-1}$	0.064**	0.063**	0.165**	-0.427***	-0.423***	-0.725***
	(0.030)	(0.028)	(0.067)	(0.118)	(0.117)	(0.161)
$y_{i,t}^{t+1} - y_{i,t}^{t-1}$	0.306***			0.133**		
	(0.070)			(0.058)		
$yn_{i,t}^{t+1} - yn_{i,t}^{t-1}$		0.245***	0.696***		0.128***	0.372***
		(0.038)	(0.118)		(0.041)	(0.104)
$rev_{i,t-1}^{t-1} - rev_{i,t-1}^{t-2}$	-0.682***	-0.687***	-1.874***	-0.075	-0.079	-0.370
	(0.095)	(0.097)	(0.295)	(0.133)	(0.126)	(0.263)
$exp_{i,t-1}^{t-1} - exp_{i,t-1}^{t-2}$	0.229***	0.172***	0.484***	-0.191*	-0.225**	-0.483**
	(0.066)	(0.063)	(0.172)	(0.098)	(0.099)	(0.217)
$d_{i,t-1}^{t-1}$	0.009	0.006	0.011	-0.024***	-0.025***	-0.057***
	(0.006)	(0.007)	(0.021)	(0.006)	(0.006)	(0.012)
$fri_{i,t-1}$	-0.175	-0.153	-0.415	0.174	0.176	0.409

	(0.131)	(0.133)	(0.358)	(0.218)	(0.213)	(0.482)
$govchan_{i,t}$	0.001	0.049	0.149	0.270	0.296	0.803
	(0.118)	(0.122)	(0.347)	(0.246)	(0.249)	(0.508)
$govtype_{i,t-1}$	-0.085*	-0.103**	-0.289**	0.059	0.048	0.068
	(0.048)	(0.051)	(0.130)	(0.084)	(0.085)	(0.184)
N	425	425	425	425	425	425
R2	0.513	0.540	0.551	0.277	0.287	0.290
Adjusted R2	0.443	0.474	0.487	0.173	0.185	0.189
N. of countries	27	27	27	27	27	27
Time period	2000-2018	2000-2018	2000-2018	2000-2018	2000-2018	2000-2018
Estimation method	IV	IV	IV	IV	IV	IV

Notes: Standard errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Year- and country-fixed effects are included in all specifications (although the estimates are not reported), N. of countries = number of countries. We use as instrument the average forecast error in real GDP growth in all other countries in the same year, $\bar{y}_{j,t}^{t+1,t-1}$.

6. The role of the independent fiscal institutions

This section explores the role of IFIs in determining forecast errors.¹⁹ Since the variation over time of information related to IFIs is generally limited, we drop the country-fixed effects from our baseline regression framework and add information on IFIs. It should be noted, though, that any effect detected through IFI variables needs to be interpreted with care, as such effect may also (partly) be driven by other time-invariant factors. Table 7 reports the results. In order to capture relevant information on IFIs, we construct three dummy variables: $ifi_{i,t-1}$ is a dummy for the presence of an IFI, $ifi_macro_{i,t-1}$ is a dummy with value 1 when an independent IFI produces or assesses the macroeconomic forecast used in the budgetary process and $ifi_himedia_{i,t-1}$ is a dummy with value 1 when an IFI with high media impact produces or assesses the macroeconomic forecast.²⁰ The data on IFIs are obtained from the IMF Fiscal Council dataset which we update to match the sample period of our other data. For convenience, Column (1) repeats the baseline regression. As a stepping stone for the regression with a fiscal council dummy in Column (3), we drop the country-fixed effects in Column (2). In particular, the lagged debt ratio switches from a significant positive to a significant negative sign, indicating that it partly takes over the role of the country-fixed effects in Column (1). The negative sign on the lagged debt ratio in Column (2) suggests that it is the high debt countries that are relatively over-optimistic in their budgetary projections. The government type loses significance in Column (2). Column (3) includes the lagged IFI dummy. The estimates suggest that its presence is conducive to better realized budgetary performance relative to what was projected. This effect seems to be mainly present for IFIs with high media impact. Reassuringly, the coefficient estimates of the baseline variables are essentially unaffected in terms of significance or insignificance by the inclusion of dummies related to IFIs.

We also conducted variants of the regression in Column (2) of Table 7 in which we added the World Bank Worldwide Governance Indicators for Voice and Accountability and Government Effectiveness as explanatory variables. These regressions were conducted to capture the potential effect of media oversight and quality of civil service and policy formulation on forecast errors. Both these measures of institutional quality, which display little variation over time for each country, have no significant effect on the budget balance forecast errors. Other coefficient estimates remain unchanged. Hence, we do not explicitly report the results, but they are available upon request. In Appendix F we also split the regressions in Table 7 into regressions for revenues and spending. The existing results are unaffected, while we find that the presence of an IFI significantly improves the revenues realization relative to its forecast.

Table 7: Including indicators of IFIs

Dependent variable	$bb_{i,t}^{t+1} - bb_{i,t}^{t-1}$				
	(1)	(2)	(3)	(4)	(5)
$bb_{i,t-1}^t - bb_{i,t-2}^{t-1}$	0.121***	0.232***	0.210***	0.217***	0.202***

¹⁹ The effectiveness of national IFIs in holding governments to account for their fiscal policies is the focus of an intense debate. The EU Independent Fiscal Institutions (2019) has pleaded for minimum standards that all national would need to adhere to.

²⁰ Ideally, one would capture the strength of the IFIs through a time-varying index. Unfortunately, such an index is not available for the period we consider.

	(0.036)	(0.041)	(0.042)	(0.041)	(0.041)
$bb_{i,t}^{t-1} - bb_{i,t-1}^{t-1}$	-0.233***	-0.198**	-0.183**	-0.216**	-0.215**
	(0.083)	(0.087)	(0.088)	(0.093)	(0.093)
$y_{i,t}^{t+1} - y_{i,t}^{t-1}$	0.274***	0.222***	0.227***	0.240***	0.237***
	(0.074)	(0.057)	(0.055)	(0.060)	(0.060)
$d_{i,t}^{t-1}$	0.026***	-0.006***	-0.009***	-0.007**	-0.007**
	(0.008)	(0.002)	(0.002)	(0.003)	(0.003)
$fri_{i,t-1}$	-0.343*	0.023	-0.038	0.011	-0.035
	(0.205)	(0.155)	(0.155)	(0.188)	(0.182)
$ifi_{i,t-1}$			0.585***		
			(0.195)		
$ifi_macro_{i,t-1}$				0.217	
				(0.180)	
$ifi_himedia_{i,t-1}$					0.525***
					(0.186)
$govchan_{i,t}$	-0.464**	-0.449**	-0.456**	-0.482**	-0.485**
	(0.186)	(0.190)	(0.190)	(0.208)	(0.202)
$govtype_{i,t-1}$	-0.124**	0.016	-0.007	0.020	-0.002
	(0.056)	(0.084)	(0.078)	(0.090)	(0.081)

N	432	432	432	378	378
Adjusted R2	0.429	0.420	0.430	0.418	0.425
N. of countries	27	27	27	27	27
Time period	2000-2018	2000-2018	2000-2018	2000-2016	2000-2016
Estimation method	IV	IV	IV	IV	IV
Year-fixed effects	Yes	Yes	Yes	Yes	Yes
Country-fixed effects	Yes	No	No	No	No

Notes: Standard errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. N. of countries = number of countries. We use as instrument the average forecast error in real GDP growth in all other countries in the same year, $\bar{y}_{j,t}^{t+1,t-1}$.

7. Concluding remarks

In this paper we exploited data from the European Union's Stability and Convergence Programmes over the period since the start of EMU until just before the coronavirus crisis to explore to what extent budgetary projections are followed up, and what are the driving forces of the degree of follow-up. We delved deeper by also exploring the driving forces behind the errors in revenues and expenditures, and then exploring the base, growth and denominator effects which make up these errors. Throughout, the GDP growth error plays a crucial role driving the error of the budget balance as well as the components of these errors. This is not surprising: budgetary projections are based on projections of economic growth, and the more optimistic economic growth projections are, the more optimistic budgetary projections can be. However, we also find that the effect of errors in economic growth projections goes beyond the mechanical denominator effect. A positive error in economic growth produces positive effects on the growth rates of both revenues and spending (in euros), but more so in the former.

The empirical confirmation of this statement points to an important governance lesson: institutional settings conducive to more accurate GDP growth projections should lead to more accurate budgetary projections. This has benefits in terms of planning on the government's side. It also benefits a government's standing in the financial markets, which do not like the budgetary uncertainty created by inaccurate budgetary projections. The SGP's 2013 "two-pack" reform mandates GDP growth projections underpinning budgetary plans of euro area countries to be constructed by an independent institution or to be endorsed by such an institution. Compared to the former, the latter is sub-optimal, because a rejection of a government's macro-projections is a major verdict, which is not lightly issued. Hence, the government will generally have some wiggle room. Outsourcing the construction of the macro-projections seems the preferable route: a truly independent fiscal institution will provide an unbiased projection of GDP growth, conditional on the information it has, because it is at a sufficient distance from the political fray. Moreover, by constructing the macro-projections itself, an independent fiscal institution acquires the analytical capacity to perform such projections, from which it will also benefit in its other work. It might even be better if the independent fiscal institution were made responsible also for the budgetary projections, because even with truly unbiased macro-projections governments may find ways to tweak budgetary projections into their preferred direction, for example by deploying estimates of tax elasticities that differ from the actual ones.

We explore also how political factors and independent fiscal institutions affect projection errors. Political factors do not play a substantial role, but to the extent that they do play a role, their effects go into the expected direction. Both a preceding change in the government and a more fragmented government produce a deterioration of budgetary performance relative to what was forecast. By contrast, independent fiscal institutions with a high media impact producing or assessing the macroeconomic forecast appear to lead to better budgetary performance relative to projections.

In the near future particular attention may need to be paid to the relationship between structural reforms and growth projections. Improving growth forecasts does not merely involve a more prudent assessment within a given model of the economy. It also requires a prudent assessment of how planned reforms affect this model. Optimistic growth forecasts often reflect a sanguine assessment of the expected effects of planned structural reforms rather than optimism about the cycle. This issue can be expected to increase in importance in the coming years with the implementation of the EU's Recovery and Resilience Plans.

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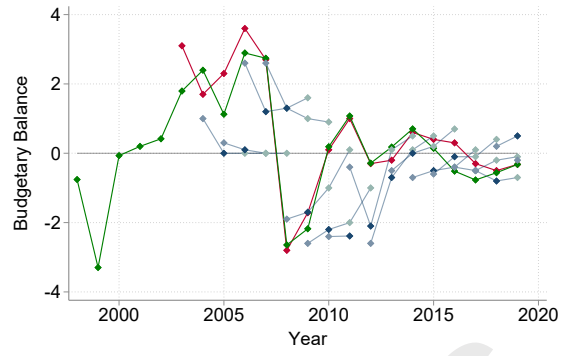
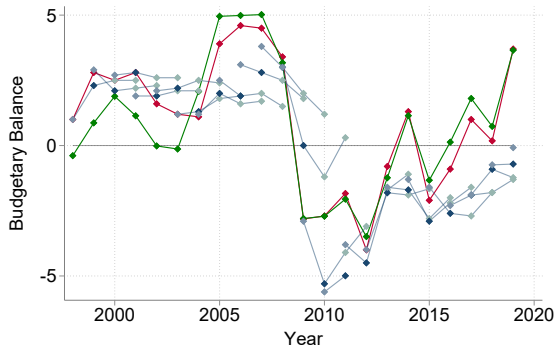
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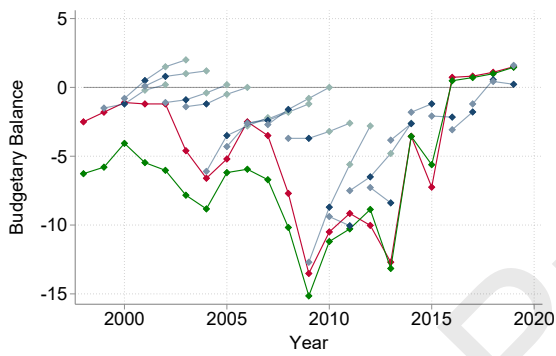
Appendix: NOT for publication

A: Projections, first releases and *ex-post* values of the budget balance for individual EU countries



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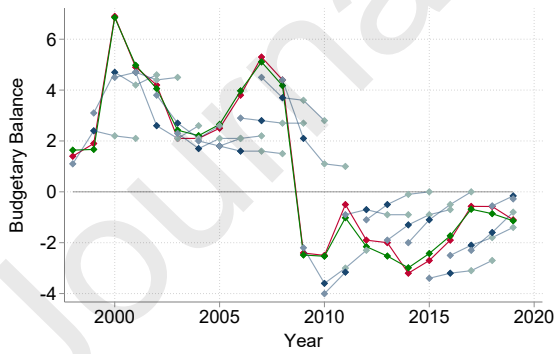
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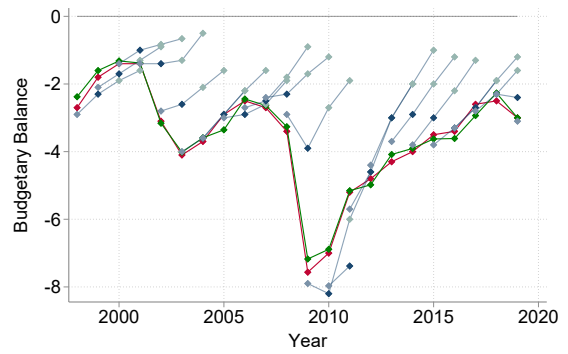
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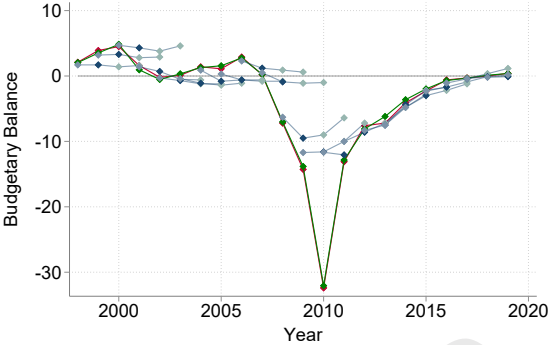
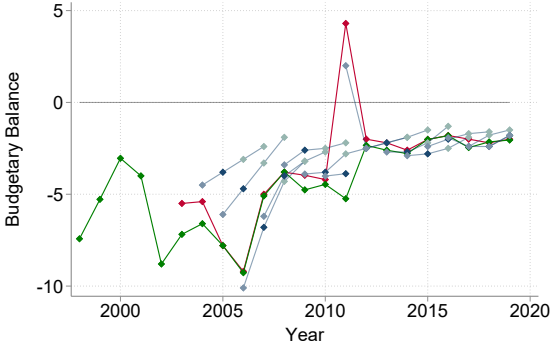


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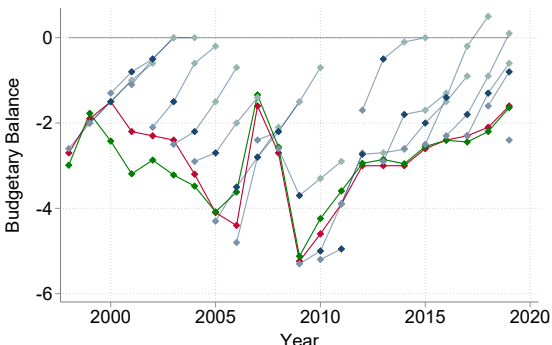


Hungary

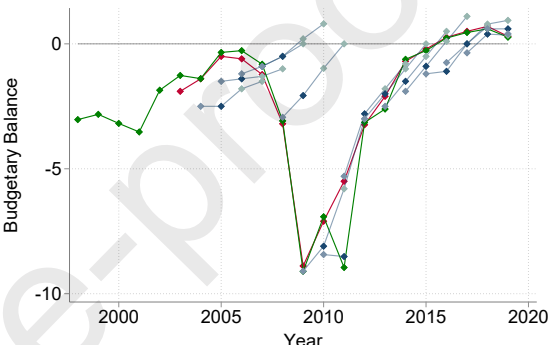
Ireland



Italy

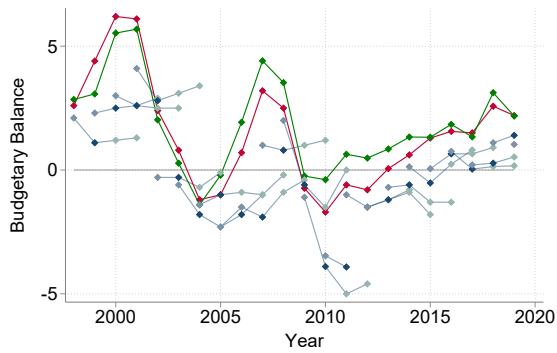


Lithuania



... continued

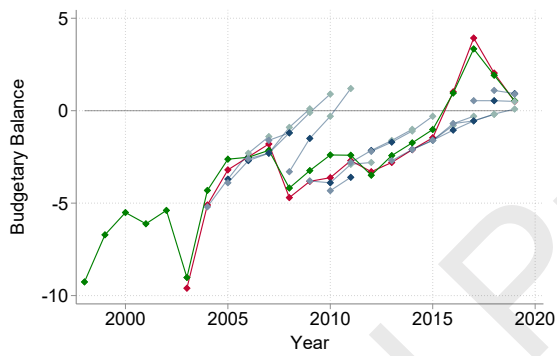
Luxembourg



Latvia



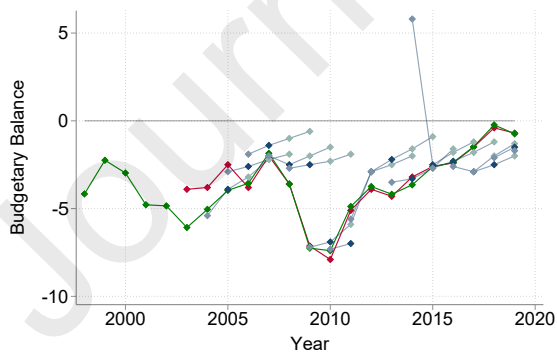
Malta



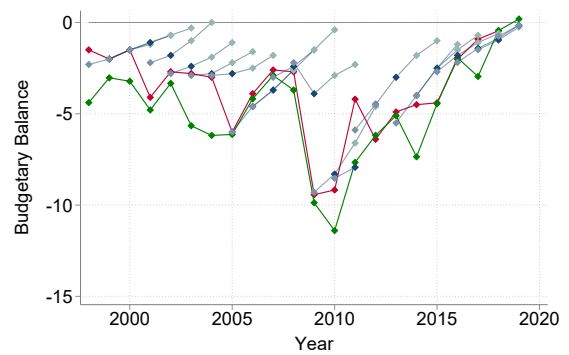
The Netherlands



Poland



Portugal

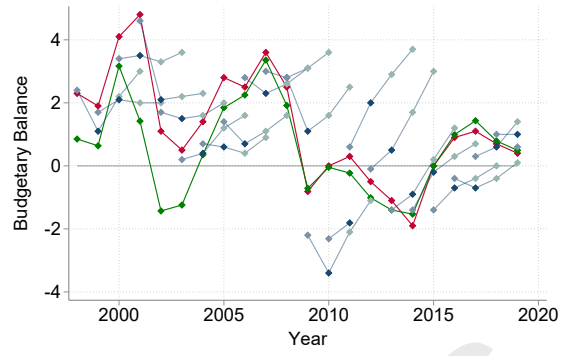
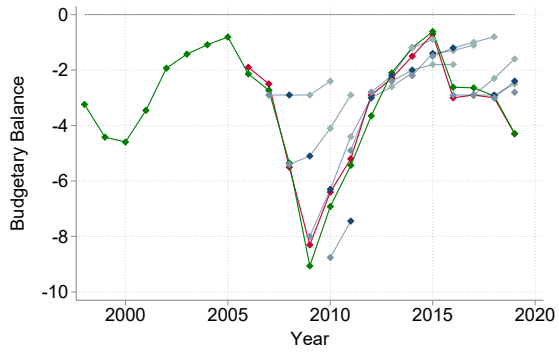


Romania



Sweden





Journal Pre-proofs

... continued

Slovak Republic



Slovenia



United Kingdom



EU (averages)

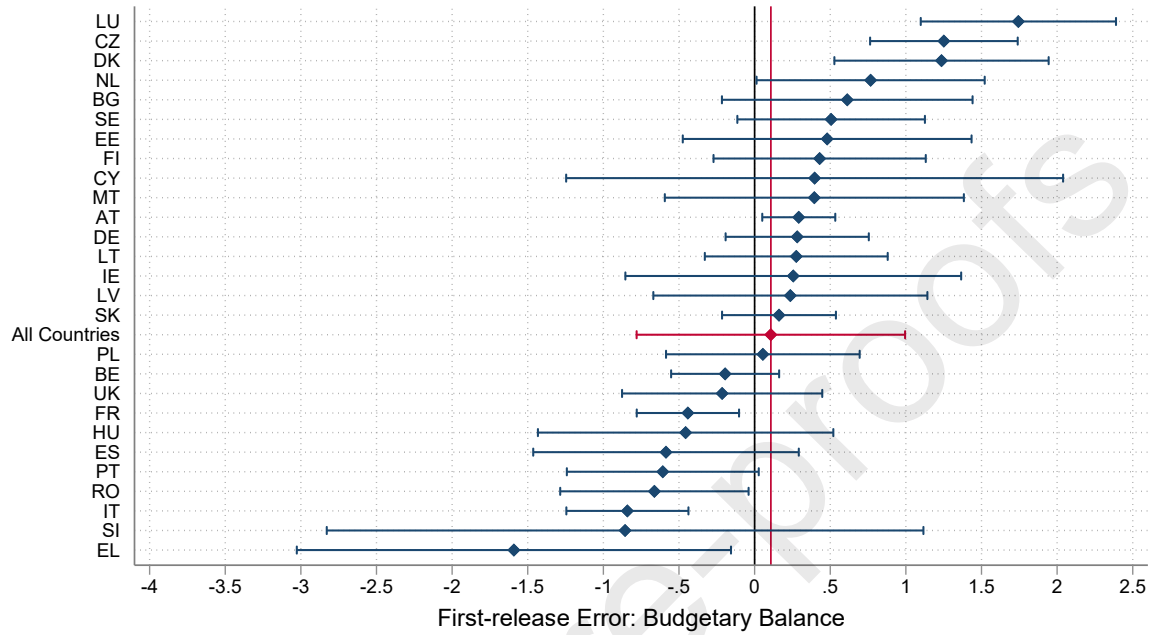


- ◆ First-release
- ◆ Nowcasts
- ◆ Two- and three-years ahead forecasts

- ◆ Ex-post
- ◆ One-year ahead forecasts

B: Leaving out crisis years 2009-2012

Averages and Stand. Dev. Forecast Errors Budget Balance – excluding 2009-2012

**Variance-covariance matrix of the errors excluding 2009-2012**

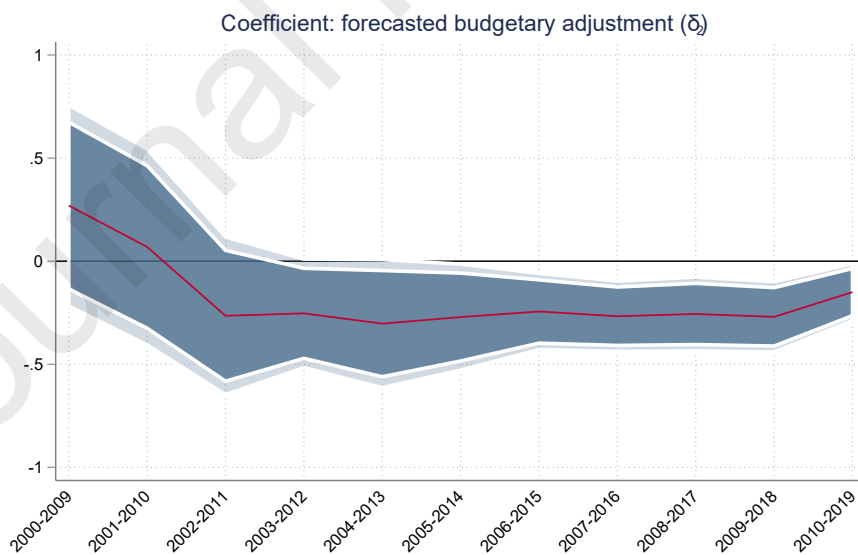
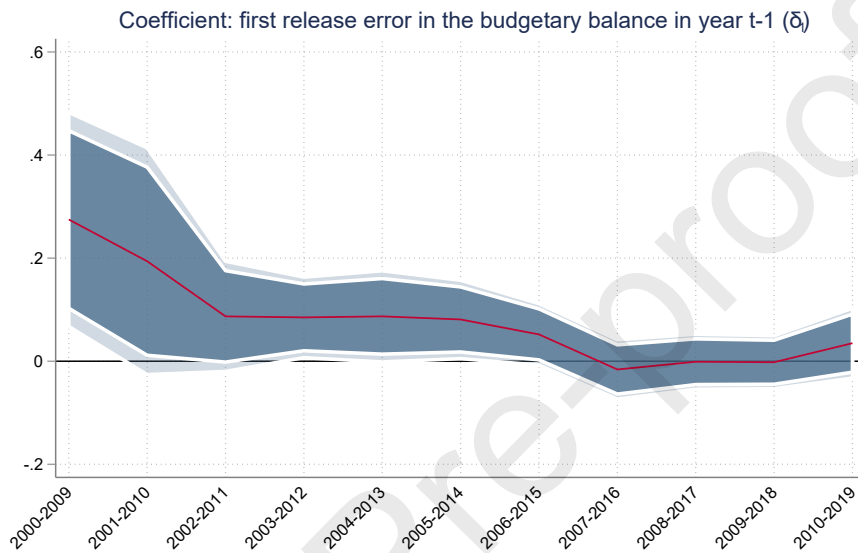
First-release error	<i>Budget balance</i>	<i>Revenues</i>	<i>Expenditures (-)</i>
<i>Budget balance</i>	3.14	0.76	2.37
<i>Revenues</i>		3.77	- 3.00
<i>Expenditures</i>			5.37

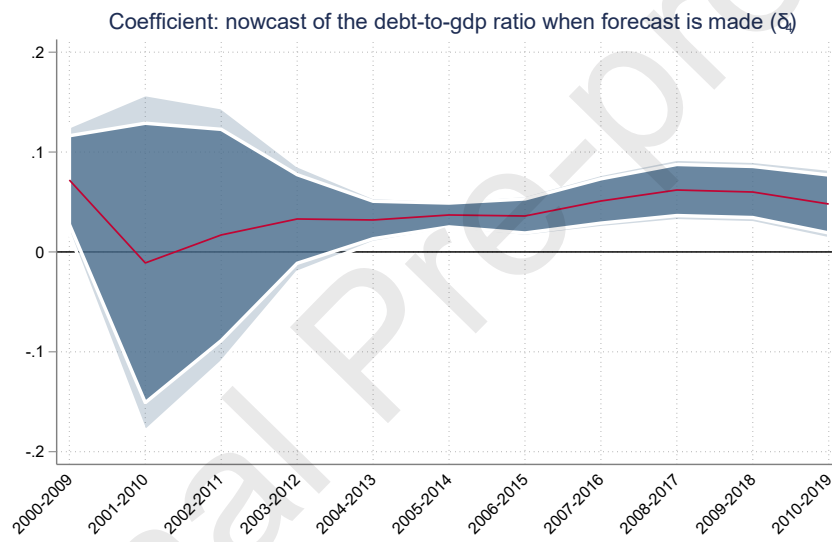
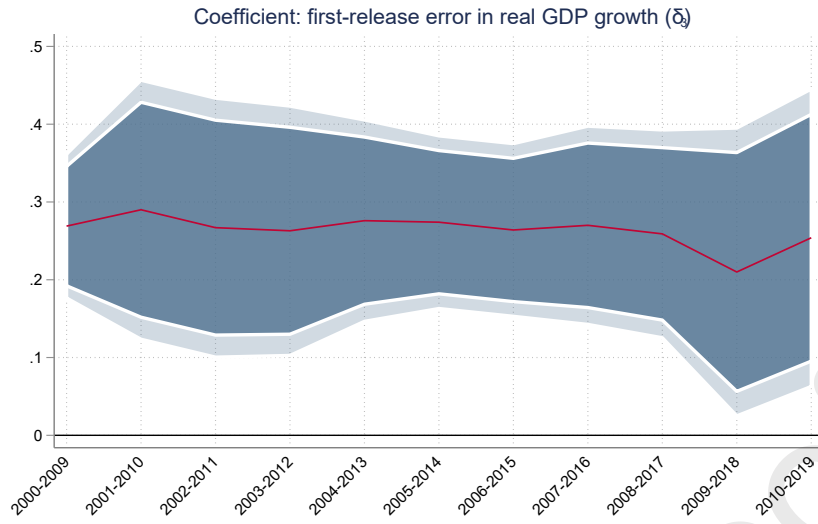
C: Coefficient estimates for a rolling window

The regression specification is:

$$bb_{i,t}^{t+1} - bb_{i,t}^{t-1} = \alpha_i + \beta_t + \delta_1(bb_{i,t-1}^t - bb_{i,t-2}^{t-1}) + \delta_2(bb_{i,t}^{t-1} - bb_{i,t-1}^{t-1}) + \delta_3(y_{i,t}^{t+1} - y_{i,t}^{t-1}) + \delta_4 d_{i,t-1}^{t-1} + \varepsilon_{it}$$

The figures below depict the coefficient estimates for a rolling estimation window of 10 years.





D. Derivation of decomposition in equation (3)

$$\begin{aligned}
x_t^{t+1} - x_t^{t-1} &= x_t^{t+1} \frac{1 + g_{x,t}^{t+1}}{1 + yn_t^{t+1}} - x_t^{t-1} \frac{1 + g_{x,t}^{t-1}}{1 + yn_t^{t-1}} \\
&= (x_t^{t+1} - x_t^{t-1}) \frac{1 + g_{x,t}^{t-1}}{1 + yn_t^{t-1}} + x_t^{t+1} \left(\frac{1 + g_{x,t}^{t+1}}{1 + yn_t^{t+1}} - \frac{1 + g_{x,t}^{t-1}}{1 + yn_t^{t-1}} \right) \\
&= \frac{1 + g_{x,t}^{t-1}}{1 + yn_t^{t-1}} (x_t^{t+1} - x_t^{t-1}) + \frac{x_t^{t+1}}{(1 + yn_t^{t+1})(1 + yn_t^{t-1})} (g_{x,t}^{t+1} - g_{x,t}^{t-1}) \\
&\quad - \frac{x_t^{t+1}}{(1 + yn_t^{t+1})(1 + yn_t^{t-1})} (yn_t^{t+1} - yn_t^{t-1}) - \frac{x_t^{t+1}}{(1 + yn_t^{t+1})(1 + yn_t^{t-1})} (g_{x,t}^{t+1} yn_t^{t-1} - g_{x,t}^{t-1} yn_t^{t+1})
\end{aligned}$$

E. Estimates of the base effect of revenues and expenditures

The table below shows the estimates for the base effect of revenues and expenditures. The updating between $t-1$ and $t+1$ of revenues and spending in $t-1$ overlaps partially with the updating between $t-2$ and t for the same year $t-1$. Hence, $rev_{i,t-1}^t - rev_{i,t-2}^{t-1}$ enters highly significantly in the regression for $revbe_{i,t+1}$, while $exp_{i,t-1}^t - exp_{i,t-2}^{t-1}$ is highly significant in determining $expbe_{i,t+1}$. A rise in the error of output causes a downward base adjustment in spending. A higher debt ratio exerts a significantly positive effect on the size of the base effect in spending. Finally, a change in government lowers the base effect in revenues.

	<i>revbe_{i,t}</i>			<i>expbe_{i,t}</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
$bb_{i,t-1}^t - bb_{i,t-2}^{t-1}$	0.068*			-0.517***		
	(0.039)			(0.125)		
$rev_{i,t-1}^t - rev_{i,t-2}^{t-1}$		0.323***	0.325***		-0.235***	-0.235***
		(0.033)	(0.033)		(0.083)	(0.084)
$exp_{i,t-1}^t - exp_{i,t-2}^{t-1}$		-0.002	-0.002		0.600***	0.604***
		(0.033)	(0.032)		(0.112)	(0.110)
$y_{i,t}^{t+1} - y_{i,t}^{t-1}$	-0.091*	-0.063		-0.158**	-0.113*	
	(0.053)	(0.051)		(0.062)	(0.059)	
$yn_{i,t}^{t+1} - yn_{i,t}^{t-1}$			-0.054*			-0.082***
			(0.029)			(0.028)
$bb_{i,t-1}^{t-1} - bb_{i,t-2}^{t-2}$	-0.023			-0.358***		
	(0.152)			(0.121)		
$rev_{i,t-1}^{t-1} - rev_{i,t-2}^{t-2}$		0.151	0.150		-0.237**	-0.242**

		(0.148)	(0.151)		(0.097)	(0.101)
$exp_{i,t}^{t-1} - exp_{i,t-1}^{t-1}$		0.018	0.034		0.206*	0.230**
		(0.095)	(0.096)		(0.113)	(0.117)
$d_{i,t-1}^{t-1}$	0.004	0.002	0.002	0.016***	0.011***	0.010***
	(0.007)	(0.004)	(0.004)	(0.006)	(0.003)	(0.003)
$fri_{i,t-1}$	0.029	0.051	0.048	0.004	0.036	0.027
	(0.130)	(0.111)	(0.111)	(0.132)	(0.117)	(0.118)
$govchan_{i,t}$	-0.128	-0.181**	-0.189**	0.023	-0.034	-0.041
	(0.089)	(0.078)	(0.081)	(0.093)	(0.083)	(0.090)
$govtype_{i,t-1}$	-0.056	-0.050	-0.046	-0.091	-0.081*	-0.075
	(0.067)	(0.049)	(0.049)	(0.069)	(0.045)	(0.046)
N	429	426	425	429	426	425
R2	0.197	0.386	0.389	0.492	0.606	0.611
Adjusted R2	0.089	0.298	0.302	0.423	0.55	0.555
N. of countries	27	27	27	27	27	27
Time period	2000-2018	2000-2018	2000-2018	2000-2018	2000-2018	2000-2018
Estimation method	IV	IV	IV	IV	IV	IV

Notes: Standard errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Year- and country-fixed effects are included in all specifications (although the estimates are not reported), N. of countries = number of countries. We use as instrument the average forecast error in real GDP growth in all other countries in the same year, $\bar{y}_{jt}^{t+1,t-1}$.

F. Indicators of IFIs splitting between revenues and spending

In the table below we split the regressions in Table 7 of Section 6 into regressions for revenues and spending. Column (1) features as dependent variable the revenue forecast error $rev_{i,t}^{t+1} - rev_{i,t}^{t-1}$, while Column (2) features as dependent variable the spending forecast error $exp_{i,t}^{t+1} - exp_{i,t}^{t-1}$. The existing results are unaffected, while the presence of an IFI significantly improves the revenues realization relative to its forecast. No significant effect on the forecast error of spending is found. We can decompose the forecast errors further to explore the role of IFIs for the base effect and the growth effect. However, in none of the cases is the influence of an IFI being present significantly different from zero.

Dependent variable	$rev_{i,t}^{t+1} - rev_{i,t}^{t-1}$	$exp_{i,t}^{t+1} - exp_{i,t}^{t-1}$
	(1)	(2)
$rev_{i,t-1}^t - rev_{i,t-1}^{t-2}$	0.268***	0.035
	(0.059)	(0.085)
$exp_{i,t-1}^t - exp_{i,t-1}^{t-2}$	0.054	0.250***
	(0.036)	(0.046)
$y_{i,t}^{t+1} - y_{i,t}^{t-1}$	-0.222**	-0.456***
	(0.076)	(0.070)
$rev_{i,t}^{t-1} - rev_{i,t-1}^{t-1}$	-0.582***	-0.396***
	(0.167)	(0.130)
$exp_{i,t}^{t-1} - exp_{i,t-1}^{t-1}$	0.088	-0.031
	(0.100)	(0.148)
$d_{i,t-1}^{t-1}$	-0.002	0.007**
	(0.002)	(0.003)

$fri_{i,t-1}$	-0.141	-0.117
	(0.116)	(0.186)
$govchan_{i,t}$	-0.111	0.333
	(0.132)	(0.231)
$govtype_{i,t-1}$	-0.033	-0.024
	(0.052)	(0.075)
$ifi_{i,t-1}$	0.401*	-0.157
	(0.221)	(0.268)
N	426	426
R2	0.326	0.300
Adjusted R2	0.277	0.249
N. of countries	27	27
Time period	00-19	00-19
Estimation method	IV	IV
Year-fixed effects	Yes	Yes
Country-fixed effects	No	No

Notes: Standard errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. N. of countries = number of countries. We use as instrument the average forecast error in real GDP growth in all other countries in the same year, $\bar{y}_{j,t}^{t+1,t-1}$.

Highlights

1. We study errors in one-year-ahead budgetary projections of EU Member States
2. We consider budget balance, revenues and spending, and further splits
3. More optimistic GDP projections produce more optimistic budgetary projections
4. The effect also works through projected euro amounts of spending and revenues 5. Well-designed independent fiscal institutions may reduce budget overoptimism

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Author statement

We confirm that this paper is our own original work that is not under consideration for publication at another journal. The work is independent and there is no conflict of interest with positions held by any of the authors. The research did not receive outside funding.

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