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A decomposition of structural revenue developments for euro area member states

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Abstract

This paper presents a framework for analysing the evolution of the structural government deficit estimated using the official EU methodology relevant for the Stability and Growth Pact. The focus of our framework lies in the analysis of the main driving forces of changes in estimated structural government revenue, including the impact of changes to tax legislation, fiscal drag (caused e.g. by the non-indexation of income tax brackets), the composition of economic growth, and a residual. This approach allows us to scrutinise estimates of discretionary revenue measures and fiscal elasticities, both of which play a crucial role in the current EU fiscal governance framework.

Between 2010 and 2018, Germany's structural revenue ratio increased substantially even though the estimated impact of changes to tax legislation was close to zero. In most other larger euro area countries, by contrast, structural revenue performed worse than could have been expected based on the estimated impact of discretionary revenue measures. Our approach shows that the composition of economic growth was unfavorable for generating revenue in all analysed countries over this time span. Moreover, in most countries actual revenue grew by less than what could have been expected in view of the discretionary measures taken and developments in the macroeconomic aggregates used to approximate tax bases.

Keywords: cyclical adjustment, fiscal policy, revenue windfalls

JEL codes: H3, H6, E32, E62

Non-technical summary

Fluctuations in economic activity exert a major influence on the public finances. Adjusting for the economic cycle, to distinguish between a "cyclical" and "structural" deficit, therefore plays an important role in fiscal analysis. The EU's approach to fiscal surveillance is no exception in this respect, where fiscal consolidation has been assessed with reference to the evolution of the estimated structural government deficit for many years. To account for measurement problems with this concept, the European Commission has estimated consolidation efforts also via the so-called "expenditure benchmark" in recent years. In the latter approach, revenue-based adjustments are approximated "bottom-up" via the estimated impact of discretionary measures, while the "top-down" change in estimated structural revenue is used for the traditional consolidation indicator, namely the change in the structural balance.

Our main contribution is to help to better understand the observed sizeable differences between these two different indicators for revenue-based adjustments. For this purpose, we decompose the difference between the change in structural revenue and legislative changes (discretionary revenue measures) into three different factors: First, "fiscal drag" indicates how the (structural) ratio of a particular tax to (potential) GDP is expected to evolve over time given the structure of the tax system. This factor gauges, in particular, the bracket creep caused when taxpayers' average tax rates increase as a result of rising average incomes (partly by moving into different tax brackets). Second, the "composition effect" is a gauge of how the structural revenue ratio is being influenced by the composition of economic growth. In this respect, the point is that the cyclical component of the budget balance is derived using a set of elasticities which imply a certain "typical" evolution of macroeconomic aggregates with respect to GDP, with wages assumed to be less cyclical than profits and (at least presently in the OECD/EC methodology) private consumption assumed to grow in line with GDP. Every economic cycle is different, however, and as macroeconomic aggregates grow at rates different to those implied by their elasticities, other things equal, this will exert upward – or downward – pressure on estimated structural revenue. Finally, there remains a residual which captures all other influences on structural revenue. Specifically, this residual captures measurement errors of any kind including (i) under-/over-estimation of tax elasticities, (ii) the fact that actual tax bases are different to the macroeconomic aggregates used to approximate them, and (iii) under-/over-estimation of

the effect of tax measures.

In this paper we present two applications of the framework. The first is a more detailed analysis applied to the case of Spain. This country has been chosen because the Spanish tax administration publishes detailed estimates of the impact of tax measures, which means that revenues can be analysed at the level of different revenue streams (personal income tax, corporate income tax, etc.). In this example, we show how our analytical framework can be used to interpret the effect that Spain's housing market boom and subsequent bust had on the structural deficit as revenues were affected in a way not well gauged by the OECD/EC elasticities used for cyclical adjustment. In this example, we can also see how the structure of government expenditure changed over the course of the substantial fiscal consolidation which took place from 2010 onwards.

The second application of the framework is a more rudimentary one, using mainly AMECO data, but applied to a number of the larger euro area Member States. The analysis shows that in most countries estimated discretionary revenue measures indicated a larger revenue based fiscal adjustment than the change in structural revenue. Furthermore, in several countries over the period 2010-18, fiscal drag has played an important role in delivering fiscal consolidation on the revenue side (as tax brackets have not been adjusted (fully) in line with rising incomes), while the composition of economic growth has tended to make fiscal consolidation difficult, as e.g. a declining wage share dampened growth of personal income tax revenue and social contributions.

1 Introduction

Fluctuations in economic activity exert a major influence on the public finances. Adjusting for the economic cycle, to distinguish between a "cyclical" and "structural" deficit, therefore plays an important role in fiscal analysis. The relationship between the economy and public finances is, however, complex, so estimates of the structural government deficit are only a broad gauge. Understanding the factors driving the evolution of the structural deficit requires subsequent analysis, not least to disentangle the effects of "policy" from other influences.

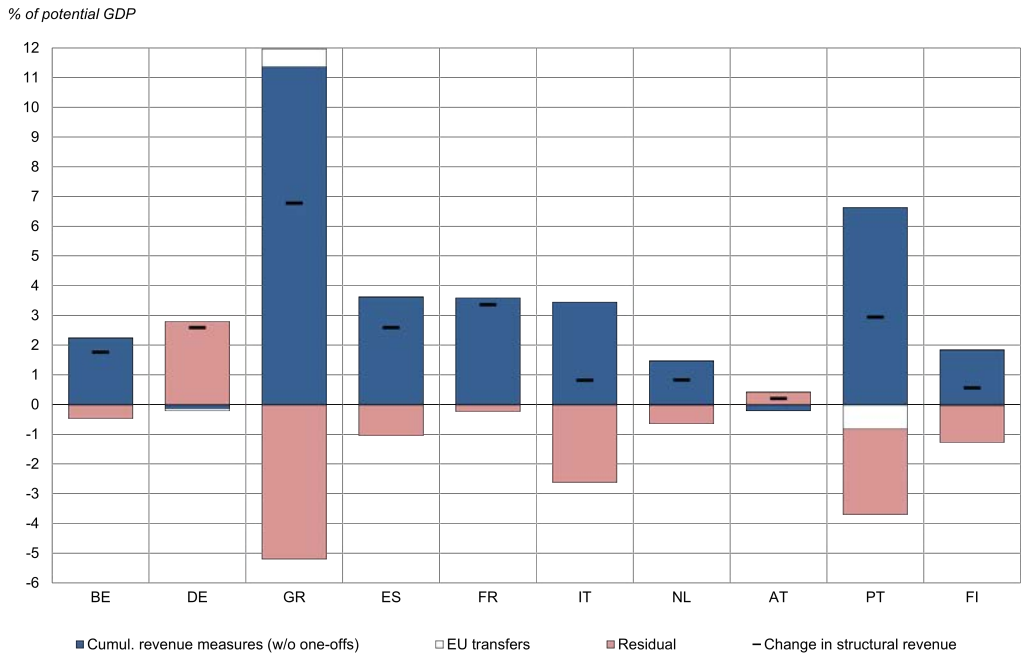
Over time these measurement issues have been increasingly recognised in the European fiscal governance framework. Until the early 2010s, the change in the structural balance was the stand-alone gauge of fiscal adjustment in the European fiscal framework. There the amount of revenue-based adjustment is proxied by the change in the structural revenue ratio. After the "six-pack" legislation and some smaller refinements to the Stability and Growth Pact (SGP), the change in the structural balance is now complemented by an "expenditure benchmark", in which revenue-based consolidation is instead measured on the basis of the discretionary revenue measures adopted (European Commission, 2019).

As can be seen in figure 1.1, differences between the change in the structural revenue ratio and the amount of discretionary measures are sizeable for most larger euro area countries[1]. For example, if we take Germany over the period 2010-18, the structural revenue ratio increased by more than 2 percentage points, but the estimated impact of discretionary revenue measures (reported in the AMECO database) was even slightly negative. This raises the question of what was driving the increase in the structural revenue ratio during this period. Was it fiscal drag caused by non-indexation of progressive income tax brackets? Was it a favourable ("tax rich") composition of economic growth? Which components of revenue were affected? Were or should these developments have been anticipated when making revenue forecasts?[2] May the impact of discretionary measures have been misestimated? Are these discrepancies more of a cyclical or a structural nature? Similar questions arise for countries where estimated discretionary measures

[1] Ireland has been left out due to the distortive effect of the high actual (and estimated potential) GDP growth in 2015.

[2] When a country is subject to an Excessive Deficit Procedure, the higher the projected discrepancy between the change in structural revenue and discretionary measures, the lower are consolidation requirements under the expenditure benchmark (see annex B).

Figure 1.1: Decomposition of change in structural revenue from 2010 to 2018 based on European Commission numbers



Source: Own calculations based on European Commission and ECB data.

were far smaller than the change in structural revenue (like Greece, Italy, Portugal and Finland).

In this paper we present an analytical framework which can be used to examine these issues. We intend to decompose the residual shown in figure 1.1 into three components, namely the effect of non-indexation of tax brackets ("fiscal drag"), the effect of unexpected behaviour of tax bases for given changes in output gap and nominal GDP ("composition effects"), and into a narrower residual covering revenue developments inconsistent with tax elasticities and growth in tax bases ("residual").

A similar decomposition has been made before in the "disaggregated framework for analysing structural developments in public finances" developed by Kremer and Wendorff (2004) and Kremer et al. (2006). However, their approach was meant to explain the evolution of the structural government balance based on the disaggregated method of cyclical adjustment developed by Momigliano and Staderini (1999) and Bouthevillain et al. (2001). While this method of cyclical adjustment has its merits, it differs substantially from the one relevant for the EU fiscal governance framework as it calculates the cyclical component based on individual gaps for different

macroeconomic tax bases (instead of only using the gap between GDP and its trend/potential). Therefore, our contribution is to substantially modify this earlier framework to decompose the evolution of structural revenue based on the OECD/EC methodology used for EU fiscal surveillance described in Mourre et al. (2019).[3]

Our paper is structured as follows. In section 2 we recall the OECD/EC methodology of cyclical adjustment used in EU fiscal surveillance and explain how to decompose the cyclical component derived using this methodology. In section 3 we develop our approach for analysing changes in structural revenue. In section 4 we present two applications of the analysis, one requiring detailed country-specific information on discretionary measures (discussing Spain) and one relying (predominantly) on AMECO data (focussing on Germany and Austria). Section 5 concludes.

2 Calculation of the cyclical component

In the OECD/EC cyclical adjustment methodology, the cyclical component of the budget balance in any given year is estimated as the product of the output gap in that year and the semi-elasticity of the budget balance with respect to output, which is a constant parameter. So the cyclically adjusted balance *cab* and the structural balance *sb* (both in % of potential GDP) are given by:

$$cab_t = bb_t - \epsilon\, og_t, \tag{2.1}$$

$$sb_t = cab_t - tm_t = b_t - tm_t - \epsilon\, og_t, \tag{2.2}$$

where $bb_t = \frac{BB_t}{Y_t}$ denotes the headline budget balance BB_t in per cent of nominal GDP Y_t, tm_t are temporary measures (one-offs) in per cent of nominal GDP and $og_t = \frac{Y_t - Y_t^*}{Y_t^*}$ denotes the output gap in per cent of potential GDP.[4] Finally, the semi-elasticity ϵ is a constant parameter which gauges the typical reaction of the budget balance (as a ratio to GDP) to a one percentage

[3] Appendix C shortly explains this alternative method and compares it to the OECD/EC method and to our decomposition.

[4] We will base our notation on that contained in the annually published Vade Mecum on the SGP (most recently European Commission, 2019). However, we will consistently use large letters to denote variables in nominal terms and small latters to denote ratios to nominal or potential GDP. Furthermore, growth rates will be expressed by using hats.

point increase in the output gap. It is calculated as in Mourre et al. (2019):

$$\epsilon = (\eta^R - 1)r_0 - (\eta^G - 1)g_0, \tag{2.3}$$

where η^R and η^G are the elasticities of revenue and expenditure with respect to output and r_0 and g_0 denote the average (typical) revenue and expenditure ratios.[5] The semi-elasticity is calculated for each EU Member State by the European Commission (Mourre et al., 2019), who in turn rely on fiscal (fiscal-to-base) and macro (base-to-output) elasticities estimated by the OECD (Price et al., 2014).[6]

Now, (2.3) can be decomposed as follows: First, let $r_{i,0}$ and $g_{i,0}$ denote the (typical) shares in GDP of, respectively, $i = 1, ..., k$ revenue components and $i = k+1, ..., n$ expenditure components. Second, let η_i denote the elasticity of each revenue (or expenditure) component with respect to output (the fiscal-to-output elasticity). Third, note that η_i is the product of the elasticity of the revenue (expenditure) component with respect to its base (the "fiscal-to-base elasticity", which we will denote η_i^{RB}) and the elasticity of its base with respect to output (the "base-to-ouput elasticity", which we will denote η_i^{BY}):

$$\eta_i \quad = \quad \eta_i^{RB}\eta_i^{BY}. \tag{2.4}$$

The overall semi-elasticity can then be expressed (and decomposed) in terms of contributions of individual revenue and expenditure components:

$$\epsilon \quad = \quad \sum_{i=1}^{k} r_{i,0}(\eta_i^{RB}\eta_i^{BY} - 1) - \sum_{i=k+1}^{n} g_{i,0}(\eta_i^{RB}\eta_i^{BY} - 1). \tag{2.5}$$

The contribution of each revenue component to the semi-elasticity is given by:

$$\epsilon_i \quad = \quad r_{i,0}(\eta_i^{RB}\eta_i^{BY} - 1). \tag{2.6}$$

If for a particular component of revenue $\eta_i^{RB}\eta_i^{BY} > 1$, then this component of revenue will tend to rise as share of GDP during upturns and fall during downturns (i.e. it has relatively high

[5] Presently, a 10-year average covering the period 2008-2017 is used (Mourre et al., 2019).
[6] This division of work is the reason why we refer to the "OECD/EC cyclical adjustment methodology".

cyclicality) and its contribution to ϵ is positive. By contrast, if $\eta_i^{RB}\eta_i^{BY} < 1$, then the revenue stream has relatively low cyclicality and its contribution to ϵ is negative. In the OECD/EC cyclical adjustment model structure, for most components of revenue $\eta_i^{RB}\eta_i^{BY}$ is relatively close to 1 and so the contribution to ϵ is small. Overall, revenue is expected to rise and fall with the economic cycle leaving the revenue-to-GDP ratio roughly unchanged.

The contribution of each expenditure component to the semi-elasticity is calculated in the same way (just entering the final calculation with the opposite sign). In the OECD/EC structure, only unemployment-related expenditure is viewed as cyclical, and this is a relatively small component of overall spending. For all other (non-cyclical) expenditure $\eta_i^{RB}\eta_i^{BY} = 0$ and so $\epsilon_i = g_{i,0}$, and the contribution of non-cyclical expenditure items to ϵ simply corresponds to its (typical) weight in GDP (the same is true for non-tax revenue).

A crucial point here is that, whereas $\eta_i^{RB}\eta_i^{BY}$ tells us how cyclical components of revenue and expenditure respond to cyclical fluctuations in output in "levels", $(\eta_i^{RB}\eta_i^{BY} - 1)$ tells us how both cyclical and non-cyclical revenue and spending fluctuate as "ratios" to GDP over the economic cycle. While cyclical fluctuations in economic activity mainly influence government revenue, when we analyse the public finances in terms of ratios, the impact of the economic cycle comes mainly through fluctuations in the expenditure-to-GDP ratio.

The derivation of the semi-elasticity is summarised in table 2.1 for the case of Spain. According to the OECD/EC estimates and calculations, the overall contribution of revenue to the semi-elasticity is just 0.01. This means that, for every one percentage point change in the output gap, the revenue-to-GDP ratio would be expected to rise by 0.01 of a percentage point. The ratios of personal and corporate income tax to GDP would rise, but this would be offset by a decline in the ratios of social contributions and (non-cyclical) non-tax revenue to GDP. The overall contribution of expenditure to the semi-elasticity is 0.53. For every one percentage point change in the output gap, the ratio of non-cyclical expenditure to GDP falls by 0.42 of a percentage point (pure denominator effect) on top of which the ratio of unemployment-related expenditure to GDP falls by 0.17 of a percentage point. The latter reflects both the denominator effect and the sensitivity of unemployment (and therefore of unemployment benefits) to output.

Table 2.1: Decomposition of the semi-elasticity for Spain

Revenue/expenditure	Base	Fiscal-to-base elasticity ν_i	Base-to-output elasticity γ_i	Fiscal-to-output elasticity $\eta_i = \nu_i \gamma_i$	Weight in GDP $r_{i,0}$	Semi-elasticity $\epsilon_i = r_{i,0}(\eta_i - 1)$
Personal income tax		1.88	0.99	1.84	0.08	0.07
PIT on earnings	Earnings	1.93	0.88	1.69	0.07	0.05
PIT on self-employment income	Self-employment income	1.48	0.98	1.44	0.01	0.00
PIT on capital income	Capital income	1.83	4.55	8.33	0.00	0.01
Corporate income tax	Gross operating surplus	1.32	1.18	1.56	0.02	0.01
Indirect taxes	Private consumption	1.00	1.00	1.00	0.11	0.00
Social contributions	Earnings	0.82	0.88	0.72	0.13	-0.04
Non-tax revenue	-	0.00	0.00	0.00	0.04	-0.04
Total revenue				1.02	0.37	0.01
Unemployment-related expenditure	Unemployment	1.00	-5.83	-5.83	0.03	-0.17
Other expenditure	-	0.00	0.00	0.00	0.42	-0.42
Total expenditure				-0.33	0.44	-0.59
TOTAL						0.60

Source: OECD, European Commission.

Table 2.2: Decomposition of the cyclical component for Spain

	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
	% of potential GDP											
Budget balance	**1.7**	**0.7**	**-1.9**	**-2.6**	**-3.4**	**-4.8**	**-5.3**	**-4.6**	**-2.8**	**-1.4**	**-0.3**	**0.5**
Total revenue	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-0.1**	**-0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
"Corporate income tax"	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0
"Personal income tax"	0.2	0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.5	-0.3	-0.2	0.0	0.1
Indirect taxes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Social contributions	-0.1	0.0	0.1	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.0	0.0
Capital taxes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-tax-related revenue	-0.1	0.0	0.1	0.1	0.2	0.3	0.3	0.2	0.1	0.1	0.0	0.0
Expenditure	**-1.7**	**-0.7**	**1.9**	**2.5**	**3.4**	**4.7**	**5.3**	**4.5**	**2.8**	**1.4**	**0.3**	**-0.5**
Interest payments	-0.1	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.1	0.1	0.0	0.0
Social benefits in cash	-0.8	-0.3	0.9	1.3	1.7	2.4	2.8	2.4	1.4	0.7	0.2	-0.3
of which: unemployment benefits	-0.5	-0.2	0.6	0.7	1.0	1.4	1.5	1.3	0.8	0.4	0.1	-0.2
Compensation of employees	-0.3	-0.1	0.4	0.5	0.6	0.8	1.0	0.8	0.5	0.3	0.1	-0.1
Intermediate consumption and D.632	-0.3	-0.1	0.3	0.4	0.5	0.7	0.8	0.7	0.4	0.2	0.0	-0.1
Other current expenditure	-0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.0
Gross fixed capital formation	-0.1	-0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0
Other capital expenditure	0.0	0.0	0.0	0.0	0.1	0.3	0.1	0.1	0.0	0.0	0.0	0.0
Memorandum item: Output gap	2.8	1.2	-3.2	-4.3	-5.7	-8.0	-8.9	-7.7	-4.7	-2.3	-0.5	0.9

Source: Own calculations based on European Commission and ECB data. Note: D.632 = social transfers in kind provided via market producers.

Keeping with our example of Spain, table 2.2 reports the decomposition of the cyclical component $\epsilon og_t = b_t - cab_t$ over the period 2007-18. This serves to illustrate, for example, how, in theory, a recession (like in 2009) is expected to put downward pressure on the personal and corporate income tax-to-GDP ratios, offset by upward pressure on the ratios of social contributions and (non-cyclical) non-tax revenue to GDP, while leaving the overall revenue-to-GDP ratio unaffected.

3 Analytical decomposition of the structural revenue ratio

In the following we will show how to decompose the change in the structural revenue ratio in a manner consistent with the method used for EU fiscal surveillance. Our calculations have been inspired by Kremer et al. (2006), who did so for a quite different method of cyclical adjustment laid out in Bouthevillain et al. (2001). Appendix C explains the most important differences between these two methods of cyclical adjustment and the two different decompositions.

The change in the structural revenue ratio sr_t is given by $\Delta sr_t = \Delta car_t - (tm_t^R - tm_{t-1}^R)$, where tm_t^R are temporary revenue measures, and where the change in the cyclically-adjusted revenue ratio car_t can be expressed as follows (see also European Commission, 2016, page 144):

$$\Delta car_t \quad = \quad \Delta r_t - r_0(\eta^R - 1)\Delta og_t. \tag{3.1}$$

$\Delta r_t = \frac{R_t}{Y_t} - \frac{R_{t-1}}{Y_{t-1}}$ is the change in the actual revenue ratio and $r_0(\eta^R - 1)\Delta og_t$ is the change in the economic cycle's influence on the revenue ratio.

The change of cyclically adjusted revenue from an individual component i is given by:

$$\begin{aligned} \Delta car_{i,t} &= \Delta r_{i,t} - r_{i,0}(\eta_i^{RB}\eta_i^{BY} - 1)\Delta og_t \\ &= \frac{R_{i,t-1}}{Y_t}\left(\widehat{R}_{i,t} - \widehat{Y}_t\right) - r_{i,0}(\eta_i^{RB}\eta_i^{BY} - 1)\Delta og_t, \end{aligned} \tag{3.2}$$

where $\Delta car_t = \sum_{i=1}^{n} \Delta car_{i,t}$, and where $\widehat{R}_{i,t}$ and $\widehat{Y}_t$ refer to the growth rates in revenue category R_i and in nominal GDP Y. To arrive at the change in the structural revenue ratio, one has to deduct the change in revenue one-offs tm^R:

$$\Delta sr_{i,t} \quad = \quad \frac{R_{i,t-1}}{Y_t}\left(\widehat{R}_{i,t} - \widehat{Y}_t\right) - r_{i,0}(\eta_i^{RB}\eta_i^{BY} - 1)\Delta og_t - \Delta tm_{i,t}^R. \tag{3.3}$$

3.1 Tax elasticities and the law of motion for tax revenue

We can decompose growth in revene item i $\widehat{R}_{i,t}$ in terms of a typical model (equation) for making revenue forecasts, where tax revenue will depend on the evolution of some base (approximated by a macroeconomic aggregate), the elasticity of tax revenue to that base and the estimated

impact of any discretionary measures. In general, this equation will look as follows:

$$\widehat{R}_{i,t} \quad = \quad f\left(\widehat{B}_{i,t}, \eta_i^{RB}\right) + \frac{DM_{i,t} + RES_{i,t}}{R_{i,t-1}}, \tag{3.4}$$

where $\widehat{B}_{i,t}$ is the growth of the tax base (or whatever macroeconomic variable is used to approximate the tax base), $DM_{i,t}$ is the estimated impact of any changes to tax legislation (discretionary measures) and $RES_{i,t}$ is a residual capturing any other forecast judgements. The same model (equation) can also be used to analyse outturns; only in this case $RES_{i,t}$ now captures the difference between the outturn and what would be predicted by the model equation and the (potentially erroneous) estimate of $DM_{i,t}$.[7]

One important ingredient in our decomposition of the change in structural revenue will be fiscal drag, which is the effect of non-indexation of tax brackets (to inflation or wage growth) of non-proportional (i.e. progressive or regressive) taxes on tax revenue. The estimation of fiscal drag is closely related to the exact functional relationship $f\left(\widehat{B}_{i,t}, \eta_i^{RB}\right)$ between revenue growth and tax bases and tax elasticities. In case of a unit tax elasticity (like for indirect taxes in all countries except Italy), i.e. $\eta_i^{RB} = 1$, we simply have $f\left(\widehat{B}_{i,t}, \eta_i^{RB}\right) = \eta_i^{RB}\widehat{B}_{i,t} = \widehat{B}_{i,t}$; and fiscal drag is zero.

However, non-unit tax elasticities in the OECD framework can be interpreted in different ways. As explained in section 2, the European Commission relies on tax-to-base elasticities estimated by the OECD, most recently by Price et al. (2014) and before that by Girouard and Andre (2005). The earlier paper only used tax codes (partially applying microsimulations) for estimating these elasticities, such that a proportional tax like the corporate income tax would have a tax-to-base elasticity of 1.

To account for the potentially high cyclicality of corporate taxes, Price et al. (2014) estimated the elasticity of corporate taxes to gross operating surplus econometrically, which for most countries leads to elasticities far above 1 (e.g. the 1.32 for Spain reported in table 2.1; for France it is even 2.03). The reasoning is that the true corporate tax base tends to be much more

[7] As discretionary measures $DM_{i,t}$ and residuals $RES_{i,t}$ are expressed in units of national currency, they need to be divided by $R_{i,t-1}$ to yield their contribution to the growth rate of the tax category.

cyclical than the gross operating surplus (which is used as macro base by the OECD), meaning that η_i^{RB} is really just an extension of η_i^{BY} trying to correct for imperfect measurement of the tax base. So here η_i^{RB} represents what we will call a "short-run elasticity", translating trend deviations of the tax base into trend deviations of tax revenue. For example, if the tax elasticity were 2, we would expect growth of gross operating surplus of 1% above trend to translate into a growth in corporate taxes of 2% above trend. However, when gross operating surplus grows by 50% over a decade (and trend and actual growth are roughly the same), we should expect revenue in corporate taxes not to double, but only to increase by about 50% as they are proportional to their true tax base (so there is no fiscal drag). This has to be distinguished from the case of progressive taxes like the personal income tax (on wages), where tax-to-base elasticities are typically around 2. Should average wages increase by 50% over a decade, we would expect – in the absence of discretionary measures and for stable employment – revenue from personal income tax on wages to double (as it is a progressive tax, there is fiscal drag).[8]

3.1.1 Long-run-elasticity

The most intuitive cases are non-proportional taxes, where a 1% growth in the tax base typically leads to a growth in revenue by $\eta_i^{RB}\%$, both in the short and the long run (which we call a "long-run elasticity"). In the absence of discretionary measures, the trend growth of the affected taxes will be different from that of the tax base; this phenomenon is called fiscal drag throughout the paper. So it holds that $\eta_i^{RB} := \frac{\partial \ln R_{i,t}}{\partial \ln B_{i,t}}$, implying that $f\left(\widehat{B}_{i,t}, \eta_i^{RB}\right) = \eta_i^{RB}\widehat{B}_{i,t}$. This leads to the following law of motion for growth in unadjusted revenue $\widehat{R}_{i,t}$:[9]

$$\widehat{R}_{i,t} \quad = \quad \eta_i^{RB}\widehat{B}_{i,t} + \frac{DM_{i,t} + RES_{i,t}}{R_{i,t-1}}. \tag{3.5}$$

This specification is only employed for personal income taxes on capital income (for an explanation see section 3.1.3).

[8] The European Commission does not need to make this distinction, as this is actually not needed for calculating the cyclical component of revenue, which is only about trend deviations.

[9] This equation can also be rewritten as $R_{i,t} = \left(1 + \eta_i^{RB}\widehat{B}_{i,t}\right) R_{i,t-1} + DM_{i,t} + RES_{i,t}$, which would be a typical formulation of a fiscal forecasting equation using variables in currency units.

3.1.2 Short-run-elasticity

When a non-unit tax elasticity is applied to a proportional tax, we use the label "short-run elasticity". If the tax base grows by 1% above trend, tax revenue will grow by η_i^{RB}%, while if in the long run the tax base grows by x%, tax revenue will grow by x%, too (i.e. there is no fiscal drag). In this case it holds that $\eta_i^{RB} := \frac{\partial \ln \frac{R_{i,t}}{B^*_{i,t}}}{\partial \ln \frac{B_{i,t}}{B^*_{i,t}}}$, which implies that $f\left(\widehat{B}_{i,t}, \eta_i^{RB}\right) - \widehat{B}^*_{i,t} = \eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{B}^*_{i,t}\right)$ and $\widehat{R}_{i,t} - \widehat{B}^*_{i,t} = \eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{B}^*_{i,t}\right) + \frac{DM_{i,t}+RES_{i,t}}{R_{i,t-1}}$, which can be rewritten as:

$$\begin{aligned} \widehat{R}_{i,t} &= \eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{B}^*_{i,t}\right) + \widehat{B}^*_t + \frac{DM_{i,t} + RES_{i,t}}{R_{i,t-1}} \\ &= \eta_i^{RB}\widehat{B}_{i,t} - (\eta_i^{RB} - 1)\widehat{B}^*_{i,t} + \frac{DM_{i,t} + RES_{i,t}}{R_{i,t-1}}. \end{aligned} \tag{3.6}$$

This specification is not only applied for corporate income taxes, but also for indirect taxes[10] and social contributions (for an explanation see section 3.1.3). As the European Commission's method for estimating output gaps does not make any statements on trend growth rates of GDP income components, we will assume a balanced growth path in the following. This means that the trend growth of the tax base will be identical to the one of trend GDP, i.e. $\widehat{B}^*_{i,t} = \widehat{Y}^*_t$.

3.1.3 Personal income taxes

In Price et al. (2014) the elasticities of personal income tax (PIT) with respect to personal income (and of social contributions with respect to earnings) are derived via a microsimulation of tax codes. This approach gives an indication of how the tax paid by a representative household will tend to rise as their income rises. In the case of personal income taxes, $\eta_i^{RB} > 1$ because individuals' (households') average tax rate tends to increase as their income rises due to a progressive tax schedule ("bracket creep"). In the case of social contributions, usually $\eta_i^{RB} \approx 1$, but it can be a bit above or below one depending on whether there are ceilings and/or floors on the size of the tax base.

When the non-unit fiscal-to-base elasticity is calibrated in this way and fiscal drag is understood to refer to bracket creep, $\eta_i^{RB} > 1$ is applicable to growth in "average" incomes W_t, not "total" income $B_t = N_t W_t$. The application of the non-unit elasticity for personal income tax

[10] This is only relevant for Italy as for all other countries the tax elasticity of indirect taxes is 1.

to total income is a quirk of the OECD/EC methodology, which tends to exaggerate the cyclical component in relation to these particular components of revenue. If, for example, earnings growth is only driven by an increase in the number of employees N_t (rather than average earnings), then revenue from PIT on wages should increase by the same rate, while the OECD/EC method assumes an elasticity far above 1.

In order to avoid exaggerating the influence of this assumption on fiscal drag, it is necessary to interpret η_i^{RB} as a long-term elasticity with regard to average income W_t, but as a short-term-elasticity with regard to the number of taxpayers N_t, i.e. $\eta_i^{RB} = \frac{\partial \ln R_{i,t}}{\partial \ln W_t} = \frac{\partial \ln \frac{R_{i,t}}{N_t^*}}{\partial \ln \frac{N_t}{N_t^*}}$, which implies that $f\left(\widehat{B}_{i,t}, \eta_i^{RB}\right) = \eta_i^{RB}\widehat{W}_t + \eta_i^{RB}\left(\widehat{N}_t - \widehat{N}_t^*\right) + \widehat{N}_t^*$. This leads to the following law of motion for PIT revenue:

$$\begin{aligned} \widehat{R}_{i,t} &= \eta_i^{RB}\widehat{W}_t + \eta_i^{RB}\widehat{N}_t - (\eta_i^{RB} - 1)\widehat{N}_t^* + \frac{DM_{i,t} + RES_{i,t}}{R_{i,t-1}} \\ &= \eta_i^{RB}\widehat{B}_{i,t} - (\eta_i^{RB} - 1)\widehat{N}_t^* + \frac{DM_{i,t} + RES_{i,t}}{R_{i,t-1}}. \end{aligned} \tag{3.7}$$

The same modification is also applied for self-employment income, where the tax elasticity is different from 1, too. As there is no macroeconomic information on the number of taxpayers for capital income taxes, we are unable to make this modification for PIT on capital income. However, we might generally expect that fluctuations in capital income (interest, dividends, capital gains) are mainly due to fluctuations in average incomes. Therefore, we use equation (3.5) to describe the development of the latter subcategory. Furthermore, note that the OECD estimates the elasticity of social contributions with regard to compensation of employees to be below 1 for most countries based on tax codes, likely due to the effect of ceilings on the tax base. As these ceilings tend to be indexed in most countries, we apply equation (3.6) for social contributions.

3.2 Decomposing the change in the structural revenue ratio

In the following we will decompose the change in the cyclically adjusted revenue ratio in equation (3.2) into the following components: (trend) fiscal drag, composition effect, discretionary measures and a residual. The latter two components already show up in the equations for unadjusted revenue in section 3.1. Fiscal drag describes the effect that – in the absence of

discretionary measures – non-proportional taxes have a different trend growth rate than their bases. The composition effect is driven by the difference between the actual growth of the tax base and its predicted growth based on GDP growth and the change in the output gap, i.e. it is based on the residuals from the equations estimating the macro elasticities η_i^{BY}. It is derived such that the expression is identical regardless of whether the tax elasticity is a short-run- or a long-run-elasticity and such that fiscal drag is not driven by cyclical movements in real variables. Appendix A discusses the rationale for the exact definitions of fiscal drag and composition effects.

3.2.1 Long-run-elasticity

Putting (3.5) into (3.2) yields:

$$\begin{aligned}
\Delta car_{i,t} &= \frac{R_{i,t-1}}{Y_t}\left(\eta_i^{RB}\widehat{B}_{i,t} - \widehat{Y}_t\right) - r_{i,0}(\eta_i^{RB}\eta_i^{BY} - 1)\Delta og_t + \frac{R_{i,t-1}}{Y_t}\frac{DM_{i,t} + RES_{i,t}}{R_{i,t-1}} \\
&= car_{i,t-1}\left(\eta_i^{RB}\widehat{B}_{i,t} - \widehat{Y}_t - \eta_i^{RB}\eta_i^{BY}\Delta og_t + \widehat{Y}_t - \widehat{Y}_t^* + \eta_i^{RB}\widehat{Y}_t^* - \eta_i^{RB}\widehat{Y}_t^*\right) \\
&\quad + dm_{i,t} + res_{i,t} \\
&= \underbrace{car_{i,t-1}(\eta_i^{RB} - 1)\widehat{Y}_t^*}_{\text{fiscal drag}} + \underbrace{car_{i,t-1}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{Y}_t^* - \eta_i^{BY}\Delta og_t\right)}_{\text{composition effect}} \\
&\quad + dm_{i,t} + res_{i,t}, \qquad (3.8)
\end{aligned}$$

where $dm_{i,t}$ refers to discretionary measures in per cent of nominal GDP, and the residual $res_{i,t}$ contains the approximation errors due to linearization. For the intermediate steps we have used that (due to the low cyclicality of the revenue ratio) $\frac{R_{i,t-1}}{Y_t} \approx r_{i,t} \approx r_{i,0} \approx car_{i,t}$ and that $\widehat{Y}_t^* \approx \widehat{Y}_t - \Delta og_t$.

The expression $car_{i,t-1}(\eta_i^{RB} - 1)\widehat{Y}_t^*$ is now the structural fiscal drag, which depends on how much the fiscal-to-base elasticity η_i^{RB} differs from one and on the structural growth of the tax base (which according to our assumption of a balanced growth path is identical to that of trend output).

The term $car_{i,t-1}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{Y}_t^* - \eta_i^{BY}\Delta og_t\right)$ is the composition effect which derives from any difference between the actual growth of the tax base $\widehat{B}_{i,t}$ and its stylised cyclical path, which is to fluctuate around the growth path of overall trend output in the order of magnitude given

by the base-to-output elasticity η_i^{BY}.

This distinction between fiscal drag, composition effect and residual is also important for assessing the "true" structural adjustment on the revenue side: Fiscal drag should be considered as a discretionary revenue measure in a broader sense. In case all tax bases have indeed the same trend growth rate as GDP, the composition effect is of a purely cyclical nature. But if there were indeed deviations in long-term trend growth rates (e.g. a downward trending wage share), the composition effect would be partly structural.[11] As the residual in our approach is directly taken from the underlying equations for unadjusted revenue (i.e. equations 3.5, 3.6 and 3.7), systematically large residuals may indicate that one or more of the ingredients of this equation (i.e. tax base, tax elasticity, estimate of discretionary revenue measures) suffers from problems.

3.2.2 Short-run-elasticity

Putting (3.6) into (3.2) (assuming $\widehat{B}_{i,t}^* = \widehat{Y}_t^*$) yields:

$$\begin{aligned}
\Delta car_{i,t} &= \frac{R_{i,t-1}}{Y_t}\left(\eta_i^{RB}\widehat{B}_{i,t} - (\eta_i^{RB}-1)\widehat{B}_{i,t}^* - \widehat{Y}_t\right) \\
&\quad -r_{i,0}(\eta_i^{RB}\eta_i^{BY}-1)\Delta og_t + \frac{R_{i,t-1}}{Y_t}\frac{DM_{i,t}+RES_{i,t}}{R_{i,t-1}} \\
&= car_{i,t-1}\left(\eta_i^{RB}\widehat{B}_{i,t} - (\eta_i^{RB}-1)\widehat{Y}_t^* - \widehat{Y}_t - \eta_i^{RB}\eta_i^{BY}\Delta og_t + \widehat{Y}_t - \widehat{Y}_t^*\right) \\
&\quad +dm_{i,t} + res_{i,t} \\
&= \underbrace{car_{i,t-1}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{Y}_t^* - \eta_i^{BY}\Delta og_t\right)}_{\text{composition effect}} + dm_{i,t} + res_{i,t}. \qquad (3.9)
\end{aligned}$$

This equation is similar to (3.8), with the composition effect being the same, but the fiscal drag is set to 0.

[11] This is one of the largest differences to the approach of Kremer et al. (2006), where the change in cyclically adjusted revenue (calculated using an alternative method of cyclical adjustment described in Bouthevillain et al., 2001) is decomposed into fiscal drag, decoupling, discretionary measures and a residual. There "decoupling" shows the impact of the tax base having a different trend growth rate than GDP, which is therefore in principle of a structural nature.

3.2.3 Personal income taxes

Putting (3.7) into (3.2) (assuming $\widehat{B}_t^* = \widehat{Y}_t^*$) yields:

$$\begin{aligned}
\Delta car_{i,t} &= \frac{R_{i,t-1}}{Y_t}\left(\eta_i^{RB}\widehat{B}_{i,t} - (\eta_i^{RB}-1)\widehat{N}_t^* - \widehat{Y}_t\right) \\
&\quad -r_{i,0}(\eta_i^{RB}\eta_i^{BY}-1)\Delta og_t + \frac{R_{i,t-1}}{Y_t}\frac{DM_{i,t}+RES_{i,t}}{R_{i,t-1}} \\
&= car_{i,t-1}\left(\eta_i^{RB}\widehat{B}_{i,t} - (\eta_i^{RB}-1)\widehat{N}_t^* - \widehat{Y}_t - \eta_i^{RB}\eta_i^{BY}\Delta og_t + \widehat{Y}_t - \widehat{Y}_t^*\right) \\
&\quad +car_{i,t-1}\left(\eta_i^{RB}\widehat{Y}_t^* - \eta_i^{RB}\widehat{Y}_t^*\right) + dm_{i,t} + res_{i,t} \\
&= \underbrace{car_{i,t-1}(\eta_i^{RB}-1)\left(\widehat{Y}_t^* - \widehat{N}_t^*\right)}_{\text{fiscal drag}} \\
&\quad + \underbrace{car_{i,t-1}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{Y}_t^* - \eta_i^{BY}\Delta og_t\right)}_{\text{composition effect}} + dm_{i,t} + res_{i,t}. \qquad (3.10)
\end{aligned}$$

The expression for the composition effect is identical to the one in (3.8) and (3.9), but the fiscal drag is now driven by the trend growth of nominal GDP per person employed. This adjustment is necessary as trend growth in employment of 1% should induce structural revenue to increase by exactly 1%, too. Due to the OECD's assumption of a non-unit elasticity for overall earnings, the composition effect can take somewhat odd values in case actual employment growth differs significantly from trend employment growth.

3.2.4 Equations for the change in structural revenue ratios

To get from the decomposed change in cyclically adjusted revenue $car_{i,t}$ to the one in structural revenue $sr_{i,t} = car_{i,t} - tm_{i,t}^R$, one has to adjust both sides of equations (3.8), (3.9) and (3.10) for temporary measures:

$$\Delta sr_{i,t} = fd_{i,t} + car_{i,t-1}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{Y}_t^* - \eta_i^{BY}\Delta og_t\right) + \widetilde{dm}_{i,t} + res_{i,t}, \qquad (3.11)$$

where $\widetilde{dm}_{i,t} := dm_{i,t} - (tm_{i,t}^R - tm_{i,t-1}^R)$ are structural revenue measures (i.e. total revenue measures $dm_{i,t}$ adjusted for temporary measures) and fiscal drag $fd_{i,t} = car_{i,t-1}(\eta_i^{RB}-1)\widehat{Y}_t^*$ in case of a long-run elasticity, $fd_{i,t} = 0$ in case of a short-run elasticity and $fd_{i,t} = car_{i,t-1}(\eta_i^{RB} - 1)\left(\widehat{Y}_t^* - \widehat{N}_t^*\right)$ for personal income taxes.

4 Shedding some light on the differences between discretionary revenue measures and changes in structural revenue

In this section we illustrate different ways of applying this framework: In subsection 4.1 we show a detailed decomposition of the change in the structural balance of Spain from 2008 to 2018, which requires detailed information on the composition of discretionary revenue measures across tax categories. If such data is not available, a fallback is to use data on total revenue measures contained in the AMECO database, which then limits us to a less detailed analysis than in subsection 4.2.

Most of the data used for the following decompositions (and for the figures and tables in the previous sections) is taken from the spring 2019 vintage of the AMECO database of the European Commission[12], with the exceptions of the discretionary and temporary measures for the detailed decomposition in section 4.1, revenue from EU transfers (taken – if available – from Eurostat or alternatively from the ECB's external Statistical Data Warehouse) and the labour contribution to potential growth[13] (taken from the European Commission's CIRCABC platform).

4.1 Detailed decomposition of structural revenue in Spain

A full application of the framework requires detailed information regarding the (estimated) impact of changes to tax legislation as well as the effect of temporary or one-off influences which may also be excluded from the structural deficit. Unfortunately, the European Commission only provides estimates for the sum of discretionary revenue measures (over all tax categories), and temporary measures are only available for total revenue and for total expenditure. Furthermore, these series in the Commissions' AMECO database only start in 2010. Therefore, we have to rely on alternative (and country-specific) data sources for a detailed analysis. In the case of Spain, the tax administration (AEAT) provides estimates of the impact of changes to tax legislation in its monthly and annual reports on tax receipts.[14] In this application we use these estimates,

[12]Note that in the EC/OECD method "Corporate income tax" and "Personal income tax" are supposed to cover all current taxes on income, wealth, etc., and not only taxes on income. Total revenue from current taxes on income, wealth, etc. has been attributed to corporates and households according to information from the household and corporate sector accounts provided in AMECO.

[13]As the Commission method assumes a labour share of 0.65 in a Cobb-Douglas production function, trend employment growth equals the labour contribution to potential growth divided by 0.65.

[14]www.agenciatributaria.es

with a few very minor adjustments.[15] Overall, these estimates tend to be much smaller than the ones released by the European Commission in its AMECO database (which are used in figures 1.1, 4.1) and 4.2 as well as in table E.3). As far as temporary or one-off influences on the government balance are concerned, in this section we exclude (only) the impact of government support to financial institutions on capital expenditure (based on information contained in Eurostat's supplementary tables for the financial crisis). Hence the temporary or one-off influences we identify here will not be the same as those identified by the EC in its implementation of the SGP.

Table 4.1 reports the resulting decomposition of the change in the structural balance over the period 2008-18. The numbers in the first 10 columns refer to year-on-year changes, while the final column shows the cumulated figures for the entire period. This period consists of two years of substantial fiscal deterioration in 2008-09 at the time of the global economic and financial crisis, followed by several years of subsequent fiscal consolidation (2010-13), and finally an episode of neutral to expansive policies (2014-18). The first four lines show the transition from the change in the headline balance-to-GDP ratio to the change in the structural balance ratio (in per cent of potential GDP). The remaining lines decompose the change in the structural balance ratio across different components of revenue and expenditure.

To illustrate succinctly the benefits of the analysis, let us first say a few words about the fiscal deterioration in 2008-09 and then focus on the fiscal consolidation period from 2010-2018. In 2008-09, Spain's government balance ratio lurched from a surplus of almost 2% to a deficit of 11%. As gauged by the EC cyclical adjustment methodology, most (around three-quarters) of this deterioration was structural, which in turn was mainly caused by a decline in the structural revenue ratio. Our analytical framework, however, attributes most of this decline in the structural revenue ratio to the residual (i.e. meaning that it was neither caused by discretionary measures nor by fiscal drag nor by the composition of GDP growth). Instead, it reflects the fact that tax receipts were hit hard by developments not reflected in the evolution of the macroeconomic aggregates used to approximate tax bases. Before the financial crisis, tax revenue in Spain had been boosted by rising property values and transactions, reflected in higher corporate

[15] We exclude a measure which changed the way VAT on imports was paid and which affected annual VAT collection on a cash - but not on an accrual - basis. We also exclude the estimated impact on personal income tax stemming from the suspension of government employees' Christmas bonus in 2012 and its subsequent compensation in 2015-16, as the effect on revenue would be captured by the evolution of the base.

Table 4.1: Detailed decomposition of the change in the structural balance for Spain

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	08-18
	% of potential GDP											
Change in unadjusted balance	**-6.3**	**-6.5**	**1.6**	**-0.3**	**-0.8**	**3.5**	**1.0**	**0.7**	**0.8**	**1.4**	**0.6**	**-4.4**
Cyclical component	-1.0	-2.6	-0.7	-0.9	-1.3	-0.6	0.8	1.8	1.4	1.1	0.8	-1.2
Temporary measures	0.0	0.0	0.0	-0.4	-3.3	3.4	0.2	0.1	-0.2	0.2	0.0	0.0
Change in structural balance	**-5.3**	**-3.9**	**2.3**	**1.0**	**3.8**	**0.6**	**0.1**	**-1.2**	**-0.4**	**0.1**	**-0.3**	**-3.2**
Change in structural revenue	**-4.2**	**-1.9**	**1.4**	**0.0**	**1.5**	**0.9**	**0.3**	**-0.4**	**-0.7**	**0.2**	**0.9**	**-2.1**
"Corporate income tax"	-1.8	-0.5	-0.4	0.0	0.4	-0.1	-0.1	0.3	-0.2	0.0	0.2	-2.3
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Composition effect	0.0	0.1	-0.1	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0	0.1
Discretionary measures	-0.7	0.1	-0.1	0.1	0.4	0.0	-0.1	-0.3	0.1	-0.1	0.0	-0.5
Residual	-1.1	-0.7	-0.3	-0.2	-0.1	0.0	0.1	0.6	-0.3	0.1	0.2	-1.8
"Personal income tax"	-0.4	-0.2	0.4	0.4	0.5	0.2	-0.1	-0.6	-0.2	0.1	0.2	0.3
Fiscal drag	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	1.0
Composition effect	0.3	0.1	-0.2	0.1	-0.4	-0.1	0.1	0.0	-0.1	-0.1	0.1	-0.4
Discretionary measures	-0.8	-0.3	0.3	0.2	0.5	0.1	0.0	-0.4	-0.4	0.1	0.0	-0.7
Residual	-0.2	-0.1	0.3	0.0	0.4	0.1	-0.2	-0.2	0.2	0.0	0.1	0.4
Indirect taxes	-1.8	-1.1	1.7	-0.3	0.5	0.8	0.3	0.3	-0.2	0.0	0.1	0.2
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Composition effect	-0.1	-0.1	0.2	0.1	0.2	-0.1	0.1	-0.1	-0.1	0.0	0.0	0.1
Discretionary measures	0.0	0.1	0.4	0.4	0.2	1.1	0.1	0.1	0.0	0.0	0.0	2.3
Residual	-1.8	-1.1	1.1	-0.7	0.2	-0.2	0.1	0.3	-0.1	0.0	0.1	-2.2
Social contributions	0.0	0.1	-0.2	0.0	-0.3	-0.2	0.1	-0.2	0.0	0.2	0.2	-0.3
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Composition effect	0.4	0.1	-0.2	-0.1	-0.4	-0.2	0.0	0.1	0.0	0.0	0.1	-0.2
Discretionary measures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual	-0.3	0.0	0.0	0.1	0.1	-0.1	0.0	-0.3	0.0	0.2	0.1	0.0
Capital taxes	-0.1	-0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	-0.1	0.0	0.0
Discretionary measures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual	-0.1	-0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	-0.1	0.0	0.0
Total taxes and social contributions	**-4.0**	**-1.8**	**1.5**	**0.0**	**1.1**	**0.8**	**0.3**	**-0.2**	**-0.6**	**0.2**	**0.7**	**-2.0**
Fiscal drag	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	1.0
Composition effect	0.7	0.2	-0.3	0.1	-0.6	-0.4	0.1	-0.1	-0.2	-0.2	0.1	-0.5
Discretionary measures	-1.5	-0.1	0.6	0.7	1.1	1.2	0.0	-0.6	-0.3	0.0	0.0	1.1
Residual	-3.5	-2.0	1.1	-0.8	0.5	-0.1	0.1	0.4	-0.2	0.2	0.5	-3.7
Non-tax-related revenue	-0.2	-0.1	0.0	-0.1	0.4	0.2	0.0	-0.3	-0.2	-0.1	0.2	0.0
EU transfers	-0.1	-0.1	0.1	0.1	0.1	-0.1	0.0	0.0	-0.2	0.0	0.2	0.0
Residual	-0.1	0.0	-0.1	-0.1	0.3	0.3	0.1	-0.2	0.1	-0.1	0.0	0.0
Change in structural expenditure	**1.1**	**2.0**	**-0.8**	**-1.1**	**-2.3**	**0.3**	**0.2**	**0.7**	**-0.3**	**0.0**	**1.2**	**1.1**
Interest payments	0.0	0.1	0.1	0.5	0.4	0.4	0.0	-0.3	-0.2	-0.2	-0.1	0.9
Structural primary expenditure	1.2	2.0	-1.0	-1.6	-2.8	-0.1	0.2	1.0	-0.1	0.2	1.3	0.3
Social benefits in cash	0.4	0.8	0.3	-0.2	0.2	0.0	0.2	0.2	0.5	0.2	0.5	3.3
Compensation of employees	0.5	0.6	-0.2	-0.3	-0.7	0.1	0.0	0.3	0.1	-0.1	0.1	0.3
Intermediate consumption and D.632	0.3	0.3	-0.1	-0.1	-0.5	-0.3	0.0	0.2	-0.1	0.1	0.1	-0.1
Other current expenditure	0.2	0.1	-0.2	0.1	-0.2	0.1	-0.1	-0.1	0.1	-0.1	0.1	-0.1
Gross fixed capital formation	-0.1	0.3	-0.5	-1.0	-1.2	-0.3	-0.1	0.4	-0.5	0.1	0.2	-2.7
Other capital expenditure	0.0	-0.1	-0.3	-0.2	-0.4	0.3	0.0	0.0	-0.1	0.1	0.3	-0.5
Memorandum items												
Growth rate of real potential GDP	2.8	0.8	1.2	0.5	-0.6	-0.7	0.0	0.4	0.7	1.1	1.2	
Growth rate of GDP deflator	2.1	0.3	0.2	0.0	0.1	0.4	-0.2	0.5	0.3	1.2	1.0	
Growth rate of nominal potential GDP	5.0	1.0	1.3	0.5	-0.5	-0.3	-0.2	0.9	1.0	2.3	2.2	

Source: Own calculations based on European Commission, Eurostat, AEAT and ECB data. Note: D.632 = social transfers in kind provided via market producers.

income tax and revenue from stamp duties. Revenue then fell sharply as the market ceased up, prices and transactions fell and corporates suffered substantial losses. This is why the negative residuals in 2008-09 appear mainly under corporate income tax and indirect taxes.

From 2010 to 2018, Spain's headline government balance-to-GDP ratio improved by almost 8 percentage points (the deficit-to-GDP ratio was reduced from a peak of 11 per cent in 2009 to below 3 per cent in 2018). Applying the OECD/EC methodology and current EC estimates

of the output gap, this improvement was mostly structural. The improvement in the structural balance-to-GDP ratio, of about 6 percentage points, came by about 2/3 from an increase in the structural revenue ratio and by 1/3 from a reduction in the structural expenditure ratio.

When looking at expenditure, we notice a significant increase in the structural ratios of interest payments to GDP and social benefits in cash. The latter was largely due to the growing number of pensioners in a period during which potential output was overall broadly stagnant. The overall reduction of the structural expenditure ratio was delivered first and foremost by reducing investment (gross fixed capital formation) and consumption (compensation of employees, intermediate consumption and social transfers in kind provided via market producers). In the case of expenditure, our analytical framework does not go beyond the decomposition of the change in the expenditure ratio across components, leaving interpretation in the hands of the analyst.

In the case of revenue, however, for taxes and social contributions we can analyse the driving forces of developments in the structural revenue ratio based on the model set out in section 3. This decomposition illustrates that the increase in the structural revenue ratio during the consolidation period was mainly driven by indirect taxes, which in turn reflected changes to tax legislation introduced during this period (there were important increases in VAT rates in mid-2010 and in mid-2012).

The composition effect has weighed down on the structural revenue ratio since 2010, which is a consequence of the wage moderation during this period, while wages grew somewhat more than predicted by macro elasticities in 2008-09 (leading to positive composition effects in those years). Revenue residuals over the consolidation period have tended to be positive, although far from offsetting the development during the 2008-09 recession. Some of this can be seen as the flip-side of earlier developments as, for example, house prices and transaction have gradually recovered. In the case of personal income tax, the positive residuals over the consolidation period reflects (at least in part) the taxation of pension income, the growth of which has outpaced that of wage income. An increase in the share of people who are self-employed is another factor contributing to positive residuals for both personal income tax and social contributions.[16] Revenue residuals

[16]For the informed analyst, nearly every number in table 4.1 may have a story behind it. But our purpose

were significantly negative in 2011 (mainly due to indirect taxes, which also include property-related taxes), also reflecting the surprisingly poor headline fiscal performance of Spain that year (in autumn 2011, the European Commission projected a headline deficit of 6.6% of GDP for 2011, while the autumn 2012 notification for 2011 was at 9.4% of GDP). These developments contributed to the European Commission going beyond using only the change in the structural balance for assessing consolidations of countries in Excessive Deficit Procedures,[17] which was initially done via the "adjusted fiscal effort" (page 66ff in European Commission, 2013).

This analysis also shows the merits of having somewhat more detailed data on revenue measures than published by the European Commission, as here we can analyse residuals for each of the broad revenue subcategories. Such information is useful when scrutinizing future discretionary revenue measures and when revising the tax-to-base elasticities (and possibly the tax bases themselves). For example, in Spain residuals have been much larger in absolute value for corporate and indirect taxes than for social security contributions and personal income taxes. This indicates that the evolution of the first two revenue categories has been harder to model than the latter two. Especially for corporate income taxes, the tax-to-base elasticity may be too low, as residuals were highly negative in the downturn around 2009 and tended to be positive during the recovery.

4.2 Decomposition for the larger euro area countries

Calculating the decomposition shown in the previous section requires detailed information concerning which tax revenue subcategories are affected by discretionary measures and which revenue and expenditure items are affected by one-offs. However, the European Commission's AMECO database only offers a separation of discretionary revenue measures into current and capital revenue and a separation of one-offs into revenue and expenditure.

Therefore, this section shows a less detailed approach, which can be easily replicated for any EU country. Expenditure is just decomposed into primary expenditure and interest expenditure (assuming that expenditure-side one-offs do not affect interest spending). On the revenue side fiscal drag, composition effects, discretionary measures and residuals are summed up over

here is limited to illustrating the usefulness of having such an analytical framework.

[17] In the "six-pack" legislation of 2011, the use of an expenditure benchmark for assessing fiscal efforts was only foreseen for the preventive arm of the SGP (i.e. for countries not subject to an Excessive Deficit Procedure).

all subcategories. This also includes non-tax revenue, which is why the revenue residual also contains unexplained changes in the ratio of non-tax revenue over potential GDP. As government revenue from the EU budget (part of non-tax revenue) is accounted for separately in EU fiscal rules, the change in this subcategory is also reported in the following tables and figures. For most euro area countries these transfers are typically below $\frac{1}{4}$% of GDP in all years (and year-on-year changes are mostly very close to 0).[18]

Table 4.2: Decomposition of the change in the structural balance for Germany

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2011-18**
	% of potential GDP								
Change in unadjusted balance	**3.3**	**0.9**	**-0.1**	**0.7**	**0.2**	**0.1**	**0.1**	**0.7**	**5.9**
Cyclical component	1.4	-0.2	-0.6	0.2	0.0	0.3	0.2	-0.1	1.3
Temporary measures	1.1	0.1	0.1	-0.3	0.3	0.0	-0.2	0.0	1.1
Change in structural balance	**0.8**	**1.1**	**0.4**	**0.7**	**-0.1**	**-0.2**	**0.1**	**0.7**	**3.6**
Change in structural revenue	**0.7**	**0.5**	**0.3**	**0.0**	**0.0**	**0.3**	**0.2**	**0.6**	**2.6**
Fiscal drag	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.5
Composition effect	0.0	0.4	-0.1	-0.3	-0.3	-0.2	0.1	0.1	-0.4
Discretionary measures	0.3	0.1	-0.2	-0.1	0.0	-0.1	-0.1	-0.1	-0.1
EU transfers	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1
Residual	0.4	-0.2	0.4	0.2	0.1	0.5	0.0	0.3	1.7
Change in structural expenditure	**-0.1**	**-0.6**	**-0.1**	**-0.8**	**0.1**	**0.5**	**0.0**	**-0.1**	**-1.0**
Structural primary expenditure	-0.2	-0.3	0.3	-0.4	0.3	0.7	0.2	0.0	0.5
Interest payments	0.1	-0.2	-0.3	-0.4	-0.2	-0.2	-0.1	-0.1	-1.5
Change in SPB adjusted for composition effects and residuals	**0.6**	**0.6**	**-0.3**	**0.5**	**0.0**	**-0.6**	**-0.1**	**0.2**	**0.8**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

Table 4.3: Decomposition of the change in the structural balance for Austria

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2011-18**
	% of potential GDP								
Change in unadjusted balance	**1.9**	**0.4**	**0.2**	**-0.8**	**1.7**	**-0.5**	**0.8**	**0.9**	**4.6**
Cyclical component	1.1	-0.1	-0.5	-0.2	-0.1	0.3	0.5	0.5	1.5
Temporary measures	0.1	-0.2	0.0	-1.0	1.2	0.2	0.1	0.0	0.3
Change in structural balance	**0.6**	**0.7**	**0.7**	**0.5**	**0.6**	**-1.1**	**0.3**	**0.3**	**2.7**
Change in structural revenue	**0.0**	**0.6**	**0.5**	**0.1**	**0.3**	**-1.2**	**-0.3**	**0.2**	**0.2**
Fiscal drag	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	1.7
Composition effect	-0.2	0.4	0.2	-0.1	-0.4	-0.1	-0.1	0.1	-0.1
Discretionary measures	0.3	0.2	0.2	0.3	0.1	-1.1	-0.2	-0.1	-0.2
EU transfers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual	-0.4	-0.3	0.0	-0.3	0.3	-0.3	-0.1	-0.1	-1.2
Change in structural expenditure	**-0.7**	**-0.1**	**-0.2**	**-0.3**	**-0.3**	**-0.1**	**-0.6**	**-0.2**	**-2.5**
Structural primary expenditure	-0.6	0.0	-0.1	-0.1	-0.2	0.1	-0.3	0.0	-1.3
Interest payments	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2	-0.2	-0.2	-1.2
Change in SPB adjusted for composition effects and residuals	**1.1**	**0.5**	**0.5**	**0.7**	**0.6**	**-1.0**	**0.3**	**0.1**	**2.9**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

[18] For France there is no publicly available data on these revenue items (therefore EU transfers are also not shown in table E.4).

Tables 4.2 and 4.3 show this decomposition for Germany and Austria. They are the only two larger euro area countries with a positive gap between structural revenue developments and discretionary revenue measures in figure 1.1, with Germany showing a relatively large gap.[19] In both countries, fiscal drag contributed significantly to the observed increase in structural revenue, while explicit discretionary measures were close to 0 in cumulated terms. Composition effects tended to be negative (except for 2012) as relatively high growth in compensation of employees was more than compensated by weak growth in private consumption, capital income and the number of self-employed[20]. For Germany, the revenue residual becomes much smaller when accounting for fiscal drag and composition effects, but it still amounts to about $1\frac{1}{2}\%$ of GDP (indicating a strong over-performance of tax revenue even when accounting for the composition of GDP growth). For Austria the residual becomes even negative, which is to a large extent due to the strong decline in the government's non-tax revenue from property income over this period.

Developments on the expenditure side are dominated by a strong decline in interest spending in both countries, which in Germany actually compensates for an increase in structural primary spending. For both countries the "true" revenue-based adjustment is very likely between the change in structural revenue and estimated discretionary measures. On the one hand, increases in structural revenue have been partly driven by factors like increases in prepayments of corporate taxes, making the size of discretionary revenue measures relatively more meaningful. On the other hand, non-adjustment of income tax brackets pushes up structural revenue each year and is not reported as a measure, while income tax cuts (resp. increases in income tax brackets) are indeed reported as discretionary measures (which distorts discretionary revenue measures for personal income taxes).

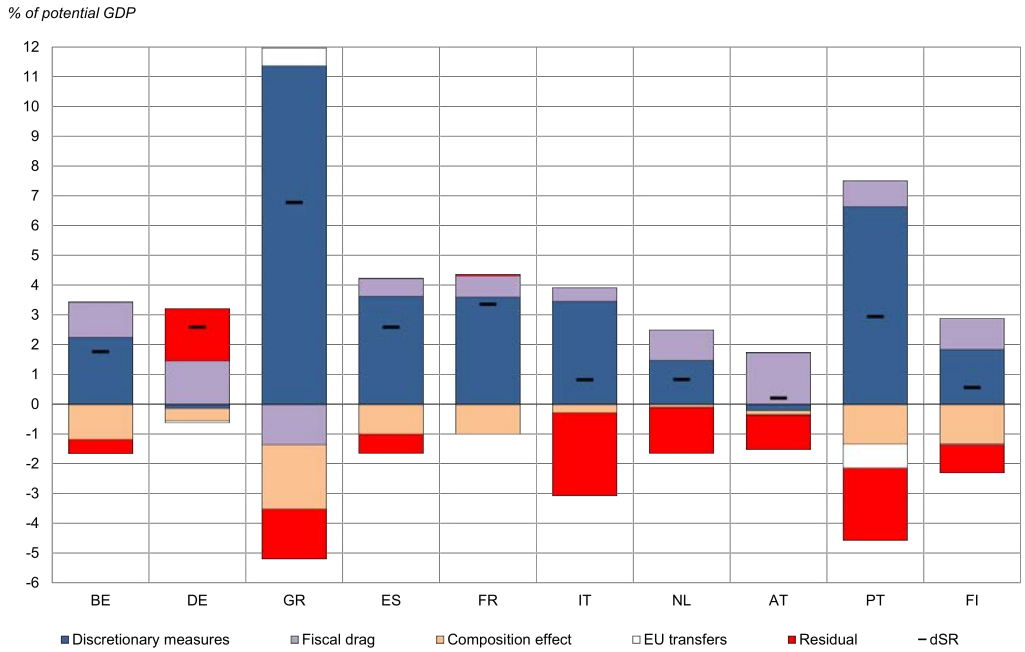
Figure 4.1 decomposes the change in structural revenue from 2010 to 2018 for all large euro area countries. On average, the absolute value of the residual (the unexplained component) shrinks by about $\frac{1}{3}\%$ of GDP when comparing it to the more simplistic decomposition shown in figure 1.1.[21] For five of the six countries with cumulative residuals above 1% of GDP in absolute value in figure 1.1, the residual shrinks by more than $\frac{1}{4}\%$ of GDP (DE, GR, ES, PT, FI); for most

[19] Tables for the other large euro area countries can be found in the appendix.

[20] In case of Austria, the composition effect is not only distorted by the non-unit-elasticity on employment, but also by the strong decline in agricultural self-employment, which artificially dampens the trend growth of the constructed base for income taxes payable by the self-employed.

[21] Note that discretionary revenue measures and EU transfers are identical in both figures.

Figure 4.1: Decomposition of the change in structural revenue from 2010 to 2018



Source: Own calculations based on European Commission, Eurostat and ECB data.

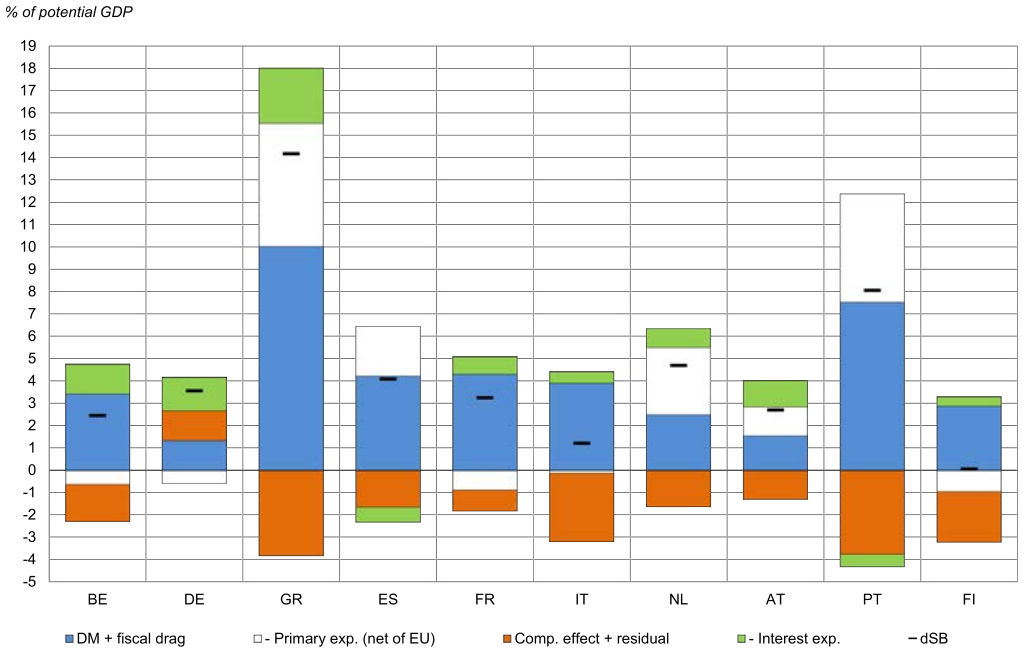
other countries the residual is broadly unchanged (except for NL and AT, where it increases by more than $\frac{1}{2}$% of GDP). However, residuals are still below -2% of GDP for Greece, Italy and Portugal. This indicates significant problems with the ex-ante estimates of discretionary tax measures, or with the collection of taxes, or with the European Commission's choice of tax bases and tax elasticities. If the latter point were true, then the expenditure benchmark would be the more appropriate way of measuring revenue-based consolidation; otherwise the change in structural revenue would be superior (or more effort has to be put in collecting and verifying estimates of discretionary revenue measures).

Furthermore, one can see that all countries suffered from negative composition effects over this time period. This a relatively strong argument in favour of using the expenditure benchmark, as pure reliance on the change in the structural balance would penalize Member States for an unfavourable composition of growth. Figure D.1 in the appendix shows that this was mainly due to developments in compensation of employees (which tends to be taxed higher than profits) and private consumption (which tends to be taxed higher than investment and exports), which were even more unfavorable than what could have been expected on developments in the output

gap. This was partly a reversal from the very positive composition effects from 2008 to 2010 (figure D.2), where euro area labor markets performed better than one would have expected based on output gap developments.

For all countries except Greece (where nominal trend GDP per person employed dropped), fiscal drag was in positive territory. The European Commission's expenditure benchmark excludes fiscal drag, so it may underestimate revenue-based consolidation efforts for certain Member States. This is especially true for countries like Germany, where the residual is positive, too.

Figure 4.2: Decomposition of the change in the structural balance from 2010 to 2018



Source: Own calculations based on European Commission, Eurostat and ECB data.

Figure 4.2 shows the underlying drivers of the overall change in the structural balance from 2010 to 2018. All countries showed improvements in their structural balances over that period, with Greece and Portugal having the largest fiscal adjustments. This still holds when taking out the change in interest payments, composition effects and revenue residuals. However, excluding these factors (none of which are included in the fiscal adjustment as defined by the SGP's expenditure benchmark[22]), Germany has had by far the smallest fiscal consolidation, while the

[22]However, these figures differ from the ones based on the expenditure benchmark as the latter does not account for the impact of fiscal drag on government revenue.

estimated adjustment of Finland and Italy becomes larger.

5 Conclusions

The current EU fiscal governance framework uses both the change in structural revenue and estimates of the impact of discretionary revenue measures to assess consolidation efforts on the revenue side. This paper seeks to improve the understanding of the difference between these two concepts, which is typically referred to as "revenue windfall/shortfall" by the European Commission. We present a framework where these "windfalls" are decomposed into three different components: fiscal drag, composition effects and a residual.

Fiscal drag, which is mostly caused by the non-indexation of non-proportional taxes, is important as it also constitutes a kind of discretionary measure. Composition effects, which denote the impact of macroeconomic aggregates behaving differently to their assumed cyclical characteristics, can inform us about the fiscal effects of changes in the composition of economic growth, as well as potentially flagging problems with the employed elasticities. Residuals, meanwhile, capture any remaining measurement error and may be caused by actual tax bases behaving differently to the corresponding macroeconomic aggregates employed in the cyclical adjustment model, mis-estimation of elasticities and/or errors in the estimates of the impact of discretionary measures. For fiscal developments to be interpreted correctly, it is important for each of these elements to be gauged and understood. Employing this framework also exposes some oversights or questionable choices (e.g. the non-unit elasticity of PIT with regard to the number of employees) in the underlying OECD/EC cyclical adjustment methodology, which could be improved upon in future updates.

While some of the modelling assumptions underlying the OECD/EC method can lead to somewhat strange results, especially for composition effects, our suggested decomposition still helps to explain the large cumulative differences between changes in structural revenue and the amount of discretionary revenue measures between 2010 and 2018. Most importantly, we were able to reduce the residual in absolute value by more than $\frac{1}{4}pp$ for five of the six countries with the largest residuals according to the EC. This has been achieved by accounting for the relatively large fiscal drag in Germany and by quantifying the impact of the unfavorable composition of

GDP growth in Southern Europe. However, for some countries a sizeable unexplained component remains, indicating that underperformance of structural revenue compared to the official amount of discretionary revenue measures cannot be solely explained by an unfavourable composition of growth.

References

Bouthevillain, C., P. Cour-Thimann, G. van de Dool, P. Hernandez de Cos, G. Langenus, M. Mohr, S. Momigliano, and M. Tujula (2001): "Cyclically adjusted budget balances: an alternative approach," Working Paper Series 0077, European Central Bank.

European Commission (2013): "Vade mecum on the Stability and Growth Pact," European Economy - Occasional Papers 151.

——— (2016): "Vade mecum on the Stability and Growth Pact – 2016 edition," European Economy - Institutional Paper 021, Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

——— (2019): "Vade mecum on the Stability and Growth Pact – 2019 edition," European Economy - Institutional Paper 101, Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Girouard, N. and C. Andre (2005): "Measuring Cyclically-adjusted Budget Balances for OECD Countries," OECD Economics Department Working Papers 434.

Kremer, J., C. Rodrigues Braz, T. Brosens, G. Langenus, S. Momigliano, and M. Spolander (2006): "A disaggregated framework for the analysis of structural developments in public finances," Working Paper Series 0579, European Central Bank.

Kremer, J. and K. Wendorff (2004): "Germany after Qualification for EMU: A Disaggregated Approach to the Analysis of Structural Public Finance Developments," *Vierteljahrshefte zur Wirtschaftsforschung / Quarterly Journal of Economic Research*, 73, 358–370.

Momigliano, S. and A. Staderini (1999): "A New Method of Assessing the Structural Budget Balance: Results for the Years 1995-2000," in *Indicators of Structural Budget Balances*, ed. by B. d'Italia.

Mourre, G., A. Poissonnier, and M. Lausegger (2019): "The Semi-Elasticities Underlying the Cyclically-Adjusted Budget Balance: An Update and Further Analysis," European Economy - Discussion Paper 098, Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Price, R. W., T.-T. Dang, and Y. Guillemette (2014): "New Tax and Expenditure Elasticity Estimates for EU Budget Surveillance," OECD Economics Department Working Papers 1174.

A Rationales behind the definition of composition effect and fiscal drag

A.1 Defining fiscal drag

The impact of fiscal drag on trend revenue growth is computed by evaluating equations (3.5), (3.6) and (3.7) at a balanced growth path with a stable output gap, where $\widehat{B}_{i,t} = \widehat{B}^*_{i,t} = \widehat{Y}^*_t$, and by setting discretionary measures and residuals to 0 (as they are already separate categories in our decomposition). To get from the impact on trend growth of this tax category to the effect on the cyclically adjusted revenue ratio, one deducts $\widehat{Y}^*_t$ and multiplies the whole expression by $car_{i,t}$. This yields

$$
\begin{aligned}
&car_{i,t}\left(\eta_i^{RB}\widehat{B}^*_{i,t} - \widehat{Y}^*_t\right) = car_{i,t}\left(\eta_i^{RB}\widehat{Y}^*_t - \widehat{Y}^*_t\right) = car_{i,t}\left(\eta_i^{RB} - 1\right)\widehat{Y}^*_t \quad \text{for (3.5)},\\
&car_{i,t}\left(\eta_i^{RB}\widehat{B}^*_{i,t} - (\eta_i^{RB} - 1)\widehat{B}^*_{i,t} - \widehat{Y}^*_t\right) = 0 \quad \text{for (3.6)},\\
&car_{i,t}\left(\eta_i^{RB}\widehat{B}^*_{i,t} - (\eta_i^{RB} - 1)\widehat{N}^*_t - \widehat{Y}^*_t\right) = car_{i,t}\left(\eta_i^{RB} - 1\right)\left(\widehat{Y}^*_t - \widehat{N}^*_t\right) \quad \text{for (3.7)}.
\end{aligned}
$$

In principle, alternative definitions of (trend) fiscal drag are thinkable, too. For example, for personal income taxes one may use $car_{i,t}\left(\eta_i^{RB} - 1\right)\widehat{W}^*_t$ (actual growth in average wages) or $car_{i,t}\left(\eta_i^{RB} - 1\right)\left(\widehat{W}^*_t - \eta_W^{BY}\Delta og_t\right)$ (actual growth in average wages corrected for the "cyclical component" of average wages)[23]. However, both specifications would make fiscal drag dependent on cyclical movements in real average wages.

[23] η_W^{BY} would correspond to the part of the cyclicality of the overall wage bill (described by η^{BY}, the elasticity of the wage bill with regard to the output gap) which is driven by movements in average wages.

Furthermore, by allocating parts of cyclical developments in macro variables to fiscal drag, using one of these alternative specifications would also lead to differing expressions for the composition effect between the case of a long-run and a short-run elasticity. This would be in contradiction to the approach of the OECD, which does not distinguish between the short-run impact of non-unit long-run-elasticities (like for personal income tax on wages) or short-run-elasticities (like for corporate income taxes), and where the composition effect can be directly derived from the definition of macro elasticities (as explained in the next section).

A.2 Macro elasticities and composition effects

The macro elasticities η_i^{BY} are estimated as short-run-elasticities, i.e. they are defined as $\eta_i^{BY} := \frac{\partial \ln \frac{B_{i,t}}{Y_t^*}}{\partial \ln \frac{Y_t}{Y_t^*}}$. This implies $\widehat{B}_{i,t} - \widehat{Y}_t^* = \eta_i^{BY}\left(\widehat{Y}_t - \widehat{Y}_t^*\right) + res_{i,t}^B$, which can be rewritten as:

$$\widehat{B}_{i,t} \quad = \quad \widehat{Y}_t^* + \eta_i^{BY}\Delta og_t + res_{i,t}^B = \widehat{Y}_t + (\eta_i^{BY} - 1)\Delta og_t + res_{i,t}^B.$$

The tax base equation residual $res_{i,t}^B =$ shows how the actual composition of GDP (described by the development of tax bases $\widehat{B}_{i,t}$) differs from the predicted one (i.e. $\widehat{Y}_t + (\eta_i^{BY} - 1)\Delta og_t$). The product of $res_{i,t}^B$ with $car_{i,t-1}\eta_i^{RB}$ shows up in the equations for the change in the cyclically adjusted ratio, i.e. $car_{i,t-1}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{Y}_t^* - \eta_i^{BY}\Delta og_t\right)$. This term is labelled composition effect because it describes the effect of deviations of the actual from the predicted composition of GDP on the cyclically adjusted revenue ratio.

B Revenue "residuals" in the SGP

SGP-related documents by the European Commission typically do not use the term (revenue) residual, but they occasionally refer to revenue windfalls or shortfalls (e.g. page 32 in Mourre et al., 2019). They are explicitly defined in the derivation of the so-called beta-correction of the (meanwhile abandoned) adjusted change in the structural budget balance (page 144 in European Commission, 2016). In this correction the following term is deducted from the observed change in the structural balance:

$$\beta_t \quad = \quad \frac{\left(\Delta R_t^a - \widetilde{DM}_t^a - \left(\widehat{Y}_t^a + (\eta - 1)\Delta og_t^a\right) R_{t-1}^a\right) - \left(\Delta R_t^e - \widetilde{DM}_t^e - \left(\widehat{Y}_t^e + (\eta - 1)\Delta og_t^e\right) R_{t-1}^e\right)}{Y_t^a},$$

where superscript a refers to the vintage of (ex-post) assessment and e to the vintage of the EDP recommendation. Rearranging the part referring to the vintage of assessment leads to the following definition of revenue windfalls resp. residuals:

$$\begin{aligned} res_t^{\beta} &:= \frac{\Delta R_t - DM_t - (\widehat{Y}_t + (\eta^R - 1)\Delta og_t)R_{t-1}}{Y_t} \\ &= \frac{\Delta R_t}{R_{t-1}}\frac{R_{t-1}}{Y_t} - dm_t - \frac{R_{t-1}}{Y_t}\left(\widehat{Y}_t + (\eta^R - 1)\Delta og_t\right) \\ &\approx sr_{t-1}\left(\widehat{R}_t - \widehat{Y}_t - (\eta^R - 1)\Delta og_t\right) - dm_t \\ &\approx \Delta sr_t - dm_t. \end{aligned}$$

So $\Delta sr_t = \widetilde{dm}_t + res_t^{\beta}$, which implies that (as stated in the main text) the European Commission's revenue windfalls (residuals) merge our residual res_t, fiscal drag and composition effects. Adjusting the change in structural revenue at the time of assessment Δsr_t^a by β_t yields:

$$\Delta sr_t^{\beta} = \Delta sr_t^a - \beta_t = \Delta sr_t^a - (res_t^{a,\beta} - res_t^{e,\beta}) = \widetilde{dm}_t^{\,a} + res_t^{e,\beta}.$$

This means that ex-post consolidation on the revenue side is measured as the sum of structural discretionary revenue measures and the European Commission's projected residual $res_t^{e,\beta}$, which implies an important role for these revenue projections.

The adjusted change in the structural balance has recently been sidelined (it is not covered by the most recent SGP vade mecum; see European Commission, 2019). However, when only looking at the revenue side, the currently applied "expenditure benchmark" in Excessive Deficit Procedures can shown to be (roughly) equivalent to the adjusted change in the structural balance. EDP recommendations (at vintage e) now include "the maximum allowable growth rate of expenditure net of discretionary revenue measures and of one-off (revenue and expenditure) measures" (European Commission, 2019, page 56) which is consistent with achieving the envisaged improvement in the structural balance. This implies that at the time of assessment a, consolidation on the revenue side is measured by adjusting the projected (at the time of recommendation e) change in structural revenue sr_t^e by discretionary measures implemented after the

EDP recommendation (by adding $dm_t^a - dm_t^e$).[24] This can be rearranged as follows:

$$\Delta sr_t^{exp} = \Delta sr_t^e + (\widetilde{dm}_t^{\,a} - \widetilde{dm}_t^{\,e}) = dm_t^a + res_t^{e,\beta}.$$

C Comparison to "disaggregated approach"

The disaggregated framework by Kremer and Wendorff (2004) and Kremer et al. (2006) decomposes figures based on the disaggregated method of cyclical adjustment by Momigliano and Staderini (1999) and Bouthevillain et al. (2001). There the cyclical component of the budget balance has been calculated by applying fiscal-to-base elasticities revenue category by category to an estimated gap between the respective macroeconomic (tax) base $B_{i,t}$ and its estimated trend $B_{i,t}^*$ (via HP filter with $\lambda = 30$). The term "disaggregate" refers to the use of different "gaps" for each individual tax base instead of just using an "aggregate" approach where only a gap for GDP (the output gap) is needed. The cyclical adjustment method described in Bouthevillain et al. (2001) can be expressed analytically as follows:

$$cab_t^{DA} = \frac{BB_t - \sum_{i=1}^{k} R_{i,t}\eta_i^{RB}\frac{B_{i,t}-B_{i,t}^{*DA}}{B_{i,t}^{*DA}} + \sum_{i=k+1}^{n} G_{i,t}\eta_i^{RB}\frac{B_{i,t}-B_{i,t}^{*DA}}{B_{i,t}^{*DA}}}{Y_t^*},$$

where we have used the superscript ^{DA} for the cyclically adjusted balance *cab* and the trend of fiscal bases B^* to indicate that they are conceptually different from the European Commission method (while variables like tax elasticities and output gaps are different in practice, too, their definitions are identical or at least very similar between the two methods). Cyclically adjusted revenue from category i is given by:

$$car_{i,t}^{DA} = \frac{R_{i,t} - R_{i,t}\eta_i^{RB}\frac{B_{i,t}-B_{i,t}^{*DA}}{B_{i,t}^{*DA}}}{Y_t^*} = \frac{R_{i,t}}{Y_t^*}\left(1 - \eta_i^{RB}\frac{B_{i,t} - B_{i,t}^{*DA}}{B_{i,t}^{*DA}}\right).$$

[24] This presentation abstracts from comparatively minor differences such as the treatment of revenue from EU funds.

Kremer et al. (2006) decompose the change in cyclically adjusted revenue as follows:[25]

$$\Delta car_{i,t}^{DA} = \underbrace{\frac{R_{i,t-1}^{*DA}}{Y_{t-1}^{*}}\left(\eta_i^{RB}-1\right)\widehat{B}_{i,t}^{*DA}}_{\text{fiscal drag}} + \underbrace{\frac{R_{i,t-1}^{*DA}}{Y_{t-1}^{*}}\left(\widehat{B}_{i,t}^{*DA}-\widehat{Y}_{t}^{*}\right)}_{\text{decoupling}} + dm_{i,t} + res_{i,t}.$$

Except for approximation errors, discretionary measures and residuals are identical to the ones in our approach. However, Kremer et al. (2006) compute fiscal drag based on the trend growth of the individual tax base (computed by HP-filtering private consumption, compensation of employees, etc.), which may – in their approach – differ from the one of GDP. The most important difference is that they have no composition effect as the cyclical component is calculated directly via HP-filtering tax bases and not by making naive predictions based on changes in the output gap. If trend growth of tax bases differs from that of GDP, they have a decoupling effect (e.g. if the trend growth of compensation of employees is below the one of GDP, this will decrease cyclically adjusted social contributions).

These differences can also be illustrated by comparing the change in cyclically adjusted revenue to $t-1$ in the two different concepts. For getting there, we first compare the two different definitions of cyclically adjusted revenue:

$$\begin{aligned}
car_{i,t} - car_{i,t}^{DA} &= r_{i,t} - r_{i,0}\left(\eta_i^{RB}\eta_i^{BY}-1\right)og_t - \frac{R_{i,t}}{Y_t^{*}}\left(1-\eta_i^{RB}\frac{B_{i,t}-B_{i,t}^{*DA}}{B_{i,t}^{*DA}}\right) \\
&= r_{i,t} - r_{i,0}\left(\eta_i^{RB}\eta_i^{BY}-1\right)og_t - \frac{R_{i,t}}{Y_t}(1+og_t)\left(1-\eta_i^{RB}\frac{B_{i,t}-B_{i,t}^{*DA}}{B_{i,t}^{*DA}}\right) \\
&\approx r_{i,0}\left(1-\eta_i^{RB}\eta_i^{BY}og_t+og_t\right) - r_{i,0}\left(1+og_t-\eta_i^{RB}\frac{B_{i,t}-B_{i,t}^{*DA}}{B_{i,t}^{*DA}}\right) \\
&= r_{i,0}\eta_i^{RB}\left(\frac{B_{i,t}-B_{i,t}^{*DA}}{B_{i,t}^{*DA}} - \eta_i^{BY}og_t\right).
\end{aligned}$$

[25] In the following we compare their decomposition to ours for a "long-run tax elasticity". Kremer et al. (2006) do not make such a distinction.

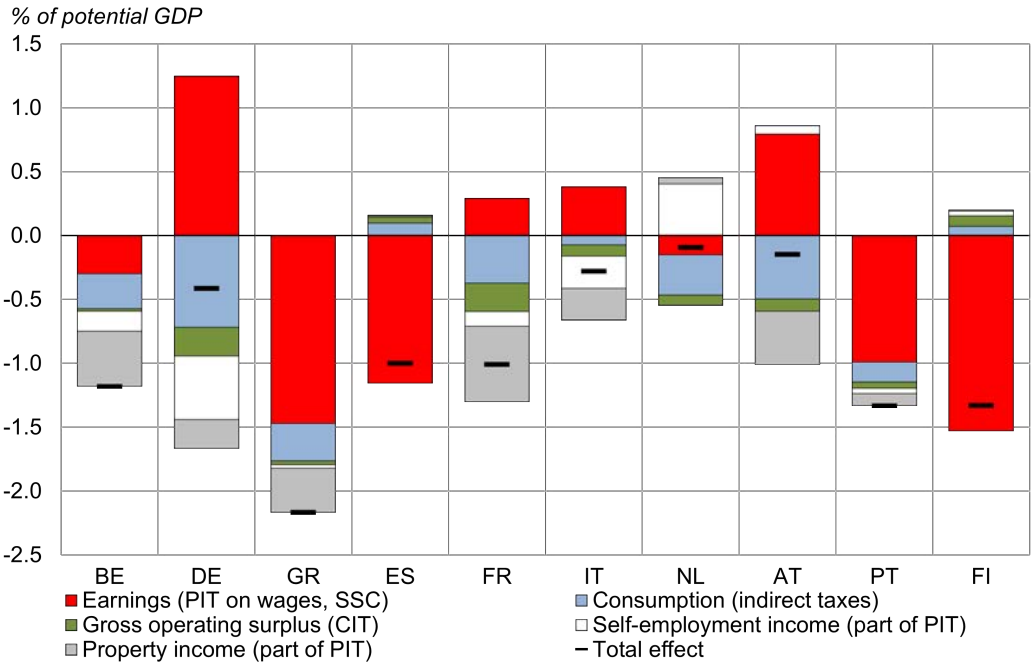
Taking the change in that expression compared to $t-1$ yields:

$$\begin{aligned}
\Delta car_{i,t} - \Delta car_{i,t}^{DA} &= r_{i,0}\eta_i^{RB}\left(\frac{B_{i,t}-B_{i,t}^{*DA}}{B_{i,t}^{*DA}} - \frac{B_{i,t-1}-B_{i,t-1}^{*DA}}{B_{i,t-1}^{*DA}} - \eta_i^{BY}\left(og_t - og_{t-1}\right)\right) \\
&= r_{i,0}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{B}_{i,t}^{*DA} - \eta_i^{BY}\Delta og_t + \widehat{Y}_t^* - \widehat{Y}_t^*\right) \\
&= r_{i,0}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{Y}_t^* - \eta_i^{BY}\Delta og_t\right) + r_{i,0}\eta_i^{RB}\left(\widehat{Y}_t^* - \widehat{B}_{i,t}^{*DA}\right) \\
&= r_{i,0}\eta_i^{RB}\left(\widehat{B}_{i,t} - \widehat{Y}_t^* - \eta_i^{BY}\Delta og_t\right) - r_{i,0}\left(\widehat{B}_{i,t}^{*DA} - \widehat{Y}_t^*\right) \\
&\quad + r_{i,0}\left(\eta_i^{RB} - 1\right)\left(\widehat{Y}_t^* - \widehat{B}_{i,t}^{*DA}\right), \qquad \text{(C.1)}
\end{aligned}$$

where we have used that in the EC/OECD method $car_{i,t} = r_{i,t} - r_{i,0}\left(\eta_i^{RB}\eta_i^{BY} - 1\right)og_t$, that $r_{i,0} \approx r_{i,t}$ and that the change in the relative difference between a variable and its trend can be approximated by the difference in growth rates (e.g. $\Delta og_t \approx \widehat{Y}_t - \widehat{Y}_t^*$). As $r_{i,0} \approx car_{i,t-1} \approx \frac{R_t^*-1}{Y_t^*}$, the first part of (C.1) is approximately the composition effect (i.e. the effect of tax bases behaving differently from a naive projection based on the output gap) from our approach, while the second one is decoupling from Kremer et al. (2006). The third expression is the difference in the two definitions of fiscal drag. Should the trend growth rate of the tax base by identical to that of GDP, then the only difference between the two approaches would be the composition effect.

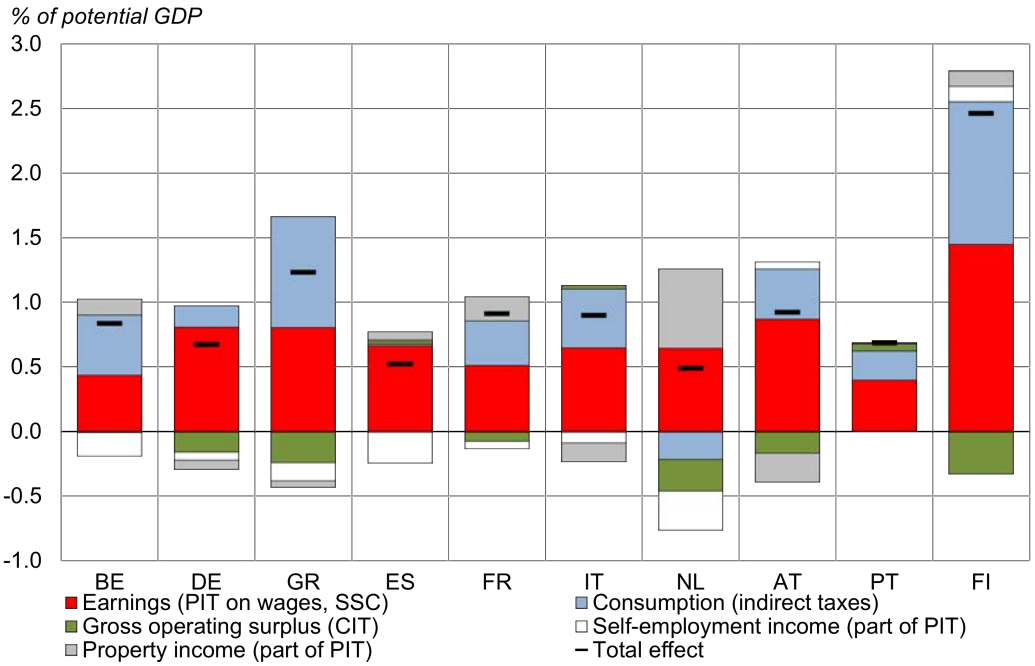
D Figures on composition effects

Figure D.1: Composition effects from 2011 to 2018



Source: Own calculations based on European Commission, Eurostat and ECB data.

Figure D.2: Composition effects from 2008 to 2010



Source: Own calculations based on European Commission, Eurostat and ECB data.

E Tables for the other large euro area countries

Table E.1: Decomposition of the change in the structural balance for Belgium

	2011	2012	2013	2014	2015	2016	2017	2018	2011-18
	% of potential GDP								
Change in unadjusted balance	**-0.2**	**0.0**	**1.1**	**0.0**	**0.7**	**0.0**	**1.6**	**0.1**	**3.3**
Cyclical component	0.3	-0.4	-0.4	0.2	0.3	0.1	0.2	0.0	0.3
Temporary measures	-0.2	-0.2	1.0	-0.3	-0.2	-0.1	0.5	0.1	0.5
Change in structural balance	**-0.2**	**0.6**	**0.5**	**0.2**	**0.6**	**0.0**	**0.8**	**0.0**	**2.5**
Change in structural revenue	**1.1**	**0.8**	**0.8**	**-0.3**	**-0.5**	**-0.7**	**0.3**	**0.3**	**1.8**
Fiscal drag	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.1	1.2
Composition effect	0.1	0.2	0.2	-0.3	-0.8	-0.6	-0.1	0.1	-1.2
Discretionary measures	0.4	1.0	0.3	0.0	0.0	-0.1	0.3	0.3	2.2
EU transfers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual	0.4	-0.6	0.2	-0.1	0.1	-0.2	-0.1	-0.2	-0.5
Change in structural expenditure	**1.3**	**0.3**	**0.4**	**-0.5**	**-1.1**	**-0.7**	**-0.5**	**0.3**	**-0.7**
Structural primary expenditure	1.3	0.3	0.7	-0.5	-0.9	-0.6	-0.1	0.5	0.7
Interest payments	0.0	0.0	-0.3	0.0	-0.2	-0.2	-0.4	-0.2	-1.3
Change in SPB adjusted for composition effects and residuals	**-0.7**	**0.9**	**-0.2**	**0.6**	**1.0**	**0.6**	**0.6**	**-0.1**	**2.8**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

Table E.2: Decomposition of the change in the structural balance for Greece

	2011	2012	2013	2014	2015	2016	2017	2018	2011-18
	% of potential GDP								
Change in unadjusted balance	**0.9**	**1.4**	**-4.3**	**9.6**	**-2.1**	**6.1**	**0.2**	**0.3**	**12.3**
Cyclical component	-3.5	-2.1	-0.2	1.3	0.7	0.6	1.1	1.3	-0.9
Temporary measures	0.1	-2.9	-6.2	8.5	-2.5	3.3	-0.4	-0.9	-1.0
Change in structural balance	**4.3**	**6.4**	**2.1**	**-0.2**	**-0.2**	**2.3**	**-0.5**	**-0.1**	**14.2**
Change in structural revenue	**2.2**	**2.6**	**1.1**	**-0.6**	**1.3**	**1.4**	**-1.0**	**-0.1**	**6.8**
Fiscal drag	-0.1	-0.3	-0.5	-0.3	-0.1	-0.1	0.0	0.0	-1.4
Composition effect	-0.6	-0.5	-0.6	-0.1	-0.5	-0.2	0.2	0.1	-2.2
Discretionary measures	4.9	2.5	0.5	1.4	0.3	1.1	0.5	0.2	11.4
EU transfers	0.4	0.0	0.7	0.1	-0.4	0.0	-1.0	0.8	0.6
Residual	-2.3	0.8	1.1	-1.8	2.0	0.5	-0.7	-1.3	-1.7
Change in structural expenditure	**-2.1**	**-3.9**	**-1.0**	**-0.5**	**1.5**	**-0.9**	**-0.5**	**-0.1**	**-7.4**
Structural primary expenditure	-3.0	-1.7	-0.1	-0.3	1.7	-0.6	-0.5	-0.3	-4.9
Interest payments	0.9	-2.1	-0.9	-0.1	-0.3	-0.3	0.0	0.3	-2.5
Change in SPB adjusted for composition effects and residuals	**7.7**	**4.0**	**0.1**	**1.4**	**-1.5**	**1.6**	**1.0**	**0.6**	**14.9**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

Table E.3: Decomposition of the change in the structural balance for Spain

	2011	2012	2013	2014	2015	2016	2017	2018	2011-18
	% of potential GDP								
Change in unadjusted balance	**-0.3**	**-0.8**	**3.5**	**1.0**	**0.7**	**0.8**	**1.4**	**0.6**	**6.9**
Cyclical component	-0.9	-1.3	-0.6	0.8	1.8	1.4	1.1	0.8	3.1
Temporary measures	-0.2	-2.7	2.5	0.1	0.0	0.3	-0.1	-0.2	-0.3
Change in structural balance	**0.8**	**3.2**	**1.5**	**0.2**	**-1.1**	**-0.9**	**0.4**	**0.0**	**4.1**
Change in structural revenue	**-0.2**	**1.2**	**1.3**	**0.3**	**-0.4**	**-1.1**	**0.5**	**1.0**	**2.6**
Fiscal drag	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.6
Composition effect	0.1	-0.6	-0.4	0.1	-0.1	-0.2	-0.2	0.1	-1.0
Discretionary measures	0.7	1.3	2.0	0.2	-0.6	-0.3	0.2	0.0	3.6
EU transfers	0.1	0.1	-0.1	0.0	0.0	-0.2	0.0	0.2	0.0
Residual	-1.0	0.3	-0.2	0.0	0.1	-0.5	0.2	0.5	-0.7
Change in structural expenditure	**-1.0**	**-2.0**	**-0.2**	**0.2**	**0.7**	**-0.1**	**0.1**	**1.0**	**-1.5**
Structural primary expenditure	-1.6	-2.5	-0.6	0.1	1.0	0.1	0.3	1.0	-2.2
Interest payments	0.5	0.4	0.4	0.0	-0.3	-0.2	-0.2	-0.1	0.7
Change in SPB adjusted for composition effects and residuals	**2.3**	**3.8**	**2.7**	**0.1**	**-1.4**	**-0.3**	**0.1**	**-0.9**	**6.4**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

Table E.4: Decomposition of the change in the structural balance for France

	2011	2012	2013	2014	2015	2016	2017	2018	2011-18
	% of potential GDP								
Change in unadjusted balance	**1.7**	**0.2**	**0.9**	**0.2**	**0.3**	**0.1**	**0.8**	**0.2**	**4.4**
Cyclical component	0.7	-0.4	-0.3	0.0	0.1	0.1	0.6	0.2	1.1
Temporary measures	0.3	-0.1	0.1	-0.2	0.0	0.0	0.0	-0.2	0.0
Change in structural balance	**0.8**	**0.7**	**1.0**	**0.4**	**0.2**	**0.0**	**0.1**	**0.2**	**3.3**
Change in structural revenue	**0.9**	**1.0**	**0.9**	**0.4**	**-0.1**	**-0.1**	**0.3**	**0.1**	**3.4**
Fiscal drag	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7
Composition effect	-0.3	0.0	-0.3	-0.1	-0.3	-0.1	0.1	0.1	-1.0
Discretionary measures	0.8	1.1	1.1	0.6	0.1	-0.2	0.0	0.0	3.6
Residual	0.3	-0.2	0.0	-0.2	0.0	0.2	0.1	-0.1	0.1
Change in structural expenditure	**0.1**	**0.4**	**-0.1**	**0.0**	**-0.3**	**-0.1**	**0.2**	**-0.1**	**0.1**
Structural primary expenditure	-0.1	0.5	0.2	0.2	-0.2	0.0	0.3	0.0	0.9
Interest payments	0.2	-0.1	-0.3	-0.1	-0.2	-0.1	-0.1	0.0	-0.8
Change in SPB adjusted for composition effects and residuals	**1.0**	**0.8**	**1.0**	**0.5**	**0.3**	**-0.1**	**-0.2**	**0.2**	**3.4**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

Table E.5: Decomposition of the change in the structural balance for Italy

	2011	2012	2013	2014	2015	2016	2017	2018	2011-18
	% of potential GDP								
Change in unadjusted balance	**0.5**	**0.8**	**0.0**	**-0.1**	**0.4**	**0.1**	**0.1**	**0.3**	**2.1**
Cyclical component	0.3	-1.0	-0.8	0.1	0.6	0.7	0.8	0.2	1.0
Temporary measures	0.2	-0.3	0.1	-0.1	-0.4	0.4	-0.2	0.1	-0.1
Change in structural balance	**0.0**	**2.0**	**0.7**	**-0.2**	**0.2**	**-1.0**	**-0.4**	**-0.1**	**1.2**
Change in structural revenue	**-0.1**	**2.5**	**0.3**	**-0.3**	**-0.2**	**-1.3**	**-0.2**	**0.3**	**0.8**
Fiscal drag	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.5
Composition effect	0.0	-0.3	-0.2	-0.4	0.1	0.0	0.1	0.3	-0.3
Discretionary measures	-0.2	3.0	0.5	0.2	0.3	-0.5	-0.2	0.3	3.5
EU transfers	0.1	0.0	0.0	0.1	0.0	-0.3	0.1	-0.1	0.0
Residual	-0.1	-0.3	0.0	-0.2	-0.7	-0.7	-0.3	-0.4	-2.8
Change in structural expenditure	**-0.2**	**0.5**	**-0.4**	**-0.1**	**-0.5**	**-0.2**	**0.2**	**0.4**	**-0.4**
Structural primary expenditure	-0.6	0.0	0.0	0.1	-0.1	-0.1	0.3	0.4	0.1
Interest payments	0.4	0.4	-0.4	-0.2	-0.4	-0.1	-0.1	-0.1	-0.5
Change in SPB adjusted for composition effects and residuals	**0.4**	**3.1**	**0.5**	**0.2**	**0.4**	**-0.3**	**-0.4**	**0.0**	**3.8**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

Table E.6: Decomposition of the change in the structural balance for the Netherlands

	2011	2012	2013	2014	2015	2016	2017	2018	2011-18
	% of potential GDP								
Change in unadjusted balance	**0.8**	**0.5**	**1.0**	**0.8**	**0.1**	**2.0**	**1.2**	**0.3**	**6.7**
Cyclical component	0.4	-0.9	-0.3	0.5	0.3	0.5	0.7	0.5	1.9
Temporary measures	0.1	0.0	0.6	-0.7	0.1	0.3	0.2	-0.4	0.2
Change in structural balance	**0.2**	**1.4**	**0.7**	**1.0**	**-0.3**	**1.3**	**0.3**	**0.2**	**4.7**
Change in structural revenue	**-0.3**	**0.5**	**0.8**	**0.0**	**-1.0**	**1.0**	**-0.4**	**0.3**	**0.8**
Fiscal drag	0.1	0.2	0.1	0.0	0.1	0.1	0.1	0.3	1.0
Composition effect	0.3	0.2	-0.2	0.0	-0.3	-0.1	-0.1	-0.1	-0.1
Discretionary measures	0.1	0.1	1.4	0.7	-0.6	-0.2	0.0	0.0	1.5
EU transfers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual	-0.8	0.0	-0.6	-0.7	-0.3	1.2	-0.5	0.1	-1.6
Change in structural expenditure	**-0.5**	**-0.9**	**0.1**	**-1.0**	**-0.7**	**-0.3**	**-0.7**	**0.1**	**-3.9**
Structural primary expenditure	-0.5	-0.7	0.2	-0.9	-0.6	-0.2	-0.5	0.2	-3.0
Interest payments	0.0	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	-0.8
Change in SPB adjusted for composition effects and residuals	**0.7**	**1.0**	**1.3**	**1.7**	**0.1**	**0.1**	**0.7**	**0.0**	**5.5**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

Table E.7: Decomposition of the change in the structural balance for Portugal

	2011	2012	2013	2014	2015	2016	2017	2018	2011-18
	% of potential GDP								
Change in unadjusted balance	**3.8**	**1.7**	**0.8**	**-2.3**	**2.8**	**2.4**	**-1.0**	**2.5**	**10.7**
Cyclical component	-0.7	-1.5	-0.1	0.5	0.7	0.6	0.8	0.3	0.7
Temporary measures	2.6	0.0	0.3	-4.1	2.6	1.7	-2.5	1.4	2.0
Change in structural balance	**1.9**	**3.1**	**0.6**	**1.2**	**-0.6**	**0.2**	**0.7**	**0.9**	**8.0**
Change in structural revenue	**1.5**	**0.4**	**1.8**	**0.2**	**-0.9**	**-1.2**	**0.1**	**1.0**	**2.9**
Fiscal drag	0.0	0.0	0.2	0.1	0.2	0.1	0.1	0.1	0.9
Composition effect	-0.4	-0.5	-0.1	-0.2	-0.4	0.0	0.0	0.3	-1.3
Discretionary measures	1.7	1.8	2.6	0.3	0.3	-0.1	0.0	0.0	6.6
EU transfers	-0.2	0.4	-0.3	-0.1	-0.3	-0.3	-0.1	0.0	-0.8
Residual	0.4	-1.3	-0.5	0.2	-0.8	-1.0	0.1	0.6	-2.4
Change in structural expenditure	**-0.4**	**-2.7**	**1.2**	**-1.0**	**-0.3**	**-1.4**	**-0.6**	**0.1**	**-5.1**
Structural primary expenditure	-1.7	-3.2	1.3	-1.1	-0.1	-1.1	-0.3	0.5	-5.7
Interest payments	1.3	0.4	0.0	0.1	-0.3	-0.3	-0.3	-0.4	0.6
Change in SPB adjusted for composition effects and residuals	**3.5**	**5.0**	**1.5**	**1.5**	**0.6**	**1.1**	**0.4**	**-0.4**	**13.2**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

Table E.8: Decomposition of the change in the structural balance for Finland

	2011	2012	2013	2014	2015	2016	2017	2018	2011-18
	% of potential GDP								
Change in unadjusted balance	**1.6**	**-1.1**	**-0.4**	**-0.6**	**0.5**	**1.0**	**0.9**	**0.1**	**1.9**
Cyclical component	1.3	-0.9	-0.5	-0.5	0.0	1.0	0.9	0.5	1.9
Temporary measures	0.0	0.0	0.0	0.2	-0.1	0.0	0.0	-0.1	0.0
Change in structural balance	**0.3**	**-0.2**	**0.0**	**-0.3**	**0.5**	**0.0**	**0.1**	**-0.3**	**0.1**
Change in structural revenue	**1.3**	**0.6**	**0.8**	**-0.1**	**-0.5**	**0.0**	**-0.7**	**-0.8**	**0.6**
Fiscal drag	0.2	0.2	0.2	0.1	0.1	0.0	0.1	0.2	1.0
Composition effect	0.1	0.5	-0.2	-0.1	-0.3	-0.3	-0.9	-0.2	-1.3
Discretionary measures	0.3	0.3	1.0	0.4	0.5	0.3	-0.6	-0.2	1.8
EU transfers	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
Residual	0.8	-0.4	-0.1	-0.5	-0.8	-0.1	0.7	-0.5	-0.9
Change in structural expenditure	**1.1**	**0.8**	**0.8**	**0.2**	**-1.1**	**0.0**	**-0.8**	**-0.5**	**0.5**
Structural primary expenditure	1.0	0.8	0.9	0.2	-1.0	0.0	-0.7	-0.4	0.9
Interest payments	0.1	0.0	-0.2	-0.1	0.0	-0.1	-0.1	-0.1	-0.4
Change in SPB adjusted for composition effects and residuals	**-0.5**	**-0.4**	**0.2**	**0.3**	**1.6**	**0.3**	**0.2**	**0.3**	**1.9**

Source: Own calculations based on European Commission, Eurostat and ECB data. Note: SPB = structural primary balance.

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