The new ESCB methodology for the calculation of cyclically adjusted budget balances: an application to the Portuguese case

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Abstract
The analysis of public finance developments relies, amongst other indicators, on estimates of cyclically adjusted budget balances (CABs), which correct headline government balances for business cycle fluctuations. The European System of Central Banks (ESCB) endorsed in late 2018 a new aggregate methodology for the calculation of CABs, developed by Bouabdallah *et al.*, 2019. This article presents the application of this new methodology to the Portuguese case, providing details on the calculation of the underlying fiscal-to-base and base-to-output elasticities. Additionally, it describes the output gap estimations used to assess the cyclical position of the economy. The article also presents the analytical tool developed by Bouabdallah *et al.*, 2019 to disentangle the drivers of structural fiscal developments, providing details on its application to Portugal. (JEL: E62, H20, H60)

Introduction

In the last decades, the analysis of public finance developments has been relying, amongst other indicators, on estimates of cyclically adjusted budget balances (CABs), which correct headline government balances for business cycle fluctuations. When measured in levels, CABs are a good indicator of the underlying fiscal position of a country. Its changes represent a rough proxy for the discretionary action by governments and, as such,

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are considered indicators of the fiscal stance. CABs are computed by many institutions, including the European Commission, the IMF and the OECD, in each case according to specific methodologies and respective parameters. The Commission estimates are used in the context of the European fiscal surveillance framework since the 2005 reform of the Stability and Growth Pact.

The European System of Central Banks (ESCB) adopted a methodology for the calculation of CABs in 2001 (Bouthevillain *et al.*, 2001). The measurement of the cyclical component relied on a trend/cycle decomposition of different macroeconomic variables, with the aim of better approximating the main bases of selected fiscal items. As such, it differed from the methodologies followed by other institutions, which gauge the cyclical component by applying a budgetary semi-elasticity to an aggregate output gap. Since then, Banco de Portugal has been following Bouthevillain *et al.*, 2001, presenting estimates of CABs for Portugal in its regular publications and other ad-hoc analysis (Neves and Sarmento, 2001, and Braz, 2006, provide further details on the application to the Portuguese case). Subsequently, in 2006, a disaggregated framework for assessing public finances was introduced, anchored in the ESCB CAB methodology (Kremer *et al.*, 2006). This framework proved to be a valuable tool in fiscal analyses, both in terms of past developments and projections, as it allowed for a detailed breakdown of the drivers of the structural change of revenue and expenditure items.

Over the course of time, several issues have emerged when using the ESCB methodology adopted in 2001, justifying its review. This review culminated in the adoption of a new aggregated method to compute CABs, similar to those used by other institutions, at the end of 2018. Bouabdallah *et al.*, 2019, present the developed methodology. It should be noted that the authors preserve the detailed analysis of structural developments through an adaptation of the previous disaggregated framework (see also Morris and Reiss, 2019). Technical details on the application to the Portuguese case of the new CAB and disentanglement frameworks may be found in Braz *et al.*, 2019.

The present article provides a brief overview of the new ESCB methodologies and illustrates its use to analyse the Portuguese public finances. It is structured in two main sections. The first one briefly describes the previous methodology and presents the new CAB method, including details on the estimation of both fiscal-to-base and base-to-output elasticities and the calculation of potential GDP underlying the output gap. A second section elaborates on the revised disaggregated framework, illustrating its application with the 2015-17 fiscal developments in Portugal.

The new ESCB cyclical adjustment method

Overview

Since 2001, the analysis of fiscal developments undertaken by Banco de Portugal has relied on a commonly agreed methodology for the estimation of CABs developed by the ESCB Working Group on Public Finance (WGPF)[1] and presented in Bouthevillain *et al.* (2001). Its application to the Portuguese case is summarized in Braz (2006).

Differently from most alternative methods, the ESCB methodology was disaggregated in the sense that, rather than focusing solely on GDP, it assumed that there is a set of other variables that provide better proxies for the macroeconomic bases driving fiscal developments. These macroeconomic variables were defined in real terms and, for each of them, the trend path was obtained using a Hodrick-Prescott (HP) filter (Hodrick and Prescott, 1997) with a smoothing parameter λ equal to 30.[2] As typically assumed in cyclical adjustment methods, the former ESCB framework also considered that revenue from taxes and social contributions and expenditure on unemployment benefits are the only fiscal items affected by macroeconomic developments.

The possibility to account for composition effects was one of the key advantages of the former ESCB method. These were assessed as the difference between the cyclical component computed with the ESCB methodology and that based on an aggregate semi-elasticity. Indeed, the former ESCB methodology still allowed the derivation of the semi-elasticity of the budget balance, calculated as described in Bouthevillain *et al.* (2001). At that time, the resulting figure for Portugal stood at 0.5, which was very close to the semi-elasticities used by the European Commission and the OECD (respectively 0.51 and 0.54).[3]

In addition, the former ESCB methodology presented a number of other merits. The fact that it was based on relationships between cyclical budgetary items and specific macroeconomic variables allowed for a detailed structural analysis of both past and projected fiscal developments, as described in Kremer *et al.* (2006). Moreover, reliance on the statistical HP-filter ensured that the breakdown of the series into trend and cyclical

1. The Working Group on Public Finance is a sub-committee of the Monetary Policy Committee composed by representatives of the National Central Banks of the European Union and the European Central Bank.

2. A value of 30 for the λ parameter is consistent with the assumption of 8 years for the average duration of business cycles.

3. However, it should be noted that using a derivation formula consistent with that underlying the new methodology, but with data, elasticities and weights used at that time, the semi-elasticity would be slightly revised upwards from 0.5 to 0.53.

components was transparent, easy to replicate and not subject to changes in technical assumptions. Finally, the HP-filter yields trend deviations that are symmetric by construction, minimizing risks of optimistic biases towards the underestimation of structural deficits.

In practice, however, the limitations of the former cyclical adjustment methodology were also manifold. First, the composition effect was found to exhibit a counter-cyclical behaviour, resulting in an underestimation of the cyclical component of budget balances. This effect might have been reinforced in the recent period by the inability of the HP-filter to adequately break down between trend and cycle the severe recessions experienced in many member states. Moreover, the measurement of the composition effect in the former ESCB methodology was sensitive to the choice of deflators. Finally, a more fundamental limitation of the former ESCB method is that it relied on an assessment of the cyclical position of the economy that was based on a statistical filter.

In light of the aforementioned limitations, the WGPF conducted a review and adopted a new methodology to be implemented as of 2019 (Bouabdallah *et al.*, 2019). In the new ESCB methodology the CAB (*i.e.*, the budget balance that would prevail if the economy was at its potential level) is determined by an aggregate procedure. Indeed, it is obtained by subtracting the cyclical component of the budget balance – computed as the product of the semi-elasticity and the output gap – from the headline budget balance in percentage of GDP. Formally:

$$cab_t = \frac{BB_t}{Y_t} - \varepsilon^{BB} \times og_t, \tag{1}$$

where $\frac{BB_t}{Y_t}$ stands for the headline balance in percentage of GDP, ε^{BB} is the budgetary semi-elasticity and og_t is the output gap obtained on the basis of a production function approach for calculating potential output. Variable cab_t should be interpreted as the ratio of the cyclically adjusted balance to nominal potential GDP, given that the semi-elasticity captures the impact of the business cycle both on the numerator and the denominator[4]. This budgetary semi-elasticity is obtained as the difference between the semi-elasticity of revenue (ε^R) and the semi-elasticity of expenditure (ε^E). The elasticities of total revenue and expenditure to the output gap can be defined as a product between a fiscal-to-base elasticity (η^{RB} and η^{EB}, measuring the response of revenue and expenditure to changes in the respective macroeconomic bases) and a base-to-output elasticity (η^{BY}, measuring the response of

4. Nominal potential GDP is obtained using real potential GDP estimates and the actual GDP deflator. Throughout this article *ratios to potential GDP* should be interpreted as *ratios to nominal potential GDP*.

each macroeconomic base to changes in the output gap). In particular, the budgetary semi-elasticity can be expressed as

$$\varepsilon^{BB} = \varepsilon^{R} - \varepsilon^{E} = \left(\eta^{RB}\eta^{BY} - 1\right) \cdot \bar{r} - \left(\eta^{EB}\eta^{BY} - 1\right) \cdot \bar{e}, \tag{2}$$

where $\bar{r}$ and $\bar{e}$ stand for the 10 year average share of total revenue and expenditure in GDP.

Furthermore,

$$\varepsilon^{BB} = \varepsilon^{R} - \varepsilon^{E} = \sum_{i} \varepsilon_{i}^{R} - \sum_{j} \varepsilon_{j}^{E}, \tag{3}$$

where ε_{i}^{R} and ε_{j}^{E} represent each revenue and expenditure item contribution to the overall semi-elasticity (respectively i and j), whether assumed to be cyclical or non-cyclical. Four revenue categories and one expenditure item are considered to be sensitive to the business cycle: i) direct taxes paid by households (split into personal income tax and other current taxes); ii) direct taxes paid by corporations; iii) taxes on production and imports (split into VAT and other indirect taxes); iv) net social contributions (split into paid by employers and employees and by self- and non-employed); and v) unemployment benefits. For the remaining non-cyclical revenue and expenditure items, the contribution to the aggregate semi-elasticity stems only from a denominator effect, as the base-to-output elasticities are nil.

It should be noted that in the new ESCB cyclical adjustment method the calculation of the semi-elasticity takes into account two sorts of time lags: those related to the tax code and the way it defines tax collection (relevant when taxes are levied on aggregates referring to the previous year – referred to as the collection lag)[5]; and those stemming from a lagged response of the macroeconomic bases to cyclical fluctuations (referred to as the cyclical lag). As explained below, in the case of Portugal, only the cyclical lag is considered.

Data

The estimation of base-to-output elasticities for the calculation of the budgetary semi-elasticity draws on various sources of information. Most data concerning the macro bases are collected from the main annual national accounts aggregates, which are then complemented with annual sector accounts. All variables are expressed in nominal terms. On the income approach to GDP, gross operating surplus and mixed income is split by the main sectors (households and NPISH, general government and corporations)

5. For each revenue item, the methodology allows the definition of the share of the tax which is levied with a collection lag, constant over time or time-varying.

and other aggregates, like net entrepreneurial income of corporations and property income received by households, are used. On the expenditure approach to GDP, imputed rents are excluded from households' private consumption[6] and gross fixed capital formation on dwellings is identified.

The fiscal database is also mostly drawn from official national accounts, national tax lists[7] and government expenditure by function data (COFOG), the latter regarding old age and survivors' pensions and unemployment benefits. Information concerning the impact of discretionary measures largely corresponds to official estimates made public in government documents, although they are in some instances adjusted by expert judgement. Additionally, data of *Taxation Trends* and the VAT gap published by the European Commission (DG-TAXUD) are used for the weighting of the fiscal items (European Commission, 2017; Poniatowski *et al.*, 2017).

Base-to-output elasticities

For each relevant macroeconomic base, the base-to-output elasticities η_i^{BY} have been estimated using a standard regression specified in log-differences to account for non-stationarity. The regressions include one lag in order to capture the possibility that some macroeconomic bases respond to business cycle fluctuations with a delay (the cyclical lag). Similar regressions have been run for three blocks: i) GDP – income approach; ii) GDP – expenditure approach; and iii) labour market. By default, all elasticities have been obtained pooling data from a panel of EU countries for the period from 1995 to 2017. The panel regressions have been conducted with country fixed effects (and cross-sectional weights) but, because they may still fail to capture country-specific elements, individual, country-specific estimates were also obtained. The choice between panel and country-specific as the most plausible base-to-output elasticities was ultimately made on the basis of informed judgement by country experts. In any case, the chosen set of elasticities should broadly meet aggregation constraints, which is in principle made easier by making a consistent choice within each block. In the case of Portugal, panel estimates were adopted for the GDP-income and labour market blocks, while country-specific estimates were used for the GDP-expenditure block. In the country-specific regressions, coefficients referring to the lagged response of macroeconomic variables to changes in the output gap were found to be

6. Imputed rents are transmitted by member states to Eurostat under the reporting of final consumption expenditure of households by consumption purpose. In the new CAB methodology, they are also deducted from operating surplus of households and NPISH on the income approach to GDP.

7. The questionnaire on national tax lists is sent by member states to Eurostat and contains detailed information on taxes and social contributions according to national classifications.

non-significant. As such, in the GDP-expenditure block the base-to-output elasticities do not include a lagged component.

With regard to the choice of the appropriate macro bases for each fiscal item, alternatives are suggested for some taxes. These suggestions provide an harmonized solution for possible data unavailability of the true bases or the poor fit of some less straightforward proxy bases.[8] In the case of Portugal, we opted for gross operating surplus and mixed income of the total economy as the base for direct taxes paid by corporations and personal income tax with respect to capital and business incomes, while the default option for VAT was maintained (households' consumption excluding imputed rents). There is also room for country-specific adjustments on the basis of economically-sound arguments. For instance, in the case of Portugal the suggested base for the stamp duty (investment on dwellings) is not applicable as it gives a negligible contribution to this tax's revenue which is mostly driven by financial and commercial transactions. Instead, nominal GDP is found to provide a better proxy for the macroeconomic base of the stamp duty. Finally, other current taxes paid by households and other taxes on production, together with social contributions payable by the self-employed, are considered non-cyclical.

Fiscal-to-base elasticities

Regarding the choice of fiscal-to-base elasticities, these are widely considered "structural" elasticities resulting from the tax code. In most cases, this would imply an elasticity equal to 1, with the exception of progressive taxes such as the personal income tax or, in some countries, social contributions. Usually, when tax elasticities appear to be cyclical it is due to a mis-measurement of the base. The first-best strategy followed in this methodology is to address this issue with the estimation of the base-to-output elasticities. In particular, the aim is to approximate as well as possible the base and adjust, when necessary, the corresponding elasticity. By prioritizing the estimation of the base-to-output elasticities, we avoid the problem of changes to the tax system distorting the estimation of fiscal elasticities. Notwithstanding, given that it is not always possible to approximate the tax base reasonably, direct fiscal-to-output elasticities were also estimated (correcting for the expected impact of tax changes) as additional information, in order to cross-check the plausibility of the final results.

In the case of Portugal, given that most taxes are broadly proportional, unit elasticities have been assumed in line with the suggested default option. The only exceptions refer to: i) personal income tax on earnings ($\eta^{RB} = 1.07$); ii)

8. The methodology suggests that whenever one of the alternative macro bases is chosen to replace the "true" base, the fiscal elasticity should be adjusted to avoid impacting the aggregate semi-elasticity.

direct taxes paid by corporations ($\eta^{RB} = 1.95$); iii) VAT on households final consumption ($\eta^{RB} = 1.26$) and iv) stamp duty ($\eta^{RB} = 2.27$).

For the personal income tax (on average earnings, business income, capital income and social benefits), given its progressive nature, the corresponding elasticity should be preferably derived from the tax code and income distributions. In face of data unavailability, the default elasticities are those calibrated by the OECD (Price *et al.*, 2015). The fiscal-to-base elasticity of personal income tax with respect to total earnings is calculated as a weighted average of the elasticity of personal income tax with respect to average earnings ($\eta^{RB} = 2.22$, OECD) and the unit elasticity of the number of employees. For the remaining components of this tax (on business income, capital income and social benefits) we have deviated from the default option of using the OECD elasticities due to a poor fit of the considered macro bases. To avoid additional distortions, a simplifying but reasonable assumption of unitary fiscal elasticities was adopted.

For direct taxes paid by corporations, the true base is considered to be the net entrepreneurial income and therefore a tax elasticity of 1 is the default option suggested for this base. However, given the unavailability of projections for this series, we have opted to use the suggested proxy for the base, namely gross operating surplus and mixed income of the total economy. Therefore, we have adjusted the fiscal-to-base elasticity by the ratio between the base-to-output elasticities, such that the contribution of this revenue item to the budget semi-elasticity is not affected by the choice of the proxy base.

Given that different VAT rates are applied to different types of goods and services consumption, an elasticity above unity is assumed to gauge the effect of shifts in the composition of household consumption over the economic cycle. With regard to the stamp duty, it was necessary to allow the fiscal-to-base elasticity to diverge from unity, despite being a proportional tax, because of the unavailability of data on the actual base.

Finally, as mentioned, it was decided not to include collection lags. In the Portuguese tax system the main taxes collected with some lag are the corporate and personal income taxes. In the case of the former, data regarding the most recent years confirms that the final settlement of the tax regarding the previous year's revenue, which could be considered the share of the tax which is collected with a lag, represents in net terms a minor proportion of the total yearly tax receipt. Furthermore, this share has shown a strong volatility in the last years, complicating the assessment of an "average" collection lag for the entire period. With regard to the personal income tax, despite the withholding rates, a part of the tax is settled with a lag, following the filling of the income declaration of the previous year. Due to the unavailability of data and high

volatility of these refunds net of additional payments regarding previous year income, the collection lag was assumed to be zero.[9]

Potential output

The calculation of cyclically adjusted budget balances based on an aggregate approach requires the estimation of the output gap, *i.e.* the deviation of actual output from its potential level. The latter is an indicator of the overall supply of an economy, measuring the quantity it can produce when all resources are fully employed, following a sustainable and non-inflationary path. While potential output is an important tool for analysis and informed policy advice, it is an unobservable variable that requires caution in its use, given that its estimation involves various sources of uncertainty.[10]

In the methodology presented in this article, the computation of potential output follows a production function approach. Rather than focusing on simple statistical trends, this methodology gives some economic structure to the analysis, allowing to relate the quantity produced by an economy to the quantity of production factors and their productivity. Potential output is obtained as the outcome of the production function, when the quantity and productivity of the factors of production are at their reference value – or at their sustainable maximum levels. A Cobb-Douglas production function is used, where real GDP (Y_t) is determined by the contributions of labour (L_t), capital (K_t), as well as their productivity (A_t). The production function takes the form:

$$Y_t = A_t L_t^{\alpha} K_t^{(1-\alpha)} \tag{4}$$

The constants α and $(1-\alpha)$ correspond to the elasticity of output with respect to labour and capital, respectively. Under the assumption of perfect competition, α can be calibrated to match the empirical average labour income share. We use a share of 64% as estimated and described in Félix and Almeida (2006).

Total factor productivity is an unobserved variable with an encompassing nature, including factors such as the level of technology, human capital or the institutional framework. Indeed, A_t captures the share of production which is associated to any factor other than the quantities of the employed inputs. The actual value of this variable is usually computed as a residual, known as the *Solow residual*. The labour input is measured by the total number of hours

9. These simplifying assumptions imply that any extraordinary developments in these lagged components will be reflected in the residual of the disaggregated analysis described in Section 3.

10. For a thorough discussion of uncertainty surrounding potential output estimates see Banco de Portugal (2017).

actually worked in the economy and is further decomposed into: working age population (between 15 and 64 years); participation rate, defined as the ratio of the labour force over the working age population; total hours worked per worker; employment rate, defined as function of the unemployment rate; and an adjustment term that considers the gap between national accounts employment and the implied level of employment of the Labour Force Survey.

Regarding the benchmark values for the estimation of potential output, in the case of the capital stock the standard assumption of a nil contribution to the output gap is considered, *i.e.* that actual values coincide with the potential capital stock. The benchmark level of the labour supply is computed on the basis of the reference value of its various components. More specifically, the actual value of working age population is taken on board – as the population level is not deemed a cyclical variable – and HP-filters are applied to the series of the participation rate, average hours per worker and the adjustment term. Finally, the benchmark unemployment rate, commonly referred to as NAWRU (non-accelerating wage rate of unemployment) – when estimated in a context of stable wage growth rates – corresponds to model-based estimates computed as described in Duarte *et al.* (2019).

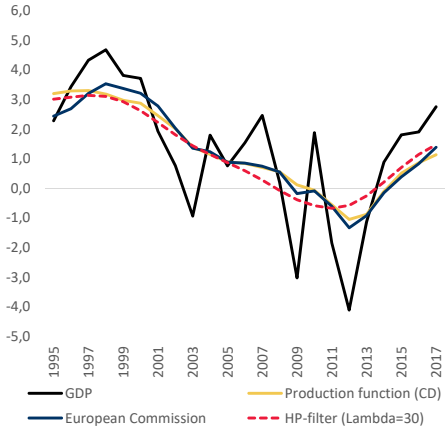
Lastly, the calculation of potential output also requires an estimate for trend total factor productivity, which is computed as the HP-filtered *Solow residual*, following Félix and Almeida (2006). As for the smoothing parameter of the HP-filter, it was set to $\lambda = 7680$, also according to Félix and Almeida (2006), and in line with a $\lambda = 30$ for annual data.[11]

The estimates presented in this article were obtained using a quarterly dataset, which relies on Statistics Portugal and Banco de Portugal databases. It includes official national accounts data regarding real GDP, employment and hours worked; and Labour Force Survey data about working age population and the labour force. The capital stock series is from the Banco de Portugal database and was built using the perpetual inventory method. Whenever the HP-filter is applied to a series, historical data (prior to 1995) and projections from Banco de Portugal are considered.

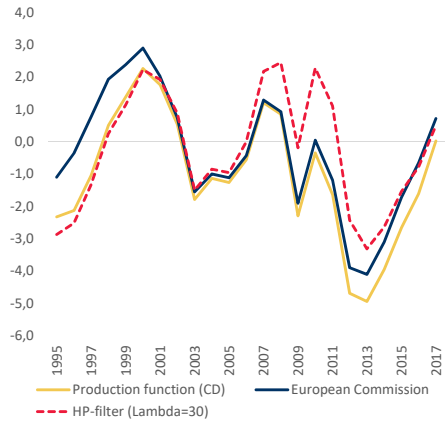
Figure 1A illustrates actual GDP and potential output growth rates for the Portuguese economy. This figure depicts potential output estimates for the period 1995-17 obtained as described above, an HP-filtered GDP series (with a smoothing parameter of 30) and official European Commission estimates (Autumn 2018 forecast).

All methods point towards similar developments, in particular as regards the Banco de Portugal production function approach and the European Commission method. Broadly, all approaches suggest that potential output was decelerating since the beginning of the sample, reaching negative growth

11. Notice that the HP-filter is applied to the logarithm of each of the variables and that the exponentiated trend is then plugged into the production function.



(A) GDP and potential output growth rates in Portugal | In percentage



(B) Output gaps in Portugal | In percentage

FIGURE 1: Potential output and the output gap

Sources: Statistics Portugal, AMECO and authors' calculations.

rates during the last recession. In the most recent period, however, potential growth rates have been recovering. For 2017, the estimates lie between 1 and 1.5%, clearly below the figures estimated for the mid-nineties.

Figure 1B presents the output gap estimates implicit in the same three methods. Despite the small differences in growth rates, as these accumulate, they translate into more considerable differences in terms of output gap estimates. While there is a notable gap between estimates based on our production function and the Commission's in the beginning of the sample, this gap narrows significantly since the early 2000s until the trough of the crisis, when differences become again relevant. In particular, the European Commission approach points towards more negative potential growth rates during the crisis (see Figure 1A), resulting in lower potential output estimates and therefore smaller output gaps.[12]

Close to the end of the decade starting in 2000, the HP-filtered output gap has been diverging from the production function-based estimates, culminating in much smaller output gaps during the recent crisis, similarly to other statistical filters with no economic structure (see Banco de Portugal, 2017). In particular, around 2009, the HP-filter points towards a closed output gap, while the production function-based estimates point towards a negative gap of around 2%. The zero output gap is not a credible estimate during

12. The European Commission estimates a much higher trend impact of the crisis on unemployment, translating into higher NAWRU levels and therefore lower potential output estimates.

the economic and financial crisis, suggesting a better performance of the production function approach in cyclical turning points.

In the recent past, all methods suggest that GDP levels approached potential output levels, such that the negative output gap vanished by 2017.

Results

The semi-elasticities of revenue, expenditure and the balance with respect to the output gap are obtained by plugging-in the weight of each fiscal item in GDP, the base-to-output and fiscal-to-base elasticities into equations (2) and (3). The results are presented in Table 1.

As expected, the semi-elasticity of revenue is close to zero (standing at -0.01). This reflects the fact that most tax revenues are highly cyclical (as shown by their fiscal-to-base elasticities equal or above unity). Thus, revenue *as a ratio to GDP* is relatively constant across the cycle (because the numerator and denominator move closely together). The small magnitude of the semi-elasticity of revenue implies that the respective cyclical component, *i.e.* the product between the semi-elasticity and the output gap, is also small. As such, the difference between actual revenue (as a percentage of GDP) and the cyclically adjusted revenue (as a ratio to potential GDP) is very modest (Figure 2).

By contrast, on the expenditure side only unemployment benefits are assumed to respond to cyclical developments. Since they account for a minor share of overall spending (and only 1.2% of GDP), the bulk of expenditure is unresponsive to the cycle. This yields a relatively large semi-elasticity with a negative sign (-0.56), mirroring the counter-cyclical behaviour of overall expenditure *as a ratio to GDP*. Therefore, in the case of the expenditure ratio, the cyclical component assumes a larger magnitude than in the case of revenue and exhibits stronger counter-cyclical fluctuations.

The combination of the semi-elasticities of revenue and expenditure yields an aggregate semi-elasticity of the budget balance of 0.54 (bottom right corner of Table 1). This implies that a 1 pp increase (decrease) in the output gap is estimated to induce a 0.54 improvement (deterioration) in the headline balance as a ratio to GDP.

Figure 3 plots the estimates for the CAB obtained on the basis of this semi-elasticity against the actual headline balance and the output gap. It shows that the headline balance tends to improve in peaks and to deteriorate in troughs. This is essentially driven by the counter-cyclicality of the expenditure ratio which illustrates the functioning of automatic stabilizers: in "bad" times, the headline balance deteriorates because the expenditure ratio rises and stimulates domestic demand, smoothing the cyclical fluctuations. In turn, the CAB exhibits both smaller fluctuations and a weaker, and negative, correlation with the output gap, implying an average counter-cyclicality. These features

Fiscal Item	Weight in GDP	Base	Base to output		Fiscal to base	Semi-elasticity		
			T	(T-1)		T	(T-1)	Total
i, j	$\bar{r}_i, \bar{e}_j$	B	η_0^{BY}	η_1^{BY}	η^{RB}, η^{EB}	ε_0	ε_1	ε
Current taxes on income and wealth	**9.8%**					**0.02**	**-0.01**	**0.01**
Direct taxes paid by corporations	3.2%	Gross operating surplus & mixed income	1.25	-0.34	1.95	0.05	-0.02	0.02
Direct taxes paid by households								
Personal income tax	6.2%					-0.02	0.01	-0.01
on earnings	3.6%		0.59	0.31	1.07	-0.01	0.01	0.00
w.r.t. employees		Employees	0.53	0.33	1.00			0.00
w.r.t. average earnings		Compensation per employee	0.07	-0.02	2.22			0.00
on business income	0.4%	Gross operating surplus & mixed income	1.25	-0.34	1.00	0.00	0.00	0.00
on capital income	1.0%	Gross operating surplus & mixed income	1.25	-0.34	1.00	0.00	0.00	0.00
on social benefits	1.3%	Pensions	0.00	0.00	1.00	-0.01	0.00	-0.01
Other current taxes	0.4%	Not cyclical / nominal trend GDP	0.00	0.00	1.00	0.00	0.00	0.00
Taxes on production and imports	**13.9%**					**0.06**	**0.00**	**0.06**
VAT	8.1%					0.05	0.00	0.05
on HH final consumption	6.4%	HH consumption excl. imputed rent	1.35	0.00	1.26	0.05	0.00	0.05
on govern. and NPISH consumption	1.0%	Government intermediate consumption and social transfers in kind	0.00	0.00	1.00	-0.01	0.00	-0.01
on GFCF	0.7%	Gross fixed capital formation	3.32	0.00	1.00	0.02	0.00	0.02
Other indirect taxes	5.9%					0.01	0.00	0.01
Stamp duties	1.1%	Nominal GDP	1.00	0.00	2.27	0.01	0.00	0.01
Other taxes on products	3.6%	HH consumption excl. imputed rent	1.35	0.00	1.00	0.01	0.00	0.01
Other taxes on production	1.2%	Not cyclical / nominal trend GDP	0.00	0.00	1.00	-0.01		-0.01
Net social contributions	**11.8%**					**-0.05**	**0.04**	**-0.01**
Paid by employers and employees	11.5%		0.59	0.31	1.00	-0.05	0.04	-0.01
w.r.t. employees		Employees	0.53	0.33	1.00			0.00
w.r.t. average earnings		Compensation per employee	0.07	-0.02	1.00			0.00
Paid by self- and non-employed	0.3%	not cyclical / nominal trend GDP	0.00	0.00	1.00	0.00	0.00	0.00
Other (non-cyclical) revenue	**7.2%**		**0.00**	**0.00**	**0.00**	**-0.07**		**-0.07**
TOTAL REVENUE (1)	**42.7%**					**-0.04**	**0.02**	**-0.01**
Unemployment benefits	1.2%	Unemployment	-3.80	-2.24	1.00	-0.06	-0.03	-0.08
Non-cyclical expenditure	47.5%					-0.47		-0.47
TOTAL EXPENDITURE (2)	**48.6%**					**-0.53**	**-0.03**	**-0.56**
OVERALL BALANCE (3)=(1)-(2)						**0.49**	**0.05**	**0.54**

TABLE 1. Computation of the aggregate semi-elasticity of the budget balance

Source: Authors' calculations.
Notes: No collection lags are assumed in the computation of the budgetary semi-elasticity. As such, it is assumed that there is no response of fiscal items to the output gap of $t-2$.

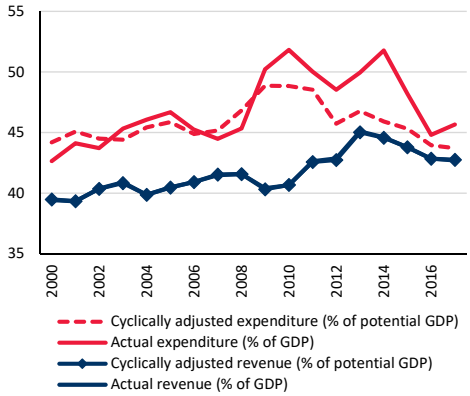


FIGURE 2: Actual and cyclically adjusted revenue and expenditure

Sources: Authors' calculations.
Note: The differences between the actual and the cyclically adjusted lines represent the cyclical components.

are reinforced when focusing on the structural balance, which is corrected also for the impact of temporary measures.

According to the new ESCB methodology, since EMU accession and up to the onset of the crisis, the Portuguese structural balance hovered around -4% of potential GDP. It rock-bottomed at -8.5% in 2009 and then sharply increased during the Economic and Financial Assistance Programme (Programme, henceforth), while the output gap was declining further into negative territory. Since 2015, the structural deficit recorded a small improvement and is estimated to have stood at 1% of potential GDP in 2017.

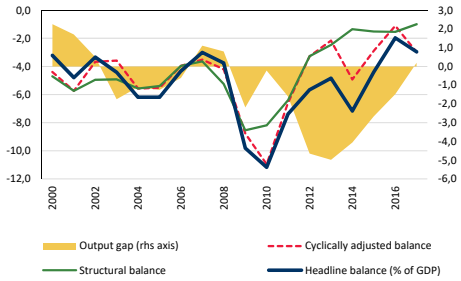


FIGURE 3: The cyclically adjusted and structural budget balances in the new ESCB methodology | In percentage of potential GDP

Sources: Authors' calculations.

The 0.54 semi-elasticity is slightly higher than the one implicit in the former ESCB cyclical adjustment method (0.50 recomputed to 0.53). Across EU

countries, the new semi-elasticities of the budget balance range from 0.32 to 0.64. Although there are some exceptions, lower semi-elasticities are typically associated with Eastern European countries, whereas higher semi-elasticities generally refer to economies with relatively large public sectors. The figure obtained for Portugal stands slightly above the EU (simple) average (0.46, see Figure 4).

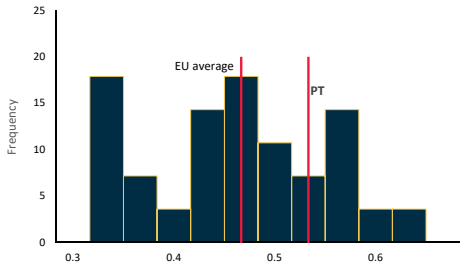


FIGURE 4: Empirical distribution of semi-elasticities across EU countries | In percentage

Sources: ESCB estimates and authors' calculations.

The new ESCB semi-elasticity for Portugal largely coincides with that recently obtained by the European Commission in the context of the regular update of the semi-elasticities used for fiscal surveillance (European Commission, 2019). Indeed, the most recent estimate by the Commission stands at 0.54, also revised up from the 0.51 figure obtained in 2014 (Mourre *et al.*, 2014). In spite of the relatively similar semi-elasticities, the fact that the ESCB and the European Commission rely on distinct assessments of the cyclical position of the economy yields differences also as regards CABs. In particular, CABs in *levels* estimated by the Commission are lower than those obtained on the basis of the new ESCB method throughout the whole 2000-17 period. Since the trough of the crisis the differential is larger, as the difference in the output gaps estimated by the two institutions is also wider (Figure 5).

In addition to the differences stemming from the assessment of the output gap, the ESCB and the European Commission also use distinct criteria to identify the temporary measures (and one-off factors) that are netted-out of the CAB to obtain the structural balance. Nonetheless, the assessments of the fiscal stance (as measured by the *change* in the structural primary balance, which further excludes the impact of interest payments) based on these two methodologies largely coincides. In particular, both assessments point to a broadly neutral stance of fiscal policy in the post-Programme years (Figure 6).

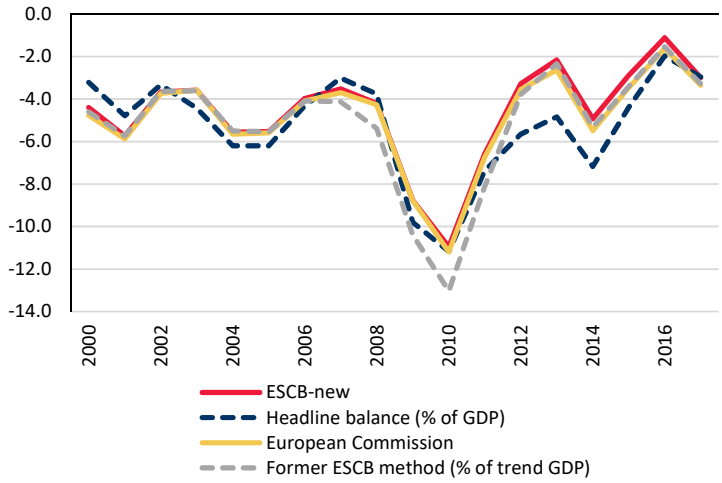
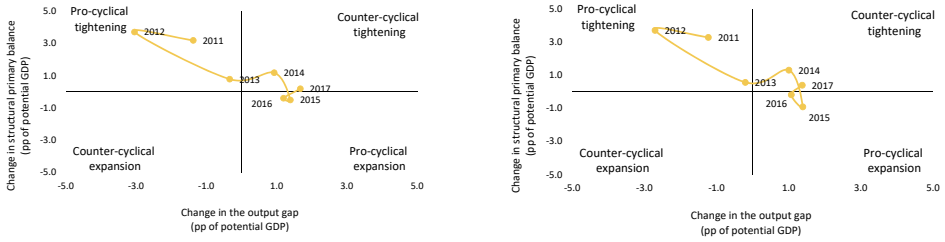


FIGURE 5: Estimates for the cyclically adjusted balance in Portugal: ESCB *vs* European Commission | In percentage of potential GDP

Sources: European Commission (AMECO data base and European Commission, 2019) and authors' calculations.
Notes: Figures referring to the European Commission were obtained using this institution's estimates for the output gap and the updated semi-elasticity published in European Commission (2019). Figures referring to the former ESCB cyclical adjustment method were obtained on the basis of (confidential) projections compatible with the December 2018 ESCB Broad Macroeconomic Projection Exercise.



(A) ESCB methodology

(B) European Commission methodology

FIGURE 6: Fiscal policy stance according to the methods adopted in the ESCB and the European Commission | In percentage points of potential GDP

Sources: European Commission (AMECO database and European Commission, 2019) and authors' calculations.
Note: This comparison can only be made as of 2011 because information on the temporary measures and one-off effects considered by the European Commission is only available as of 2010.

A revised disaggregated framework for the analysis of fiscal developments

Overview

Since 2006, the ESCB has been implementing a framework for a detailed analysis of structural public finance developments, explained in Kremer *et al.*

(2006). As a standardised method, it allowed a transparent and effective cross-country analysis of both past and projected fiscal developments. It identified the structural path of the main expenditure and revenue items, separating the effects of fiscal policy decisions from those of other factors and excluding the impacts of transitory elements beyond those of the economic cycle (such as temporary measures). The new ESCB CAB methodology allows the continuation of this analysis but it requires an adaptation of the framework. This section sheds light on the new adapted framework, developed in Bouabdallah *et al.*, 2019, and Morris and Reiss, 2019. An illustration for Portuguese public finances is also provided, with a particular emphasis on the 2015-17 period.

On the revenue side, the overall structural change as a ratio to potential GDP encompasses changes in revenue referring to taxes (and social contributions) assumed to be cyclical, as well as in items that are unresponsive to the cycle.

For each tax revenue item deemed to be sensitive to cyclical fluctuations, the change in structural revenue as a ratio to potential GDP can be decomposed into four components:

- The impact of **permanent discretionary measures** as a ratio to GDP. As aforementioned, this impact is largely based on official quantifications for the yield of measures presented in government documents. Nonetheless, in some cases, it is adjusted on the basis of expert judgement.

- A (expected) **fiscal drag**, usually associated with tax progressivity, which emerges in the context of the personal income tax reflecting the non-indexation of tax brackets of the withholding tables. It is computed on the basis of potential GDP growth, which corresponds to the macro base's potential growth in the new methodology. It should, however, be noted that the growth of average income induces fiscal drag but growth in employment does not. As such, for calculating the fiscal drag it is assumed that the potential growth rate of average wages is identical to the potential growth rate of GDP per person employed. In some cases, the fiscal-to-base elasticity is higher than one due to the use of a proxy for the macro base (as with using gross operating surplus and mixed income instead of net entrepreneurial income for corporate income tax), or as a result of structure effects in the relation of a fiscal item and its macro base (like in VAT, for which the average rate stemming from consumption of durables is higher than that associated with consumption of non-durables). In these cases, the fiscal drag is assumed to be inexistent.

- Residuals from (unexpected) **composition effects**. These correspond to the impact on tax revenue of macro bases not behaving according to the naive prediction yielded by the base-to-output elasticities, reflecting

different types of shocks to the economy.

- Other (unexpected) **residuals**, which capture the remaining developments of structural revenue. It is clearly more difficult to interpret and it may show deviations between the evolution of tax revenue and the naive estimate based on the tax to base elasticities and/or reflect mismeasurement errors in the other components.

Regarding other (non-cyclical) revenue, the structural ratio to potential GDP can be subsequently broken down into somewhat narrower sub-items on the basis of the observed share of each item in overall other revenue, excluding temporary measures. The difference in each of these ratios vis-à-vis the previous year corresponds approximately to the simple annual change in ratios to potential GDP. As such, values differing from zero in the disaggregated analysis will show up, whenever, after excluding the impact of temporary measures, the growth of the non-tax item is not aligned with that of potential GDP.

On the expenditure side, unemployment benefits have a similar treatment to cyclical tax revenue. However, in this case there is no fiscal drag and the composition effect is computed on the basis of the difference between the growth rate of the respective macro base (number of unemployed) and what would be naively expected given the estimated elasticity, as described above. Moreover, as the macro base is defined in volume, the composition effect is computed on the basis of the potential growth rate of employment, instead of the growth rate of potential GDP.

For the other items of expenditure, which are considered non-cyclical, a similar treatment to non-tax revenue is applied. After computing the structural ratio to potential GDP of non-cyclical expenditure, the result is split according to the weight of the non-cyclical expenditure item in overall non-cyclical expenditure observed in each year, with both the numerator and denominator adjusted for the impact of temporary measures.

Results

The objective of this subsection is to apply the revised disaggregated methodology to past Portuguese public finance developments as a way of illustration. Although some charts present the data for the 2000-17 period, for the sake of conciseness, the descriptive analysis will focus on the three years after the end of the Programme for which outturn data is currently available, *i.e.* 2015 to 2017.

As shown in Figure 3, the structural balance in Portugal, computed in accordance with the new ESCB methodology, improved slightly from -1.4% of potential GDP in 2014 to -0.9 in 2017. However, as the ratio of interest payments to potential GDP declined by 0.9 pp in the same period due to the significant reduction in the implicit interest rate on public debt, the structural

primary balance deteriorated by 0.3 pp. This evolution is explained by a strong reduction in the structural revenue ratio (by 1.9 pp) that more than offset the decline in structural primary expenditure, which reached 1.5 pp (Figure 7).

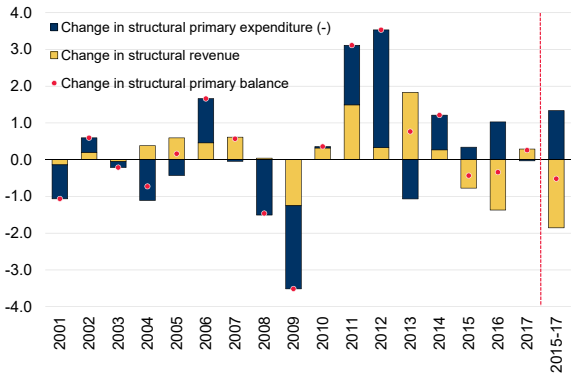
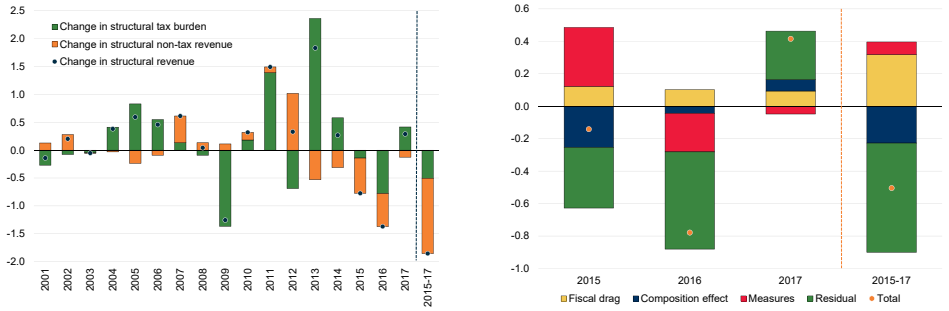


FIGURE 7: Change in the structural primary balance: revenue and expenditure contributions | In percentage points of potential GDP

Sources: Authors' calculations.
Note: An increase (reduction) in structural primary expenditure should be read as negative (positive) in the figure.

Figure 8A shows that the bulk of the reduction in the structural revenue ratio in 2015-17 stems from the behaviour of non-tax revenue. Indeed, interest received by general government declined in this period, in a context of decreasing market interest rates, and so did receipts from EU funds recorded as government revenue (an expected development in the first years of an EU support framework). Regarding the structural tax burden, the cumulative drop in the ratio to potential GDP is mostly explained by a negative residual and, to a smaller extent, a negative composition effect. By contrast, discretionary measures and the (personal income tax) fiscal drag contributed positively to the evolution of structural tax burden but these effects were not enough to offset the drop in the other two aforementioned components (Figure 8B).

The revised disaggregated methodology allows even a finer breakdown of the change in the structural tax burden by category (see Figure 9). Regarding the impact of (permanent) discretionary measures, the positive effect stems almost entirely from rises in indirect taxation. This especially refers to the tax on oil products but also to several other smaller taxes/fees. By contrast, there was in this period a decline in the VAT rate applicable to some restaurant



(A) Tax and non-tax revenue contributions 2001-17

(B) Breakdown of the change of the structural tax burden 2015-17

FIGURE 8: Breakdown of the change in structural revenue | In percentage points of potential GDP

Sources: Authors' calculations.

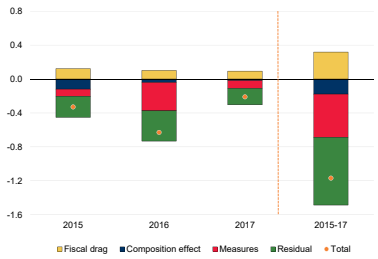
services that negatively affected this tax's collection in both 2016 and 2017. This effect was reinforced by significant permanent discretionary changes in the context of the personal income tax: the 2015 reform and the elimination of a surcharge introduced during the Programme which yielded a non-negligible drop in revenue.

In this period the cumulative impact of the fiscal drag, relevant only in the case of the personal income tax, reached 0.3 pp of potential GDP. Although small, as it should be expected, this effect may be overestimated as it is assumed in its computation that there was no regular update of the tax brackets of the withholding tables. As significant modifications were introduced in the personal income tax in 2015-17, it is difficult to disentangle the impact of the regular update from that related to the changes in the tax code, particularly in the absence of a detailed analysis based on micro data.

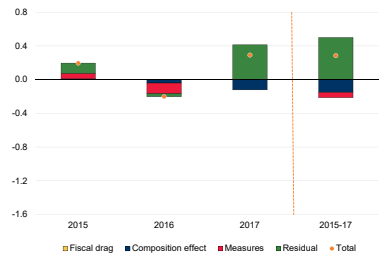
The composition effect is relatively small in each of the four main tax categories. Cumulatively over the period under analysis, it is broadly neutral regarding the taxes on production and imports. This reflects the fact that the behaviour of the main macro base for this aggregate – households' private consumption excluding imputed rents – was close to what could be expected on the basis of the naive prediction. Gross operating surplus and mixed income of the total economy exhibited, cumulatively over the three years, a slightly more mitigated evolution than the benchmark expectation. This affects taxes on income and wealth paid by corporations, but also the personal income tax levied on business and capital incomes, yielding a negative composition effect for these tax components. Finally, the composition effect associated to the compensation of employees of the economy as a whole, visible in the breakdown of social contributions and underlying the splitting

of taxes on income and wealth paid by households, is positive but small over the 2015-17 period.

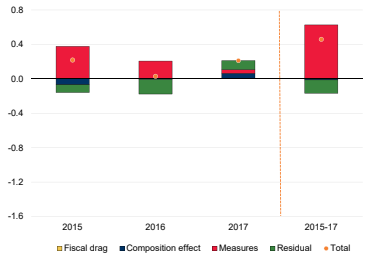
The residual component shows a significant negative magnitude over 2015-17, stemming to a large extent from direct taxes paid by households. This captures the fact that in this period there was an increase in net refunds in personal income tax, much concentrated in 2016, as well as a substantial drop in personal income tax collection on interest income, associated to the steep decline in interest rates. The positive residual in direct taxes paid by corporations reflects the difficulties in obtaining a good fit for developments in actual receipts using a constant fiscal elasticity and a macro base. Indeed, in the case of Portugal, corporate income tax revenue is much concentrated in a relatively small number of large firms which justifies its considerable volatility and disconnection from its theoretical macroeconomic base. Taxes on production and imports also show a negative cumulative residual, which is partly attributed to the performance of the tax on real estate property. Also, the possibility of an overestimation of discretionary measures' impact should not be excluded as an explanatory factor. Lastly, the negative residual of social contributions stems entirely from the evolution of imputed contributions.



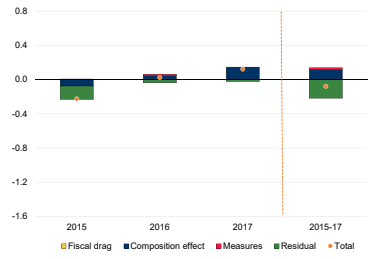
(A) Taxes on income and wealth paid by households



(B) Taxes on income and wealth paid by corporations



(C) Taxes on production and imports

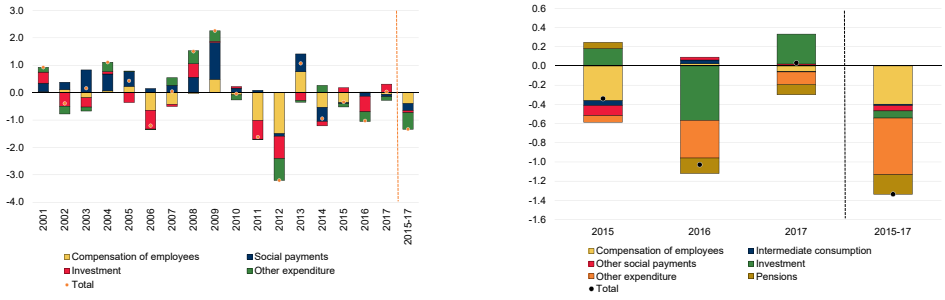


(D) Social contributions

FIGURE 9: Breakdown of the change of the structural tax burden by category | In percentage points of potential GDP

Sources: Authors' calculations.

On the expenditure side, all main items reduced their ratio to potential GDP in the 2015-17 period as a whole (Figure 10). The main contribution to the decline came from "other expenditure", which encompasses reductions in both subsidies and current transfers. Compensation of employees in the public sector also played a role, in spite of the small increase in the number of public employees and the impact of the reversal of some wage cuts introduced just before and during the Programme. Pension expenditure also grew below nominal potential GDP as the increase in the number of pensioners and the annual update of pensions were rather limited. Investment has shown in the three years under analysis a volatile profile, which translated into a small reduction as a ratio to potential GDP. The contribution of the other items (intermediate consumption and other social payments) to changes in overall structural primary expenditure was negligible.



(A) Main primary expenditure items contributions 2001-17

(B) Finer breakdown of the change of the structural primary expenditure 2015-17

FIGURE 10: Breakdown of the change in structural primary expenditure | In percentage points of potential GDP

Sources: Authors' calculations.

Concluding remarks

The new ESCB methodology is broadly similar to aggregate cyclically adjustment methods adopted by other institutions, most notably the European Commission. Nonetheless, it presents a number of advantages compared to alternative frameworks. First, it takes time lags into account. Second, it allows for the disentanglement of the various drivers of structural fiscal developments, with an emphasis on the improved estimation of composition effects. Finally, the estimation of fiscal-to-base and base-to-output elasticities introduces a number of refinements.

Additionally, the new ESCB methodology relies on more informed estimates of the output gap, departing from a purely statistical trend/cycle

decomposition. Moreover, the new potential output estimates are subject to a peer review and ensure the consistency between the views of macro and fiscal experts on the cyclical position of the economy. This integration between macroeconomic and fiscal analysis is also beneficial from the point of view of communicating policy advice.

According to the new ESCB methodology, the semi-elasticity of the budget balance with respect to the economic cycle stands at 0.54 in the case of Portugal. This result stems almost exclusively from the larger cyclical component of total expenditure as a ratio to GDP, as the semi-elasticity of the total revenue ratio is close to zero. When correcting the estimated cyclically adjusted balance for the impact of temporary measures, it is shown that since EMU accession and up to the onset of the crisis, the Portuguese structural balance hovered around -4% of potential GDP. It reached a minimum of -8.5% in 2009 and then sharply increased during the Programme. Since 2015, the structural deficit recorded a small improvement and is estimated to have stood at 1% of potential GDP in 2017.

The new ESCB semi-elasticity for Portugal largely coincides with that recently obtained by the European Commission in the context of the regular update of the semi-elasticities used for fiscal surveillance. However, the fact that the ESCB and the European Commission rely on distinct assessments of the cyclical position of the economy and temporary measures yields differences also as regards structural balances' estimates. The differences in levels can be significant in some years, particularly in the more recent period. However, the assessment of the fiscal stance (as measured by the change in the structural primary balance) is broadly similar.

Regardless of the methodology adopted, quantifying the effect of fluctuations in economic activity on public finances is inherently complex and requires several assumptions. All cyclical adjustment methodologies rely on unobservable variables. This, together with frequent *ex post* revisions, has lead to heightened criticism on the use of CABs in several *fora*. These views, however, are much centered on the fact that CABs (or more specifically, structural balances) are indicators on the basis of which fiscal targets are set and assessed in the context of the European fiscal surveillance mechanism. At the margins of this debate, CABs continue to be an useful and functional fiscal indicator, provided that the underlying methodology is well understood, allowing a proper interpretation of results.

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