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Article

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Gilles Mourre and Aurélien Poissonnier*

What Drives the Responsiveness of the Budget Balance to the Business Cycle in EU Countries?

The European Commission methodology for computing the cyclically adjusted government budget balance provides a robust measurement of the fiscal position of the Member States. The fiscal semi-elasticities at the core of this method are structural parameters, mostly of fiscal nature, not linked to cyclical or other economic factors. Fiscal semi-elasticities also exhibit an emulation effect between neighbours and some groupings of countries.

Governments' budget balances fluctuate with the business cycle and this requires computing a cyclically adjusted balance (CAB). To do this, the European Commission uses a methodology based on the output gap,¹ which measures the position in the business cycle, and the semi-elasticity of the budget balance to output; this is the focus of this paper. The semi-elasticity measures the percentage points by which the governments' budget balance to GDP ratio changes for every one percent increase in GDP.

The EU methodology seeks to provide a simple and transparent measure of the fiscal stance while remaining

economically sound. The current formula is rather intuitive: the CAB is equal to the headline balance minus the semi-elasticity times the output gap represented in Equation (1). This is an important issue given the current complexity of the fiscal rules.² It is also easy to implement in real time and in the Commission's forecasts.

We show that the Commission methodology is robust. Controlling for some of the factors influencing the estimates during the crisis has a marginal effect on the semi-elasticities. Using time-varying weights in their computation generates some volatility in the estimates but has a limited impact on the CAB. Also, using a linearised formula for the CAB does not affect the assessment of the fiscal stance in the EU or in Member States.

We run a panel data analysis to find the possible determinants of the fiscal semi-elasticities in the EU. The analysis confirms that the fiscal semi-elasticities are structural, i.e. country-specific and lasting features that are largely related to budgetary variables such as the size of government expenditure, the share of non-tax revenue, the share of unemployment-related expenditure and the progressivity of the tax system. Reassuringly, we find no sign of cyclical bias in the semi-elasticities. Other non-fiscal structural features of the economies do not seem to explain the level of fiscal semi-elasticities. There are nevertheless some identifiable geographical patterns: newly acceded Member States and lower-income Member States tend to have lower semi-elasticities. Semi-elasticities also appear to be subject to an emulation effect between neighbouring Member States.

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1 K. Havik, K. Mc Morrow, F. Orlandi, C. Planas, R. Raciborski, W. Röger, A. Rossi, A. Thum-Thysen, V. Vandermeulen: The production function methodology for calculating potential growth rates and output gaps, European Economy Economic Papers No. 535, 2014; K. Mc Morrow, W. Roeger, V. Vandermeulen, K. Havik: An assessment of the relative quality of the Output Gap estimates produced by the EU's Production Function Methodology, European Commission Economic Discussion Papers No. 20, 2015.

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2 S. Deroose, N. Carnot, L. Pench, G. Mourre: EU fiscal rules: Root causes of its complexity, VoxEU.org, 14 September 2018.

The cyclical-adjustment 'aggregate' methodology for the EU fiscal surveillance

A short review of literature

The CAB corresponds to the deficit/surplus-to-GDP ratio that would prevail if the economy was running at its potential. It is computed as the difference between the headline budget balance (B , in percentage of GDP) and an estimated cyclical component. The cyclical component of the budget balance is the product of ε , the semi-elasticity of the headline budget balance to output and the output gap ($OG = (Y - Y^P)/Y^P$), i.e. the distance between actual and potential real GDP).

$$CAB_t = B - \varepsilon OG_t \quad (1)$$

Early estimations of the fiscal semi-elasticities date back to the mid-nineties and early 2000s³ and were used by the OECD and the Commission.⁴ These estimates have been regularly updated for all OECD and EU countries and extended the subsequent waves of accession to the EU.⁵

Some limitations of the EU methodology are discussed in the literature. It is often referred to as an aggregate approach, since it is using the output gap as a single (synthetic) measure of the business cycle, applied to all fiscal items. By contrast, more disaggregated methodologies identify a specific cyclical pattern for each and every component of the budget balance. Advocates of disaggregated approaches often argue that the cyclical correc-

tion based on the output gap could overlook important dimensions. First, the economic cycles may differ across revenue and expenditure components.⁶ Second, while the EU methodology corrects for real business cycle fluctuations, it neglects the price effects, which can be sizeable in times of high inflation.⁷ Third, fiscal elasticities can differ in the short and long run and, therefore, vary substantially over time.⁸ However, the lack of long-time series corrected for tax policy changes and the absence of a clear pattern in the volatility of implicit/empirical elasticities in some Member States make it difficult to measure time-varying elasticities.⁹ All these factors could account for the residual cyclical component identified by studies carried out before the Great Financial Crisis.¹⁰ Despite this, the EU aggregate method performed relatively well during the economic and financial crisis compared with more disaggregated approaches.¹¹

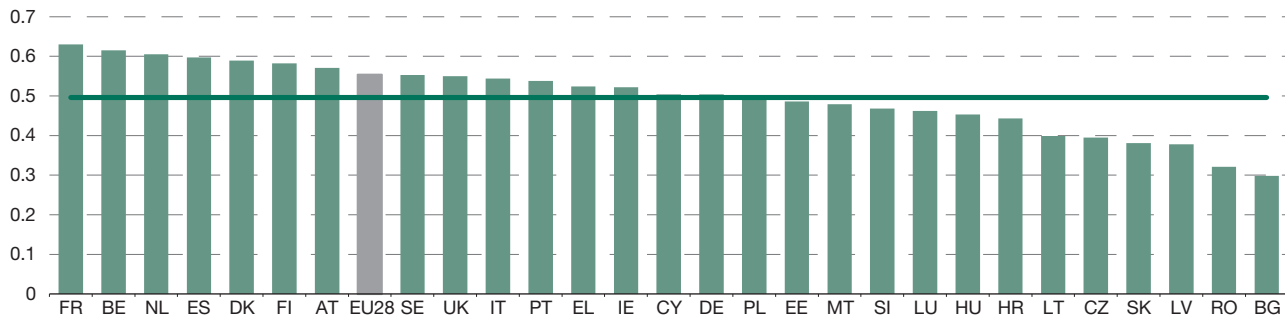
Semi-elasticities of the budget balance in the EU

The budgetary semi-elasticity measures the sensitivity of the budget balance (as a share of GDP) to the economic cycle. It measures the percentage point change of the headline balance to the GDP ratio for a one percent increase in GDP. This concept reflects the impact of the business cycle both on the numerator of the budget bal-

- 3 C. Giorno, P. Richardson, P. van den Noord: Estimating Potential Output, Output Gaps and Structural Budget Balances, OECD Economics Department Working Papers No. 24, 1995; European Commission: The Commission services' method for the cyclical adjustment of government budget balances, in: European Economy Broad economic policy guidelines, Vol. 60, 1995, pp. 35-90; P. van den Noord: The Size and Role of Automatic Fiscal Stabilizers in the 1990s and Beyond, OECD Economics Department Working Papers No. 230, 2000.
- 4 OECD: Economic Outlook December 1999, European Commission: Public Finances in EMU, European Economy No. 3, 2000.
- 5 N. Girouard, C. Andre: Measuring Cyclically-Adjusted Budget Balances for the OECD Countries, OECD Economics Department Working Papers No. 434, 2005; European Commission: Public Finances in EMU, European Economy No. 3/2006, Part II.4.3, 2006, pp. 115-122; G. Mourre, G.-M. Isbasoiu, D. Paternoster, M. Salto: The cyclically-adjusted budget balance used in the EU fiscal framework: an update, in: European Economy, Economic Papers No. 478, 2013; R. Price, T. Dang, Y. Guillemette: New Tax and Expenditure Elasticity Estimates for EU Budget Surveillance, OECD Economics Department Working Papers No. 1174, 2014; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; R. Price, T. Dang, J. Botev: Adjusting fiscal balances for the business cycle: New tax and expenditure elasticity estimates for OECD countries, OECD Economics Department Working Papers, No. 1275, 2015.

- 6 C. Bouthevillain, P. Cour-Thimann, G. van den Dool, P. Hernandez de Cos, G. Langenus, M. Mohr, S. Momigliano, M. Tujula: Cyclically Adjusted Budget Balances: An Alternative Approach, ECB Working Paper Series No. 77, 2001.
- 7 V. Tanzi: Inflation, Lags in Collection, and the Real Value of Tax Revenue, Staff Papers (International Monetary Fund), Vol. 24, No. 1, 1977, pp. 154-167; V. Tanzi, M.I. Blejer, M.O. Teixeira: Inflation and the Measurement of Fiscal Deficits, Staff Papers (International Monetary Fund), Vol. 34, No. 4 (Dec.), 1987, pp. 711-738; J. Escolano: A Practical Guide to Public Debt Dynamics, Fiscal Sustainability, and Cyclical Adjustment of Budgetary Aggregates, IMF Technical Note and Manuals No. 10/02, 2010; R. Morris, L. Schuknecht: Structural Balances and Revenue Windfalls: The Role of Asset Prices Revisited, ECB Working Paper No. 737, 2007.
- 8 G. Koester, C. Priesmeier: Revenue elasticities in euro area countries: An analysis of long-run and short-run dynamics, ECB Working Paper Series No. 1989, 2017; G. Mourre, S. Princen: Tax Revenue Elasticities Corrected for Policy Changes in the EU, in Directorate-General for Economic and Financial Affairs Discussion Paper No. 18, 2015; V. Belingia, D. Benedek, R.A. de Mooij, J. Norregaard: Tax Buoyancy in OECD Countries, IMF Working Paper No. 110, 2014.
- 9 G. Mourre, S. Princen: The dynamics of tax elasticities in the whole European Union, CESifo Economic Studies, ify028, 25 January 2019.
- 10 E. Alberola, J.M. González Mínguez, P. Hernández de Cos, J.M. Marqués: How cyclical do cyclically-adjusted balances remain? An EU study, in: Hacienda Pública Española, IEF, Vol. 166, No. 3, 2003, pp. 151-181; R. Morris, C. Rodrigues Braz, F. de Castro, S. Jonk, J. Kremer, S. Linehan, M.R. Marino, C. Schalck, O. Tkacevs: Explaining Government Revenue Windfalls and Shortfalls: An Analysis for Selected EU Countries, ECB Working Paper No. 1114, 2009.
- 11 Indeed, the cyclical pattern of some specific granular components can be particularly erratic in periods of strong recession and thereby very difficult to identify.

Figure 1
Budget balance semi-elasticities in the EU



Note: EU28 corresponds to the EU treated as a single country, which differs from the (unweighted) average across the Member States (horizontal line).

Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' own calculations.

ance ratio (budget balance in monetary terms) and on its denominator (GDP).¹²

The semi-elasticity of the budget balance in the EU is equal to 0.5 on average and semi-elasticities range from 0.29 in Bulgaria to 0.63 in France (Figure 1). Members of the EU before 2004 who had fairly large government expenditure (France, Belgium, Denmark, Finland and Austria) and/or high expenditure elasticity due to a large share of unemployment-related expenditure (Netherlands and Spain) tend to have a higher semi-elasticity. Countries with relatively small government expenditure that acceded to the EU in 2004 have a semi-elasticity below 0.4 (Lithuania, Czech Republic, Slovakia, Latvia, Romania and Bulgaria). Due to these differences, the cyclical component of the budget balance corresponding to a one percent output gap would be around 0.6% of (potential) GDP in France compared to around 0.3% of (potential) GDP in Bulgaria.

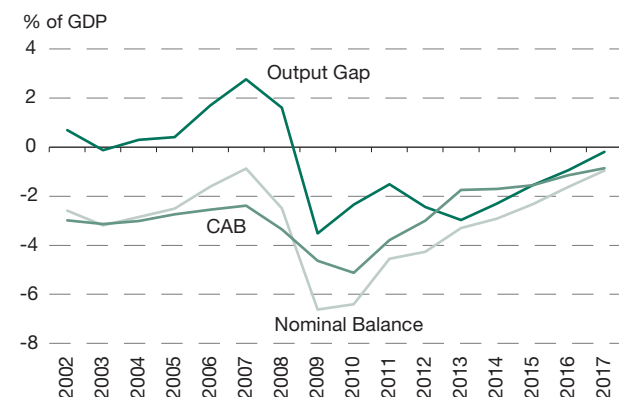
The fiscal semi-elasticity is positive for all Member States; the headline budget balance increases in good times and deteriorates in bad times. The cyclical inertia of public spending combined with the cyclically-driven pattern of public revenue induce the so-called fiscal stabilisers: the headline budget balance deteriorates in economic troughs and improves in booms, which mitigates the

business cycle itself. As an illustration, the correlation between the output gap and the headline balance in the EU is equal to 71%, whereas the correlation of the output gap with the CAB (correcting for this cyclical component) drops to 17% (Figure 2). The CAB is therefore more representative of the fiscal stance decided by governments.

Decomposition of the semi-elasticities

The fiscal semi-elasticities are a combination of the weights and elasticities of the revenue and expenditure components. Four individual revenue categories (personal income taxes, corporate income taxes, indirect taxes,

Figure 2
Composition of the general government expenditure in the EU



Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' own calculations.

¹² By contrast, the elasticity captures the relative variation of one variable to the relative variation of another variable, e.g. measures by how many percent revenue changes for a 1% increase in GDP. Both are directly related as shown in the technical appendix of G. Mourre, A. Poissonnier, M. Lauegger: The semi-elasticities underlying the cyclically-adjusted budget balance: an update and further analysis, Directorate-General for Economic and Financial Affairs Discussion Paper No. 098, 2019.

social security contributions, denoted $R_{1<i<4}$) and one spending category (unemployment-related expenditure, denoted G_u) are found to be sensitive to the economic cycle. Their elasticities are denoted $\eta_{R,i}$ and $\eta_{G,u}$. Non-tax revenue (sales and capital transfers other than capital taxes, R_s) and other expenditure (G_o) are assumed to be non-cyclical, i.e. their elasticities are zero.¹³

$$\varepsilon = \underbrace{\sum_{i=1}^4 (\eta_{R,i} - 1) \frac{R_i}{Y} - \frac{R_s}{Y}}_{\varepsilon_R} - \underbrace{(\eta_{G,u} - 1) \frac{G_u}{Y} - \frac{G_o}{Y}}_{\varepsilon_G} \quad (2)$$

Individual elasticities ($\eta_{R,i}$ and $\eta_{G,u}$) are assumed to be constant. The elasticities of the cyclical revenue are above one for personal income tax and corporate income tax, below one for social security contributions (except for Estonia, Ireland and Lithuania) and by assumption equal to one for indirect taxes (except for Italy) and equal to zero for non-tax revenue. The elasticity of unemployment related expenditure is (very) negative but its weight in total expenditure is no larger than six percent. Other expenditure has an elasticity of zero by assumption.¹⁴

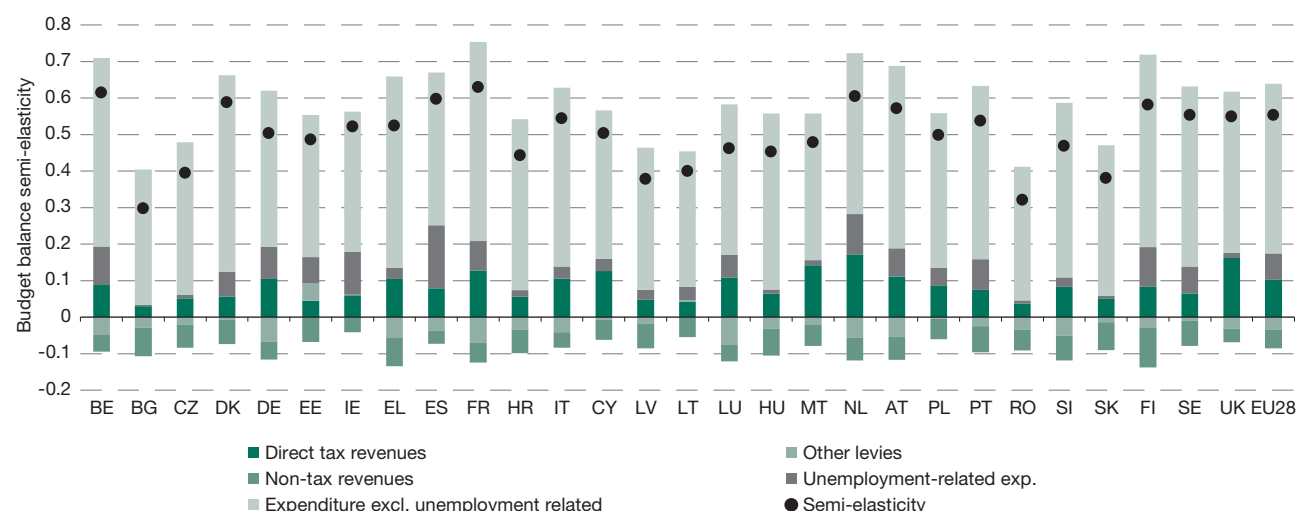
13 Elasticities of the revenue and expenditure components are taken from R. Price, T. Dang, J. Botev, op. cit. They also document the absence of cyclical pattern in non-tax revenue and other expenditure.

14 G. Mourre, A. Poissonnier, M. Lausegger, op. cit.

The weights are computed as ten year averages. The weights are time varying in principle. It is, however, much more convenient to assume that they are constant in order to compute a unique semi-elasticity per Member State. In the latest vintage, they are computed as 10-year averages over the 2008-2017 period.

Public expenditure contributes most to fiscal semi-elasticities, while the contributions of various tax items broadly offset each other (Figure 3). Looking at the EU28, expenditure excluding unemployment-related spending appears the main driver of fiscal semi-elasticities (with a contribution of 0.46). This contribution directly reflects its economic size of around 46% of GDP and implies a good correlation between the semi-elasticities and the size of the government (Figure 4). Unemployment-related expenditure brings an additional contribution of almost 0.1 because of the highly counter-cyclical fluctuations of unemployment benefits and despite their low size as a percentage of GDP. Direct taxes (personal and corporate income taxes) contribute to fiscal semi-elasticities by 0.1 as well due to their progressivity. In contrast, non-tax revenue and other levies (indirect taxes and social security contributions) contribute negatively to the semi-elasticities, due to no or limited responsiveness to the business cycles. This decomposition of the semi-elasticities for the EU28 is similar across Member States.

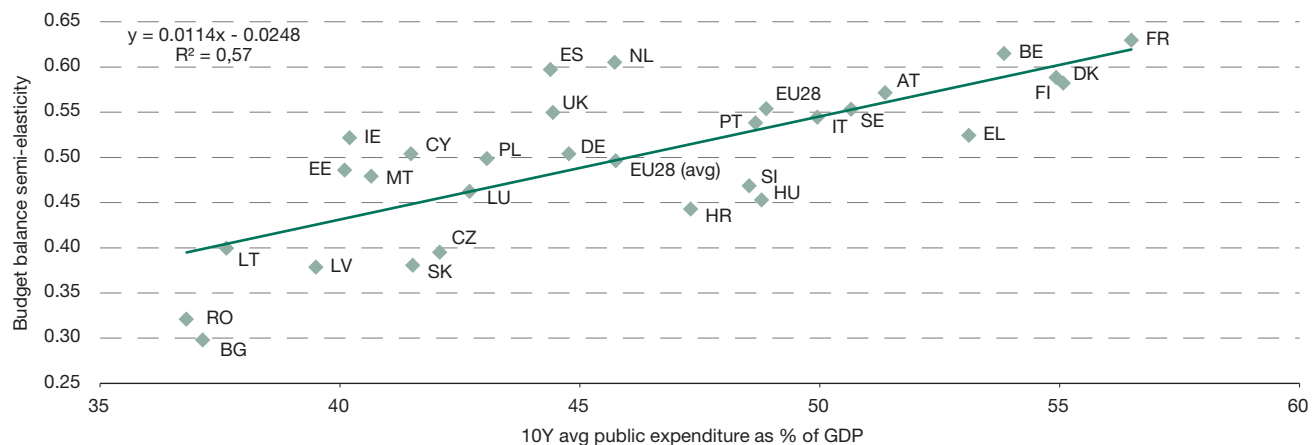
Figure 3
Decomposition of the fiscal semi-elasticities



Note: EU28 corresponds to the EU treated as a single country.

Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' own calculations.

Figure 4

Public expenditure to GDP and the semi-elasticities of the budget balance

Note: EU28 corresponds to the EU treated as a single country while EU28 (avg) is the simple average of the 28 Member States.

Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' calculations.

Robustness of the EU fiscal semi-elasticities to simplifying assumptions

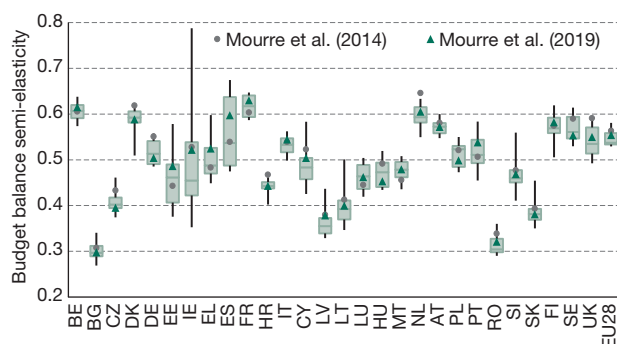
We calculate the semi-elasticities of the budget balance over time in Figure 5.¹⁵ Lines illustrate the maximum and minimum values while boxes illustrate the middle 50% of the estimations between 2002 and 2017. For Estonia (EE), Ireland (IE), Greece (EL), Spain (ES), Cyprus (CY), Lithuania (LT) and Slovenia (SI), the maximum to mini-

¹⁵ Note that this time-varying estimation of the semi-elasticities solely uses time-varying weights and not time-varying individual elasticities, due to the non-availability of the latter.

imum distance is larger than 0.15. As expected, Commission estimates, which rely on 10-year average weights, are in the middle of the distribution. Interestingly, the revisions of semi-elasticities since the last vintage appear relatively minor compared to the hypothetical revisions occurring if annual time varying weights were to be used.¹⁶ For some countries, the semi-elasticities exhibit large volatility when based on annual weights.

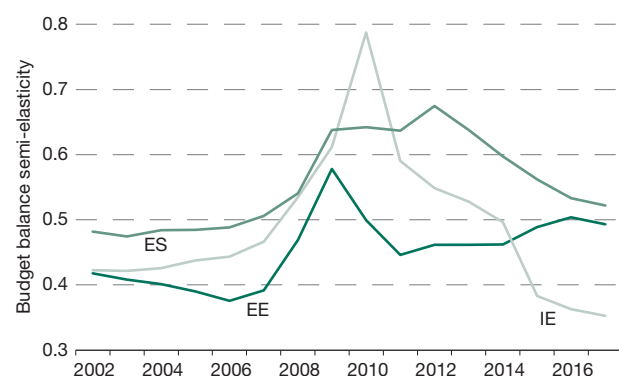
¹⁶ Among the sources of revisions, the weights were not only updated, but the new system of national accounts was put in place. G. Mourre, A. Poissonnier, M. Laussegger, op. cit.

Figure 5

Dispersion of budget balance semi-elasticities with time varying weights between 2002 and 2017

Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' own calculations.

Figure 6

Time varying fiscal semi-elasticities (three examples)

Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' own calculations.

For Estonia, Ireland, and Spain, the dispersion of the time varying semi-elasticity is quite large (0.2, 0.43 and 0.2 respectively). The recent crisis led to drastic increases of the semi-elasticities from 2008 onwards (Figure 6). This was primarily caused by increasing unemployment expenditure. While they amounted to 0.94% of GDP in Estonia, 4.23% in Ireland and 4.02% in Spain in 2006, they increased to 4.51%, 4.79% and 6.69% respectively in 2009. The increase in this weight had a positive effect on the budget balance elasticities which more than compensated for the effect of decreasing revenue.

Smoothing out the impact of the economic and financial crisis barely affects the semi-elasticities, which would become only marginally lower than the revised value (Table 1). We address the effects of the Great Recession in two ways. First, we exclude capital transfers from total expenditure in order to exclude one-off capital transfers (bank recapitalisation) that occurred during the financial crisis. Excluding capital transfers from public expenditure would automatically decrease the semi-elasticities. The effect on the semi-elasticity is on average only -0.01 and ranges from zero to 0.03 across the EU. Second, we calculate the semi-elasticities using the full 2002-17 time window to reduce the weight of the crisis in an expanded sample. The revisions compared to the present estimates would be negative for most Member States (also -0.01 on average) and range from 0.02 to -0.04. The decrease in the semi-elasticities would be the largest for the three countries where the weights have the greatest time variance (-0.04 for Estonia and Spain, -0.03 for Ireland).

Empirically observable semi-elasticities – measured from one year to another – are far more volatile than our time varying estimates and their information is not easy to interpret (Figure 7). By making the weights time-varying, we capture part of the year-on-year variations of the fiscal elasticities. Our estimates, however, neglect other sources of volatility, in particular changes to the individual elasticities and the impact of new policy decisions. While the comparison between our estimates and the empirical elasticity illustrates the existence of other sources of volatility, it should be borne in mind that the empirically observable semi-elasticities remain a temporal concept (measured between two years) and cannot be equated with the underlying cyclical semi-elasticities (an unobserved concept that is used to correct the cyclical component for a given year). In practice, the empirical semi-elasticities greatly depart from our estimates and show large variations, sometimes linked numerically to small GDP growth rates in the denominator. In the Irish case, for instance, which shows one of the greatest displays of volatility, the peak observed in 2010 in

Table 1
Robustness analysis of budget balance semi-elasticities

Country	Budget balance semi-elasticities				Revisions compared to 2014	Revisions compared to 2018	
	2014	2018	2018 excl. capital transfers (D9p)	2018 weights computed over extended window 2002-17	2018	2018 excl. capital transfers (D9p)	2018 weights computed over extended window 2002-17
BE	0,61	0,61	0,60	0,61	-0,01	-0,01	-0,00
BG	0,31	0,30	0,29	0,30	0,01	-0,01	0,00
CZ	0,43	0,40	0,39	0,40	0,04	-0,01	0,00
DK	0,62	0,59	0,58	0,59	0,03	-0,01	0,00
DE	0,55	0,50	0,49	0,52	0,05	-0,01	0,02
EE	0,44	0,49	0,47	0,45	-0,04	-0,02	-0,04
IE	0,53	0,52	0,49	0,49	0,01	-0,03	-0,03
EL	0,48	0,52	0,50	0,50	-0,04	-0,02	-0,02
ES	0,54	0,60	0,59	0,56	-0,06	-0,01	-0,04
FR	0,60	0,63	0,62	0,61	-0,03	-0,01	-0,02
HR	0,47	0,44	0,43	0,45	0,02	-0,01	0,01
IT	0,54	0,54	0,53	0,53	-0,01	-0,01	-0,01
CY	0,52	0,50	0,48	0,49	0,02	-0,02	-0,01
LV	0,38	0,38	0,37	0,37	0,00	-0,01	-0,01
LT	0,41	0,40	0,39	0,40	0,01	-0,01	0,00
LU	0,44	0,46	0,45	0,46	-0,02	-0,01	-0,00
HU	0,49	0,45	0,43	0,47	0,04	-0,02	0,02
MT	0,46	0,48	0,47	0,47	-0,02	-0,01	-0,01
NL	0,65	0,61	0,60	0,60	0,04	-0,01	-0,01
AT	0,58	0,57	0,56	0,57	0,01	-0,01	-0,00
PL	0,52	0,50	0,50	0,51	0,02	0,00	0,01
PT	0,51	0,54	0,53	0,52	-0,03	-0,01	-0,02
RO	0,34	0,32	0,31	0,32	0,02	-0,01	-0,00
SI	0,48	0,47	0,45	0,47	0,01	-0,02	0,00
SK	0,39	0,38	0,37	0,38	0,01	-0,01	-0,00
FI	0,57	0,58	0,58	0,57	-0,01	-0,00	-0,01
SE	0,59	0,55	0,55	0,57	0,04	-0,00	0,02
UK	0,59	0,55	0,53	0,54	0,04	-0,02	-0,01
EU28	0,56	0,55	0,55	0,55	0,01	-0,00	-0,00

Note: Counterfactual revisions of the semi-elasticities are computed by either taking the period covering both vintages for the weights or by excluding capital transfers from public expenditure (D9p). Such changes in the methodology would have resulted in minor differences in the semi-elasticities, with the largest effects on EE, IE, and ES. EU28 calculations are based on elasticities and weights of the Union as if it was a country of its own.

Source: AMECO 2018 Spring vintage; G. Murre, C. Astarita, S. Prinsen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' calculations.

Figure 7
Comparison with the empirical semi-elasticities



Note: EU28 corresponds to the EU treated as a single country.

Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' own calculations.

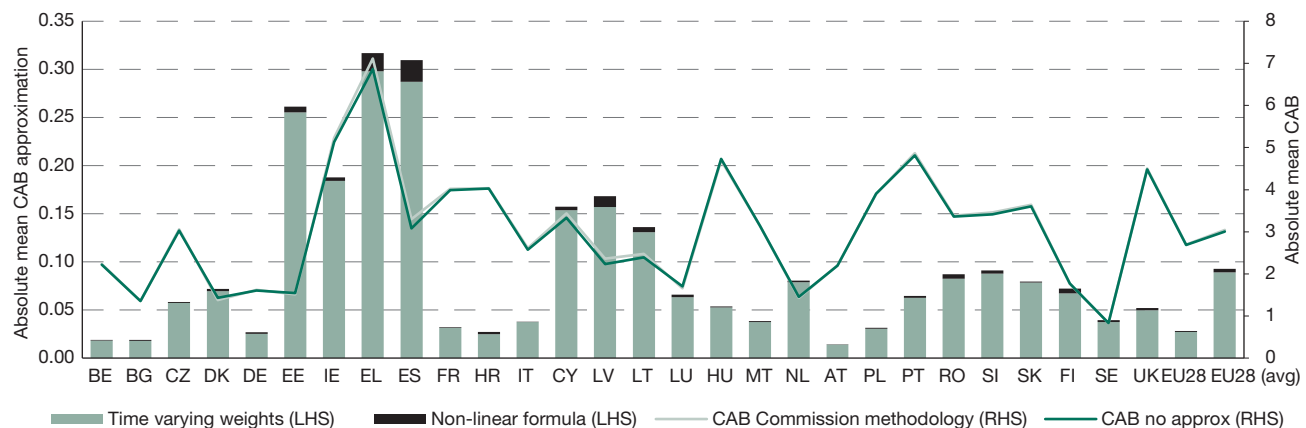
the time-varying semi-elasticities (Figure 6) is very limited compared to the jump in the empirical semi-elasticity that same year (Figure 7). In addition to this high volatility, country comparisons show that the empirical semi-elasticity does not fluctuate around the value computed using the EU methodology (from a detailed approach considering each revenue and expenditure item

separately). The effective semi-elasticities are therefore hardly exploitable in the context of fiscal policy analysis.

This confirms the results of Princen et al.¹⁷ This very strong volatility of empirical elasticities could be traced

¹⁷ S. Princen, G. Mourre, D. Paternoster, G. Isbasoiu, op. cit.

Figure 8
Absolute mean CAB approximations across Member States (2002 to 2017)



Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' own calculations.

Figure 9
CAB calculation (and approximation) in selected Member States

CAB in % of potential GDP



Sources: AMECO 2018 Spring forecast; G. Mourre, C. Astarita, S. Princen: Adjusting the budget balance for the business cycle: the EU methodology, European Economy, Economic Papers No. 536, 2014; and authors' own calculations.

back to a number of factors. Four types of factors can be distinguished: i) the composition of growth, with more or less tax-rich components; ii) asset price cycle effects (generating tax shortfall/windfall); iii) dynamic effects (fiscal drags, but also declaration/collection lags) and iv) tax compliance effects (due to higher credit constraints or higher bankruptcy rates in bad times). These elements – not taken into account in the EU methodology – are mostly country-specific.

The EU estimator of the CAB is robust to using time-varying weights and a non-linear formula.¹⁸ Both approximations are relatively close to the level of the CAB. This empirically supports the EU's CAB methodology and reassuringly shows that little information is lost with the simplified approach (Figure 8). Figure 9 displays the

¹⁸ To compute the CAB as in Equation (1), one has to assume that $(1 + OG_i)^c \approx 1 + \varepsilon OG_i$.

CAB for the Member States with the most time varying semi-elasticities (Ireland, Spain, Estonia), with the most volatile output gap (Greece, Latvia, Estonia), or with the highest semi-elasticity (France). It shows that the CAB is only marginally impacted by the use of constant elasticities (the effect is most visible during the crisis) and almost not impacted by the linear approximation (Figure 9). This is confirmed across Member States by the mean absolute effects of these approximations from 2002-17 (Figure 8).

The determinants of fiscal semi-elasticities: Using a panel of EU countries

The econometric specification

We consider the semi-elasticities for the EU 28 countries computed in 2018, 2014, 2013 and 2005.¹⁹ We derive a simple model to explain the semi-elasticities from Equation (2). Our econometric model specification (3) closely follows this formula. The estimated coefficients for α and β capture the average semi-elasticity of the two types of expenditure (unemployment-related spending and the rest), while the estimated value for γ_k captures the average semi-elasticity of each revenue component k . The residual corresponds to the cross-country dispersion and time variations in individual elasticities. Part of these effects can be captured with country and vintage fixed effects:

$$\varepsilon_{i,v} = \alpha \frac{G_{ul,v}}{Y_{i,v}} + \beta \frac{G_{ol,v}}{Y_{i,v}} + \sum_{k=1}^5 \gamma_k \frac{R_{k,i,v}}{Y_{i,v}} + \varphi X_{i,v} + \delta_i + \mu_v + \rho_{i,v} \quad (3)$$

with i and v the country and vintage indexes, δ_i country fixed effects, μ_v vintage fixed effects, X additional explanatory variables and $\rho_{i,v}$ a residual.

We run several specifications sequentially to seek a parsimonious model (Table 2). A minimalistic model (column a), including only the total revenue and expenditure-to-GDP ratio (alongside two measures of the business cycle) shows the significance of these two aggregate ratios but has a limited explanatory power, due to missing variables. An exhaustive model including all revenue and expenditure components (column b, Equation (3)) has much larger explanatory power, but may be partly tautological, since based on the very formula defining the semi-elasticities. It is used to empirically identify the variables contributing the most to the cross-country dispersion. For instance,

the effect of tax revenue categories turns out to be insignificant. The non-significance of tax variables can be related to their weak contribution to fiscal semi-elasticities, as shown in Figure 3. This result proves robust under the introduction of vintage dummies (column c) and under the grouping of taxes (column d). This allows specifying a reduced model with vintage dummies (column e) that includes only the non-tax revenue-to-GDP ratio, the ratios of unemployment-related spending and other expenditure to GDP.

Results

We obtain a baseline specification, which is in line with the expectation of the theory. Throughout the models shown in columns (a) to (e), there is no evidence of a residual cyclical effect, either measured by the output gap or unemployment gap, which is a desirable feature. Adding the deficit does not turn out to be significant. In an amended reduced model, which we use as our baseline in the subsequent regressions shown in Table 3 and 4 (column f), we remove all cyclical variables (and the deficit) to retain only three significant variables at the one percent threshold (plus vintage dummies, which are jointly statistically significant at the one percent threshold). We test the restrictions that the coefficient on non-tax revenue is equal to -1 and that the coefficient on other expenditure is equal to 1, which is accepted at the standard five percent threshold, as expected from Equation (2). Also in line with Equation (2), the estimated coefficient of unemployment expenditure is not statistically different from 5.15, which is the opposite of the panel average of the unemployment expenditure output semi-elasticity. Finally, the baseline model proves robust under the presence of country fixed effects, which do not substantially improve the model's goodness of fit, although being statistically significant.

We investigate the link between the semi-elasticities and economic and geographical factors and consider economic factors potentially related to fiscal elasticities. In particular, we consider factors related to i) the fundamentals of the economy (relative size in the EU28, economic volatility, GDP per capita, wage to value-added ratio), ii) fiscal and taxation policy (debt and deficit-to-GDP ratio, rates of top personal income tax (PIT) and corporate income tax (CIT)). We also test the significance of geographical clusters, such as the euro area membership, Member States who joined the EU in 2004 and after,²⁰

19 G. Mourre, A. Poissonnier, M. Lauegger, op. cit.; G. Mourre, C. Astarita, S. Princen, op. cit.; G. Mourre, G.-M. Isbasoiu, D. Paternoster, M. Salto, op. cit.; N. Girouard, C. Andre, op. cit., extended to the EU27 by the European Commission. The 2005 vintage of semi-elasticities excludes HR.

20 Bulgaria, Czech Republic, Cyprus, Estonia, Croatia, Latvia, Lithuania, Malta, Hungary, Poland, Romania, Slovenia and Slovakia.

Table 2
Baseline models for semi-elasticities in a four-vintage panel

	(a)	(b)	(c)	(d)	(e)	(f)
Expenditure						
Exp./GDP	0.986*** (0.000)					
Unemployment exp./GDP		8.680*** (0.000)	7.646*** (0.000)	7.584*** (0.000)	7.622*** (0.000)	7.026*** (0.000)
Other exp./GDP		1.011*** (0.000)	0.890*** (0.000)	0.871*** (0.000)	0.998*** (0.000)	0.867*** (0.000)
Revenue						
Revenue/GDP	-0.881*** (0.000)					
Total taxes/GDP				0.0702 (0.828)		
Direct taxes (PIT+CIT)/GDP				0.182 (0.643)		
PIT/GDP		-0.384 (0.511)	0.249 (0.530)			
CIT/GDP		-0.502 (0.406)	0.184 (0.751)			
SSC/GDP		-0.921*** (0.007)	-0.0154 (0.961)			
Indirect tax/GDP		-0.124 (0.731)	0.329 (0.362)			
Non tax rev./GDP		-0.910*** (0.000)	-0.798*** (0.000)	-0.776*** (0.000)	-0.898*** (0.000)	-0.803*** (0.000)
Possible residual cyclical effect						
Output gap	0.00239 (0.507)	0.00459 (0.217)	0.00425 (0.230)	0.00438 (0.226)	0.00410 (0.230)	
Unemployment gap	0.00504* (0.084)	0.00233 (0.444)	-0.00232 (0.360)	-0.00186 (0.459)	-0.00204 (0.406)	
Budget balance					0.133 (0.617)	
Vintage dummies						
Vintage 2005			0 (.)	0 (.)	0 (.)	0 (.)
Vintage 2013			-0.00882 (0.186)	-0.00984 (0.175)	-0.0102 (0.170)	-0.00803 (0.212)
Vintage 2014			0.0361*** (0.001)	0.0359*** (0.001)	0.0358*** (0.001)	0.0385*** (0.000)
Vintage 2018			0.0409*** (0.000)	0.0411*** (0.000)	0.0410*** (0.000)	0.0376*** (0.000)
Constant	0.403*** (0.000)	0.162* (0.070)	-0.0404 (0.681)	-0.00980 (0.917)	-0.00870 (0.926)	0.0457 (0.257)
Observations	111	111	111	111	111	111
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Vintage fixed effects	No	No	Yes	Yes	Yes	Yes
R2 within	0.238	0.418	0.674	0.670	0.669	0.660
R2 between	0.0243	0.804	0.841	0.839	0.823	0.831
R2 overall	0.0617	0.737	0.809	0.807	0.795	0.801

Note: p-values in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Source: Authors' own calculations.

Table 3
Estimation of semi-elasticity models against economic indicators

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Baseline specification											
Unemployment exp. / GDP	7.026***	5.581***	5.731***	6.056***	6.229***	6.157***	6.319***	6.372***	6.185***	4.682***	5.872***
Other exp. / GDP	0.867***	0.880***	0.888***	0.897***	0.911***	0.905***	0.923***	0.875***	0.887***	0.743***	0.878***
Non tax rev. / GDP	-0.803***	-0.846***	-0.845***	-0.858***	-0.883***	-0.879***	-0.902***	-0.827***	-0.860***	-0.792***	-0.862***
Economic fundamentals											
Income per capita (average)		0.000846 (0.172)									
Income per capita (end value)			0.000657 (0.207)								
GDP Member State / GDP EU				0.00113 (0.522)							
Economic volatility (stdev OG)					-0.000370 (0.893)						
Economic volatility (stdev GDP growth)						-0.000630 (0.659)					
Labour market											
Wage / GDP							0.000201 (0.800)				
NAWRU								-0.00373** (0.030)			
Fiscal and tax policy											
Debt / GDP									0.000131 (0.444)		
PIT top rate										0.00185*** (0.002)	
CIT top rate											0.00125* (0.086)
Constant	0.0457 (0.257)	0.0363 (0.223)	0.0344 (0.246)	0.0393 (0.235)	0.0371 (0.319)	0.0425 (0.273)	0.0188 (0.673)	0.0818* (0.061)	0.0401 (0.206)	0.0369 (0.169)	0.0137 (0.729)
Observations	111	111	111	111	111	111	106	111	111	111	111
Country fixed effects	Yes	No	No	No	No	No	No	No	No	No	No
Vintage fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2 within	0.660	0.659	0.656	0.657	0.655	0.653	0.685	0.665	0.654	0.650	0.668
R2 between	0.831	0.860	0.857	0.847	0.845	0.848	0.849	0.859	0.848	0.883	0.841
R2 overall	0.801	0.825	0.822	0.814	0.812	0.814	0.821	0.825	0.815	0.844	0.811

Note: p-values in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Source: Authors' calculations.

Table 4

Estimation of semi-elasticity models against tentative geographical typologies

	(a)	(b)	(c)	(d)	(e)	(f)
Baseline specification						
Unemployment exp. / GDP	7.026***	5.537***	6.289***	5.434***	5.907***	6.271***
Other exp. / GDP	0.867***	0.863***	0.911***	0.862***	0.906***	0.918***
Non tax rev. / GDP	-0.803***	-0.848***	-0.881***	-0.826***	-0.872***	-0.886***
Peer effect						
Weighted neighbours' semi-elasticity		0.193** (0.027)				
Geographical groups						
Euro area (time varying)			-0.000982 (0.923)			
Joined EU no sooner than 2004				-0.0261* (0.085)		
Lower income Europe					-0.0254** (0.050)	
Programme countries						0.00553 (0.708)
Constant	0.0457 (0.257)	-0.0331 (0.500)	0.0362 (0.254)	0.0753** (0.050)	0.0459 (0.174)	0.0317 (0.301)
Observations	111	111	111	111	111	111
Country fixed effects	Yes	No	No	No	No	No
Vintage fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R2 within	0.660	0.660	0.656	0.653	0.655	0.656
R2 between	0.831	0.868	0.843	0.863	0.857	0.844
R2 overall	0.801	0.832	0.811	0.826	0.822	0.812

Note: p-values in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Lower income Europe includes Bulgaria, Croatia, Hungary, Poland and Romania. This definition follows the categories used by the IMF.

Source: Authors' calculations.

lower-income countries,²¹ programme countries,²² and the GDP-weighted elasticity of the neighbouring countries.²³ In order to identify the additional explanatory power of these variables/dummies (introduced in the baseline model one by one) we remove the country fixed effects.

Unlike fiscal variables, many non-fiscal economic variables tested are not significantly related to the semi-elasticities. The semi-elasticities are structural parameters specific to EU economies. However, the income per capita, the economic size, the labour share and the economic volatility

are not statistically significant in our regressions (Table 3). When considering additional fiscal variables, the progressivity of the tax system (as roughly proxied by PIT and CIT top statutory rates) appears to significantly affect the semi-elasticity.²⁴ This result was expected, since the tax progressivity should capture part of the cross-country variability related to different elasticities of direct taxes.

Some economic and geographical grouping of the Member States seems to be relevant as well as an emulation effect

21 Bulgaria, Croatia, Hungary, Poland, Romania. This follows the categories used by the IMF.

22 This includes the euro area Member States once covered by an Economic Assistance Programme or non-euro-area Member States once subject to a Balance of Payment Programme following the crisis (Ireland, Greece, Spain, Cyprus, Latvia, Portugal, Romania).

23 Using the elasticity of the neighbouring countries in our model tests for the influence of neighbours on each Member State, which can be interpreted as a sort of peer pressure or exemplarity effect.

24 Time series on top marginal statutory rates are available on-line and correspond by definition to reliable data (DG TAXUD): https://ec.europa.eu/taxation_customs/business/economic-analysis-taxation/data-taxation_en. A high top marginal statutory rate generally means a very progressive tax scale for personnel income taxation. This is even true for "flat tax" countries, because of the existence of a tax-free allowance. For corporate income taxation, the link is more indirect, given the existence of many tax expenditures, e.g. for small and medium size firms taxed at a lower rate than the top statutory rate.

between neighbours. Using geographical dummies (see Table 4, column c to f), we find that Member States who joined the EU after 2004 or those with lower income tend to have lower semi-elasticities.²⁵ We also test for the influence of proximity with the GDP-weighted semi-elasticity of the neighbouring countries as a regressor. Member States tend to have higher semi-elasticities when the semi-elasticity of their neighbours is higher (Table 4, column b). This would suggest that Member States are somehow aligning their semi-elasticities, or rather some elements of their tax and benefit systems, with those of the neighbouring countries.

Conclusion

We highlight the robustness of the EU methodology of fiscal cyclical adjustment to the use of some simplifying assumptions. The approximations made for the calculation of the cyclically adjusted budget balance by the EU common methodology, such as using constant weights or making a linear approximation, are empirically negligible.

We run exploratory panel data analysis based on the four available vintages of fiscal semi-elasticities to investigate their determinants. The semi-elasticities used by the Commission are not affected by a residual impact of the business cycle, which is a desirable property. They are related to structural fiscal variables, in particular to the size of government and the share of non-tax revenue, which capture the share of budgetary items that are less affected by the business cycle in nominal terms. The share of unemployment-related spending and indicators of tax progressivity are also highly significant. Other (non-fiscal) structural economic variables prove not to be robust explanatory variables, such as the income per capita and the output volatility. However, some clustering effects seem to be relevant: Member States with lower income or those who have joined the EU since 2004 tend to have lower semi-elasticities. Moreover, semi-elasticities appear to be subject to an emulation effect across neighbouring EU countries.

Overall, the EU methodology to compute the cyclically-adjusted budget balance manages broadly to reconcile the goals of communicability and stability with that of economic soundness. On the one hand, the measure remains simple enough to be intuitive and communicable, avoiding the ‘black-box’ syndrome, while simultaneously remaining stable over time so as to ensure time-consistent fiscal surveillance and comparability of the data over the years. On the other hand, the methodology is economically robust capturing the adequate concept with a proper measurement using regularly updated information.

²⁵ This effect is on top of the link with the size of their government exemplified in Figure 4 and controlled for by other regressors.