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Adjusting the budget balance for the business cycle: the EU methodology

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Abstract

The cyclically-adjusted budget balance (CAB) is the backbone of the EU framework of fiscal surveillance, both in its preventive and corrective arms. The concept corresponds to the budget balance prevailing if the economy was running at potential. After correcting for the one-off and temporary measures, it is called structural budget balance and used to assess the fiscal policy stance. This paper presents the EU methodology for computing the CAB. It derives the new value of the budgetary semi-elasticities following the recent revision of individual revenue and expenditure elasticities by the OECD and shows the effect of the revised elasticities on the CAB.

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The importance of the cyclically-adjusted budget balance (CAB) and of the structural balance (CAB minus one-offs and temporary measures) was restated forcefully with the reform of the European economic governance since 2011. This reform alongside the dramatic changes in economic data brought about by the economic and financial crisis underscored the need of making necessary technical improvements. In this context, the Commission launched a two-tiered process to improve the CAB methodology in early 2012.

The first tier of revision consisted in using a budgetary semi-elasticity (rather than a budgetary sensitivity) as cyclical adjustment parameter and of updating all weighting parameters used in the CAB (see Mourre et al., 2013) for technical details). This first tier of revision has been fully up and running since the Commission 2013 Winter Forecast in February 2013. The second tier of revision consisted in updating the decade-old individual elasticities with respect to the output gap, which were calculated by the OECD (for OECD countries) and by the Commission (for EU Member States not part of the OECD). The Commission asked the OECD to revise their estimates of country-specific elasticities underlying the CAB in order to (i) extend the exercise to cover all EU Member States, (ii) update the individual elasticities based on most recent datasets and tax codes and (iii) improve the methodology where needed (see OECD, 2014) for technical explanations and detailed results). This work was conducted with the guidance of the Commission and under the supervision of EU Member State representatives (in the framework of the Output Gap Working Group attached to the EU's Economic Policy Committee), who provided suggestions and inputs to the exercise. This second tier of revision was completed in September 2014 and applied in the Commission 2014 Autumn Forecast released in November 2014.

This paper first recalls the main lines of the revision of individual revenue and expenditure elasticities by the OECD:

- *The OECD continued to apply the two-step methodology used in Girouard and André (2005) to compute individual revenue and expenditure elasticities: it estimates separately (i) the elasticity of individual revenue (expenditure) categories with respect to their base and (ii) the elasticity of the revenue (expenditure) base to the output gap. Moreover, some assumptions used by the OECD in the past were retained. In particular, the elasticity of indirect tax revenue to the output gap was still assumed unitary (with one motivated exception) given robustness and data issues associated with empirical estimates country by country. This assumption was also in line with panel estimates. Moreover, the elasticity of public expenditures other than those related to unemployment was kept to zero.*

- *The OECD improved the 2005 methodology by introducing some necessary refinements and useful methodological innovations. Notably, the elasticities were estimated on more disaggregated data for personal income taxes (wages and salaries, self-employment income, capital income) and for social security contributions (employees' and employers' contributions). The elasticities for corporate income taxes were estimated empirically (instead of being based on assumptions). The zero elasticity assumption for non-tax revenue was backed by empirical estimations. The elasticities of bases to output gap were estimated using the revised EU output gaps, based on a production function methodology and including recent NAWRU estimates for the non-cyclical part of unemployment, as explained in Havik et al. (2014).*

The paper then thoroughly analyses the effect of the revision of individual revenue and expenditure elasticities on the cyclical adjustment of the budget balance (CAB methodology), used to compute the structural balance employed in EU fiscal surveillance. The following insights could be drawn:

- *Revisions in individual revenue and expenditure elasticities can be substantial at country level but do not follow a clear pattern across Member States, except for corporate income taxes, the revised elasticities of which seem to be higher than the former ones in most countries. The elasticities of unemployment-related expenditure and corporate income taxation show the largest revisions on average (in absolute value). However, given the small share of unemployment-related expenditure in total expenditure and of corporate income taxation in total revenue, they are not the main driver of the budgetary semi-elasticities, which are mainly steered by personal income taxes. In the majority of Member States (18 out of 28), revisions in individual revenue and expenditure elasticities partly offset each other.*

- *Overall, the revisions of individual revenue and expenditure elasticities have a fairly limited impact on budgetary semi-elasticities. The difference between the budgetary semi-elasticities based on revised elasticities and those based on 2005 elasticities varies from -0.02 to 0.15 across countries.*

- *The budgetary semi-elasticities average out to 0.50 for the EU and range from 0.31 to 0.65 across Member States, suggesting significant cross-country differences in the cyclicality of the budget balance.*

- *The average of the semi-elasticities for revenue is close to zero, ranging from -0.08 to 0.07, since revenue is broadly as cyclical as GDP, except for non-tax revenue. Therefore, the revenue-to-GDP ratio moves only slowly with the business cycle. In contrast, the semi-elasticities for expenditure average out to -0.50, ranging from -0.38 to -0.62, which accounts for the larger part of the disparity in the budgetary semi-elasticity across Member States.*

- *Revisions of individual revenue and expenditure elasticities do not substantially alter the level of the CAB on average and in most countries for most years. However, for specific countries in specific years, where the level of the output gap is large, the revision of the cyclical components can be non-negligible. The impact of the revisions on the annual variation of the CAB is even smaller in general.*

The appendices present step by step how the budgetary semi-elasticity is derived from the revised individual elasticities and the weighting parameters (updated in 2013 as part of the first tier of the revision of the CAB methodology) to ensure transparency and replicability. They also indicate the data sources and other background information on the elasticities of individual revenues with respect to their base.

1. INTRODUCTION

In the context of the reform of the European economic governance, the Commission launched a two-tiered process to improve the cyclically-adjusted budget balance (CAB) methodology. The importance of the CAB and of the structural balance (CAB minus one-offs and temporary measures) was restated forcefully with the reform of the European economic governance since 2011. This reform alongside the dramatic changes in economic data brought about by the economic and financial crisis underscored the need of making necessary technical improvements in the computation methodology of the CAB. The Output Gap Working Group of the Economic Policy Committee, which gathers together representatives of all Member States, received at the end of 2011 the mandate to revise the CAB methodology. Following this mandate, the Commission launched in early 2012 a two-tiered process.

The first tier of revision resulted in a conceptual improvement and in the update of all weighting parameters used in the CAB: (i) employing a budgetary semi-elasticity parameter instead of the usual budgetary sensitivity parameter and (ii) updating the decade-old data underlying the computation of the weighting parameters used in the CAB (shares of individual revenue and expenditure, ratios of total revenue/expenditure to GDP). The technical details are explained thoroughly in Mourre *et al.* (2013). This first tier of revision has been fully up and running since the Commission 2013 Winter Forecast in February 2013.

The second tier of revision consisted in updating the decade-old individual revenue and expenditure elasticities underlying the CAB. The Commission asked the OECD to revise their estimates of country-specific elasticities, as reported in Girouard and André (2005). This work aimed at (i) extending the exercise to cover all EU Member States, since the elasticities for Member States which are not part of the OECD were computed by the Commission (European Commission, 2006), (ii) updating the calculation of revenue and expenditure elasticities based on most recent datasets and tax codes and (iii) making useful improvements or refinements of the methodology. The technical details on the revision of the individual OECD elasticities are explained thoroughly in OECD (2014). This second tier of revision was completed and approved by all Member States in September 2014 and applied for the first time in the Commission 2014 Autumn Forecast, released in early November 2014.

The CAB is part of the 'top down' approach to identifying discretionary fiscal policy by correcting the actual budget balance for elements not controlled by the government. The annual change in the CAB is interpreted as the discretionary fiscal policy. By contrast, the 'bottom-up' approach considers the sum of the budgetary impact of individual 'discretionary' budgetary measures, which correspond to a change in policy, both on the revenue and expenditure side, and generally follow a legislative or administrative decision. The two approaches differ in the benchmark used: the CAB benchmark corresponds to the nominal budget balance, which remains stable as a percentage of potential output, while the 'bottom-up' benchmark is the development of the nominal budget balance in absence of new policy actions. Recent studies using the 'bottom-up' approach include Barrios and Fargnoli (2010), Agnello and Cimadomo (2011), Princen *et al.* (2013).

The EU fiscal framework consists in first computing the cyclical component of the budget and then subtracting it from the actual budget balance. In algebraic terms, the CAB could be expressed as: $CAB = B/Y - CC$, where B/Y stands for the nominal budget balance to GDP ratio and CC for its cyclical component. ([1]) The determination of the cyclical component of the budget balances in the EU methodology requires two inputs: (i) a measure of the cyclical position of the economy (output gap) and (ii) a measure of the link between the economic cycle and the budget (cyclical adjustment parameter).The

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([1]) The budget balance is statistically defined as the *net lending of the general government*. If its sign is negative, this means a net borrowing of the general government, i.e. a budget deficit.

product of the two inputs gives the cyclical component of the budget, $CC = \varepsilon * OG$, which is then subtracted from the headline budget-to-GDP ratio to obtain the CAB. Most international organisations, including the European Central Bank and the International Monetary Fund, as well as national EU governments use this approach for budgetary surveillance. [2] This is the official methodology used for fiscal surveillance in the EU and the one presented in this paper. An advantage of the subtractive approach is its relative simplicity and the fact that the cyclically-adjusted budget balance obtained thereby has a straightforward interpretation. [3]

This paper presents the CAB methodology used in EU fiscal surveillance and derives the new value of the budgetary semi-elasticities, following the recent revision of individual elasticities. Section 2 sets out the theoretical framework for computing the CAB. Section 3 presents the main methodological improvements brought by the OECD in the calculation of the revised individual revenue and expenditure elasticities and compares them with the previously estimated elasticities. Section 4 shows the effect of the recent revisions of individual elasticities on the value of budgetary semi-elasticities and on the CAB. In order to ensure transparency and replicability, Appendix 1 presents step by step how the budgetary semi-elasticities are derived from the revised individual elasticities and from the weighting parameters. It also indicates the data sources in detail. Appendix 2 contains other background information on the elasticities of individual revenues with respect to their base, which is also useful in the conduct of fiscal surveillance.

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[2] As an example, economists from the European System of Central Banks (Bouthevillain *et al.*, 2001) presented a variant of the two-step approach. Instead of employing the cyclical component of output, they corrected the different elements of the budget balances using cyclically-adjusted macroeconomic proxies of the relevant tax and expenditure bases, in order to better capture compositional effects. However, the cyclical correction relied on statistical filtering rather than on an economic approach, such as the production function approach, used by the European Commission to compute the potential output and the output gap. For IMF calculations, see Escolano (2010). For an update and refinement of this approach, see Kremer (2006).

[3] The drawbacks of this subtractive approach are well known (Larch and Turrini, 2009). It is subject to the uncertainty stemming from two sources: (i) the measurement of the potential output and the output gap in real time and (ii) the estimation of the fiscal elasticities. The compounded error is difficult to measure, especially in real time. This approach may also disregard the importance of shocks that could affect the budget balance (e.g. asset-price movements). An alternative group of 'top down' methods derives the CAB directly from regression-based analysis. This direct approach, first developed by Blanchard (1990), benefited from the theoretical shift towards supply-side theories in the analysis of the business cycle, the progress made in the decomposition of time series between temporary and permanent components as well as advances in computing technology. This type of approach is interesting as sensitivity analysis. However, it remains complex and difficult to communicate upon and to handle practically in the context of fiscal surveillance. It is also based on past statistical patterns, as the subtractive approach, and is thus still subject to the Lucas critique.

2. THEORETICAL FRAMEWORK FOR COMPUTING THE CYCLICALLY-ADJUSTED BUDGET BALANCE

The cyclically-adjusted budget balance (CAB) corresponds to the deficit/surplus-to-GDP ratio that would prevail if the economy was running at potential. It is computed as the difference between the actual balance-to-GDP ratio and an estimated cyclical component. In algebraic terms:

$$CAB_t = \frac{(R_t - G_t)}{Y_t} - \varepsilon \cdot OG_t \qquad (1)$$

where R and G stand for the nominal government revenue and expenditure respectively and Y for nominal GDP. The nominal budget balance B is defined as the difference between the nominal government revenue and expenditure. The cyclical component of the budget balance is the product of a cyclical adjustment parameter (ε) and the output gap (OG). This cyclical component is subtracted from the actual budget as a percentage of GDP (also called 'headline budget balance' in the fiscal literature) to obtain the CAB. This formula is a linear approximation of order one of an exponential expression (see Mourre *et al.*, 2013). ([4]) It has the merit to be easily calculated and be clearly communicable to policymakers.

2.1. BUDGETARY SEMI-ELASTICITY: CONCEPT AND CALCULATION

The key concepts to compute the CAB are the output gap and the cyclical adjustment parameter, i.e. the budgetary semi-elasticity. The assessment of the cyclical position of the economy is the first key input for the computation of the CAB. It is provided by the output gap, i.e. the distance between actual and potential real GDP in percentage points of potential output, $OG = (Y - Y^p)/Y^p$. Output gap estimates are surrounded by a degree of uncertainty and, therefore, often subject to significant revisions. It appears difficult in practice to estimate potential output in real time, especially at cyclical turning points or in the presence of structural breaks (see D'Auria *et al.*, 2010). The output gap estimates used to compute the semi-elasticities are those of the Commission 2014 Spring Forecast and are explained in detail in Havik *et al.* (2014). The second key parameter is the budgetary semi-elasticity, which measures the reaction of the budget balance to the level of the output gap. This parameter and its calculation are explained in detail in this paper.

([4]) Because of non-additivity, the CAB cannot be derived exactly from the budget balance, which makes the non-approximated algebraic formulation cumbersome. In the full formula, the CAB is derived from the very definition of an elasticity. The superscript *p* corresponds to the potential level of budget balance, revenue, expenditure and output, prevailing when the economy is running at its potential. The other notations are explained in detailed in subsection 2.1.

$$CAB = \frac{B^p}{Y^p} = \frac{R^p}{Y^p} - \frac{G^p}{Y^p} = \frac{R}{Y^p}\left(\frac{R^p}{R}\right) - \frac{G}{Y^p}\left(\frac{G^p}{G}\right)$$

Considering the (constant) revenue elasticity η_R and the (constant) expenditure elasticity η_G and solving a differential equation of order one, gives:

$$\left(\frac{R^p}{R}\right) = \left(\frac{Y^p}{Y}\right)^{\eta_R} \qquad \text{and} \qquad \left(\frac{G^p}{G}\right) = \left(\frac{Y^p}{Y}\right)^{\eta_G}$$

Using these in the CAB formula gives:

$$CAB = \frac{R}{Y^p}\left(\frac{R^p}{R}\right) - \frac{G}{Y^p}\left(\frac{G^p}{G}\right) = \frac{R}{Y^p}\left(\frac{Y^p}{Y}\right)^{\eta_R} - \frac{G}{Y^p}\left(\frac{Y^p}{Y}\right)^{\eta_G}$$

$$= \frac{R(1+OG)}{Y}\left(\frac{1}{1+OG}\right)^{\eta_R} - \frac{G(1+OG)}{Y}\left(\frac{1}{1+OG}\right)^{\eta_G} = \frac{R}{Y}(1+OG)^{1-\eta_R} - \frac{G}{Y}(1+OG)^{1-\eta_G}$$

$$\cong \frac{R}{Y}(1 + (1-\eta_R)OG) - \frac{G}{Y}(1 + (1-\eta_G)OG) = \frac{R}{Y} - \frac{G}{Y} - \left(\frac{R}{Y}(\eta_R - 1) - \frac{G}{Y}(\eta_G - 1)\right)OG = B - (\varepsilon_R - \varepsilon_G)OG = B - \varepsilon OG$$

This proxy is mathematically derived from a limited development of order one.

The budgetary semi-elasticity adequately corrects the budget balance for cyclical effects, providing its (unobserved) value when assuming the economy running at its potential. By definition, a semi-elasticity captures the absolute (first-difference) variation of a ratio (here the budget balance as a percentage of GDP) to the relative variation of another variable (here the output gap). This concept reflects the impact of the business cycle both on the numerator of the budget balance ratio (budget balance in monetary terms) and on the denominator of the budget balance (output or GDP).

$$Semi-elasticity = \varepsilon = \frac{d\left(\frac{B}{Y}\right)}{\frac{dY}{Y}} \qquad (2)$$

Multiplied with the output gap and subtracted from the actual budget balance, the budgetary semi-elasticity ε yields the correct calculation of the CAB[5]:

$$CAB = \frac{B}{Y} - \varepsilon \cdot OG = \frac{B}{Y} - \frac{d\left(\frac{B}{Y}\right)}{\frac{dY}{Y}} \cdot OG = \frac{B}{Y} - \frac{\frac{dB}{dY}Y - \frac{dY}{dY}B}{\frac{Y^2}{Y}} \cdot OG = \frac{B}{Y} - \left(\frac{dB}{dY} - \frac{B}{Y}\right)\frac{dY}{Y^p}$$

$$= \left(1 + \frac{dY}{Y^p}\right)\frac{B}{Y} - \frac{dB}{Y^p} = \left(1 + \frac{Y - Y^p}{Y^p}\right)\frac{B}{Y} - \frac{dB}{Y^p} = \frac{Y}{Y^p}\frac{B}{Y} - \frac{dB}{Y^p} = \frac{B - dB}{Y^p} = \frac{B^p}{Y^p} \qquad (3)$$

where dB measures the gap between the actual budget balance and the budget balance prevailing when the economic output is at its potential level, $dB = B - B^p$. Using the budgetary semi-elasticity yields the accurate concept of the CAB, namely, the budget balance-to-GDP ratio that would prevail if the economy was at potential. ([6])

The budgetary semi-elasticity is equal to the difference of the semi-elasticity of revenue and the semi-elasticity of expenditure. Rewriting the actual surplus/deficit in terms of its components (revenue and expenditure), the semi-elasticity ε can be broken down into the weighted average of the cyclical elasticity of revenue (expressed in monetary amount) minus one and the cyclical elasticity of expenditure (expressed in monetary amount) minus one. The term 'minus one' indeed corresponds to the elasticity of the denominator (GDP) of the revenue-to-GDP ratio and the expenditure-to-GDP ratio to itself.

$$\varepsilon = \frac{d\left(\frac{B}{Y}\right)}{\frac{dY}{Y}} = \frac{d\left(\frac{R}{Y}\right)}{\frac{dY}{Y}} - \frac{d\left(\frac{G}{Y}\right)}{\frac{dY}{Y}} = \left(\frac{\frac{dR}{R}}{\frac{dY}{Y}} - 1\right)\frac{R}{Y} - \left(\frac{\frac{dG}{G}}{\frac{dY}{Y}} - 1\right)\frac{G}{Y} = (\eta_R - 1)\frac{R}{Y} - (\eta_G - 1)\frac{G}{Y} \qquad (4)$$

where η_R and η_G denote respectively the elasticity of (total) revenue and expenditure with respect to the output gap. $(\eta_R - 1)$ and $(\eta_G - 1)$ correspond to the elasticity of the revenue-to-GDP ratio and the elasticity of the expenditure-to-GDP ratio respectively.

The semi-elasticity of revenue is fairly close to zero, since all tax revenue categories have a marked cyclical pattern. More precisely and as shown in the following section, revenues - except for non-tax

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([5]) This concept is a local one, valid in the vicinity of the point considered. This is why we use the derivative form. In practice, the empirical elasticities used in the paper are an approximation. Since the estimated elasticities are constant over time, the empirical approximation is very limited.

([6]) This was not the case before the implementation of the first tier of the CAB revision, where the concept of budgetary sensitivity was used. The latter only corrects the budget balance in monetary terms for cyclical effects (the numerator of the budget balance as a percentage of GDP). The cyclically-adjusted budget balance in monetary terms was then divided by the actual nominal GDP (instead of the potential nominal GDP).

revenue - broadly follow the cyclical developments in GDP (output gap) and the total revenue as a percentage of GDP (i.e. the revenue-to-GDP ratio) does therefore not vary much with the cycle. Technically, the revenue-to-GDP ratio does not move much with the economic cycle, since the (often large) fluctuations in the numerator (revenue) and denominator (GDP) broadly offset each other.

The semi-elasticity of expenditure is negative and fairly close to the expenditure-to-GDP ratio, since only unemployment-related spending, among all expenditures, is considered cyclical. The latter only forms a small fraction of total public spending. The other expenditures are assumed to be invariant with the cycle.([7]) In other words, the low cyclicality of expenditures makes the expenditure-to-GDP ratio very cyclical, since the ratio is mainly influenced by its denominator, i.e. GDP, with little offsetting effect from the numerator (expenditure): the expenditure-to-GDP ratio rises in bad times and decreases in good times.

2.2. VARIOUS COMPONENTS OF THE BUDGETARY ELASTICITY

The budgetary semi-elasticity can be further broken down into the weighted sum of individual elasticities by type of revenue and expenditure. The budgetary semi-elasticity with respect to the output gap can be rewritten as:

$$\varepsilon = \varepsilon_R - \varepsilon_G = (\eta_R - 1)\frac{R}{Y} - (\eta_G - 1)\frac{G}{Y} = \left(\sum_{i=1}^{5} \eta_{R_i} \frac{R_i}{R} - 1\right)\frac{R}{Y} - \left(\eta_{G_U} \frac{G_U}{G} - 1\right)\frac{G}{Y} \tag{5}$$

This requires estimating the elasticities to the output gap of five individual revenue categories η_{Ri} (personal income taxes, corporate income taxes, indirect taxes, social security contributions, non-tax revenue) and of one cyclically-sensitive spending category η_{GU} (unemployment-related expenditure). Individual elasticities are then aggregated to an overall revenue elasticity η_R and an overall expenditure elasticity η_G.

To compute the budgetary semi-elasticity, individual elasticities need to be summed together using weighting parameters. Individual revenue elasticities are then aggregated to an overall revenue elasticity η_R using the share of each item in the total revenue as weights R_i/R. The same calculation applies for the overall expenditure elasticity η_G, where the elasticity of unemployment-related expenditure is transformed into the overall expenditure elasticity using the share of unemployment-related expenditure in total expenditure as weight G_U/G. After subtracting 1 from the elasticity of the revenue level and from the expenditure level, both elasticities are then multiplied by the revenue-to-GDP ratio R/Y and expenditure-to-GDP ratio G/Y to yield the semi-elasticity of revenue and expenditure. This is done since budgetary variables are generally expressed as a percentage of GDP. Appendix 1 presents step by step how the semi-elasticities are derived from the individual elasticities and from the weighting parameters. It also indicates the data sources.

The following weighting parameters need to be estimated to derive the budgetary semi-elasticity:

- The revenue and expenditure structure
- the share of the five individual revenue categories in % of total general government revenue (R_i/R),
- the share of the unemployment-related expenditure in % of total general government expenditure (G_U/G).

([7]) The cyclical inertia of public spending, combined with the cyclically-driven pattern of public revenue, corresponds to the so-called fiscal stabiliser: the headline budget balance deteriorates in troughs and improves in booms, which mitigates the economic cycle itself by supporting domestic demand (i.e. exercising a counter-cyclical effect).

- The aggregate revenue and expenditure ratios

- the weight of total general government revenue in % of GDP (R/Y),

- the weight of total general government expenditure in % of GDP (G/Y).

The weighting parameters are those set in 2013 during the first tier of revision (see Mourre *et al.*, 2013). To take into account both recent developments and data revisions, the shares of individual revenue and spending categories, as well as the revenue/expenditure-to-GDP ratios were updated in 2013. This updating was done consistently using a 10-year average over 2002 – 2011 period. The weighting parameters will be updated every six years, i.e. every second update of Medium Term Objectives, to reflect changes in the government revenue and expenditure. However, an inaccuracy in the computation of revenue shares (% of total revenues) in Mourre *et al.* (2013) needed to be adjusted. It concerns a limited number of countries (Cyprus, Latvia, Lithuania, Luxembourg, Malta and Romania), for which the AMECO database was used as OECD data were not available. The revenue shares for these countries were only slightly affected by the adjustment (see Table A.2).

Since the weighting parameters are left unchanged (except minor adjustments), the revision in the budgetary semi-elasticities is driven by the revision of individual elasticities. Section 3 presents the revision of individual revenue and expenditure elasticities performed by the OECD under the supervision of Member State representatives. The revision concerns the following six individual elasticities:

- the elasticities of the five aforementioned revenue categories with respect to the output gap $\eta_{R,i}$,

- the elasticity of unemployment expenditure with respect to the output gap η_{Gu}. The elasticity of other expenditures to the output gap is assumed to be zero, reflecting the absence of cyclical pattern according to theory.

3. REVISION OF INDIVIDUAL REVENUE AND EXPENDITURE ELASTICITIES

This section presents the revised elasticity estimates and compares them to those based on the 2005 methodology. The first subsection sets out the original methodology used by the OECD to estimate revenue and expenditure elasticities. According to this methodology, the elasticity with respect to the output gap is computed by using a two-step approach, i.e. multiplying the revenue (expenditure)-to-base elasticity and the base-to-output gap elasticity. The second subsection presents the main methodological innovations applied by the OECD when re-estimating the individual elasticities. Those innovations include the update of the decade-old data and the implementation of several improvements and refinements. The last subsection compares the revised elasticities with those previously used for EU fiscal surveillance and presents the revenue (expenditure)-to-base and base-to-output gap elasticities for all revenue and expenditure categories.

3.1 ORIGINAL OECD ESTIMATIONS OF INDIVIDUAL ELASTICITIES USED BY THE EU

To estimate the elasticities of the budget items with respect to the output gap, Van den Noord (2000) developed a two-step methodology. In this study, four revenue items (personal income taxes, corporate income taxes, social security contributions and indirect taxes) and one expenditure item (unemployment-related expenditure) are considered to be cyclically sensitive. The cyclical elasticity of non-tax revenue was implicitly assumed to be zero. The output gap elasticity of each of those budget items is computed by estimating the revenue (expenditure)-to-base elasticity $\varepsilon_{R/base}$ and the base-to-output gap elasticity $\varepsilon_{base/OG}$. Both estimated elasticities are then multiplied in order to compute the overall elasticity with respect to the output gap $\varepsilon_{R/OG}$. This can be written analytically as:

$$\varepsilon_{R/OG} = \varepsilon_{R/base} \cdot \varepsilon_{base/OG} \qquad (6)$$

This methodology was updated and improved by Girouard and André (2005), so as to feed into the calculation of the CAB. They took into account changes in the tax codes that had occurred since the former study to the extent these affect the cyclical elasticities of tax revenues. They also made several improvements to the estimation method. The original approach of computing the output gap elasticities, using a two-step methodology, however, remained unchanged.

The revenue (expenditure)-to-base elasticities were imposed or estimated based on tax code data. For personal income taxes and social security contributions, Girouard and André (2005) estimated the revenue-to-base elasticities ($\varepsilon_{R/base}$) using tax rules and income distribution data, following the methodology of Giorno *et al.* (1995). The computations were updated by using 2003 tax law information and income distributions of 1999 to 2001. The base of those revenue categories was approximated by the average wage income per employee in the manufacturing sector. The base elasticities of corporate income tax and indirect tax revenue were assumed to be one, since revenues were observed to evolve proportionally to their bases, profits and consumption respectively. On the expenditure side, the elasticity of unemployment-related expenditure to its base (unemployment) was also assumed unitary, leading to an elasticity of total expenditure to unemployment equal to the share of unemployment-related expenditure tot total expenditure.

The base-to-output gap elasticities were estimated econometrically for each budgetary item using generalised least squares estimation. Girouard and André (2005) estimated the elasticity of tax bases as well as unemployment with respect to the output gap using three decades of time-series data ending in 2003. They used the following econometric specification to estimate the elasticities of the bases to the output gap ($\varepsilon_{base/OG}$):

$$\Delta \log(base / Y^p) = \alpha_0 + \alpha_1 \Delta \log(Y / Y^p) \qquad (7)$$

where *base* is the revenue (expenditure) base, Y is output, Y^p is potential output and the coefficient α_1 denotes the elasticity of the base to the output gap. For personal income taxes and social security contributions, the base is approximated by the product of the wage rate and employment. For corporate income taxes, the elasticity of profits to the output gap is assumed to be equal to the profit share. For indirect taxes, the elasticity is set to unity, due to a wide dispersion of estimates and large standard errors. For unemployment-related expenditure, the ratio of the base to potential output is approximated using the ratio of unemployment to potential unemployment.

The elasticities computed on the basis of the 2005 methodology were used for EU fiscal surveillance until 2013. For OECD countries, the elasticities were those taken from Girouard and André (2005). The elasticities for Member States, which were not part of the OECD, were computed by the Commission based on the 2005 methodology (European Commission, 2005 and 2006).

3.2 MAIN METHODOLOGICAL INNOVATIONS RECENTLY INTRODUCED BY THE OECD

Given the decade-old data underlying the former individual elasticities, the OECD re-estimated the elasticities using the latest available data, at the request of the Commission. As the former computations of the individual elasticities used data ending in 2003, they were updated using the most recent datasets (covering the period 1990-2013) and the more recent tax codes (2010-11 tax codes). The study was also extended to cover all EU Member States, including those which are not part of the OECD, based on data provided by the European Commission.

The OECD applied the same approach as the original methodology to compute individual revenue and expenditure elasticities. As in the original methodology, a two-step approach was used. The elasticities of individual revenue (expenditure) categories with respect to their base and the elasticities of the revenue (expenditure) base to the output gap were computed separately. They were then multiplied to obtain the elasticity of individual revenue (expenditure) categories with respect to the output gap.

However, the OECD improved the methodology by introducing some necessary refinements and methodological innovations, summarised in Table 3.1, i.e.

- for personal income taxes, using more disaggregated data (wages and salaries, self-employment income, capital income) and estimating the elasticity for each disaggregated income item separately;

- for social security contributions, using more disaggregated data (employees' and employers' contributions) and estimating the elasticity for each item separately;

- for corporate income taxes, estimating the revenue-to-base elasticities empirically (instead of being assumed to unity) and estimating directly the base-to-output gap elasticities instead of using the reciprocal of the elasticity of wage bill to output gap;

- for non-tax revenue, supporting the zero elasticity assumption by empirical estimations, which indeed provided support to the assumed absence of clear cyclicality ([8]);

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[8] Whilst the role of non-tax revenue may not be negligible in some Member States in some years, its amount is generally limited and, in most cases, unrelated to the business cycle. Potential large non-tax revenue is linked to taking over pension obligations from the private sector (under the category of capital transfer but which comes with the obligation of future pension payments). The sale of market output is limited in size and dependent on demand or existing procedures for these services and thus cannot often be regarded as cyclical. Property income includes dividends from state-owned companies (such as the utilities or public networks) and renting out real estates, which can be large in some cases and are at the discretion of the government (e.g. policy regarding the perception of dividends as opposed to reinvestment in the company, renting out new estates). Their relation with the output gap is not clear cut. Moreover, many non-tax "revenue" is not considered statistically as revenue in the sense of the

- for all base-to-output gap elasticities, using the revised EU output gaps, computed following the production function methodology and including a NAWRU estimate for the non-cyclical part of unemployment, as applied since the Commission 2014 Spring Forecast (see Havik *et al.*, 2014).

Table 3.1:   **Main refinements and methodological innovations per revenue and expenditure category**

Revenue/expenditure category	Elasticity of revenue/expenditure to base	Elasticity of base to output gap
Personal income taxes	Update to 2010-11 tax/benefit codes Richer income distribution data Closer alignment of revenue to bases	Estimated for three income categories (wages and salaries, self-employment income, capital income)
Social security contributions	Update to 2010-11 tax/benefit codes Richer income distribution data Disaggregation employer-employee	Estimated for wages and salaries
Corporate income taxes	Estimated empirically rather than unitary elasticity assumption	Estimated empirically rather than taking reciprocal of wage to output gap elasticity
Indirect taxes	Estimated empirically but uniform assumption preferred	Unitary elasticity assumption
Unemployment-related expenditure	Unitary elasticity assumption	Estimated empirically

Source: OECD (2014).

Empirical estimates were made for each revenue category, even for those whose elasticity was assumed to be unitary in the 2005 methodology, as well as for unemployment and earnings-related expenditure. However, for some revenue and expenditure categories, the estimates were not fully consistent with theoretical expectations and/or very disperse across countries without clear reason. Therefore it was decided:

- to keep the unitary elasticity assumption for indirect taxes, given robustness and data issues. There is large uncertainty regarding the exact value of the elasticity for each country, due to various causes ([9]). Moreover, the elasticities empirically estimated by the OECD show a great deal of cross-country dispersion and take a value lower than unity for many countries, which cannot be easily justified. The only solid evidence, as confirmed by panel estimates by the International Monetary Fund (Belinga *et al.*, 2014) and the Commission (Princen and Mourre, 2014), is that the elasticity of indirect tax revenue to base is not far from one for most countries over the medium run. ([10]) An elasticity slightly higher than one was assumed for Italy (1.1), given the large size of IRAP – a particular form of taxation not found in other Member States – its specific base and its idiosyncratic cyclical pattern – confirmed by empirical estimates.

SGP. For instance, the 'overdraft' of dividends, i.e. exceeding the profits of the corporation, would not be regarded as revenue in ESA95 terms, but rather as a financial transaction (withdrawal of equity). Privatisation receipts (and more generally selling non-financial assets) are considered as public disinvestment, that is, negative spending rather than additional revenue. Moreover, selling financial assets is considered to be 'below the line', not affecting the ESA95 deficit but reducing the level of public debt (as part of the 'stock-flow' adjustment).

([9]) These reasons are, among others, the irregular development of asset markets, different cyclical developments in VAT and excise duties, the inability to measure compositional effects and dynamics in the CAB methodology and the only partial correction for discretionary measures (only those affecting the standard tax rate, not the tax base).

([10]) When running a panel regression for indirect tax revenue to output gap for 27 Member States (no data for Slovenia), the estimated elasticity is very close to one. The specification includes country fixed effects, a dummy for 2009 and controls for the VAT rate.

- not to retain earnings-related transfers as an additional cyclical expenditure item, given the high dispersion in the empirical estimates across countries, which was not easily explicable. Moreover, there is no binding theoretical rationale justifying a marked cyclical pattern for this type of – fairly heterogeneous – expenditure (family benefits, housing benefits, in-work-benefits).

- to retain the unitary elasticity assumption for unemployment expenditure to its base (the level of unemployment), given statistical issues affecting the indicators of unemployment benefits. Moreover, no strong theoretical rationale supports the idea that the development in unemployment benefits should deviate significantly from that of the number of unemployed people.

The revision of individual elasticities had to resolve a number of methodological issues. Those methodological challenges mainly concerned:

- *the time-invariance of elasticities*. As the former ones, the revised elasticities are considered as time-invariant. The methodology was not changed in this regards, since the variation of elasticities is not following a clearly identified output-gap-driven pattern in most countries and could be influenced by a wealth of factors (e.g. fluctuating structure of all sub-tax components, complex dynamic and lagged effects, impact of inflation and indexation mechanisms – the fiscal drags, impact of changing tax compliance).

- *the consistent application of model selection criteria for each country*. Given the complexity of the model selection, multiple statistical criteria were used (goodness-of-fit of the equation, statistical significance of the variable of interest, absence of time-series correlation). The use of all these criteria sometimes created some trade-off. In case of equally acceptable models from a statistical standpoint, the model retained was the one making most sense from an economic standpoint and avoiding the occurrence of outliers which are difficult to explain. Only suggestions by Member States that were fully in line with the common methodology were retained. ([11])

- *the coherent treatment of statistically non-significant results*. The EU average was used when empirical estimation gave rise to statistically non-significant results or when data were missing for specific countries. The alternative would have been to set statistically non-significant results to zero. This, however, would not have taken into account the fact that available time series are sometimes very short and do not allow to exploit meaningful statistical inference. Moreover, it would have led to very strong dispersion across countries in terms of cyclical responsiveness, which would not have been explicable.

- *the treatment of discretionary fiscal measures*. Discretionary fiscal measures could influence the estimates of the elasticities, since they affect revenue and expenditure. However, they do not correspond to a spontaneous reaction of the economic cycle, which revenue and expenditure elasticities are meant to capture. While this issue was difficult to solve, because of a lack of reliable

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([11]) Some technical adjustments of sometimes non-negligible magnitude were needed for accuracy purposes although not straightforward and complex to explain in non-technical words. For instance, the complex rescaling of some empirical estimates relative to the elasticity of the taxation on personal income categories was necessary to ensure economic consistency: these empirical estimates had to be rescaled to make sure that their weighted sum could add up to one. Indeed, the sum of total income items corresponds to the GDP, which have a unitary elasticity with respect to output gap by definition. As a second example, the short-term effects estimated with an error correction model had to be cumulated for a period of several years, so as to avoid an overestimation of the short term effect of the business cycle. Indeed the EU methodology uses a static model rather than a dynamic correction of the output gap, since only the contemporary output gap is considered. In more technical words, such an approach only captures the average short term effect (ST) (like in Girouard and André, 2005), which differs from the short-term overshooting in the error correction model, before its more or less fast convergence toward the long term effects (LT). In order to reconcile the two results, the lagged effects t+1 and t+2: ST + λ(ST-LT) + λ(ST + λ(ST-LT) - LT) were added to the contemporary effects, in order to avoid focusing on short-term overshooting. This also takes due account of the return to the long-term effect, which can be far away from the short term effect (in particular for corporate income taxes, where the error correction model estimates were considered over three years). For more details, see OECD (2014).

long time series for discretionary fiscal measures, the change in statutory tax rates was often used as a reasonable proxy (although the discretionary change in the base cannot be captured).

The re-estimation of individual elasticities was carried out with ESA1995 data, since ESA2010 data were not available at the time of the revision. As for the previous methodological changes of the CAB (i.e. the first tier revision in the Commission 2013 Winter Forecast and the NAWRU revision in the Commission 2014 Spring Forecast), the CAB was back-casted up to the year 1995 and as such reported in the AMECO database. This is done in order to avoid a break in the series and to favour a correct interpretation of the developments in discretionary fiscal policy. For policy purposes, it was important to change the CAB methodology at the same time as the change-over to ESA2010 and to implement the changes together. Otherwise, this would have led to staggered changes in the structural budget balance. ([12])

3.3 ESTIMATION RESULTS

Revisions of individual revenue and expenditure elasticities can be substantial at country-level but do not follow a clear pattern across EU Member States. As shown by Table 3.2, the revisions of individual elasticities are not negligible for many countries. However, the revisions do not follow a clear pattern, except for corporate income taxes where the revised elasticities are higher than the former ones in most countries.

Table 3.2: **Difference between 2014 and 2005 individual elasticities of revenue and expenditure categories with respect to the output gap**

| | Revenue | | | | | | | | | | | | Expenditure | | |
| | Personal income tax | | | Corporate income tax | | | Social security contributions | | | Indirect taxes | | | Unemployment-related expenditure | | |
	2005	2014	Difference	2005	2014	Difference	2005	2014	Difference	2005	2014	Difference	2005	2014	Difference
BE	1.09	1.31	0.22	1.57	2.48	0.91	0.80	0.71	-0.09	1.00	1.00	0.00	-3.30	-3.70	-0.40
BG	1.40	1.15	-0.25	1.40	2.13	0.73	0.88	0.61	-0.27	1.00	1.00	0.00	-3.30	-3.91	-0.61
CZ	1.19	1.65	0.46	1.39	1.78	0.39	0.80	0.86	0.06	1.00	1.00	0.00	-3.30	-2.45	0.85
DK	0.96	1.00	0.04	1.65	3.15	1.50	0.72	0.41	-0.31	1.00	1.00	0.00	-7.90	-4.97	2.93
DE	1.61	1.87	0.26	1.53	1.91	0.38	0.57	0.60	0.03	1.00	1.00	0.00	-5.00	-3.30	1.70
EE	0.80	1.58	0.78	1.40	1.78	0.38	0.70	1.40	0.70	1.00	1.00	0.00	-3.30	-5.18	-1.88
IE	1.44	1.58	0.14	1.30	1.25	-0.05	0.88	1.04	0.16	1.00	1.00	0.00	-5.30	-5.45	-0.15
EL	1.80	2.22	0.42	1.08	1.90	0.82	0.85	0.58	-0.27	1.00	1.00	0.00	-3.30	-3.15	0.15
ES	1.92	1.84	-0.08	1.15	1.56	0.41	0.68	0.72	0.04	1.00	1.00	0.00	-3.30	-5.83	-2.53
FR	1.18	1.86	0.68	1.59	2.76	1.17	0.79	0.63	-0.16	1.00	1.00	0.00	-3.30	-3.23	0.07
HR	1.23	1.71	0.48	1.41	2.29	0.89	0.74	0.70	-0.03	1.00	1.00	0.00	-3.30	-2.39	0.91
IT	1.75	1.46	-0.29	1.12	3.07	1.95	0.86	0.58	-0.28	1.00	1.10	0.10	-3.30	-2.29	1.01
CY	1.97	2.28	0.31	1.50	2.26	0.76	0.83	0.91	0.08	1.00	1.00	0.00	-3.30	-3.08	0.22
LV	0.90	1.50	0.60	1.30	1.99	0.69	0.70	0.81	0.11	1.00	1.00	0.00	-3.30	-3.94	-0.64
LT	0.90	1.79	0.89	1.40	1.67	0.27	0.70	1.04	0.34	1.00	1.00	0.00	-3.30	-5.60	-2.30
LU	1.50	1.34	-0.16	1.75	2.36	0.61	0.76	0.39	-0.37	1.00	1.00	0.00	-3.30	-3.06	0.24
HU	1.70	1.73	0.03	1.44	2.21	0.77	0.63	0.76	0.13	1.00	1.00	0.00	-3.30	-1.25	2.05
MT	1.67	2.07	0.40	1.40	2.11	0.71	0.61	0.71	0.10	1.00	1.00	0.00	-3.30	-1.96	1.34
NL	1.69	2.37	0.68	1.52	3.13	1.61	0.56	0.62	0.06	1.00	1.00	0.00	-7.90	-5.76	2.14
AT	1.31	1.66	0.35	1.69	2.74	1.05	0.58	0.65	0.07	1.00	1.00	0.00	-3.30	-4.71	-1.41
PL	1.00	1.88	0.88	1.39	2.92	1.53	0.69	0.97	0.28	1.00	1.00	0.00	-5.80	-6.18	-0.38
PT	1.53	1.97	0.44	1.17	1.33	0.16	0.92	0.79	-0.13	1.00	1.00	0.00	-3.30	-6.04	-2.74
RO	1.21	1.29	0.08	1.60	2.02	0.42	0.75	0.62	-0.13	1.00	1.00	0.00	-3.30	-3.91	-0.61
SI	1.37	1.63	0.25	1.50	3.76	2.26	0.86	0.66	-0.20	1.00	1.00	0.00	-5.80	-2.81	2.99
SK	0.70	1.93	1.23	1.32	1.58	0.26	0.70	0.89	0.19	1.00	1.00	0.00	-5.80	-2.98	2.82
FI	0.91	1.41	0.50	1.64	2.03	0.39	0.62	0.77	0.15	1.00	1.00	0.00	-5.80	-3.66	2.14
SE	0.92	1.32	0.40	1.78	1.56	-0.22	0.72	0.71	-0.01	1.00	1.00	0.00	-7.90	-4.42	3.48
UK	1.18	1.68	0.50	1.66	3.92	2.26	0.91	0.60	-0.31	1.00	1.00	0.00	-5.30	-4.21	1.09
EU-28	1.32	1.68	0.42	1.45	2.27	0.84	0.74	0.74	0.18	1.00	1.00	0.00	-4.35	-3.91	1.42

Note: The elasticities related to non-tax revenues and other than unemployment-related expenditure are omitted in the table because they are assumed to be zero in both cases. The EU-28 averages of the elasticities are simple arithmetic averages of the elasticities. The EU-28 averages of the differences are the average of the absolute differences.
Source: 2005 elasticities are taken from Girouard and André (2005) for OECD countries and from European Commission (2006) for EU non-OECD countries. 2014 elasticities are those estimated in OECD (2014).

The revised individual revenue and expenditure elasticities follow the economic expectation. On the revenue side, corporate income taxes are the most cyclical, because of the high correlation of profits to

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([12]) Regarding the possible impact of the change to ESA2010, the first component (elasticities of revenue/expenditure to base) has no reason to be altered, since the revenue/expenditure and their base are not significantly affected by the change in the statistical base. The second component (elasticity of base to output gap) may be marginally altered by the change in the output gap induced by the change in GDP figures in ESA2010 compared with ESA1995.

the fluctuation of economic activity. Moreover, in cyclical through, the proportion of firms with no or negative profits increases: they do not pay any tax. Personal income tax is also very cyclical because of the progressive tax scale in most countries. By contrast, social security contributions are less cyclical than the business cycle, since the tax base (wage bill) does not respond fully to economic fluctuations. The uniform elasticity of indirect taxation assumes that indirect tax revenue follows closely the economic fluctuation.

Even if the elasticities of unemployment-related expenditure and of corporate income taxes show the largest revisions on (absolute) average, they are not necessarily the main drivers of the revisions of budgetary semi-elasticities. The revisions of the elasticities are on average the largest for unemployment-related expenditure and corporate income taxes (see Table 3.2). However, this does not necessarily imply that those revenue and expenditure categories are the main drivers of the revisions of budgetary semi-elasticities. As explained in Section 2 and Table A.3, to compute budgetary semi-elasticities, individual elasticities are weighted by the corresponding share of the individual revenue (expenditure) category in total revenue (expenditure) and by the corresponding revenue (expenditure) weight (in percentage of GDP). In terms of contribution to the budgetary semi-elasticities, the combined effect of the weighting parameters of unemployment-related expenditure and corporate income taxes are fairly modest, compared with the other budgetary items, especially personal income taxes (see Table 3.3).

Table 3.3: **Contributions of individual categories to the revisions in budgetary semi-elasticities**

	Revenue					Expenditure		Total difference in semi-elasticity of the budget balance
	Personal income tax	Corporate income tax	Social security contributions	Indirect taxes	Non-tax revenue	Unemployment-related expenditure	Earnings-related expenditure	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*Sum (1) to (6)*
BE	0.03	0.03	-0.02	0.00	0.00	0.01	0.00	0.05
BG	-0.01	0.01	-0.02	0.00	0.00	0.00	0.00	-0.01
CZ	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.04
DK	0.01	0.05	-0.01	0.00	0.00	-0.05	0.00	0.01
DE	0.02	0.01	0.00	0.00	0.00	-0.05	0.00	-0.01
EE	0.05	0.01	0.08	0.00	0.00	0.01	0.00	0.15
IE	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02
EL	0.02	0.03	-0.04	0.00	0.00	0.00	0.00	0.01
ES	-0.01	0.01	0.00	0.00	0.00	0.05	0.00	0.06
FR	0.06	0.03	-0.03	0.00	0.00	0.00	0.00	0.06
HR	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.04
IT	-0.03	0.05	-0.04	0.01	0.00	-0.01	0.00	-0.01
CY	0.01	0.05	0.01	0.00	0.00	0.00	0.00	0.07
LV	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.06
LT	0.05	0.00	0.03	0.00	0.00	0.01	0.00	0.10
LU	-0.01	0.04	-0.04	0.00	0.00	0.00	0.00	-0.02
HU	0.00	0.01	0.02	0.00	0.00	-0.01	0.00	0.02
MT	0.02	0.02	0.01	0.00	0.00	-0.01	0.00	0.05
NL	0.06	0.05	0.01	0.00	0.00	-0.04	0.00	0.08
AT	0.04	0.02	0.01	0.00	0.00	0.02	0.00	0.09
PL	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.12
PT	0.03	0.01	-0.02	0.00	0.00	0.03	0.00	0.04
RO	0.00	0.01	-0.01	0.00	0.00	0.00	0.00	0.00
SI	0.02	0.05	-0.03	0.00	0.00	-0.02	0.00	0.02
SK	0.04	0.01	0.03	0.00	0.00	-0.01	0.00	0.06
FI	0.07	0.01	0.02	0.00	0.00	-0.05	0.00	0.05
SE	0.07	-0.01	0.00	0.00	0.00	-0.06	0.00	0.00
UK	0.06	0.08	-0.03	0.00	0.00	0.00	0.00	0.11
EU-28	0.03	0.02	0.00	0.00	0.00	-0.01	0.00	0.05
St dev.	0.03	0.02	0.03	0.00	0.00	0.02	0.00	0.04

Note: Contributions are computed by weighting the differences between the 2014 elasticities and the 2005 elasticities, i.e. multiplying the difference computed for each category (see Table 3.2) with the corresponding share of revenue/expenditure (see Table A.2) and with the corresponding weights (see Table A.3). The EU-28 averages of the elasticities are simple arithmetic averages of the elasticities.
Source: Commission services.

On the revenue side, the elasticity of revenue to its base is on average larger than the elasticity of the base to the output gap for all categories. Focussing on the two elasticities determining the individual elasticities, namely the elasticity of individual revenue with respect to its base and the elasticity of each revenue base to the output gap, Table 3.4 shows that the revenue-to-base elasticity is on average larger than the base-to-output gap elasticity for all revenue categories. This also holds at the country-level for personal income taxes. However, for corporate income taxes and social security contributions, the

revenue-to-base elasticity is smaller than the base-to-output gap elasticity for a limited number of Member States. For indirect taxes, both the revenue-to-base elasticity and the base-to-output gap elasticity were assumed to be unitary, except for the revenue-to-base elasticity of Italy, which was set to 1.1, as explained in Section 3.2.

On the expenditure side, the estimated elasticity of unemployment to the output gap is fairly large and dispersed across Member States. For unemployment-related expenditure - the only expenditure item which was assumed to be cyclically-driven - a unitary elasticity assumption was used for the expenditure-to-base elasticity. The base-to-output gap elasticities were empirically estimated and turned out to be systematically larger than one in absolute terms (Table 3.4).

Table 3.4:   **Revenue (expenditure)-to-base and base-to-output gap elasticities of revenue and expenditure categories**

	Revenue												Expenditure		
	Personal income tax			Corporate income tax			Social security contributions			Indirect taxes			Unemployment-related expenditure		
	Revenue-to-base elasticity	Base-to-output gap elasticity	Revenue-to-output gap elasticity	Revenue-to-base elasticity	Base-to-output gap elasticity	Revenue-to-output gap elasticity	Revenue-to-base elasticity	Base-to-output gap elasticity	Revenue-to-output gap elasticity	Revenue-to-base elasticity	Base-to-output gap elasticity	Revenue-to-output gap elasticity	Expenditure-to-base elasticity	Base-to-output gap elasticity	Expenditure-to-output gap elasticity
	a	b	$= a * b$	c	d	$= c * d$	e	f	$= e * f$	g	h	$= g * h$	i	j	$= i * j$
BE	1.62	0.81	1.31	1.62	1.53	2.48	1.15	0.61	0.71	1.00	1.00	1.00	1.00	-3.70	-3.70
BG	1.11	1.04	1.15	1.81	1.18	2.13	0.93	0.66	0.61	1.00	1.00	1.00	1.00	-3.91	-3.91
CZ	2.23	0.74	1.65	1.23	1.45	1.78	0.99	0.87	0.86	1.00	1.00	1.00	1.00	-2.45	-2.45
DK	1.43	0.70	1.00	2.07	1.52	3.15	0.70	0.59	0.41	1.00	1.00	1.00	1.00	-4.97	-4.97
DE	1.88	1.00	1.87	1.59	1.20	1.91	0.86	0.70	0.60	1.00	1.00	1.00	1.00	-3.30	-3.30
EE	1.36	1.08	1.58	1.81	0.99	1.78	1.36	1.03	1.40	1.00	1.00	1.00	1.00	-5.18	-5.18
IE	2.04	0.77	1.58	1.00	1.26	1.25	1.51	0.69	1.04	1.00	1.00	1.00	1.00	-5.45	-5.45
EL	2.21	1.00	2.22	1.81	1.05	1.90	0.84	0.69	0.58	1.00	1.00	1.00	1.00	-3.15	-3.15
ES	1.88	0.98	1.84	1.32	1.18	1.56	0.82	0.88	0.72	1.00	1.00	1.00	1.00	-5.83	-5.83
FR	1.68	1.11	1.86	2.03	1.36	2.76	0.95	0.66	0.63	1.00	1.00	1.00	1.00	-3.23	-3.23
HR	1.75	0.98	1.71	1.81	1.27	2.29	1.00	0.71	0.70	1.00	1.00	1.00	1.00	-2.39	-2.39
IT	1.85	0.79	1.46	2.09	1.47	3.07	0.97	0.60	0.58	1.10	1.00	1.10	1.00	-2.29	-2.29
CY	2.25	1.01	2.28	1.93	1.17	2.26	1.00	0.91	0.91	1.00	1.00	1.00	1.00	-3.08	-3.08
LV	1.31	1.14	1.50	1.89	1.05	1.99	1.00	0.81	0.81	1.00	1.00	1.00	1.00	-3.94	-3.94
LT	1.46	1.23	1.79	1.68	0.99	1.67	1.00	1.04	1.04	1.00	1.00	1.00	1.00	-5.60	-5.60
LU	2.24	0.60	1.34	1.81	1.30	2.36	0.89	0.44	0.39	1.00	1.00	1.00	1.00	-3.06	-3.06
HU	1.80	0.96	1.73	1.81	1.22	2.21	0.99	0.77	0.76	1.00	1.00	1.00	1.00	-1.25	-1.25
MT	2.11	0.98	2.07	1.81	1.17	2.11	0.92	0.76	0.71	1.00	1.00	1.00	1.00	-1.96	-1.96
NL	2.00	1.19	2.37	2.81	1.11	3.13	0.86	0.73	0.62	1.00	1.00	1.00	1.00	-5.76	-5.76
AT	1.97	0.84	1.66	1.90	1.44	2.74	0.92	0.70	0.65	1.00	1.00	1.00	1.00	-4.71	-4.71
PL	1.93	0.98	1.88	2.30	1.27	2.92	0.97	0.99	0.97	1.00	1.00	1.00	1.00	-6.18	-6.18
PT	2.15	0.91	1.97	1.07	1.24	1.33	1.00	0.79	0.79	1.00	1.00	1.00	1.00	-6.04	-6.04
RO	1.36	0.95	1.29	1.81	1.11	2.02	0.99	0.62	0.62	1.00	1.00	1.00	1.00	-3.91	-3.91
SI	2.14	0.76	1.63	2.72	1.38	3.76	1.00	0.66	0.66	1.00	1.00	1.00	1.00	-2.81	-2.81
SK	2.43	0.79	1.93	1.24	1.28	1.58	1.19	0.75	0.89	1.00	1.00	1.00	1.00	-2.98	-2.98
FI	1.48	0.95	1.41	1.63	1.25	2.03	1.00	0.77	0.77	1.00	1.00	1.00	1.00	-3.66	-3.66
SE	1.42	0.93	1.32	1.19	1.30	1.56	0.95	0.75	0.71	1.00	1.00	1.00	1.00	-4.42	-4.42
UK	1.49	1.12	1.68	2.89	1.35	3.92	1.20	0.50	0.60	1.00	1.00	1.00	1.00	-4.21	-4.21
EU-28	1.81	0.94	1.68	1.81	1.25	2.27	1.00	0.74	0.74	1.00	1.00	1.00	1.00	-3.91	-3.91

Note: The EU-28 averages of the elasticities are simple arithmetic averages of the elasticities.
Source: OECD (2014) and Commission services.

4. COMPUTING THE BUDGETARY SEMI-ELASTICITY AND THE CYCLICALLY-ADJUSTED BUDGET BALANCE

By and large, the revision of the individual revenue and expenditure elasticities has only a fairly limited effect on budgetary semi-elasticities and on the CAB. The first subsection focusses on the effect of the revised individual elasticities on the budgetary semi-elasticities. The second subsection sets out and analyses the effect of the revision on the CAB and on the annual variation of the CAB. Appendix 1 shows all the steps of the computation, leading to the revised budgetary semi-elasticities, so as to ensure full replicability of the results.

4.1 IMPACT OF REVISED ELASTICITIES ON THE BUDGETARY SEMI-ELASTICITY

Budgetary semi-elasticities based on revised elasticities average out to 0.50 for the EU and range from 0.31 to 0.65 across Member States, suggesting significant differences in the cyclicality of the budget balance (Table 4.1). For instance, the cyclical component of the budget balance corresponding to a one-percent output gap would be around 0.6% of GDP in Belgium, Denmark and France, compared to half in Bulgaria and Romania (around 0.3% of GDP). Appendix Table A.3 shows the components of the semi-elasticity of the budget balance to the output gap, based on the methodology explained in Section 2.

Table 4.1: **Impact of the revised individual elasticities on the budgetary semi-elasticities and their components**

	Semi-elasticity based on 2005 estimates			Semi-elasticity based on 2014 estimates			Difference in semi-elasticity for:		
	Revenue	Expenditure	Budget balance	Revenue	Expenditure	Budget balance	Revenue	Expenditure	Budget balance
BE	-0.03	-0.58	0.55	0.01	-0.59	0.61	0.04	-0.01	0.05
BG	-0.07	-0.39	0.32	-0.08	-0.39	0.31	-0.02	0.00	-0.01
CZ	-0.06	-0.45	0.39	-0.01	-0.45	0.43	0.04	0.00	0.04
DK	-0.06	-0.66	0.61	0.00	-0.62	0.62	0.06	0.05	0.01
DE	-0.05	-0.61	0.56	-0.01	-0.56	0.55	0.04	0.05	-0.01
EE	-0.10	-0.39	0.30	0.04	-0.41	0.44	0.13	-0.01	0.15
IE	0.00	-0.51	0.50	0.02	-0.51	0.53	0.02	0.00	0.02
EL	-0.03	-0.51	0.47	-0.02	-0.51	0.48	0.01	0.00	0.01
ES	0.00	-0.48	0.48	0.01	-0.53	0.54	0.01	-0.05	0.06
FR	-0.06	-0.60	0.55	0.00	-0.60	0.60	0.06	0.00	0.06
HR	-0.05	-0.48	0.43	-0.01	-0.48	0.47	0.04	0.00	0.04
IT	0.04	-0.51	0.55	0.04	-0.50	0.54	0.00	0.01	-0.01
CY	0.00	-0.45	0.45	0.07	-0.45	0.52	0.07	0.00	0.07
LV	-0.09	-0.40	0.32	-0.03	-0.41	0.38	0.06	0.00	0.06
LT	-0.07	-0.38	0.31	0.02	-0.39	0.41	0.09	-0.01	0.10
LU	0.02	-0.44	0.46	0.00	-0.44	0.44	-0.02	0.00	-0.02
HU	-0.05	-0.52	0.47	-0.02	-0.51	0.49	0.03	0.01	0.02
MT	-0.05	-0.46	0.41	0.01	-0.45	0.46	0.06	0.01	0.05
NL	-0.05	-0.62	0.57	0.07	-0.58	0.65	0.12	0.04	0.08
AT	-0.06	-0.55	0.49	0.01	-0.57	0.58	0.07	-0.02	0.09
PL	-0.09	-0.49	0.40	0.03	-0.49	0.52	0.11	0.00	0.12
PT	-0.03	-0.50	0.46	-0.02	-0.53	0.51	0.02	-0.03	0.04
RO	-0.05	-0.38	0.33	-0.05	-0.38	0.34	0.00	0.00	0.00
SI	-0.04	-0.50	0.46	-0.01	-0.48	0.48	0.03	0.02	0.02
SK	-0.08	-0.41	0.33	0.00	-0.40	0.39	0.07	0.01	0.06
FI	-0.13	-0.66	0.53	-0.03	-0.60	0.57	0.10	0.05	0.05
SE	-0.08	-0.67	0.59	-0.02	-0.61	0.59	0.06	0.06	0.00
UK	0.01	-0.47	0.48	0.12	-0.47	0.59	0.11	0.00	0.11
EU-28	-0.05	-0.50	0.46	0.00	-0.50	0.50	0.05	0.01	0.05
St dev.	0.04	0.09	0.09	0.04	0.07	0.09	0.04	0.02	0.04

Note: Calculations follow the methodology explained in Section 2. The EU-28 averages of the elasticities are simple arithmetic averages of the elasticities.
Source: 2005 elasticities are taken from Girouard and André (2005) for OECD countries and from European Commission (2006) for EU non-OECD countries. 2014 elasticities are those estimated in OECD (2014).

Looking at the sub-components, the average of the semi-elasticities for revenue is close to zero, while the semi-elasticities for expenditure average out to -0.50. The average of the semi-elasticities for revenue ranges from -0.08 to 0.07 and its average is close to zero. This shows that revenue is almost as cyclical as GDP, except for non-tax revenue. Therefore, the revenue-to-GDP ratio can be expected to remain broadly constant in a normal business cycle, especially in Member States where non-tax revenue

is relatively low. In contrast, the semi-elasticities for expenditure average out to -0.50, ranging from -0.38 to -0.62, which accounts for the larger part of the disparity in the budgetary semi-elasticity across Member States. Their value broadly correspond to the share of total expenditure in GDP. This mirrors the fact that the elasticity of expenditure to the output gap is close to zero, given that the only expenditure item expected to move with the business cycle is unemployment expenditure and its share in total expenditure is small. In turn, this means that the expenditure-to-GDP ratio can be expected to change in almost exact proportion as the output gap.

Revisions of individual revenue and expenditure elasticities have an impact on budgetary semi-elasticities which varies from 0.00 to 0.15 in absolute terms across Member States. As shown on Graph 4.1, the budgetary semi-elasticities based on the revised individual elasticities are slightly higher than those based on the 2005 elasticities: 0.50 versus 0.46 on average in the EU. The cross-country variability of the new budgetary semi-elasticities, as measured by the unweighted standard deviation, is similar to that of the previous budgetary semi-elasticities (see Table 4.1). Also the differences between the budgetary semi-elasticities based on 2005 and 2014 elasticities are fairly limited, as they average out to 0.05. As shown in Table 4.1, the differences are mainly driven by the revenue side, which explains almost all of the change. As regards those differences in budgetary semi-elasticities, two groups of Member States can be identified.

Graph 4.1:   **Budgetary semi-elasticities based on former and revised individual elasticities**
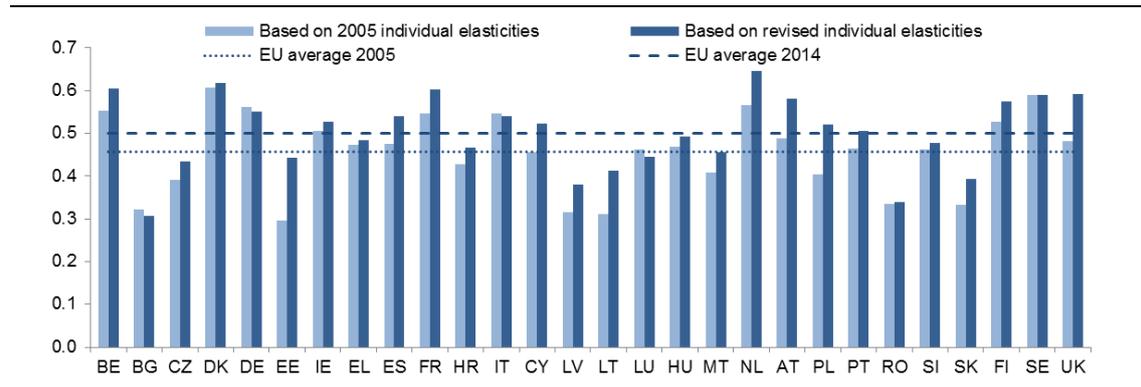
Source: Commission services.

For one group of Member States, the impact of the revised elasticities on the budgetary semi-elasticity is very limited, i.e. 0.02 or less in absolute terms. As shown on Graph 4.1, this group comprises 11 Member States (Bulgaria, Denmark, Germany, Ireland, Greece, Italy, Luxembourg, Hungary, Romania, Slovenia and Sweden). For most of these countries (except Bulgaria, Germany, Italy and Luxembourg), the budgetary semi-elasticities are slightly higher than those based on the 2005 individual elasticities.

For the other - larger - group of Member States, the revision of the individual elasticities increased the budgetary semi-elasticity, indicating a stronger cyclicality of the budget balance. This group comprises 17 Member States (Belgium, the Czech Republic, Estonia, Spain, France, Croatia, Cyprus, Latvia, Lithuania, Malta, the Netherlands, Austria, Poland, Portugal, Slovakia, Finland and the United Kingdom), as shown in Graph 4.1. For all of them, the budgetary semi-elasticities are - by at least 0.03 - higher than those based on the 2005 individual elasticities. For most of these countries (except Estonia, Lithuania, Poland and the United Kingdom) the impact of the revised elasticities on the budgetary semi-elasticity does not exceed 0.1. In none of these Member States the impact exceeds 0.15.

4.2   IMPACT OF REVISED ELASTICITIES ON THE CYCLICALLY-ADJUSTED BUDGET BALANCE

The revision of the individual elasticities has a fairly limited impact on the CAB on average and in most countries for most years. Graph 4.2 illustrates for the current year 2014 and in an optically intuitive way that the level of the CAB is only marginally affected by the revision of individual elasticities. This is shown graphically by the fact that most countries are very close to the 45 degree line. The effect of the revised individual elasticities on the CAB averages out to 0.1 for both the EU and the euro area in 2014. The difference in the CAB by using 2014 instead of 2005 individual elasticities, ranges from -0.2 pp to 0.2 pp in 2014 except for two countries. Table 4.2 shows the effect of using the revised individual elasticities on the CAB for five consecutive years (2011-15) and broadly confirms the fairly limited impact on the CAB in most countries. For the large majority of countries, the change in the CAB level does not exceed +/- 0.2 pp.

Graph 4.2:   **The cyclically-adjusted budget balance in 2014 using former and revised individual elasticities**
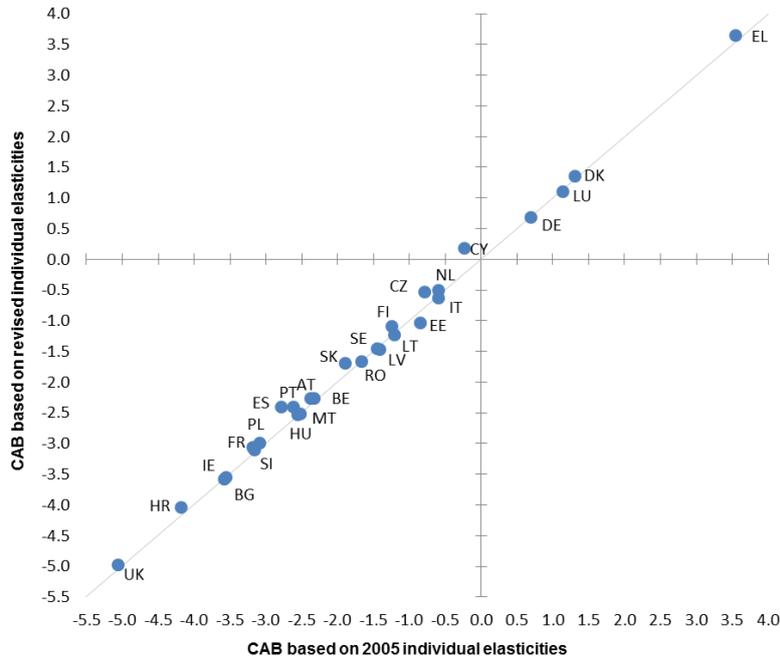
Source: Commission services.

For specific countries in specific years, however, the revision of the cyclical components can be non-negligible. For 2013 (mostly hard data), the largest revisions are observed for Spain (+ 0.5 pp), Cyprus, Estonia, the Netherlands and the United Kingdom (+/- 0.3 pp), as shown in Table 4.2. For 2014 (partly forecast), the largest revisions are observed for Cyprus and Spain (+0.4 pp). For 2015 (forecast), only Cyprus exhibits a change higher than 0.2 pp (+0.3 pp).

The impact of the revised elasticities on the annual variation in the CAB is even smaller than the impact on the level of the CAB. The impact of the revised elasticities averages out to zero for both the EU and the euro area in 2014. As for the level of the CAB, there is some non-negligible revision in some countries for some years for 2014, as shown by Graph 4.3. The United Kingdom (-0.2 pp) and Cyprus and Estonia (0.1 pp) display the largest revisions in terms of annual variation in the CAB in 2014. Table 4.3 shows the effect of using the revised individual elasticities on the annual variation of the CAB for five consecutive years (2011-15). It confirms that, for the large majority of cases between 2011 and 2015

(93%), the change in the CAB level does not (or is not expected to) exceed +/- 0.1 pp. The effect was exceeding 0.4 pp in three countries in 2011, reflecting the very large annual reduction in the output gap (upswing) in the wake of the economic and financial crisis.

Table 4.2:   **Impact of revised individual elasticities on the cyclically-adjusted budget balance (2011-15)**

	Cyclically-adjusted budget balance using 2005 elasticities					Cyclically-adjusted budget balance using 2014 elasticities					Difference				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
BE	-3.8	-3.6	-2.2	-2.3	-2.1	-3.8	-3.6	-2.1	-2.3	-2.1	0.0	0.0	0.1	0.1	0.1
BG	-2.0	-0.5	-1.3	-3.6	-3.4	-2.0	-0.5	-1.3	-3.6	-3.4	0.0	0.0	0.0	0.0	0.0
CZ	-2.6	-3.3	-0.1	-0.6	-1.8	-2.6	-3.2	0.0	-0.5	-1.7	0.0	0.1	0.1	0.1	0.0
DK	-0.6	-1.7	1.7	1.3	-0.5	-0.6	-1.7	1.7	1.3	-0.5	0.0	0.0	0.0	0.0	0.0
DE	-1.5	-0.1	0.6	0.7	0.6	-1.5	-0.1	0.6	0.7	0.6	0.0	0.0	0.0	0.0	0.0
EE	1.2	-1.0	-1.0	-0.8	-0.8	1.3	-1.3	-1.3	-1.0	-0.9	0.1	-0.3	-0.3	-0.2	-0.1
IE	-12.0	-7.1	-4.4	-3.6	-3.2	-12.0	-7.1	-4.4	-3.5	-3.2	0.0	0.0	0.1	0.0	0.0
EL	-5.2	-2.2	-5.7	3.5	2.9	-5.1	-2.0	-5.6	3.6	3.0	0.1	0.1	0.1	0.1	0.1
ES	-6.8	-7.0	-3.2	-2.8	-2.7	-6.5	-6.6	-2.8	-2.4	-2.4	0.3	0.4	0.5	0.4	0.3
FR	-4.9	-4.3	-3.2	-3.2	-3.2	-4.9	-4.2	-3.1	-3.1	-3.0	0.0	0.1	0.1	0.1	0.1
HR	-7.1	-4.5	-3.9	-4.2	-4.2	-7.1	-4.4	-3.8	-4.0	-4.1	0.0	0.1	0.1	0.1	0.1
IT	-2.6	-1.5	-0.5	-0.6	-0.9	-2.6	-1.5	-0.6	-0.6	-0.9	0.0	0.0	0.0	0.0	0.0
CY	-5.9	-5.2	-2.6	-0.2	-1.0	-5.9	-5.1	-2.3	0.2	-0.8	0.0	0.1	0.3	0.4	0.3
LV	-1.5	-0.2	-1.0	-1.4	-1.6	-1.1	-0.1	-1.0	-1.5	-1.6	0.4	0.1	0.0	-0.1	-0.1
LT	-7.8	-2.8	-2.6	-1.2	-1.5	-7.5	-2.7	-2.6	-1.2	-1.5	0.4	0.1	0.0	0.0	0.0
LU	0.8	1.6	2.1	1.1	0.4	0.8	1.5	2.0	1.1	0.4	0.0	-0.1	-0.1	0.0	0.0
HU	-4.5	-0.7	-1.2	-2.6	-2.9	-4.4	-0.6	-1.2	-2.5	-2.9	0.0	0.1	0.1	0.0	0.0
MT	-2.6	-3.5	-2.6	-2.5	-2.7	-2.6	-3.5	-2.6	-2.5	-2.7	0.0	0.0	0.0	0.0	0.0
NL	-3.9	-2.4	-0.3	-0.8	-1.0	-3.8	-2.2	0.0	-0.5	-0.8	0.1	0.2	0.3	0.2	0.2
AT	-2.7	-2.3	-1.1	-2.4	-1.4	-2.7	-2.3	-1.1	-2.3	-1.3	0.0	0.0	0.1	0.1	0.1
PL	-5.7	-3.9	-3.7	-3.1	-2.5	-6.0	-4.0	-3.5	-3.0	-2.4	-0.2	0.0	0.1	0.1	0.1
PT	-5.7	-2.6	-1.9	-2.6	-1.8	-5.5	-2.4	-1.6	-2.4	-1.6	0.2	0.3	0.3	0.2	0.1
RO	-4.7	-1.9	-1.7	-1.7	-2.5	-4.7	-1.9	-1.7	-1.7	-2.5	0.0	0.0	0.0	0.0	0.0
SI	-5.5	-1.9	-12.4	-3.2	-2.2	-5.4	-1.8	-12.3	-3.1	-2.2	0.0	0.1	0.1	0.0	0.0
SK	-3.7	-3.5	-1.6	-1.9	-1.5	-3.7	-3.3	-1.4	-1.7	-1.3	0.1	0.1	0.2	0.2	0.2
FI	-0.9	-1.2	-0.9	-1.2	-1.2	-0.9	-1.1	-0.8	-1.1	-1.1	0.0	0.1	0.1	0.1	0.1
SE	0.0	0.0	-0.3	-1.5	-1.1	0.0	0.0	-0.3	-1.5	-1.1	0.0	0.0	0.0	0.0	0.0
UK	-6.2	-6.8	-4.7	-5.1	-4.5	-5.8	-6.5	-4.4	-5.0	-4.5	0.3	0.3	0.3	0.1	0.0
EU 28	-3.9	-2.6	-2.1	-1.7	-1.7	-3.8	-2.6	-2.0	-1.6	-1.7	0.1	0.1	0.1	0.1	0.1
EA 18	-3.7	-2.7	-2.3	-1.3	-1.3	-3.7	-2.6	-2.2	-1.2	-1.2	0.1	0.1	0.1	0.1	0.1

Note: The EU-28 and EA-18 averages of the elasticities are simple arithmetic averages of the elasticities.
Source: Commission services.

Graph 4.3:   **Annual variation of the cyclically-adjusted budget balance in 2014 using former and revised individual elasticities**
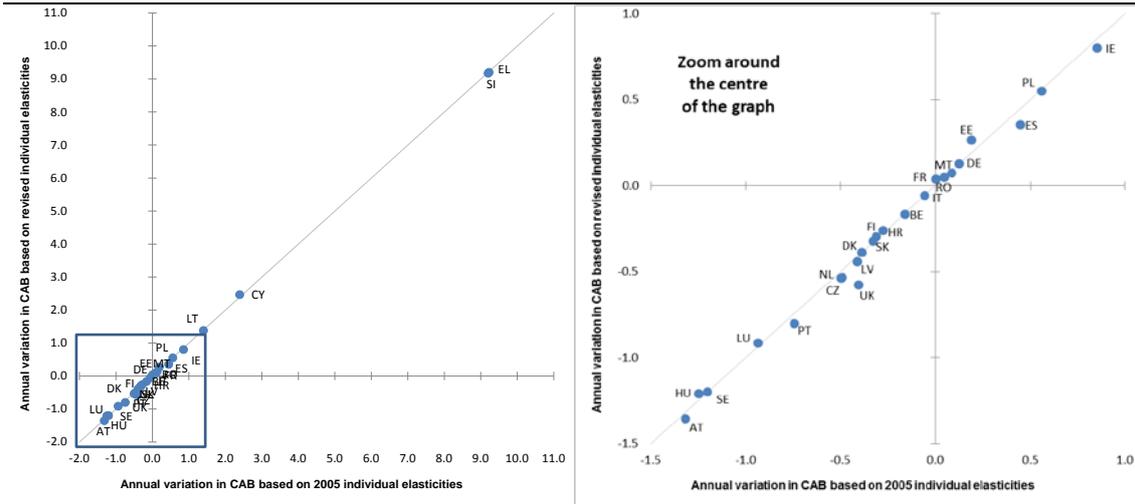
Source: Commission services.

Table 4.3:   **Impact of revised individual elasticities on the annual variation in the cyclically-adjusted budget balance (2011-15)**

	Annual variation in the cyclically-adjusted budget balance using 2005 elasticities					Annual variation in the cyclically-adjusted budget balance using 2014 elasticities					Difference				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
BE	-0.1	0.3	1.4	-0.2	0.2	-0.2	0.3	1.4	-0.2	0.2	0.0	0.0	0.0	0.0	0.0
BG	0.7	1.5	-0.8	-2.3	0.2	0.7	1.5	-0.8	-2.3	0.2	0.0	0.0	0.0	0.0	0.0
CZ	1.4	-0.6	3.2	-0.5	-1.2	1.4	-0.6	3.2	-0.5	-1.2	0.0	0.1	0.1	0.0	0.0
DK	0.2	-1.1	3.4	-0.4	-1.8	0.1	-1.1	3.4	-0.4	-1.8	0.0	0.0	0.0	0.0	0.0
DE	1.8	1.4	0.7	0.1	-0.1	1.9	1.4	0.6	0.1	-0.1	0.0	0.0	0.0	0.0	0.0
EE	-1.0	-2.2	0.0	0.2	0.0	-2.0	-2.6	0.0	0.3	0.2	-0.9	-0.4	0.1	0.1	0.1
IE	-14.2	4.9	2.7	0.9	0.4	-15.8	4.9	2.7	0.8	0.3	-1.6	0.0	0.0	-0.1	0.0
EL	3.8	3.1	-3.5	9.2	-0.6	3.9	3.1	-3.5	9.2	-0.7	0.1	0.0	0.0	0.0	0.0
ES	0.5	-0.2	3.8	0.4	0.1	0.5	-0.1	3.8	0.4	0.0	0.1	0.1	0.0	-0.1	-0.1
FR	1.2	0.6	1.1	0.0	0.0	1.1	0.6	1.2	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
HR	-1.7	2.6	0.6	-0.3	0.0	-1.7	2.7	0.7	-0.3	-0.1	0.0	0.1	0.0	0.0	0.0
IT	2.8	1.1	1.0	-0.1	-0.3	2.6	1.1	1.0	-0.1	-0.3	-0.2	0.0	0.0	0.0	0.0
CY	-0.7	0.7	2.6	2.4	-0.8	-0.7	0.8	2.8	2.5	-0.9	0.0	0.1	0.2	0.1	-0.1
LV	3.2	1.3	-0.8	-0.4	-0.2	2.8	1.0	-1.0	-0.4	-0.2	-0.3	-0.3	-0.2	0.0	0.0
LT	-3.6	5.0	0.2	1.4	-0.3	-4.1	4.7	0.1	1.4	-0.3	-0.5	-0.3	-0.1	0.0	0.0
LU	0.6	0.8	0.5	-0.9	-0.7	0.6	0.8	0.5	-0.9	-0.7	0.0	0.0	0.0	0.0	0.0
HU	-1.8	3.8	-0.6	-1.3	-0.3	-1.8	3.9	-0.6	-1.4	-0.3	0.0	0.0	0.0	0.0	0.0
MT	0.5	-0.9	0.9	0.1	-0.2	0.5	-0.9	0.9	0.1	-0.2	0.0	0.0	0.0	0.0	0.0
NL	0.2	1.4	2.2	-0.5	-0.2	0.1	1.6	2.2	-0.5	-0.3	-0.1	0.1	0.1	0.0	-0.1
AT	0.8	0.4	1.1	-1.2	1.0	0.6	0.4	1.2	-1.2	1.0	-0.2	0.0	0.1	0.0	0.0
PL	2.5	1.8	0.3	0.6	0.6	2.4	2.0	0.4	0.5	0.6	-0.1	0.2	0.2	0.0	0.0
PT	4.6	3.1	0.8	-0.7	0.9	4.7	3.2	0.8	-0.8	0.8	0.1	0.1	0.0	-0.1	-0.1
RO	1.3	2.8	0.2	0.0	-0.8	1.3	2.8	0.2	0.0	-0.8	0.0	0.0	0.0	0.0	0.0
SI	-0.9	3.6	-10.4	9.2	0.9	-0.9	3.6	-10.4	9.2	0.9	0.0	0.0	0.0	0.0	0.0
SK	3.7	0.3	1.9	-0.3	0.4	3.8	0.4	1.9	-0.3	0.4	0.1	0.1	0.1	0.0	0.0
FI	0.4	-0.3	0.3	-0.3	0.0	0.3	-0.3	0.3	-0.3	0.0	-0.1	0.1	0.1	0.0	0.0
SE	-0.8	0.1	-0.3	-1.2	0.3	-0.8	0.1	-0.3	-1.2	0.3	0.0	0.0	0.0	0.0	0.0
UK	1.7	-0.7	2.2	-0.4	0.6	1.6	-0.6	2.1	-0.6	0.5	-0.1	0.0	-0.1	-0.2	-0.1
EU 28	0.2	1.2	0.5	0.5	-0.1	0.1	1.2	0.5	0.5	-0.1	-0.1	0.0	0.0	0.0	0.0
EA 18	0.3	1.3	0.5	0.5	-0.1	0.1	1.3	0.5	0.5	-0.1	-0.1	0.0	0.0	0.0	0.0

Note: The EU-28 and EA-18 averages of the elasticities are simple arithmetic averages of the elasticities.
Source: Commission services

The reason for this limited effect on the CAB can be attributed to the small revision in the cyclical components of the budget balance. As illustrated by Graph 4.4 and 4.5, the revision in the cyclical components of the budget balance, which is the product of the revised semi-elasticity and the output gap, has been fairly limited in 2013 and 2014. The two graphs also suggest that, for most countries except Bulgaria, Germany, Italy and Luxembourg, the budget balance based on revised elasticities is slightly more responsive to the business cycle. By definition, the magnitude of the revision depends on both the size of the revision of the budgetary semi-elasticity and the value of the output gap. A one-percent output gap leads to a revision in the CAB of at most 0.6 pp, which corresponds to the maximum value of the budgetary semi-elasticity in the EU. The overall impact on cyclically-adjusted values can be larger (smaller) in years when the output gap is above (below) one in absolute value.

Graph 4.4:   **Cyclical components of the budget balance in 2013 using former and revised individual elasticities**
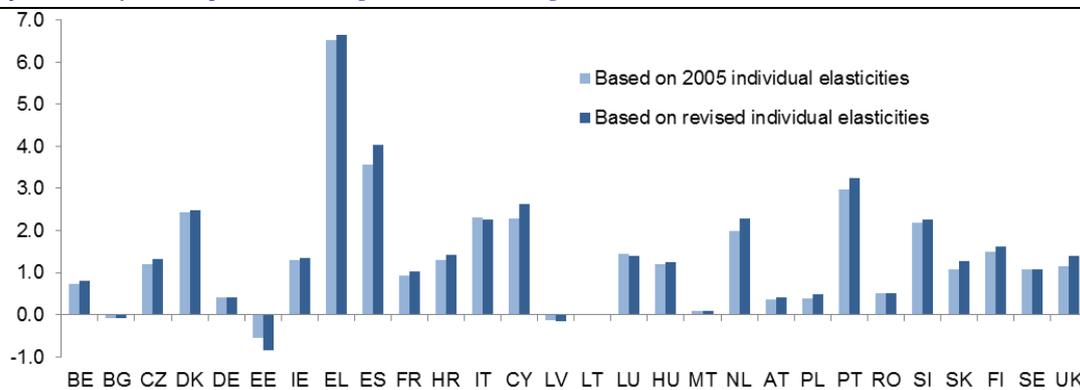
Source: Commission services.

Graph 4.5:   **Cyclical components of the budget balance in 2014 using former and revised individual elasticities**
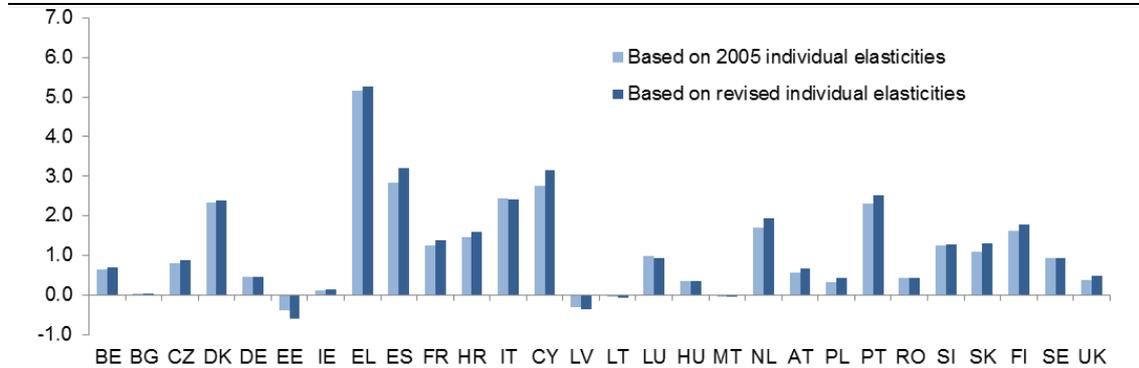
Source: Commission services.

For specific countries in specific years, however, the revision of the cyclical components can be non-negligible. For 2013 (mostly hard data), the largest revisions are observed for Spain, Cyprus, Estonia, the Netherlands and the United Kingdom. For 2014 (partly forecast), the largest revisions are observed for Cyprus and Spain. This corresponds, by definition, to the mirror image of the CAB in these countries for these years.

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APPENDIX 1

Steps to derive the semi-elasticities of the budget balance to the output gap and data sources

Table A.1:	Elasticities of individual revenue and expenditure categories							
	Revenue					**Expenditure**		
	Personal income tax	Corporate income tax	Social security contributions	Indirect taxes	Non-tax revenue	Unemployment-related expenditure	Earnings-related expenditure	Other expenditure
	(A)	*(B)*	*(C)*	*(D)*	*E)*	*(F)*	*(G)*	*(H)*
BE	1.31	2.48	0.71	1.00	0.00	-3.70	0.00	0.00
BG	1.15	2.13	0.61	1.00	0.00	-3.91	0.00	0.00
CZ	1.65	1.78	0.86	1.00	0.00	-2.45	0.00	0.00
DK	1.00	3.15	0.41	1.00	0.00	-4.97	0.00	0.00
DE	1.87	1.91	0.60	1.00	0.00	-3.30	0.00	0.00
EE	1.58	1.78	1.40	1.00	0.00	-5.18	0.00	0.00
IE	1.58	1.25	1.04	1.00	0.00	-5.45	0.00	0.00
EL	2.22	1.90	0.58	1.00	0.00	-3.15	0.00	0.00
ES	1.84	1.56	0.72	1.00	0.00	-5.83	0.00	0.00
FR	1.86	2.76	0.63	1.00	0.00	-3.23	0.00	0.00
HR	1.71	2.29	0.70	1.00	0.00	-2.39	0.00	0.00
IT	1.46	3.07	0.58	1.10	0.00	-2.29	0.00	0.00
CY	2.28	2.26	0.91	1.00	0.00	-3.08	0.00	0.00
LV	1.50	1.99	0.81	1.00	0.00	-3.94	0.00	0.00
LT	1.79	1.67	1.04	1.00	0.00	-5.60	0.00	0.00
LU	1.34	2.36	0.39	1.00	0.00	-3.06	0.00	0.00
HU	1.73	2.21	0.76	1.00	0.00	-1.25	0.00	0.00
MT	2.07	2.11	0.71	1.00	0.00	-1.96	0.00	0.00
NL	2.37	3.13	0.62	1.00	0.00	-5.76	0.00	0.00
AT	1.66	2.74	0.65	1.00	0.00	-4.71	0.00	0.00
PL	1.88	2.92	0.97	1.00	0.00	-6.18	0.00	0.00
PT	1.97	1.33	0.79	1.00	0.00	-6.04	0.00	0.00
RO	1.29	2.02	0.62	1.00	0.00	-3.91	0.00	0.00
SI	1.63	3.76	0.66	1.00	0.00	-2.81	0.00	0.00
SK	1.93	1.58	0.89	1.00	0.00	-2.98	0.00	0.00
FI	1.41	2.03	0.77	1.00	0.00	-3.66	0.00	0.00
SE	1.32	1.56	0.71	1.00	0.00	-4.42	0.00	0.00
UK	1.68	3.92	0.60	1.00	0.00	-4.21	0.00	0.00

Note: See Section 3 for information on the estimation of individual revenue and expenditure elasticities.
Source: OECD (2014).

Table A.2: **Shares of revenue categories (% of total revenues) and shares of expenditure categories (% of total expenditure), average 2002-2011**

	Revenue					Expenditure		
	Personal income tax	Corporate income tax	Social security contributions	Indirect taxes	Non-tax revenue	Unemployment-related expenditure	Earnings-related expenditure	Other expenditure
	(I)	*(J)*	*(K)*	*(L)*	*(M)*	*(N)*	*(O)*	*(P)*
BE	27.43	6.68	33.92	26.61	5.36	4.46	5.61	89.93
BG	6.11	5.29	24.81	44.23	19.56	0.70	5.27	94.03
CZ	10.68	10.25	39.05	27.44	12.58	0.74	4.62	94.65
DK	47.85	6.11	3.57	31.14	11.33	2.82	13.36	83.82
DE	20.25	5.74	40.06	24.99	8.96	6.22	4.56	89.22
EE	16.31	3.55	30.50	35.00	14.64	1.89	4.83	93.28
IE	24.30	9.77	18.45	35.76	11.72	4.32	9.56	86.12
EL	12.83	7.99	33.69	31.20	14.29	1.66	1.98	96.35
ES	19.55	8.38	34.57	28.91	8.59	4.89	2.18	92.93
FR	17.62	4.96	37.14	30.70	9.59	3.46	7.67	88.87
HR	7.25	9.09	29.49	43.23	10.94	0.80	0.00	99.20
IT	25.70	6.17	29.40	31.77	6.95	1.18	2.34	96.47
CY	11.12	15.99	19.97	37.98	14.94	1.28	7.96	90.76
LV	17.65	5.52	24.96	34.30	17.56	1.70	3.16	95.14
LT	18.48	5.60	27.40	35.58	12.94	1.48	4.81	93.71
LU	16.03	15.38	28.78	31.61	8.20	2.46	10.14	87.40
HU	16.41	4.28	29.15	35.84	14.32	1.15	8.77	90.08
MT	13.74	7.79	30.89	35.00	12.58	1.35	3.96	94.69
NL	18.65	7.08	33.13	27.50	13.63	3.87	6.38	89.75
AT	22.55	4.86	33.50	29.96	9.13	2.56	6.64	90.80
PL	12.52	6.28	31.00	35.07	15.13	2.08	3.67	94.25
PT	14.02	7.91	29.09	34.21	14.77	2.18	3.76	94.06
RO	10.47	8.55	29.74	37.09	14.14	1.14	5.23	93.63
SI	14.54	4.88	33.80	34.39	12.40	1.36	6.05	92.59
SK	9.60	8.43	37.88	32.83	11.26	1.06	5.82	93.12
FI	26.13	6.71	23.41	25.81	17.93	4.98	7.85	87.17
SE	32.11	5.69	18.33	31.95	11.92	3.32	7.37	89.30
UK	31.79	8.24	20.71	31.81	7.45	0.78	10.48	88.74

Note and data explanation: The shares are those computed in Mourre *et al.* (2013).

i) The data for non-tax revenue come from the AMECO database (Autumn 2012 vintage). Their share is computed as the relative difference between the ten-year average (2002-11) of total taxes (including imputed social security contributions) (code UTTT) and of total revenue of general government (code URTG).

ii) The data for the main tax components (personal income taxes, corporate income taxes, social security contributions and indirect taxes) come from the OECD Economic Outlook database (codes used: TYH, TYB, SSRG, TIND), which uses concepts consistent with the ESA95 national accounts (but does not include the tax transfer from the EU) and with the data used in Girouard and André (2005). The OECD Economic Outlook database corresponds to Economic Outlook No. 92, released in Mid-December 2012. This source should be distinguished from the OECD Revenue Statistics, which use another classification than ESA95. For BG, HR, CY, LV, LT, MT and RO, for which the OECD Economic Outlook data are not available, the AMECO database is used (codes used: UTYH, UTYC, UTAG, UTVT). For HR, which joined the EU in July 2013, the Spring 2013 vintage of the AMECO database is used for the major revenue categories (direct taxes, indirect taxes and social security contributions) and IMF data for the breakdown of direct taxes in personal income taxes and corporate income taxes. Data for HR start in 2009. For MT, the data are computed as the simple arithmetic average of EU-9 (i.e. other Member States that joined the EU in 2004). For EL and LU, sources are combined (AMECO database for personal income taxes, corporate income taxes and OECD Economic Outlook for indirect taxes and social security contributions) and data are rescaled to ensure that all revenue components add up to 100%, as for the other Member States. For LU, data are only available for the period 2006-2009 for all tax categories.

iii) The data for unemployment-related expenditure come from the Eurostat database on 'General government expenditure by function' (COFOG99), with the exception of BE, SK and RO where data are not available. Most COFOG data end in 2010, except for DK, DE, FR and AT, covering also 2011. Data for LV start in 2007 instead of 2002. Because of the broader concept of unemployment-related expenditure used by DK and because of the need to ensure an equal treatment with other Member States, the figure for DK was adjusted to match the OECD database on Labour Market Programmes ('Public expenditure and participant stocks on LMP') used to estimate the individual elasticities. In the Eurostat COFOG database unemployment-related expenditure is defined as a: *'Provision of social protection in the form of cash benefits and benefits in kind to persons who are capable of work, available for work but are unable to find suitable employment; administration, operation or support of such social protection schemes; cash benefits, such as full and partial unemployment benefits, early retirement benefits paid to older workers who retire before reaching the standard retirement age due to unemployment or job reduction caused by economic measures, allowances to targeted groups in the labour force who take part in training schemes intended to develop their potential for employment, redundancy compensation, other periodic or lump-sum payments to the unemployed, particularly the long-term unemployed; benefits in kind, such as mobility and resettlement payments, vocational training provided to persons without a job or retraining provided to persons at risk of losing their job, accommodation, food or clothes provided to unemployed persons and their families.'* This excludes general programs or schemes directed towards increasing labour mobility, reducing the rate of unemployment or promoting the employment of disadvantaged or other groups characterised by high unemployment; cash benefits and benefits in kind paid to unemployed persons on reaching the standard retirement age. For BE and SK, 'passive expenditures' (category 10) of the OECD database on Labour Market Programmes is used. This encompasses full unemployment benefits, partial unemployment benefits, the redundancy compensation, the bankruptcy compensation and early retirement. For HR and RO, 'total social protection benefits for the unemployment function' of the Eurostat database on social protection (ESSPROS) is used, covering up to 2010. For HR, the data start in 2008.

iv) An inaccuracy in the computation of the revenue shares in Mourre *et al.* (2013) was adjusted for CY, LV, LT, LU, MT and RO. Changes were only limited.

Source: OECD, AMECO and Commission services.

Table A.3:   **Decomposition of the semi-elasticity of budget balance to output gap**

	Elasticity of:				Weights (% of GDP) of:		Semi-elasticity for:		
	Revenue level	Expenditure level	Revenue-to-GDP ratio	Expenditure-to-GDP ratio	Total revenue	Total expenditure	Revenue	Expenditure	Budget balance
	(a)	(b)	c = a-1	d = b-1	(e)	(f)	g = c*e	h = d*f	i = g-h
BE	1.03	-0.17	0.03	-1.17	49.05	50.70	0.015	-0.591	0.605
BG	0.78	-0.03	-0.22	-1.03	37.75	38.10	-0.084	-0.391	0.308
CZ	0.97	-0.02	-0.03	-1.02	39.91	43.77	-0.012	-0.446	0.433
DK	1.00	-0.14	0.00	-1.14	55.75	54.34	-0.001	-0.620	0.619
DE	0.98	-0.21	-0.02	-1.21	44.00	46.45	-0.009	-0.560	0.551
EE	1.10	-0.10	0.10	-1.10	37.63	36.99	0.037	-0.406	0.443
IE	1.05	-0.24	0.05	-1.24	35.20	41.14	0.019	-0.508	0.528
EL	0.94	-0.05	-0.06	-1.05	39.93	48.06	-0.023	-0.506	0.483
ES	1.03	-0.28	0.03	-1.28	38.14	41.13	0.011	-0.528	0.539
FR	1.00	-0.11	0.00	-1.11	49.90	54.11	0.002	-0.601	0.603
HR	0.97	-0.02	-0.03	-1.02	40.48	46.96	-0.011	-0.479	0.467
IT	1.08	-0.03	0.08	-1.03	45.14	48.77	0.038	-0.501	0.539
CY	1.18	-0.04	0.18	-1.04	40.27	43.47	0.071	-0.452	0.523
LV	0.92	-0.07	-0.08	-1.07	35.08	38.26	-0.028	-0.408	0.380
LT	1.07	-0.08	0.07	-1.08	32.92	36.13	0.022	-0.391	0.413
LU	1.01	-0.08	0.01	-1.08	41.87	41.09	0.003	-0.442	0.445
HU	0.96	-0.01	-0.04	-1.01	44.97	50.33	-0.019	-0.511	0.492
MT	1.02	-0.03	0.02	-1.03	39.48	43.74	0.007	-0.449	0.456
NL	1.15	-0.22	0.15	-1.22	45.25	47.37	0.066	-0.579	0.646
AT	1.02	-0.12	0.02	-1.12	48.49	50.77	0.012	-0.569	0.580
PL	1.07	-0.13	0.07	-1.13	38.78	43.79	0.027	-0.494	0.521
PT	0.95	-0.13	-0.05	-1.13	41.08	46.42	-0.019	-0.525	0.506
RO	0.86	-0.04	-0.14	-1.04	32.97	36.78	-0.045	-0.384	0.339
SI	0.99	-0.04	-0.01	-1.04	43.46	46.49	-0.006	-0.483	0.477
SK	0.99	-0.03	-0.01	-1.03	34.23	38.62	-0.005	-0.398	0.393
FI	0.94	-0.18	-0.06	-1.18	53.13	51.08	-0.030	-0.604	0.574
SE	0.96	-0.15	-0.04	-1.15	53.99	53.13	-0.020	-0.609	0.590
UK	1.30	-0.03	0.30	-1.03	40.36	45.60	0.120	-0.471	0.591

Note: The parameters (a) and (b) are derived from Tables A1 and A2; a = (A * I + B * J + C * K + D * L + E * M) / 100; b = F * N + G * O + H * P / 100. The total revenue and expenditure as a percentage of GDP (columns e and f) correspond to the "Excessive Imbalance Procedure" definition, as explained in more detail in Mourre *et al.* (2013).
Source: Commission services.

APPENDIX 2

Additional information on elasticities of revenue to base

Table A.4: **Construction of revenue and expenditure bases**

Revenue/expenditure category	Base definition	Variables and codes used	Source
Personal income taxes	Wages and salaries Self-employment income Capital income	Compensation of employees, value (WSSS) Self-employment income received by households, value (YSE) Property income received by households, value (YPE)	OECD Economic Outlook No.95/AMECO OECD Economic Outlook No.93/AMECO OECD Analytical Database/AMECO
Corporate income taxes	Gross operating surplus	GDP - TIND + TSUB - WSSS Gross domestic product, value, market prices (GDP) Taxes on production and imports, value (TIND) Subsidies, value (TSUB) Compensation of employees, value (WSSS)	 OECD Economic Outlook No.93/AMECO OECD Economic Outlook No.93/AMECO OECD Analytical Database/AMECO OECD Economic Outlook No.95/AMECO
Social security contributions	Wages and salaries	Compensation of employees, value (WSSS)	OECD Economic Outlook No.95/AMECO
Indirect taxes	Private consumption	Private final consumption expenditure, value, GDP expenditure approach (CP)	OECD Economic Outlook No.93/AMECO
Unemployment-related expenditure	Unitary elasticity assumption	Unemployment rate (UNR)	OECD Economic Outlook No.95/AMECO

Source: OECD (2014).

Table A.5: **Elasticities of revenue with respect to their base per income item for personal income taxes and social security contributions**

	Personal income taxes			Social security contributions	
	Wages and salaries	**Self-employment income**	**Capital income**	**Wages and salaries (employee)**	**Wages and salaries (employer)**
BE	1.63	1.39	1.69	1.30	1.00
BG	1.07	1.02	1.60	0.95	0.91
CZ	2.24	2.24	1.77	0.98	1.00
DK	1.44	1.38	1.39	0.70	0.00
DE	1.90	1.87	1.74	0.76	0.97
EE	1.46	1.45	1.46	1.00	1.40
IE	2.11	1.61	1.81	1.49	1.41
EL	2.30	2.14	1.59	0.76	0.86
ES	1.93	1.48	1.83	0.88	0.82
FR	1.73	1.69	1.38	0.91	0.96
HR	1.77	1.72	1.60	1.00	1.00
IT	1.84	1.89	1.75	1.00	0.96
CY	2.31	2.27	1.60	1.00	1.00
LV	1.29	1.24	1.60	1.00	1.00
LT	1.45	1.40	1.60	1.00	1.00
LU	2.28	1.92	1.86	0.90	0.93
HU	1.84	1.74	1.50	1.00	0.99
MT	2.16	2.11	1.60	0.60	1.01
NL	2.15	1.84	1.20	0.75	0.71
AT	2.00	1.85	1.70	0.85	0.99
PL	1.96	1.84	1.51	0.96	0.98
PT	2.22	1.73	1.91	1.00	1.00
RO	1.35	1.30	1.60	1.00	0.99
SI	2.15	2.19	1.64	1.00	1.00
SK	2.47	2.20	1.93	0.97	0.98
FI	1.50	1.43	1.32	1.02	1.00
SE	1.45	1.21	1.17	0.69	1.00
UK	1.50	1.49	1.48	0.97	1.33
EU-28	1.84	1.70	1.60	0.94	0.97

Source: OECD (2014).

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