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The "True" Deficit

Improving structural budget balance estimation for Slovakia

Mária Marčanová, Ľudovít Ódor

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The "True" Deficit[1]

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Mária Marčanová[2], Ľudovít Ódor[3]

Abstract

In this paper we propose a new methodology to improve the estimation of structural budget balances in Slovakia. Major innovations compared to currently used methods are in using more robust output gap estimates, inclusion of pensions in the analysis, imposing consistency between various gap measures, elimination of effects of different deflators and using time-varying elasticities. Significant attention is attached also to one-off and temporary measures, where we define 10 principles for identification. The estimation is complemented with bottom-up approaches which focus more directly on discretionary fiscal action. Latest changes to the European fiscal framework have strengthened significantly the role of structural budget balances. With the adoption of the Fiscal Compact there is a numerical threshold each year for the deviation of the structural balance from the medium-term objective (or the adjustment path toward it). Moreover, automatic correction mechanisms are activated if the deviation is above the threshold. The basic motivation of this paper was that independent fiscal institutions are going to play an important role in triggering these correction mechanisms.

Keywords: fiscal policy, budget balance, structural fiscal balance, one-off measures
JEL classification: E32, E60, E62, H30, H60, H62

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[2] Council for Budget Responsibility, marcanova@rrz.sk
[3] Council for Budget Responsibility, odor@rrz.sk

Content

1 Motivation

The role of structural budget balances (SB) in the conduct and evaluation of fiscal policy has gained on its importance in the recent past. Changes in both domestic and European fiscal frameworks put much more emphasis on calculating the underlying fiscal position and to specify medium-term objectives (MTO) in structural terms. While the concept is very appealing theoretically, real time evaluation of cyclically adjusted budget balances is more an art than a science especially in small open economies with short history and many structural changes[4].

The demand for better estimates of the underlying fiscal position comes from at least 3 important legislative changes: revision to the Stability and Growth Pact (SGP), ratification of the Fiscal Compact[5] and the approval of the constitutional Act on Fiscal Responsibility in Slovakia in 2011.

Changes to the SGP were most important in legislating more automatic sanction mechanisms, putting more emphasis on the preventive arm of the pact (including the MTO) and introducing the macroeconomic imbalance procedure (MIP). Strengthening the preventive arm inevitably brings the need to find more precise estimates of the structural budget balance in real time into the forefront.

The most important change in the European fiscal framework, however, is the adoption of the Fiscal Compact. It is one thing to calculate ex-ante structural deficits, since it is impossible to have meaningful budgetary plans without an idea about major trends in the economy, but ex-post evaluation of deviations in real time with sanction attached is a completely different exercise. It is a real game changer. Now it is possible to ask questions like "who is responsible for the welfare consequences of the correction mechanisms if the independent institution´s estimate turns out to be wrong?" As Ódor (2011) points out, in less developed economies it is very hard to identify the cycle and therefore he recommends nominal expenditure ceilings (with possible escape clauses) as the main operational fiscal rule for central European countries.

The third important change is the adoption of the constitutional Act on Fiscal Responsibility in Slovakia. It tries to build on possible synergies between fiscal rules and independent fiscal institutions. The law defines a new indicator to assess long-term sustainability of public finances in Slovakia (similar to the previous S1 indicator used by the European Commission (EC)). Obviously, its construction starts with the calculation of the actual structural budget balance (including public companies and the central bank).

Moreover, the implementation of the Fiscal Compact and the expected definition of expenditure ceilings assumed by the constitutional law are likely to result in further changes to the domestic fiscal framework. CBR is now also the independent fiscal institution responsible for the

[4] In a companion paper we look at different methods to calculate more robust output gaps for Slovakia (Ódor and Jurašeková Kucserová, 2014).
[5] Part of the intergovernmental Treaty on Stability, Coordination and Governance (TSCG)

assessment of the deviation from the MTO and the likely supervisor of the newly defined expenditure ceilings (probably derived from some measure of the underlying fiscal balance). In light of past and future changes to the overall fiscal framework in Slovakia, it is necessary to pay much more attention to the real-time estimation of the output gap and structural budget balances. This topic is therefore an important priority in the research agenda of the CBR.

This paper describes the basic methodology of the CBR to calculate structural budget balances in Slovakia. Major innovations compared to currently used methods (in Slovakia) are in using more robust output gap estimates, inclusion of pensions in the analysis, imposing consistency between various gap measures, elimination of effects of different deflators and using time-varying elasticities. Significant attention is attached also to one-off and temporary measures, where we define 10 principles for identification. The estimation is complemented with bottom-up approaches which focus more directly on discretionary fiscal action.

The rest of the paper is organized as follows. The second section discusses the concept of the structural balance and also summarizes the main methods of estimation. The third part evaluates real time estimates of SB for Slovakia. Our proposed methodology is presented in the fourth section. Section 5 contains numerical estimates of the structural budget balance in Slovakia. The last part concludes and highlights several avenues for further research.

2 Structural budget balances: concepts and methods

In this section we review main concepts and methods to estimate structural budget balances.

2.1 Structural balance

To understand major trends in public finances one has to figure out the underlying fiscal stance. It usually means filtering out changes both on the revenue and expenditure side induced by business cycle fluctuations and adjustment are also made to exclude one-off and temporary measures. This way the question of consolidation effort can be answered from a top-down perspective[6].

$$SB = B - CC - OO$$

There are several methods for calculating the cyclical component (CC) depending on the purpose of the analysis, data availability, fiscal regime and economic structure. In general, two widely spread approaches are used: aggregated and disaggregated[7]. While in the disaggregated approach selected revenue and expenditure categories are directly linked to their macroeconomic bases (or gaps in the corresponding macroeconomic bases), in the aggregated

[6] We will elaborate more on a bottom-up approaches in Annex 2.

[7] Less frequently, direct regression of revenues and expenditures (as a percent of GDP) on the output gap with possible lags is used (OBR, 2012).

method a relationship between fiscal variables and the overall output gap is assumed. The aggregated approach is used mainly in situations where the composition of growth does not matter significantly. If individual cycles (derived from the related macroeconomic bases) are highly correlated with the output gap, composition effects may not differ substantially from the standard aggregated adjustment techniques which use the output gap alone.

Structural balance is a broader concept than the cyclically adjusted balance (CAB). The overall balance (B) is corrected also for one-off and temporary effects (OO). At first sight the identification of one-offs seems trivial, however as we show later, it is surrounded by controversy in some cases. Moreover the differences in identification of one-offs are sometimes more important than differences stemming from cyclical adjustments.

2.2 The aggregated CAB approach

For the purpose of decomposition of the fiscal balance into cyclical and trend component the European Council adopted the aggregated approach, where the output gap is calculated via the commonly agreed production function methodology (D'Auria et al., 2010).

In line with economic theory, potential output[8] is a combination of trends in factor inputs (capital and labour) and total factor productivity (TFP). Then, cyclically adjusted revenues and expenditures are calculated via their sensitivity to the deviation of potential from actual output.

In general, personal income tax (PIT), corporate income tax (CIT), value added tax (VAT), excise duties (ED) and social security contribution (SSC) are considered to be affected by the cycle on the revenue side, while on the expenditure side only unemployment related benefits (UB) are considered.

Output elasticity of budgetary items is the product of the elasticity of revenue/expenditure item with respect to the relevant macroeconomic base ($\epsilon_{R/X,B}$) and the elasticity of the base relative to the output gap ($\epsilon_{B,Y}$). The former elasticity is usually derived directly from the tax code, or where there is a proportional relationship, unit elasticity is assumed. The latter elasticity is mostly estimated econometrically by regression, or in cases where these results aren't satisfactory, commonly estimated elasticities are taken from the literature. Usually, compensation of employees is the base for PIT and SSC; gross operating surplus for CIT, private consumption for indirect taxes (VAT, ED or other) and the number of unemployed persons for unemployment benefits.

$$R^C = R\left(\frac{Y^*}{Y}\right)^{\epsilon_{R,Y}}, \quad X^C = X\left(\frac{Y^*}{Y}\right)^{\epsilon_{X,Y}}, \text{ and } \epsilon_{R,Y} = \epsilon_{R,B}\epsilon_{B,Y}, \epsilon_{X,Y} = \epsilon_{X,B}\epsilon_{B,Y},$$

[8] In more formal terms, with a production function, GDP (Y) is represented by a combination of factor inputs - labour (L) and the capital stock (K), corrected for the degree of excess capacity (U_L, U_K) and adjusted for the level of efficiency (E_L, E_K), hence $TFP = (E_L^{\alpha}E_K^{1-\alpha})(U_L^{\alpha}(U_K^{1-\alpha})$ and α is the factor share.

where R^C, X^C denotes the cyclical revenue/expenditure component, $\left(\frac{Y^*}{Y}\right)$ is the inverse of the output gap, $\epsilon_{R,Y}$, $\epsilon_{X,Y}$ is the revenue/expenditure elasticity with respect to output gap.

Table 1 – EC (OECD) – tax elasticities

Tax category	Elasticity of tax revenue relative to its base	Elasticity of base relative to OG	Elasticity of tax revenue relative to OG
PIT	= (1,5 - 2,0)	= (0,6 - 0,9)	= (1,0 - 1,7)
CIT	= 1	= (1,2 - 1,8)	= (1,2 - 1,8)
SSC	= (0,8 - 1,1)	= (0,6 - 0,9)	= (0,5 - 0,9)
IT	= 1	= 1	= 1

Source: OECD

If one assumes constant elasticities over time and relatively stable structure of revenues and expenditures, the final cyclically-adjusted balance can be expressed as a difference between the actual balance-to-GDP ratio and the product of the output gap (OG) and overall budget semi-elasticity (Mourre et al., 2013).

$$CAB = \frac{B}{Y} - \varepsilon_B * OG$$

$$\varepsilon_B = \varepsilon_{R-}\varepsilon_X = \left(\frac{\frac{dR}{R}}{\frac{dY}{Y}} - 1\right)\frac{R}{Y} - \left(\frac{\frac{dX}{X}}{\frac{dY}{Y}} - 1\right)\frac{X}{Y} = (\eta_R - 1)\frac{R}{Y} - (\eta_X - 1)\frac{X}{Y} =$$

$$= \sum_{i=1}^{5}(\eta_{Ri,Y}\frac{R_i}{R} - 1)\frac{R}{Y} - (\eta_{UB,Y}\frac{UB}{X} - 1)\frac{X}{Y}$$

where $\frac{R}{Y}, \frac{X}{Y}$ represents fixed revenue/expenditure-to GDP ratio, $(\eta_R - 1), (\eta_X - 1)$ denotes elasticity of revenue/expenditure with respect to GDP.

Table 2 presents these semi-elasticities for EU countries. Annex 1 presents more detailed information on elasticities used in case of Slovakia. The highest sensitivity of budgetary movements to cyclical fluctuations are in Denmark (0.607), while the lowest in Estonia (0.297).

Table 2 – Country specific budget semi-elasticities

BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	
0.553	0.322	0.391	0.607	0.562	0.297	0.505	0.473	0.476	0.546	0.547	0.434	0.31	
LT	**LU**	**HU**	**MT**	**NL**	**AT**	**PL**	**PT**	**RO**	**SI**	**SK**	**FI**	**SE**	**UK**
0.305	0.471	0.47	0.403	0.566	0.488	0.404	0.463	0.329	0.461	0.332	0.526	0.589	0.482

Source: EC

2.3 The disaggregated CAB approach

The European Central Bank (ECB) has a different methodology to calculate structural budget balances described in the working paper by Bouthevillain et al. (2001). The authors suggest a disaggregated approach, where the cyclical component is measured via gaps in the relevant macroeconomic bases instead of the overall output gap. The aggregate output gap can mask important differences in underlying developments with different implications for the budget. Consequently, individual gaps in macroeconomic variables have to be estimated and corresponding budgetary items and related elasticities have to be identified.

While on the revenue side there are four items usually included – personal income tax, corporate income tax, indirect taxes (VAT, excise duties) and social security contributions, there is only one category on the expenditure side – unemployment benefits[9]. The following variables are considered as relevant macroeconomic bases: employment in the private sector, average compensation of employees in the private sector, private consumption, unemployment and corporate profit.

Since some budgetary items are recorded both on the revenue and expenditure side (e.g. taxes and social security contributions paid by public employees and the government as an employer, indirect taxes paid by government for government purchases), adjustment to taxes paid by the government are necessary.

Gaps are estimated using a simple HP filter with a smoothing parameter $\lambda = 30$[10].

$$R_i^C = R\left(\frac{B_i^*}{B_i}\right)^{\epsilon_{Ri,Bi}},\ X_i^C = X\left(\frac{B_i^*}{B_i}\right)^{\epsilon_{Xi,Bi}},$$

where R^C, X^C denotes revenue/expenditure component, $\frac{B_i^*}{B_i}$ inverse of the gap in the corresponding macroeconomic base and $\epsilon_{Ri,Bi}$ the elasticity of the budgetary item with respect to its base.

Similarly to the aggregated approach, budgetary elasticities are estimated directly from the tax code or econometrically by regression.

[9] In some countries pension related benefits are used as well.

[10] The choice of λ=30 should secure that compression effects do not make up for more than 10% of cycles with a length of up to 8 years.

Table 3 – ECB – tax elasticities (EU15)

Tax category (tax base)	ECB	OECD
PIT (employment in private sector)	1	1.39
PIT (compensation per private sector worker)	1.5	
CIT (company profit)	1.2	1.48
SSC (compensation per private sector worker)	1	0.75
IT (private consumption)	1	1
UB (number of unemployed)	0.9	-0.16
Sensitivity of Revenues		*0.43*
Sensitivity of Expenditures		*-0.06*
Overall Sensitivity	**0.53**	**0.49**

Source: ECB

According to P. Kiss and Vadas (2005), there are several shortcomings in the basic ECB methodology[11]. Their main criticism is that partial gaps are not imposed to add-up to the aggregate output gap, there is no econometric link between wages and consumption and differences in deflators are not taken care of. P. Kiss and Vadas use the multivariate HP filter to derive gaps in macroeconomic tax bases. They incorporated a behavioral equation to estimate private consumption since wage gaps and consumption gaps are not independent of each other.

In the production function they assumed labour-augmented technological progress rather than neutral one; in addition they calculated the TFP only with a simple accounting framework instead of estimating Solow residual. Since the weighted sum of the cyclical gap of wages and corporate profit is identical to the output gap, the aggregation constraint has to be satisfied, and any output gap can be employed irrespectively of techniques used.

$$(y_i - y_i^*) = \alpha_t(wp_i - wp_i^*) + (1 - \alpha_i)(f_i - f_i^*)$$

where *y, f, wp,* denotes output, operating surplus, compensation in the private sector respectively, and * their trend or potential values.

After that, they applied multivariate HP filter to derive the gaps.

$$\min_{f^*,wp^*,cp^*,\theta_1,\theta_2,\theta_3,\theta_4} = \left[\begin{array}{c} \sum(f_i - f_i^*)^2 + \lambda\sum(\Delta f_i^* - \Delta f_{i-1}^*)^2 \quad + \\ \sum(wp_i - wp_i^*)^2 + \lambda\sum(\Delta wp_i^* - \Delta wp_{i-1}^*)^2 + \\ \sum(cp_i - cp_i^*)^2 + \lambda\sum(\Delta cp_i^* - \Delta cp_{i-1}^*)^2 \quad + \\ \sum[\Delta cp_i^* - (\theta_1 + \theta_2(cp_{i-1}^* + \rho - wp_{i-1}^*) + \theta_3\Delta cp_{i-1}^* + \theta_4\Delta wp_i^*]^2 \end{array}\right]$$

where *cp* represents private consumption and * trend or potential value. In a more recent modification (what we actually use) the wage gap is divided into two parts: employment gap

[11] Which is currently used by the whole European System of Central Banks (ESCB).

(can be a model-based estimate externally calculated as in P. Kiss and Reppa, 2010) and average compensation gap. The unemployment gap is a simple function of the employment gap and the sum of employment and unemployment. P. Kiss and Reppa also argue that the financial crisis might have changed the behavioral relationship between wages and consumption, which is a topic we leave for further research.

Secondly, they deal with the „price problem", since cyclical positions (of real vs nominal variables) might have opposite signs in extreme cases. The macroeconomic variables used in the estimation are defined in real terms, while all the budgetary items are nominal. Besides, some economic indicators are more affected by CPI (wages, private consumption), for others the GDP deflator is more suitable. P. Kiss and Vadas introduced a variable called "price gap" as the difference between CPI and GDP deflators to overcome the problems with different deflators.

Let's consider $BI_i^R = (MB_i^R)^\alpha$ where BI denotes ith budgetary item, MB its corresponding macroeconomic base, R denotes variable in real term and α the elasticity of revenue/expenditure item to its base and let's assume the base is deflated by CPI. The following formula holds:

$$BI_i^R P^{GDP} = (MB_i^R)^\alpha P^{CPI} \frac{P^{GDP}}{P^{CPI}}$$

Since $BI_i^R P^{GDP} = BI_i^N$, N denotes variable in nominal term and $P^{CPI} = (P^{CPI})^\alpha (P^{CPI})^{1-\alpha}$, then $BI_i^N = (MB_i^R P^{CPI})^\alpha P^{GDP} (P^{CPI})^{1-\alpha-1} = (MB_i^N)^\alpha P^{GDP} (P^{CPI})^{-\alpha}$, taking logarithm:

$bi_i^N = \alpha(mb_i^N) p^{GAP}$ and the price gap is defined as

$$p^{GAP} = p^Y - \alpha p^{CPI}.$$

2.4 Some recent improvements

Technical note by the IMF (Bornhorst et al., 2011) gives some practical advices when estimating cyclically adjusted budget balances. This guide lists advantages and disadvantages of both methods, while recommends using the disaggregated method to overcome possible composition effects. Furthermore the paper stresses the importance of considering other relevant indicators beyond usual business cycle fluctuations. Financial cycles, commodity price cycles or for example terms of trade cycles might be relevant in some cases to calculate the „true" underlying budget balance.

Researchers at the BIS also investigated the role of financial cycles for the output gap estimation (Borio et al, 2013 and 2014). According to them there is a conceptual problem with the definition and measurement of the output gap. They argue that output may be on an unsustainable path even if inflation is low. By including financial cycles into the analysis Borio et al. were able to improve the precision of output gap estimates. Moreover the results were robust in real-time.

The basic set-up is the following state-space representation:

$$\Delta y_t^* = \Delta y_{t-1}^* + \varepsilon_{0,t}$$

$$y_t - y_t^* = \gamma' x_t + \varepsilon_{2,t}$$

where y_t is the log output, x_t is a vector of economic (financial) variables. When estimating the measurement equation, standard estimators assign a zero weight to any information in x_t that does not help to explain business cycle fluctuations. Borio et. al (2013) include private sector credit and property prices into their final specification.

Lendvai et al. (2011) builds on the commonly agreed methodology in the EU by adding absorption cycles to the computation. They argue that large swings in external balances can have transitory effects on budget revenues beyond the cyclical component attached to traditional business cycles.

PBO carried out a study (Barnett and Matier, 2010) based on the traditional production function. To better capture the specificities of the Canadian economy, trading gain effects (income gap) were also identified. In addition, time-varying elasticities were used from a microsimulation model.

2.5 One-off and temporary measures

The last step in calculating the SB involves adjustment to one-off effects. Joumard et. al (2008) describes two possible methodologies to identify one-offs. The first one is based on a disaggregated approach in which "one-offs are identified individually on a more systematic and comprehensive basis." The second possibility according to them is to simply de-trend the national accounts data for net capital transfers to get a proxy for one-offs. Their main arguments in favor of the second approach are the following: no clear-cut definition of one-offs, information availability in some countries and complexity of the task[12].

In the European framework the definition in the Code of Conduct (EC, 2012) is very general: "one-off and temporary measures are measures having a transitory budgetary effect that does not lead to a sustained change in the inter-temporal budgetary position." In the footnote there are some examples: sales of nonfinancial assets; receipts of auctions of publicly owned licenses; short-term emergency costs emerging from natural disasters; tax amnesties; revenues resulting from the transfers of pension obligations and assets.

The definition is further clarified in the Public Finances in EMU (EC, 2006) and in Larch and Turrini (2009). It mentions several common features of one-offs: i) temporary influence on the

[12] In countries where IFIs are available these arguments are much less relevant.

deficit (one or a very limited number of years); ii) non-recurrence of measures; iii) only measures with significant impact should be considered (above 0.1% of GDP) and iv) no deficit-increasing measures should be excluded (with some exceptions). There is also an indicative and open list of one-offs in the public finance report.

Hoffmann and P. Kiss (2010) focus on the medium-term orientation of fiscal policy as to whether it contributes to the savings and investments of the economy and the sustainability of the external balance. They point out that the more we focus on individual items compared to aggregates, the more one-off measures we found. In addition to that Hoffmann and P. Kiss distinguish between "self-reversals" and "policy reversals" and use a forward looking four-year moving average to filter out underlying trends.

3 Evaluation of real-time estimates for Slovakia

In this section we illustrate the difficulty to estimate structural budget balances in Slovakia[13]. Since there is a clear threshold for the deviation of the SB from the MTO (0.5% of GDP in one year or 0.25% of GDP on average in two years) in the Fiscal Compact, we compare our results with this benchmark at the end of the section.

3.1 Real time estimates of SB

First we created a database containing all the vintages of quarterly real GDP (and other relevant variables like real private sector consumption etc.) available in real-time from 2002 onward (starting with the first quarter in 1995[14]). To allow comparison with the estimates of domestic and international organizations, we run the models on datasets ending in second (available in autumn) and fourth (available in spring) quarters. For our evaluation purposes we tried to use 5 methods on real time data and compared them with the benchmark estimates of the EC. We compared only CABs since one-offs were not available for every method.

MoF – based on the output gap calculated by the Ministry of Finance, we simply multiplied the results with the aggregate budget sensitivity 0.29[15].

NBS – since the National Bank of Slovakia (NBS) does not publish its estimate of SB, we replicated its methodology on real-time data (but without using forecasts when filtering macroeconomic aggregates; also no adjustments were made to exclude taxes paid by the public

[13] The problems with estimating the output gap are described in a companion paper (Ódor and Jurašeková Kucserová, 2014).

[14] The first two years of the existence of Slovakia (1993-1994) showed significant structural and methodological changes, so we dropped these data from our database (with the exception of soft indicators).

[15] In the past the EC used budget sensitivity instead of semi-elasticity (0,332).

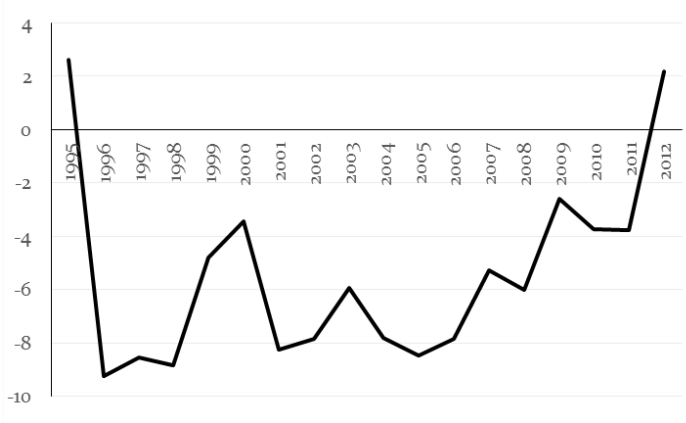
sector). Therefore the figures presented cannot be regarded as official estimates of the National Bank of Slovakia.

MNB – As we already mentioned, there are several shortcomings in the ECB methodology identified by P. Kiss and Vadas (2005). Therefore we estimated the cyclical components also with some of the refinements introduced by the researchers from the Hungarian central bank. The main differences are that partial gaps are imposed to add-up to the aggregate output gap[16] and there is an econometric link between wages and consumption. It should be noted that the official estimates of the MNB currently use model-based gaps instead of the multivariate HP filter as noted in P. Kiss and Reppa (2010).

IMF – The IMF (Bornhorst et. al, 2011) uses the standard two-step OECD procedure to calculate structural budget balances, however it also highlights several possibilities to augment the method by obtaining information from commodity prices, asset prices, current accounts, property prices or for example terms of trade. We tried to estimate the equations econometrically with these additional elements but without satisfactory results.

CAAB – We also experimented with the CAAB method invented by Lendvai et al. (2011), however we were not able to get plausible current-account norms due to many important structural changes in the dataset (for example the huge supply side shock from car production in the second half of the last decade). Arguably, there is more uncertainty around the current account norm in Slovakia than the output gap.

Figure 1 – Evolution of current account deficit in Slovakia (% of GDP)



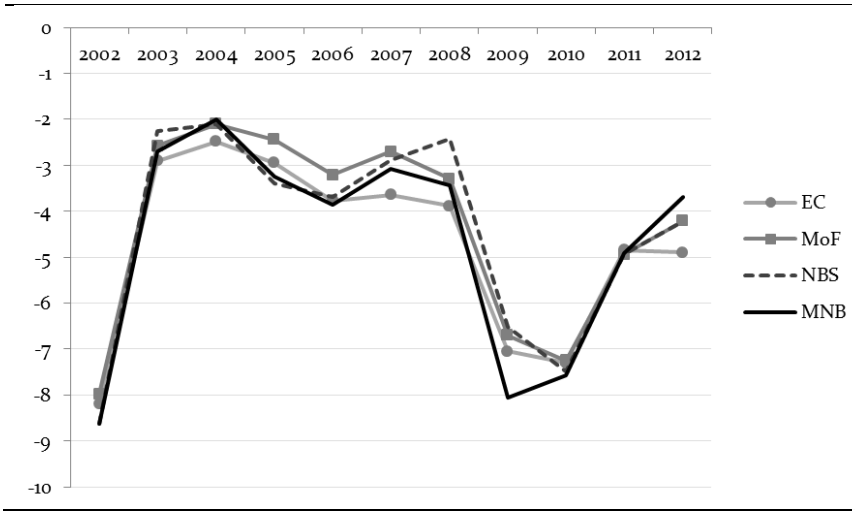
Source: NBS

Figure 2 depicts the latest vintage of cyclically-adjusted budget balances (without the IMF and CAAB methods). It is important to note, that this exercise does not use forecast augmented time series for the MNB and NBS method and was carried out only for illustration purposes.

[16] In this exercise we used the output gap from principal component analysis (Ódor and Jurašeková Kucserová).

The results show substantial swings in the CAB mainly because of two important waves of austerity periods (2003-2004) and (2011). But the interesting part is the dramatic deterioration of the structural deficit after the break-out of the financial crisis. Partially it was caused by setting expenditures based on pre-crisis trajectories, but more research is needed to understand the whole story: the potential role of financial cycles, absorption cycles or for example time-varying elasticities (more in section 6).

Figure 2 – Last vintage of CAB estimates in Slovakia (% of GDP)



Source: CBR, EC

3.2 Evaluation of results

The interesting question is: what should be the loss function of the independent fiscal institution when calculating estimates of SB? One aspect is definitely stability. To maintain credibility, big changes between different vintages of estimates should be avoided especially in a short-term horizon (up to one year). Second important aspect is plausibility. There is no point in publishing the same number every half year if it is at odds with other important macroeconomic and financial variables.

In our simple evaluation exercise we selected four measures to compare the different methods:

i) AS[17] – absolute difference between the estimate for year t in autumn t+1 compared to spring t+1; in other words the difference between the first estimates available after the completion of year t when deviation from the MTO can trigger correction mechanisms

ii) SS – absolute difference between the estimate for year t in spring t+2 compared to spring t+1

[17] A=autumn, S=spring, L=last

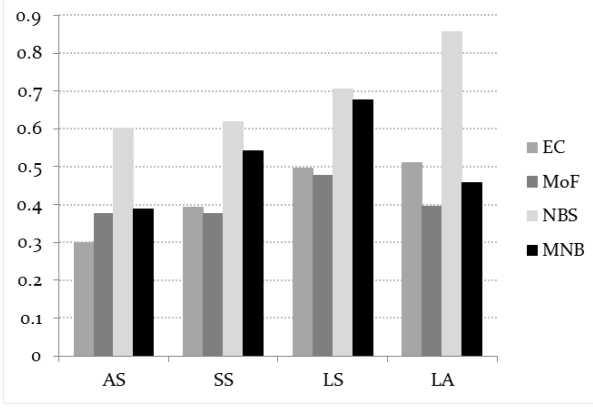
iii) LS – absolute difference between the estimate for year t in the last vintage compared to spring t+1; in other words difference between the very last and very first vintage after the completion of year t

iv) LA– absolute difference between the estimate for year t in the last vintage compared to autumn t+1

Comparison of estimates during one-year (from spring t+1 to spring t+2) is important because of credibility, while differences between first estimates and the last vintage are more about changes in views over time, when more data points are available. Figure 2 and Figure 3 illustrates the average value for these four statistics for the CAB estimates. If we compare last estimates with the first two for a given year, the MNB methodology delivers the smallest average revisions. On the other hand, the aggregated method is more stable on a one-year horizon.

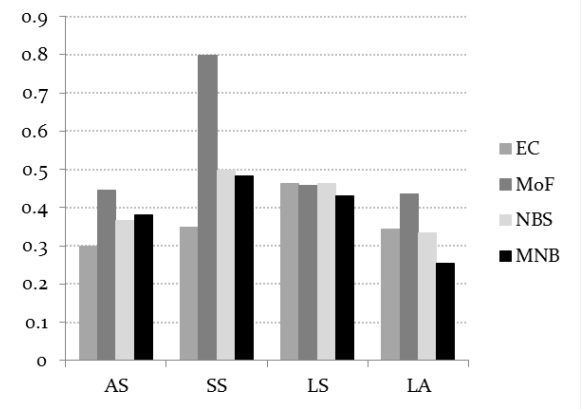
The magnitude of the average absolute revisions to the *change* in the CAB is substantial compared to the definition of the "significant deviation" in the SGP and the Fiscal Compact.

Figure 3 – Average absolute revisions to CABs (% of GDP)



Source: CBR

Figure 4 –Average absolute revisions to *change* in the CAB (% of GDP)



Source: CBR

The final step to calculate structural budget balances is to adjust the CAB figures to one-off and temporary effects. Since this was available only for the European Commission, the evaluation of real-time SB figures compared to the numerical benchmark in the Fiscal Compact was possible solely in case of this method.

Before we turn to the results, it is important to note that the application of the definition of one-offs in practice is also not without problems. There are important borderline cases and because of capacity constraints it is not always easy for the EC to spot all one-offs in real time[18]. The following examples illustrate this point (in case of Slovakia):

[18] Especially if countries are not transparent enough with their budgets.

- repaying or assuming old debt is not always a one-off according to the EC; in autumn 2011 the estimate of the Commission for one-offs was -0.8 % of GDP, while one-year later for the same period +0.5 % of GDP (the huge difference is mainly due to repayment of old liabilities)
- by decreasing the contributions to a fully funded pension pillar not much happens with the inter-temporal budgetary position (more revenue for the government now but also more future liabilities); despite the definition mentioned in section 2.5. it was not identified as one-off
- sales of oil reserves or dividends from asset revaluations were not regarded as one-off by the EC.

Now we turn to the illustration of the uncertainty involved in calculating SB with the commonly agreed methodology. We calculated the above-mentioned four simple statistics for the *change* in the SB. According to the Fiscal Compact one should assess whether this variable is bigger than 0.5 in one year on 0.25 on average in two years.

Table 4 – Average revisions to SB changes (EC methodology, % of GDP)

Changes	2006	2007	2008	2009	2010	2011	MIN	MAX
AS	-0.2	-0.2	-0.3	-1.4	0.2	-0.2	**-1.4**	**0.2**
SS	0.0	-0.6	-0.1	-1.4	0.2	-0.3	**-1.4**	**0.2**
LA	0.9	-0.4	0.8	0.2	-0.3	-0.1	**-0.4**	**0.9**
LS	0.7	-0.6	0.5	-1.2	-0.1	-0.3	**-1.2**	**0.7**
Absolute							**AVG**	**MED**
AS	0.2	0.2	0.3	1.4	0.2	0.2	**0.42**	**0.2**
SS	0.0	0.6	0.1	1.4	0.2	0.3	**0.43**	**0.25**
LA	0.9	0.4	0.8	0.2	0.3	0.1	**0.45**	**0.37**
LS	0.7	0.6	0.5	1.2	0.1	0.3	**0.58**	**0.55**

Source: CBR

The average absolute change in the policy relevant variable was in the first six months 0.42 pp (median 0.2 pp), while on a one-year horizon it reached 0.43 pp (median 0.25). The changes were slightly more significant if we compare the first estimates with the most recent vintage of estimates (average 0.58 pp, median 0.55 pp). **It clearly illustrates that with this methodology it was extremely hard to assess the degree of structural consolidation in real time compared to the benchmark in the FC.** Now we turn to a general assessment of the current benchmark methodology.

3.3 Main challenges in applying the current benchmark methodology

From the discussion above it is clear that estimating structural budget balances is a challenging task. Lack of clear definition and methodology can create lot of confusion, not mentioning revisions in data. The current benchmark method in Europe (Larch and Turrini, 2009 and

Mourre et al. 2013) has a lot of shortcomings resulting in frequent and substantial revisions of structural budget balance estimates:

- no role for financial or absorption cycles
- output composition does not matter
- no clear and consistent definition of one-offs; actually it is not possible to get detailed information about one-offs based on the methodology of the EC
- no time-varying budgetary elasticities (important if there are legislative changes)
- high sensitivity to data revisions, since are based on GDP data
- end-point problems of the HP filter.

4 Improving the estimation of SB in Slovakia

First we look at the room for improvement in estimating cyclically-adjusted balances, while in the second part of this section we define 10 principles to identify one-off and temporary measures. Given past revisions to SB estimates, both parts are very important from a practical point of view.

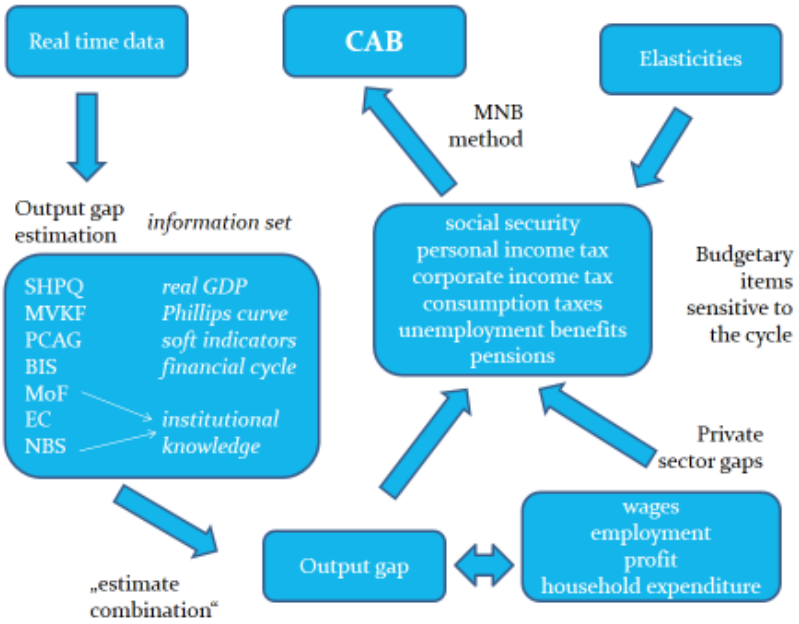
4.1 Estimation of CAB

We agree that fiscal rules at the EU level require a common methodology to calculate output gaps and structural budget balances accepted by all countries. However making figures comparable across countries is clearly not the best alternative if the focus is on domestic rules. One-size-fits-all methodology is usually a compromise, actually resulting in one-size-fits-none. Since international comparability is not a constraint, we wanted to be as pragmatic as possible, while taking into account the specificities of the Slovak economy.

In a companion paper (Ódor and Jurašeková Kucserová, 2014) we showed how to calculate more robust estimates of the output gap. The second step is the calculation of the cyclically-adjusted budget balance. From the above-mentioned four methods two are basically the same (the difference between the EC and MoF is the estimate of the output gap). The other two (MNB and NBS) are also very similar, while the former is more theoretically sound than the latter. In our view there is no point in combining only two methodologies, so we have decided to use the MNB method as our benchmark with a slight modification: the elasticities of taxes to their respective bases will be in some cases calculated via the CBR´s microsimulation model (as in Barnett and Matier, 2010) or through expert adjustments. Annex 6 contains further details. Disaggregated methodology is better suited for a small and open economy, since the same output gap can be a result of very different gaps in domestic versus external demand (GDP growth mainly due to exports has much lower tax revenue content). Figure 5 illustrates the chosen methodology.

For comparison purposes we also plan to report estimates of the structural balance based on the EC methodology using our combined output gap measure and to explain the differences between the two (see Annex 5).

Figure 5 – CBR´s methodology to calculate CABs



In section 3.1 we presented estimates of the CAB based on the MNB methodology. These were using the PCA output gap and were created just for comparison purposes with the NBS methodology. Also, no forecasts were added before filtering the data. We plan to augment the series with macroeconomic forecasts of CBR in the future. In the next section we present the full method using the combined output gap estimates, elimination of price effects, inclusion of pension expenditures and exclusion of taxes paid by the government.

4.2 One-offs

The single most important test for identifying one-off and temporary measures in our view is the likely impact of the transaction on the inter-temporal net worth. If there is no significant implication, the measures should be considered as one-offs. It is similar to the definition employed by the EC, where the inter-temporal budgetary position is the key indicator.

It is of course impossible to describe all possible one-off effects ex-ante[19]. Instead we have identified 10 guiding principles in line with the above-mentioned approach[20]:

1. Time horizon – medium term measures; no exact number of years are determined, since it can create bad incentives when designing measures.
2. Transaction value – greater impact than 0.05% of GDP in at least one year
3. Type of transaction – changes in the composition of the public sector balance sheet will be treated as one-offs (asset sales, revaluation gains, etc.)
4. Sign of the budgetary impact – more strict treatment of measures decreasing the deficit compared to transactions with negative impact
5. Consistency – same treatment across time
6. Legal power – constitutional acts are more likely to be permanent (harder policy reversals)
7. Implicit and contingent liabilities – transaction with no impact on the intertemporal budgetary position will be treated as one-offs
8. Capital expenditures – permanent measures as a rule
9. Accrual treatment – time of transaction is more important than the cash-flow
10. Political risk – careful examination of measures adopted at the end of the election cycle (transferring burden to the next government)

To calculate the real underlying budgetary position it is necessary to analyze very carefully all possible one-off effects. This is an area, where independent fiscal institutions can play an important role in the new EU fiscal framework. Especially one-offs that should be "included" instead of excluded from the headline balance (Hoffman and P. Kiss, 2010). For example, the government can "shift" the part of the deficit to public companies by cutting transfers in several years with an intention to bail them out at a later point in time.

5 Structural budget balances in Slovakia

In this section we illustrate our preferred methodology and offer a comparison to other methods/approaches.

First we start with the output gap since it is the most relevant indicator for the aggregated method. Figure 6 and Figure 7 show the last vintage (Autumn 2013) of OG estimates of the EC and the "estimate combination" used by the CBR21 and the resulting cyclical component.

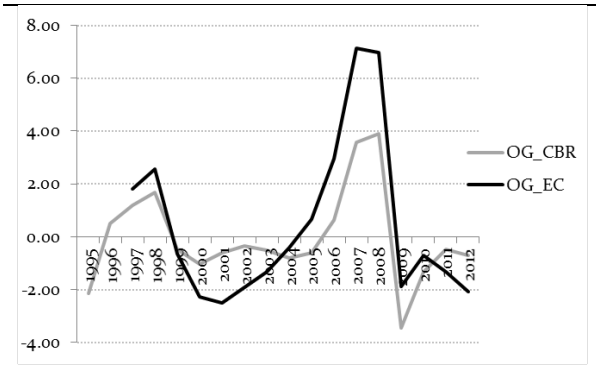
[19] Some one-offs are not self-reversing, but can be defined as policy reversals and therefore can be identified usually only ex-post.

[20] The CBR - contrary to the EC - plans to publish all one-off measures with an explanation of which principles are responsible for the identification of the individual one-offs.

[21] Calculation based on the Spring 2013 vintage, since it was the last vintage available in the Ódor and Jurašeková Kucserová (2014) paper.

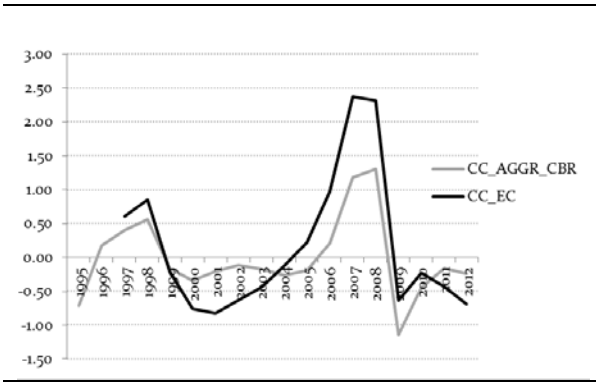
The difference is substantial especially in the period 2006-2008, where the EC estimates huge positive output gap. It is hard to reconcile with the relatively low inflationary pressures and improving current account figures in those years. The only plausible explanation – financial cycles – are not enough in our view to justify positive output gap well over 6% of GDP.

Figure 6 – OG estimates (% of GDP)



Source: CBR

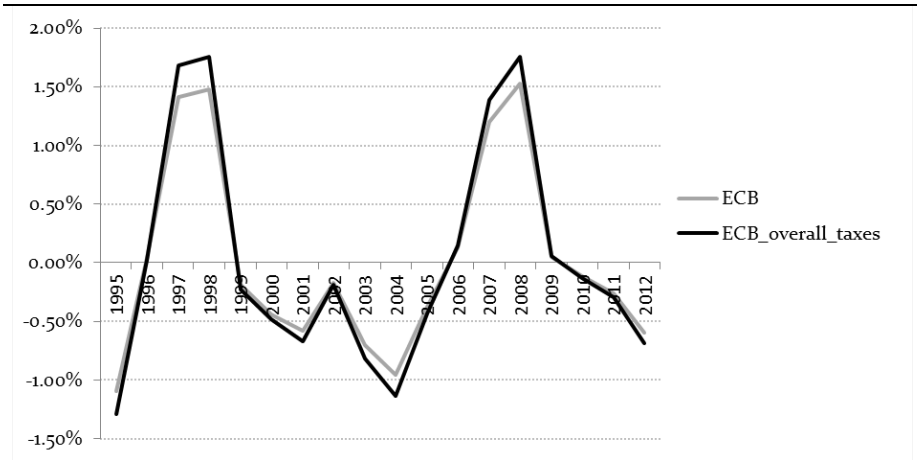
Figure 7 – CC estimates based on the aggregated methodology (% of GDP)



Source: CBR

As we stated earlier, aggregated approaches can mask important composition effects, so it is worth looking at different trends in macroeconomic bases. For comparison purposes we start the analysis with the current methodology of the National Bank of Slovakia (NBS). It is basically the Bouthevillain et al. (2001) standard approach used by the ECB. First, to highlight the effect of taxes paid by the government, we applied the standard methodology to unadjusted data and compared the results with net taxes used. The next figure illustrates this difference[22] in the final cyclical component (we used the same elasticities reported in Annex 1).

Figure 8 – Cyclical component using different tax revenues (% of GDP)

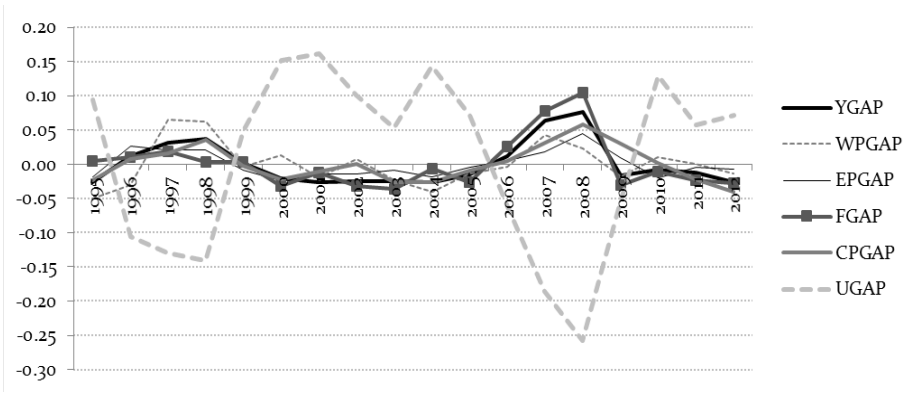


Source: CBR, EC

[22] We used no forecasts to augment time series before filtering.

The maximum difference is 0.18% of GDP, which is not very significant. The corresponding gaps in macroeconomic tax bases are illustrated on figure 9. The co-movement of cycles is apparent, but in some periods important differences emerge. The definition of variables is described in Annex 3.

Figure 9 – Gaps in macroeconomic bases (% of GDP)



Source: CBR, EC

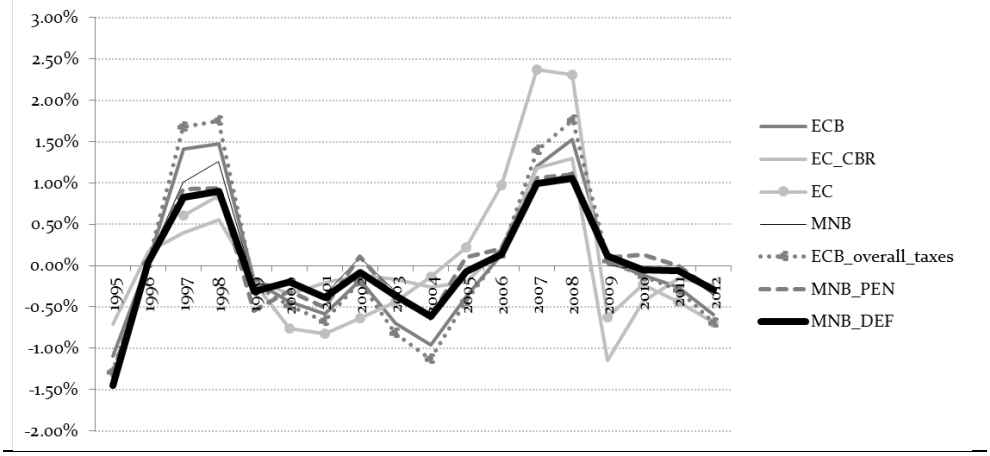
As a next step we have decided to modify the basic results in four important ways:

- pension expenditures were included in the analysis, since the basic indexation mechanism is partially linked to real wage development in the previous year;
- internally consistent gap measures were used, there should be a theoretical link for example between the employment and unemployment gap (identity) or between the gap in private consumption and the wage bill (behavioral equation);
- price gaps were eliminated – as Kiss and Vadas (2005) show due to different deflators the link between real and nominal gaps is not straightforward ($p^{GAP} = p^{Y} - \alpha * p^{CPI}$); we used GDP deflator to get real values for all series to eliminate this gap.
- elasticities in some cases are the function of the tax code and the income distribution; instead of using constant elasticities, we have decided to use the microsimulation model of CBR to calculate time-varying elasticities in the future based on the standard OECD methodology[23]

Final results - without the last adjustment – are reported on Figure 10.

[23] The elasticity of income tax is derived as follows: $\varepsilon_{tax,w} = \frac{\sum_{i=1}^{n} \gamma_i MA_i}{\sum_{i=1}^{n} \gamma_i AV_i}$, where γ_i is weight of earnings level i in total earnings, MA_i is the marginal income tax rate of a representative household at point i on the income distribution and AV_i is the average income tax rate of the representative household at point i of the income distribution. Representative household is defined as a full-time, two-earner married couple with two children, with the secondary earner receiving 50% of the wage of the principal earner. A log-normal distribution has been fitted according to two parameters, the ratio of the earnings level at the first decile to the median earnings level and the ratio of the ninth decile to the median level.

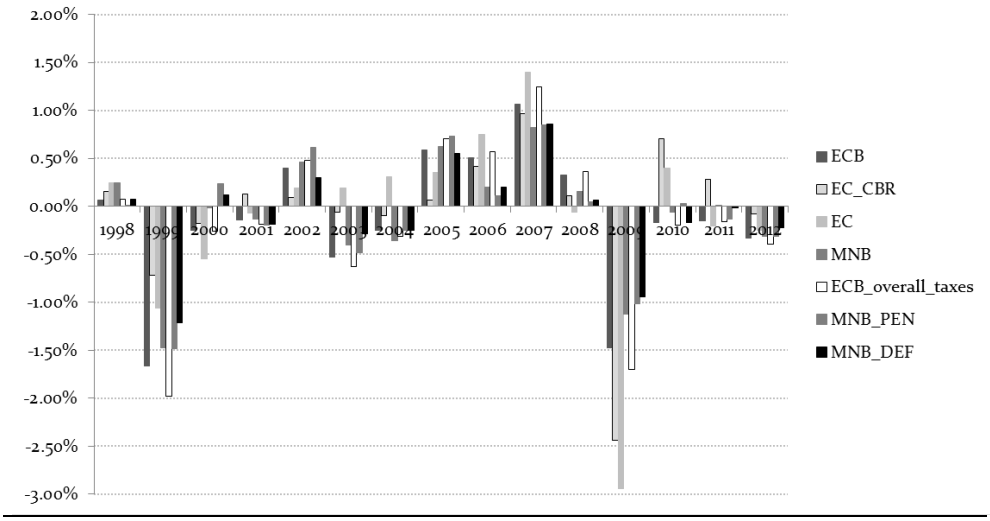
Figure 10 – Cyclical components from different approaches (% of GDP)



Source: CBR, EC

It is also informative to look at the *change* in the CAB, since it is more relevant from a policy point of view. The next figure illustrates this variable calculated by different methods. In some years the differences are substantial. The average difference between the maximum and minimum estimate across methods in the period 1998 - 2012 was 0.71 percentage points (median was 0.64 pp).

Figure 11 – Change in the cyclical components from different approaches (% of GDP)



Source: CBR, EC

To arrive at the estimate of structural balances, we need to include one-off and temporary measures. The next table shows the one-offs identified by the CBR based on the above-mentioned ten principles. These effects are not negligible and in some years reach more than 1% of GDP.

Table 5 – One-off and temporary measures identified by CBR[24] (%GDP)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
- stockpiling in excise taxes	-	-	0.3	-0.3	0.5	-0.3	-0.2	-	-	-	-	-	-	-
- exit from the fully-funded pension pillar	-	-	-	-	-	0.2	0.2	-	-	0.1	0.3	-	-	-
- personal income tax (temporary increase of basic tax allowance)	-	-	-	-	-	-	-0.3	-0.3	-	-	-	-	-	-
- tax on excess emission allowances	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-
- tax amnesty	-	-	0.2	-	-	0.0	-	-	-	-	-	-	-	-
- VAT (accrual change due to EU membership)	-1.0	-	-	-	-	-	-	-	-	-	-	-	-	-
- revenues of Social Insurance Agency from debt bailout in healthcare	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-
- VAT revenue from a PPP project	-	-	-	-	-	-	-	-	0.3	0.0	0.0	0.0	0.0	0.0
- extraordinary profit from the central bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- voucher privatization revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- revenues from the sales of telecommunication licenses	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-
- debt remission towards foreign countries	-0.4	0.0	-0.9	0.0	0.0	-	0.0	-	-	-	-	-	-	-
- foreign debt repayment via goods	-0.1	0.0	0.0	-0.1	0.0	0.0	0.0	-	-	-	-	-	-	-
- remission of receivables towards non-financial corporations	-	-	-	-	-	-0.4	-	-0.1	-	-	-	-	-	-
- assumption of high-risk guarantee of National Property Fund	-	-	-	-0.1	-	0.0	-	-	-	-	-	-	-	-
- costs of bank bailout	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- costs of natural disasters (drought/floods)	0.0	-	-	-	-	-	-	-0.2	-	-	-	-	-	-
- accrualisation of high-risk state guarantees	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- accrualisation of railway companies´ and hospitals´ liabilities	-	-	-	0.1	-	0.3	0.3	0.4	-0.9	-	-	-	-	-
- special levy in the banking sector (incl. CIT)	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
- temporary entrepreneurial levy in regul. industries (incl. CIT)	-	-	-	-	-	-	-	-	-	0.0	0.2	0.1	0.1	0.1
- taxation of retained earnings before 2004	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-
- digital dividend	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
- extended levy in banking sector	-	-	-	-	-	-	-	-	-	0.0	0.1	0.1	0.1	0.1
- selling of strategic oil reserves outside the GG sector	-	-	-	-	-	-	-	-	-	-	0.6	0.0	0.0	0.0
- cancelled "bearer" deposits	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
- dividends	-	-	-	-	-	0.1	0.1	0.0	0.2	0.3	-0.4	0.8	0.2	0.2
- revenues from sales of state property	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-
- JAVYS (voluntary grant)	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-
- reimbursement of EU sources in transport sector	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-
- repayment for loans of Cargo	-	-	-	-	-	-	-0.3	-	-	0.0	0.0	0.1	0.0	0.0
- repayments of loans Water-management development	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.1	-	-
TOTAL (%GDP)	**-1.4**	**0.0**	**-0.5**	**-0.4**	**0.5**	**-0.1**	**-0.2**	**-0.1**	**-0.2**	**0.5**	**1.0**	**1.7**	**0.4**	**0.4**

Source: CBR

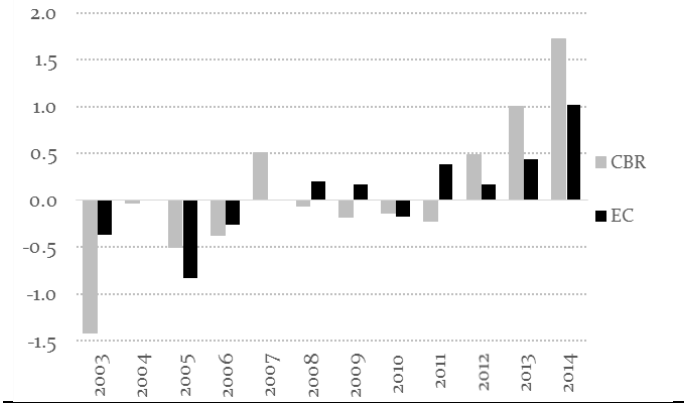
The list of one-off and temporary measures is not the same as the one used by the European Commission. The main differences are:

- old debt repayments
- decrease of mandatory contributions to the fully-funded pillar of the pension system
- basic threshold to identify one-offs
- dividends resulting from asset revaluations.

Figure 12 illustrates how important are differences in identifying one-offs and why one should be as transparent as possible in reporting these transitory effects.

[24] All one-offs identified were included irrespective of the impact (≥0.05 % GDP).

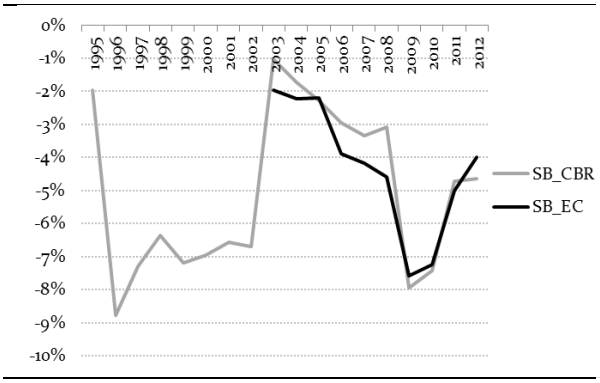
Figure 12 – One-off and temporary measures (% of GDP)



Source: CBR, EC

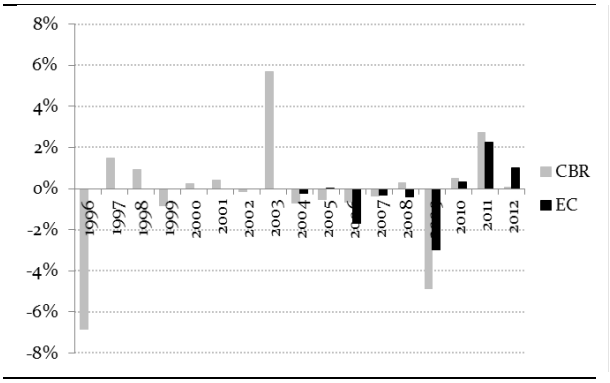
The resulting structural budget balances are highlighted on the next figure.

Figure 13 – SB estimates (% of GDP)



Source: CBR

Figure 14 –Change in SB (% of GDP)

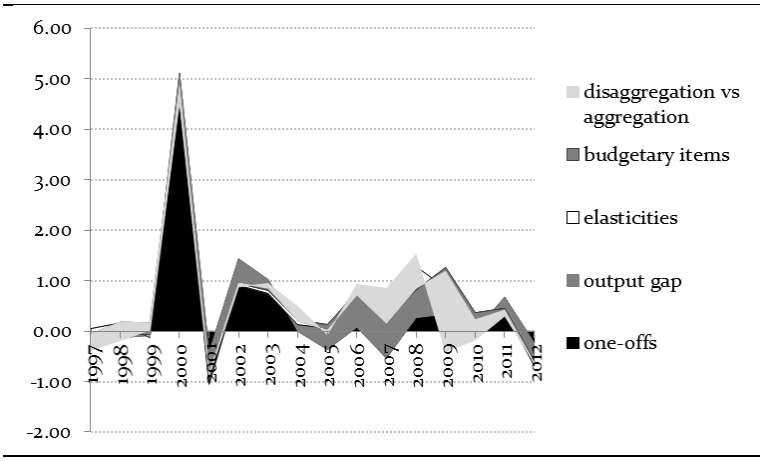


Source: CBR

There are important differences between the estimates of the European Commission and the CBR[25]. The complete break-down of differences is presented in Annex 5. We have calculated 5 important factors, which contributed to the difference: measure of the output gap, disaggregated methodology instead of aggregated, different elasticities, different set of budgetary items sensitive to the cycle and different definition of one-off and temporary measures. In some years the differences are more than the thresholds in the Fiscal Compact.

[25] It is important to note that the EC calculates one-off effects for Slovakia only since 2003. In earlier periods SB=CAB.

Figure 15 – Difference between SB estimates of the EC and the CBR (% of GDP)



Source: CBR, EC

To better understand the changes in structural budget balances, the top-down approach should be complemented with a bottom up approach, where the consolidation effort is not calculated as a residual, but rather as the size of discretionary actions compared to some form of no-policy-change (NPC) scenario. CBR (2013) also uses an alternative "combined" measure, where this bottom-up approach is adjusted to cyclical movements and one-off measures. Similar approach was taken also by Kremer et al. (2006) in an internationally comparable way. Presentation of disaggregated approaches with applications to Slovakia can be found in Annex 2. These methods can play an important role especially when evaluating effective action in the procedures of the Stability and Growth Pact.

6 Conclusions and further work

In this paper we looked at different estimation techniques to calculate structural budget balances in Slovakia. Since the change in SB is now a relevant policy indicator, it is important to better understand cyclical development in budgets and to define clear principles to identify one-off and temporary measures.

The current benchmark methodology is surrounded by substantial uncertainty, in some cases the revisions are higher than the definition of the "significant deviation" in the SGP, which raises some question marks regarding the implementation of the Fiscal Compact.

Slovakia is a small and open economy with many shocks hitting the economy from the external environment. Therefore we have decided to use disaggregated approaches to arrive at an estimate of changes in the structural budget balance. However, to get a more complex view of underlying trends, this analysis will be complemented by i) estimates from the aggregated

approach based on the output gap calculated by CBR, ii) bottom-up approaches with a more direct focus on discretionary measures.

The currently used disaggregated method by the NBS will be adjusted to reflect five important issues:

1. Taxes paid by the government will be adjusted using different assumptions[26]
2. Pension expenditures included
3. Link between various gaps will be established
4. Price effects eliminated
5. Time-varying elasticities based on microsimulation models or expert adjustments.

Despite these improvements there are still important questions for further research:

- Possible econometric estimation of some of the elasticities. Time-varying elasticities for CIT and VAT.
- More detailed analysis of the revenue and expenditure side, with possible inclusion of other items in cyclical adjustment (i.e. interest expenditures or some social benefits).
- Analysis of temporary measures via moving averages (especially important in case of investments and EU-related expenditures).
- Financial cycles and the BIS methodology. Generally speaking a lot more resources should be devoted in Slovakia to study the beyond-inflation concept of output gap. It can be useful in the future, since the nominal convergence process will imply higher inflation and lower real interest rates in the future for Slovakia. If that happens, credit cycles might mask the underlying budgetary position.
- Analysis of current account developments and their effect on budgetary variables.

[26] Mainly in case of indirect taxes.

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Annex 1 – Elasticities used in calculations

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
- PIT-to-Y	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
- CIT-to-Y	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
- SSC-to-Y	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
- IT-to-Y	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
- UB-to-Y	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8	-5.8
- overall EC	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332
- DHT-to-AC	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
- DHT-to-E	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
- SSC-to-AC	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
- SSC-to-E	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
- F-to-GOP	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
- IT-to-PC	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
- UB-to-U	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
- PEN-to-AC	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54

In our comparison exercises we used constant elasticities for Slovakia. The upper part of the table is adopted from the OECD/EC method, where elasticities of tax revenues and unemployment benefits to output are highlighted (PIT refers to personal income tax, CIT to corporate income tax, SSC to social security contributions, IT to indirect taxes and UB to unemployment benefits).

The lower part of the table is used for the disaggregated method, where elasticities of budgetary items to corresponding macroeconomic bases are necessary (DHT is direct household taxes, F is profit tax, PEN is pension expenditure[27], while AC means average compensation, E is employment, PC is private consumption, GOP is gross operating surplus and U is unemployment)[28].

Researchers usually devote less attention to elasticities, but in our view the topic is very important to calculate structural budget balances correctly. There are several problems and difficulties when estimating elasticities (P. Kiss and Vadas, 2005):

- nominal elements of the tax system, i.e. bracket creeping, surprise inflation, etc.
- private decisions in a form of tax evasion or using tax expenditures,
- asymmetric features of the tax design (carrying forward losses for CIT or inventory cycles for VAT).

[27] We used constant elasticities for pensions with the assumption of identical gaps in public and private wages.
[28] These elasticities were taken from the National Bank of Slovakia.

Annex 2 – Bottom-up approaches[29]

To measure the value of structural adjustments the change in the structural budget balance is not the only available option. Instead of calculating the consolidation effort via top-down approaches, bottom-up approaches can play an important complementary role. Here we briefly describe two such methods.

The first was developed by the CBR with an objective to combine the strengths of calculating the SB on the one hand and discretionary measures on the other hand. Namely, the advantage of the SB is that it filters out cyclical effects and one-off measures, while the major strength of the estimation of the impact of discretionary measures is that it directly refers to government action. CBR (2013) simply adjusts total discretionary measures to the cycle and one-offs.

Table – Comparison of different approaches to measuring consolidation

	NPC scenario (% GDP)	**2013**	**2014**	**2015**	**2016**
1	NPC general government balance	-3.0	-4.6	-4.5	-3.9
2	*of which*: cycle, one-offs, interest, fully-funded pillar, other	-2.1	-3.0	-2.9	-2.9
3	Adjusted NPC general government balance (1-2)	-0.9	-1.6	-1.6	-1.1
	Different approaches to measuring consolidation (% GDP)	**2013**	**2013**	**2014**	**2015**
4	General government balance - target	-3.0	-2.8	-2.6	-1.5
5	*of which*: cycle, one-offs, interest, fully-funded pillar, other	-2.1	-1.3	-2.4	-2.4
6	Adjusted general government balance (4-5)	-0.9	-1.5	-0.1	0.9
7	Consolidation effort - annual change of line 6	**0.8**	**-0.7**	**1.4**	**1.0**
8	Size of consolidation measures - cumulative (4-1)	0.0	1.8	2.0	2.4
9	Size of consolidation measures - annual change of line 8	**2.3***	**1.8**	**0.2**	**0.5**
10	Consolidation effort – **new concept** - cumulative (6-3)	0.0	0.1	1.5	1.9
11	Consolidation effort – **new concept** - annual change of line 10	**1.3***	**0.1**	**1.4**	**0.5**

** Values used in calculation are based on NPC scenario and other data of CBR* *Source: CBR, MF SR*

The second bottom-up or disaggregated approach to analyze structural developments in public finances was developed at the ECB (Kremer et al., 2006). It aims at identifying the structural path of the general government balance and the main revenue and expenditure categories by excluding the effects of economic cycle and temporary measures. In addition to that it measures a few important factors, common to all countries. On the revenue side, changes in structural revenues are attributed to four factors: fiscal drag, decoupling of the tax base from GDP, discretionary fiscal policy measures of a permanent nature and a residual. The residual captures mostly country-specific factors. On the expenditure side, the changes in structural expenditures are split into the contribution of interest payments, social payments, subsidies, compensations, intermediate consumption, investment and other. The residual on the revenue side can be useful also in assessing fiscal forecasts, especially effects of discretionary measures.

[29] We would like to thank Geert Langenus and the NBS for providing us with the Eviews files and input data.

The following table illustrates the application of the methodology on Slovak data.

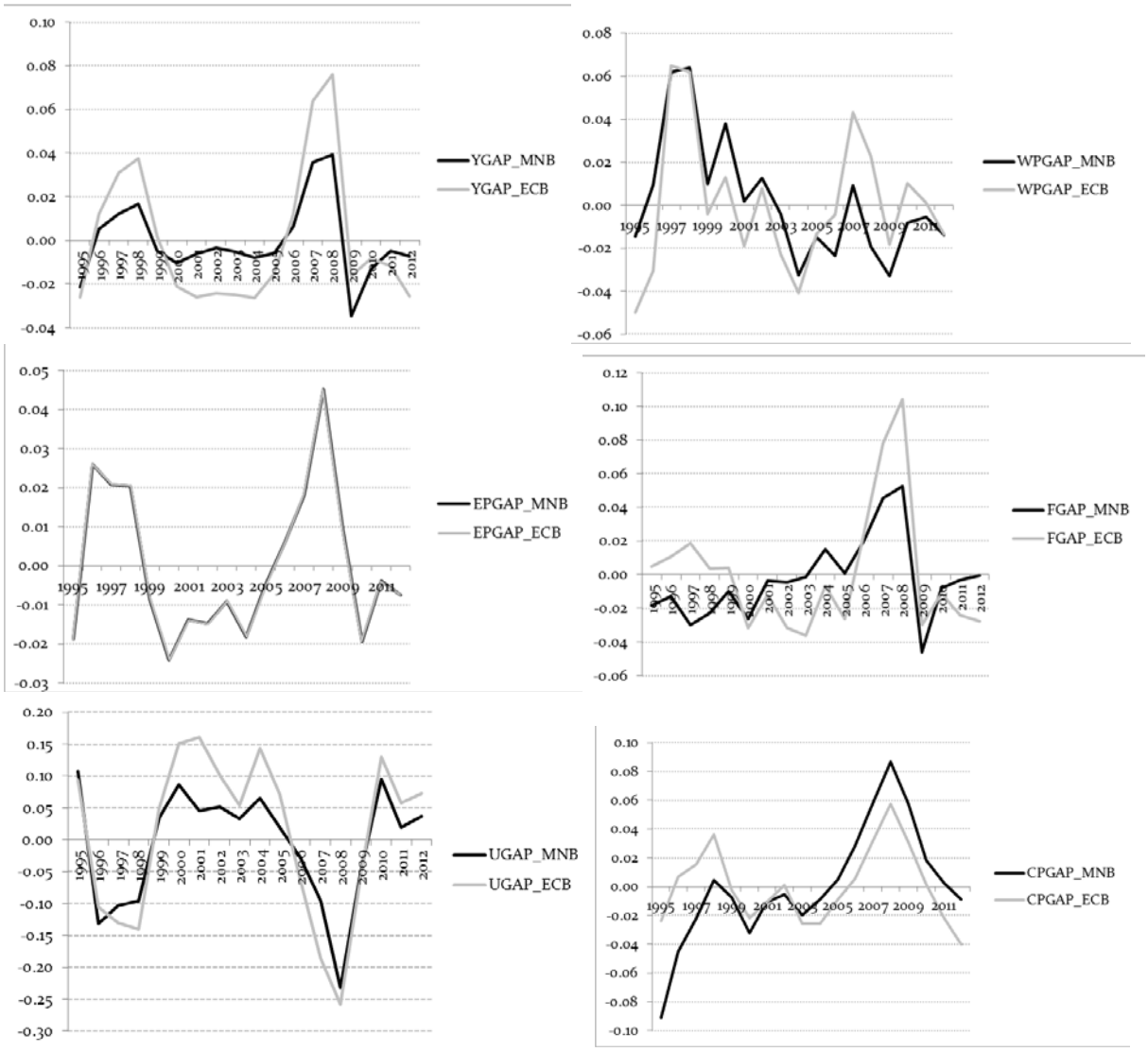
Changes in *cyclically adjusted* fiscal components, excluding temporary measures[1] (as a percentage of trend GDP) (ESA methodology)

Increasing +, decreasing -	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Unadjusted balance[2]	**-4.84**	**5.76**	**-1.71**	**5.44**	**0.42**	**-0.45**	**-0.36**	**1.36**	**-0.28**	**-5.94**	**0.37**	**2.59**	**0.53**
Cyclical component	0.11	-0.12	0.32	-0.36	-0.32	0.78	0.33	0.96	0.36	-1.20	-0.13	-0.10	-0.26
Temporary measures	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	-1.23	1.05	-0.73	1.06	-0.12
Balance	**-4.70**	**5.77**	**-1.99**	**5.66**	**0.72**	**-1.23**	**-0.77**	**-0.16**	**0.60**	**-5.46**	**1.13**	**1.61**	**0.94**
Interest payments	***0.58***	***-0.08***	***-0.43***	***-1.02***	***-0.33***	***-0.43***	***-0.21***	***0.00***	***-0.13***	***0.08***	***-0.08***	***0.23***	***0.28***
due to changes in average interest rate	*0.09*	*-0.13*	*-0.16*	*-0.76*	*-0.26*	*-0.25*	*0.00*	*0.03*	*-0.10*	*-0.03*	*-0.31*	*0.09*	*0.06*
due to changes in debt level	*0.49*	*0.06*	*-0.27*	*-0.26*	*-0.07*	*-0.18*	*-0.22*	*-0.03*	*-0.03*	*0.11*	*0.23*	*0.14*	*0.22*
Primary balance	**-4.12**	**5.69**	**-2.42**	**4.64**	**0.39**	**-1.65**	**-0.98**	**-0.17**	**0.47**	**-5.38**	**1.04**	**1.84**	**1.22**
Total revenue	**-1.80**	**-1.90**	**-1.30**	**0.86**	**-1.75**	**-0.51**	**-1.19**	**-0.71**	**1.08**	**-0.97**	**-0.50**	**0.39**	**0.20**
Direct taxes payable by corporations	**-0.60**	**-0.16**	**-0.22**	**-0.03**	**-0.34**	**0.04**	**0.08**	**0.01**	**0.25**	**-0.51**	**0.02**	**-0.09**	**-0.08**
Fiscal drag	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decoupling of base from GDP	0.05	0.05	0.04	0.04	0.04	0.03	0.02	0.02	0.01	0.01	0.00	0.00	0.00
Legislation changes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	-0.09	-0.05	0.00	0.05	0.03
Residual	-0.65	-0.20	-0.26	-0.07	-0.38	0.01	0.05	-0.15	0.33	-0.46	0.02	-0.14	-0.11
Direct taxes payable by households	**-1.14**	**0.18**	**-0.20**	**0.15**	**-0.69**	**-0.09**	**-0.05**	**0.18**	**0.18**	**-0.34**	**-0.11**	**-0.15**	**0.16**
Fiscal drag	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decoupling of base from GDP	-0.20	-0.06	-0.08	-0.01	-0.07	-0.09	0.02	-0.01	0.03	0.04	0.00	0.00	0.03
Legislation changes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.19	-0.05	0.07	0.00
Residual	-0.93	0.23	-0.12	0.17	-0.62	-0.01	-0.06	0.19	0.16	-0.18	-0.06	-0.22	0.13
Memo item: included in expenditure[3]	*-0.18*	*0.04*	*-0.05*	*-0.01*	*-0.17*	*-0.09*	*0.00*	*0.04*	*0.01*	*-0.13*	*-0.02*	*0.01*	*0.01*
Social contributions	**-0.48**	**0.31**	**0.17**	**-0.60**	**-0.36**	**-0.88**	**-0.59**	**0.08**	**0.04**	**0.17**	**0.15**	**0.00**	**0.24**
Fiscal drag	-0.11	-0.09	-0.09	-0.13	-0.11	-0.08	-0.08	-0.05	-0.08	-0.03	-0.03	-0.05	-0.06
Decoupling of base from GDP	-0.59	-0.20	-0.27	-0.05	-0.24	-0.35	0.07	-0.04	0.12	0.13	-0.01	-0.01	0.14
Legislation changes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.28	0.21
Residual	0.22	0.60	0.53	-0.43	-0.01	-0.44	-0.58	0.17	-0.39	0.08	0.20	-0.23	-0.05
Memo item: included in expenditure[3]	*0.10*	*0.09*	*0.00*	*-0.30*	*-0.19*	*-0.45*	*-0.09*	*0.04*	*-0.03*	*-0.05*	*0.03*	*-0.07*	*-0.02*
Indirect taxes	**0.01**	**-1.27**	**-0.04**	**0.76**	**0.15**	**0.25**	**-1.00**	**-0.16**	**0.04**	**-1.15**	**0.08**	**0.30**	**-0.49**
Fiscal drag	-0.10	-0.08	-0.06	-0.08	-0.10	-0.06	-0.08	-0.05	-0.06	-0.02	-0.02	-0.04	-0.04
Decoupling of base from GDP	-0.05	0.08	-0.08	0.07	0.07	-0.05	0.08	0.04	0.04	0.01	-0.06	0.06	0.06
Legislation changes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.18	-0.06	-0.03	-0.10	0.44	0.23
Residual	0.16	-1.27	0.10	0.77	0.18	0.36	-1.00	0.04	0.12	-1.10	0.25	-0.16	-0.74
Memo item: included in expenditure[3]	*-0.03*	*-0.31*	*-0.03*	*0.20*	*-0.15*	*0.01*	*-0.15*	*-0.04*	*-0.12*	*-0.11*	*0.00*	*0.00*	*-0.21*
Other tax revenue[4]	**0.02**	**-0.01**	**0.01**	**-0.01**	**0.01**	**-0.06**	**0.03**	**-0.08**	**-0.14**	**0.19**	**-0.02**	**0.06**	**-0.02**
of which Legislation changes	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Taxes and social contributions overall	**-2.18**	**-0.95**	**-0.27**	**0.28**	**-1.23**	**-0.74**	**-1.53**	**0.03**	**0.37**	**-1.63**	**0.11**	**0.11**	**-0.19**
Fiscal drag	-0.21	-0.17	-0.14	-0.21	-0.20	-0.14	-0.16	-0.10	-0.15	-0.05	-0.05	-0.09	-0.09
Decoupling of base from GDP	-0.79	-0.13	-0.38	0.05	-0.20	-0.46	0.19	0.00	0.20	0.17	-0.07	0.05	0.23
Legislation changes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.05	0.24	-0.28	-0.14	0.84	0.47
Residual	-1.18	-0.65	0.25	0.44	-0.82	-0.14	-1.56	0.18	0.07	-1.48	0.39	-0.69	-0.80
Memo item: included in expenditure[3]	*-0.11*	*-0.18*	*-0.08*	*-0.11*	*-0.51*	*-0.53*	*-0.25*	*0.05*	*-0.15*	*-0.29*	*0.02*	*-0.06*	*-0.21*
Non-tax-related revenue[5]	**0.38**	**-0.95**	**-1.03**	**0.59**	**-0.52**	**0.23**	**0.34**	**-0.74**	**0.71**	**0.66**	**-0.62**	**0.28**	**0.39**
of which EU[6]	*0.00*	*0.00*	*0.00*	*0.00*	*0.20*	*-0.09*	*0.01*	*0.24*	*0.01*	*0.12*	*0.53*	*0.15*	*-0.02*
Total primary expenditure	**2.32**	**-7.59**	**1.12**	**-3.78**	**-2.14**	**1.14**	**-0.21**	**-0.54**	**0.62**	**4.40**	**-1.55**	**-1.45**	**-1.01**
(of which: due to automatic indexation)[7]													
Social payments	-1.23	0.09	0.52	-1.22	0.08	1.67	-0.04	0.60	0.28	1.43	0.54	-0.91	0.11
of which old-age pensions	*-0.25*	*-0.13*	*0.00*	*-0.23*	*-0.59*	*0.80*	*-0.35*	*-0.95*	*0.00*	*0.56*	*0.02*	*-0.14*	*0.04*
of which unemployment benefits	*-0.17*	*-0.12*	*0.13*	*-0.19*	*-0.38*	*0.03*	*0.01*	*-0.07*	*0.01*	*0.16*	*-0.08*	*0.02*	*0.00*
of which social transfers in kind	*-0.15*	*0.07*	*0.28*	*0.52*	*-0.27*	*1.36*	*0.09*	*0.30*	*0.33*	*0.08*	*0.12*	*-0.35*	*-0.03*
Subsidies	-0.24	-0.38	-0.58	0.15	0.20	-0.53	0.04	-0.05	0.52	-0.17	-0.27	-0.10	0.14
Compensation of employees	-0.79	0.03	0.28	-0.28	-0.80	-0.67	0.15	-0.26	0.25	0.31	0.07	-0.15	-0.28
Intermediate consumption	0.49	0.02	-0.59	-0.07	-0.49	-0.59	0.79	-0.84	0.02	0.63	-0.67	0.04	-0.29
Government investment	-0.17	0.26	0.18	-0.70	-0.17	-0.27	0.15	-0.21	0.13	0.50	-0.11	0.14	-0.73
Other[8]	4.26	-7.61	1.31	-1.67	-0.96	1.53	-1.30	0.23	-0.58	1.71	-1.11	-0.47	0.04

Annex 3 – ECB vs MNB method

The following figures show the differences in individual gaps in macroeconomic bases between the ECB and MNB methods. The private sector employment gap (EPGAP) is the same, since it was calculated outside the MVHP framework in the same way as in case of the ECB method. There are substantial differences in all other cases, which show the importance of constraints. The variables used are the following:

- YGAP – aggregate output gap
- WPGAP – average compensation gap
- FGAP – profit gap
- UGAP – unemployment gap
- CPGAP – private consumption gap



Annex 4 – Data sources

List of variables:

Variable	Short description	Source	Period
Y	nominal GDP, level in mil. EUR	SOoSR	1995-2012
Y^V	real GDP at constant prices, level mil. EUR	SOoSR	1997-2012
P^Y, P^{GDP}	GDP deflator, (2000=1)	SOoSR	1997-2012
CPI, P^{CPI}	Consumer price index (2000=1)	SOoSR, NBS	1997-2012
W^p	average compensation per employee in private sector at constant prices, mil. EUR	SOoSR	1997-2012
E^p	employment in private sector, thousands of persons	SOoSR	1995-2012
GOS,f	operating surplus and mixed income, constant prices, mil. EUR	SOoSR	1995-2012
D1U	compensation of employees, public sector, at curr. prices, mil. EUR	SOoSR	1995-2012
RI	taxes on production and imports, at curr. prices, mil. EUR	SOoSR	1995-2012
C^p	private consumption, constant prices, mil. EUR	SOoSR	1995-2012
U	number of unemployed in thousands of persons	SOoSR	1995-2012
Gap, OG	output gap		
egap	employment gap, external calculation		
CIT	Corporate income tax, ESA95, annual, NSA, mil. EUR	MF SR	1993-2012
PIT	Personal income tax, ESA95, annual, NSA, mil. EUR	MF SR	1993-2012
SSC	Social Security Contributions, ESA95, annual, NSA, mil. EUR	MF SR	1993-2012
IT	Indirect taxes (VAT+ED), ESA95, annual, mil. EUR	MF SR	1993-2012
VAT	Value added tax, ESA95, annual, mil. EUR	MF SR	1993-2012
ED	Excise duties, annual, ESA95, annual, mil. EUR	MF SR	1993-2012
UB	Unemployment benefits, ESA95, annual, mil. EUR	MF SR	1993-2012
PEN	Pension related expenditures, ESA95, annual, mil. EUR	MF SR	1996-2012
bal	EDP budget balance, mil. EUR	MF SR	1993-2012

List of abbreviations:

Variable	Short description
B	General budget balance
R	Government revenues
X	Government expenditures
BI	Budgetary item
MB	Macroeconomic base
FB	Fiscal base
ε	elasticity
α	weight parameter, labour share,
OO	One-off measures
SB	Structural balance
CAB	Cyclically adjusted budget balance
R, N	superscript, real vs. nominal variable
c	superscript, cyclical component
p	superscipt, private sector

Annex 5 – Differences between the EC and the CBR

It is useful to decompose the differences between the estimates of CBR and the EC[30]. The bottom part of the next table shows this decomposition into 5 factors:

1. The methodology of one-offs is different between the CBR and the EC
2. Different output gap – we simply recalculated the EC method using the output gap estimates of the CBR
3. Different elasticities – in addition to that we also changed the elasticities in the aggregated approach to reflect those of the disaggregated method
4. Different items – we added the cyclical adjustment of pension expenditures
5. Different methods – it captures the transition from aggregated to disaggregated methodology and the effect of time-varying shares of individual budget components

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Output gap																
- CBR	1.2	1.7	-0.5	-1.0	-0.6	-0.3	-0.5	-0.8	-0.6	0.6	3.6	3.9	-3.4	-1.3	-0.5	-0.7
- EC	1.8	2.5	-0.6	-2.3	-2.5	-1.9	-1.3	-0.4	0.7	2.9	7.1	7.0	-1.9	-0.7	-1.3	-2.1
Gaps in macroeconomic bases																
- profit	-3.0	-2.3	-1.0	-2.6	-0.4	-0.5	-0.1	1.5	0.1	2.1	4.5	5.3	-4.6	-0.8	-0.3	-0.1
- average compensation	6.2	6.4	1.0	3.8	0.2	1.3	-0.4	-3.3	-1.5	-2.4	0.9	-1.9	-3.3	-0.8	-0.5	-1.4
- employment	2.1	2.1	-0.8	-2.4	-1.4	-1.5	-0.9	-1.8	-0.5	0.6	1.8	4.5	1.0	-1.9	-0.4	-0.7
- unemployment	-10.3	-9.5	3.4	8.7	4.6	5.2	3.3	6.6	2.0	-2.8	-9.5	-23.2	-4.9	9.5	1.9	3.6
- private consumption	-2.2	0.4	-0.7	-3.2	-1.1	-0.5	-2.0	-0.9	0.5	2.8	5.8	8.7	5.7	1.8	0.2	-0.9
Items sensitive to the cycle																
- direct taxes paid by households	844	924	962	905	1 015	997	1 060	987	1 071	1 138	1 336	1 502	1 182	1 208	1 413	1 514
- social security constributions	2 756	2 903	2 974	3 421	3 733	4 155	4 314	4 932	5 338	5 747	6 487	7 198	6 744	6 937	7 393	7 623
- direct taxes paid by firms	872	848	873	813	880	926	1 123	1 174	1 348	1 603	1 852	2 094	1 586	1 662	1 663	1 673
- indirect taxes paid by households	2 202	2 496	2 555	2 826	3 023	3 297	3 840	4 389	5 083	4 968	5 667	5 707	5 174	5 297	5 889	5 510
- unemployment benefits	132	182	242	205	159	153	103	132	81	64	57	66	172	150	163	174
- pensions	1 538	1 708	1 906	2 074	2 268	2 436	2 649	2 798	3 161	3 472	3 822	4 200	4 532	5 035	5 245	5 391
Nominal GDP	23 867	26 172	28 109	31 177	33 881	36 807	40 612	45 161	49 314	55 002	61 450	66 842	62 794	65 897	68 974	71 096
Elasticities																
- overall EC	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332
- DHT-to-AC	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
- DHT-to-E	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
- SSC-to-AC	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
- SSC-to-E	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
- F-to-GOP	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
- IT-to-PC	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
- UB-to-U	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
- PEN-to-AC	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Cyclical component																
- EC	0.6	0.8	-0.2	-0.8	-0.8	-0.6	-0.4	-0.1	0.2	1.0	2.4	2.3	-0.6	-0.2	-0.4	-0.7
- CBR	0.8	0.9	-0.3	-0.2	-0.4	-0.1	-0.4	-0.6	-0.1	0.1	1.0	1.1	0.1	-0.1	-0.1	-0.3
One-offs																
- EC							-0.37	0.00	-0.83	-0.27	0.00	0.20	0.17	-0.17	0.38	0.15
- CBR	0.15	0.13	0.08	-5.11	0.43	-1.43	-1.38	0.00	-0.47	-0.35	0.53	-0.07	-0.17	-0.17	-0.29	0.38
Headline balance	-1 506	-1 396	-2 087	-3 824	-2 205	-3 024	-1 127	-1 065	-1 387	-1 746	-1 115	-1 397	-5 040	-5 046	-3 499	-3 230
% of GDP	-6.3%	-5.3%	-7.4%	-12.3%	-6.5%	-8.2%	-2.8%	-2.4%	-2.8%	-3.2%	-1.8%	-2.1%	-8.0%	-7.7%	-5.1%	-4.5%
Structural balance																
- EC	-6.9%	-6.2%	-7.2%	-11.5%	-5.7%	-7.6%	-2.0%	-2.2%	-2.2%	-3.9%	-4.2%	-4.6%	-7.6%	-7.3%	-5.0%	-4.0%
- CBR	-7.3%	-6.4%	-7.2%	-7.0%	-6.6%	-6.7%	-1.0%	-1.7%	-2.3%	-3.0%	-3.3%	-3.1%	-8.0%	-7.4%	-4.7%	-4.6%
Difference in SB between CBR and EC	**-0.38**	**-0.18**	**0.02**	**4.55**	**-0.87**	**0.88**	**0.94**	**0.49**	**-0.07**	**0.92**	**0.85**	**1.52**	**-0.40**	**-0.18**	**0.30**	**-0.63**
1. Different one-offs	-0.15	-0.13	-0.08	5.11	-0.43	1.43	1.02	0.00	-0.36	0.08	-0.53	0.27	0.34	0.00	0.67	-0.23
2. Different output gap	0.20	0.29	-0.05	-0.42	-0.62	-0.52	-0.27	0.13	0.42	0.76	1.19	1.01	0.51	0.21	-0.28	-0.45
3. Different elasticities	-0.14	-0.20	0.06	0.12	0.07	0.04	0.06	0.09	0.07	-0.08	-0.42	-0.46	0.41	0.16	0.06	0.08
4. Different items	0.03	0.22	0.23	0.04	0.14	0.01	0.04	-0.01	-0.11	-0.05	-0.08	0.03	-0.08	-0.14	-0.03	-0.02
5. Disaggregation vs aggregation	-0.32	-0.37	-0.14	-0.30	-0.03	-0.08	0.09	0.28	-0.09	0.21	0.69	0.67	-1.59	-0.41	-0.12	-0.01

[30] EC estimates from SB are available only since 2003, we report CAB estimates in earlier years.

Annex 6 – Estimation of elasticities from microsimulations

The elasticity of personal income tax (PIT) and social security contributions (SSC) with respect to the tax base is calculated by using a microsimulation model of the Slovak tax and social system.

Simulation of the Slovak tax-benefit system is based upon the EUROMOD platform, a microsimulation model that was developed to simulate the redistributive systems of the European Union countries. Compared to EUROMOD, our model provides a more precise simulations of selected transfers. Microsimulation of the tax-benefit system valid in years 2009, 2010 and 2011 cover direct taxes (namely labour and capital income taxes), social insurance contributions and selected transfers (most important are contributory unemployment benefit and means tested material needs benefit).

The data we use come from three waves (2010-2012) of the annual SK-SILC survey, the national version of EU-SILC[31]. Dataset contains cross-sectional data on household and individual level and it provides information on income, living conditions, social exclusion and poverty. However, in survey data it is quite common that high-income individuals are under-sampled and low-income individuals are over-sampled compared to the official statistics[32] and the SK-SILC database is not an exception. Therefore, we include a correction step before actual microsimulation process starts. In both databases we compute the mean value of gross income in every percentile. In the next step we form shares of the computed means from the two datasets (percentile by percentile). These shares serve as a correction, we multiply the gross income in SK-SILC by these percentile specific factors.

The straightforward approach is to derive these elasticities numerically by altering the gross income (i.e., increase it by 1%), using a tax-benefit model to recompute the net income (which incorporates both PIT and SIC effect), the personal income tax and paid social security contributions for every individual and comparing it with the original state. Results are documented in the table below.

[31] Abbreviation SILC stands for "Statistics on Income and Living Conditions". 2010 SK-SILC denotes the fact that survey data were collected in 2010, while the reference period is 2009. Original datasets contain information on more than 15,000 individuals and 5,200 households yearly.

[32] We compare the income data from the SK-SILC survey to the administrative database of the Social Security Agency that collects information on paid social security contributions of all employed individuals. Gross individual income might be derived from the paid contributions. Individual tax-return data are available starting from 2013.

Table – Estimation of elasticities from microsimulations

Year	2009	2010	2011
Elasticity of net income	0.8582	0.8607	0.8639
Elasticity of PIT	1.911	1.951	1.872
Elasticity of SSC	0.9374	0.9482	0.9265

Source: CBR

As an alternative, elasticities of income tax and social security contributions can be computed by using a similar methodology as documented in a paper by Girouard and Andre (2005). Formally, elasticities are computed as a ratio of sum of individual marginal effective income tax rates (social security contribution rates) to sum of average effective income tax rates (social security contribution rates). Corresponding marginal effective rates are calculated as it is suggested by Immervoll (2002), with the margin set to 1%.

Table – Estimation of elasticities from microsimulations

Year	2009	2010	2011
Elasticity of net income	1.2958	1.3689	1.3229
Elasticity of PIT	1.7308	1.9036	1.7932
Elasticity of SSC	1.1746	1.2968	1.2334

Source: CBR

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Council for Budget Responsibility

Imricha Karvaša 1
Bratislava 1
813 25
Slovakia

www.rozpoctovarada.sk