Automatic Fiscal Stabilisers in Estonia: The Impact of Economic Fluctuations on General Government Budget Balance

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The paper discusses the functioning of automatic fiscal stabilisers in Estonia. The aim of the research is to evaluate government budget sensitivity to economic fluctuations and thereby assess the importance of automatic fiscal stabilisers in Estonia. Specifically we are interested in whether the functioning of automatic fiscal stabilisers might under certain circumstances create difficulties for the fulfilment of the Maastricht deficit criterion according to which public deficit is not allowed to exceed the limit of 3% of GDP.

The results of our research show that the role of automatic fiscal stabilisers is modest in Estonia. Budgetary sensitivity was approximately 0.35 in the period 1996–2001 – an increase in output gap by 1 percentage point causes a change in the budget balance by 0.35% of GDP. According to that maximum value, the budget's reaction was only 1.3% of GDP (while the output gap was -3.9%). A positive implication of this is that Estonia has good chances of holding the budget balance within the requested ceilings. If the output gap reaches -5%, structural deficit may still be 1% of GDP without the actual balance exceeding the 3% deficit boundary.

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Introduction

The purpose of this paper is to analyse automatic fiscal stabilisers (AFS) in Estonia, ie fluctuations in the budget revenue and expenditure affected by a change in economic activity, which, through influencing domestic demand, smoothes business cycles. The paper focuses on general government budget balance reactions only, ie the size of automatic fiscal stabilisers, which is defined as a difference between the actual budget balance and cyclically adjusted balance (structural balance). AFS stabilising capacity is not observed in the current research.

Fiscal policies and the analysis of fiscal stabilisers have been added to the agenda mainly because Estonia is applying to become a member of the European Economic and Monetary Union (EMU) necessitating the evaluation of the government's ability to maintain the budget balance within the boundaries set by the Maastricht Treaty, ie less than 3% of GDP. As AFS makes budgetary position more volatile, it is necessary to observe how significant those effects are. The role of AFS is primarily seen as the course for the future – fiscal stabilisation should be based on AFS functioning mainly in the EMU. Discretionary fiscal policy should be an exception rather than usual means. In the analysis of discretionary fiscal policy, the deficiencies of these methods are as follows:

- Temporary external inertia[1]. According to Buti and Sapir (1998), it takes from 6 to 18 months to acknowledge changes in economic circumstances and make necessary decisions.
- Loss of output. Fiscal factors usually reduce economic output[2]. At the same time, democratic election principles allow easier management of budget deficits than the balance or surplus of the budget. During economic downturn, most governments tend to support domestic demand through a general increase in the current consumption, which in turn, through the expansion of dependent groups, makes consumption cut-backs in the growth phase of the economy almost impossible[3].
- Instability. Government's discretionary actions make central bank's decision-making more complicated (Taylor, 2000). This is due to the fact that discretionary actions are often inconsistent – each new coalition seems to have a different view of the implementation of given steps.

These findings explain research results of the European Commission's 2000 report. According to this report, discretionary steps worked in a pro-cyclic manner for EU Member States from 1970 till 1990, increasing the fluctuations of the GDP gap. The European Commission has found that if discretionary steps can be at all justified, then only in the context of very strong asymmetric economic downturn affected by the decrease in demand or

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[1] Under temporary external inertia we mean the time that it takes for fiscal factors to influence domestic demand. Usually this is shorter in cases of cutting income tax, profit transfers and liquidity constraint for the management of domestic economies (Hemming *et al*, 2002).

[2] There have been a number of empirical studies in this field. Focusing on works published lately (improved methodology, better statistic base), for example, Bassanini, Scarpetta and Hemmings (2001) argue that direct tax increases on the revenue side and increased income transfers adversely affect the growth of GDP.

[3] For example, Fölster and Henrekson (2000) found in their research that, although previously missing or weak connections had been found between budget sizes and the growth of GDP, the research done was not reliable, especially from the technical point of view. The more these studies have solved econometric problems the more clearly do the negative connections between the size of the government sector and the growth of GDP appear. According to the OECD (2000), a raise in taxes of 1% in the long run reduces the productivity to the employed citizen by 0.6 to 0.7%.

in the instance of economic overheating. The situation is different if economic downturn is caused by permanent shifts in supply side, which may reduce the potential GDP. In such cases, automatic stabilisers can be destabilising (Meyermans, 2002). The problem here is that in the short term it is impossible to distinguish between negative demand side impulses and supply shock.

Consequently, the Maastricht Treaty set a 3% limit on public sector budget deficits and a 60% limit on debts in relation to GDP. In 1997 in Amsterdam, this vision was even more clearly stated within the Stability and Growth Pact (SGP). According to the agreement, Member States should keep their budgets stable or in surplus in the long term and let automatic fiscal stabilisers operate freely during the entire business cycle. Furthermore, fines[4] are imposed for those who exceed the budget deficit limits[5]. Empirical research has shown that the 3% deficit leaves more than enough room for automatic fiscal stabilisers to work without the necessity to use discretionary measures when structural budget is balanced.

To determine the size of budgetary cyclical components, ie the size of automatic fiscal stabilisers and the structural balance we have used the widely accepted two-step method. The first stage of this method is to measure GDP gap. The second stage is to identify the cyclical sensitivity of all budget components (on revenue and expenditure side) – their sensitivity to the GDP gap. Finally, budget's cyclical component and structural balance are calculated based on sensitivity estimates and the GDP gap.

The only drawback of the two-step method is a possible over-estimation of sensitivity, mainly because it does not take into account mutual impact of the fiscal position and domestic demand. Also some steps on the expenditure side (for example changes in the health insurance system) can be pro-cyclic and shifts in economic structure may affect estimation results. An alternative would be to use the SVAR (Structural Vector Auto-Regression) method to calculate structural budget balance. SVAR analysis also provides an estimation of the influence of discretionary political steps on the budget, and the corresponding component will be separated from the revenue/expenditure time series (see for example Höppner, 2002). Many factors render this method unreliable in our context. One of those is the shortness of data series, but also the modest size of our economy and our position in the transition phase all limit the use of SVAR. The main deficiency of the SVAR method is that it is useless in cases of structural changes in the economy, which are topical when dealing with a transition economy. Also, when assumptions change, results will change remarkably.

The paper is structured as follows. The first section contains a brief overview of the role of automatic fiscal stabilisers in EU Member States for the purpose of giving a comparison with Estonian data. According to the two-step method, estimation of the potential GDP and GDP gap is described in section two. In the third section the budgetary cycle sensitivity of the Estonian government sector is calculated, followed by a presentation of the Estonian government sector structural budget estimates and the size of the automatic fiscal stabilisers in the fourth section.

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[4] The size of the fine consists of a fixed portion, which is 0.2% of annual GDP, and the changing portion, depending on how much the boundaries are exceeded. Maximum fine is 0.5% of GDP.

[5] Exception from paying the fine is given when GDP decreases by more than 2% (a situation which during the last 40 years has only happened in Finland (EMU member state) and the United Kingdom and Sweden (non-members)). Depending on provisions, exemption from paying the fine can be considered in cases when the GDP falls between 0.75 to 2%.

1. The Role of Automatic Fiscal Stabilisers in the EU

European Commission uses structural budgets as inputs for budgetary analysis. According to SGP, these are one of the main indicators according to which fiscal policies of Member States are planned. It must be mentioned that structural budget estimates are not entirely adequate – even if the separation of the budget's cyclical components is not dependent upon the calculation method used, a business cycle expressed by GDP gap is not directly measurable. Different international institutions use different methods to define GDP gap and this is why the results vary quite a lot. However, structural budget estimates are still used.

According to different sources, average cyclical sensitivity of budgets among EU Member States is approximately 0.5, implying that when the GDP gap grows by 1 percentage point there is a shift in budget balance by 0.5% of GDP. In general, in southern EU member countries the sensitivity is smaller. This group includes Greece, Spain, France, Portugal, Italy, Austria, but also Luxembourg and Ireland. The indicator is highest in Denmark, Sweden, Great Britain, the Netherlands and Finland (see Figure 1).

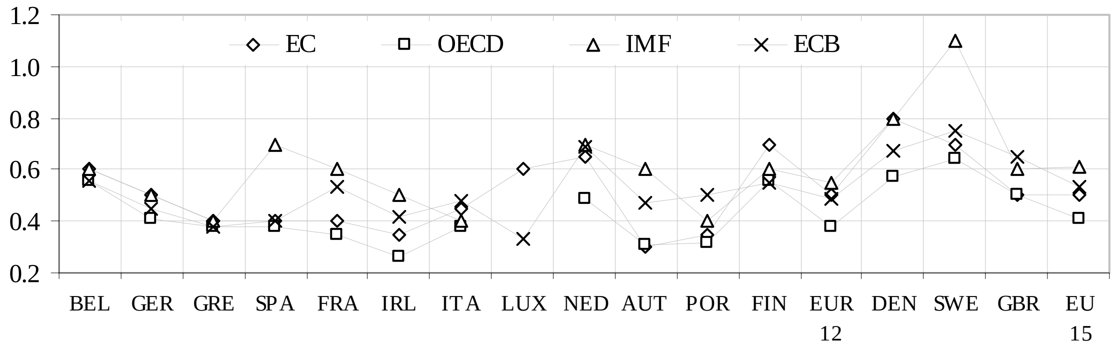

Figure 1. Budgetary sensitivities of EU countries
Source: Bouthevillain *et al*, 2001; European Economy, 2002; Valtioneuvoston Kanslia, 2000.

It is noteworthy that budget revenues are more sensitive to business cycles. The influence on expenditure is relatively small. This means, that the fluctuations of the business cycle influence taxes more than government transfers and consumption (see European Central Bank data in Table 1).

Table 1. Cyclical sensitivity of budget revenues and expenditures in EU Member States (% of GDP when the GDP gap grows by 1 percentage point)

	BEL	GER	GRE	SPA	FRA	IRL	GBR	ITA
Total	0.56	0.45	0.38	0.40	0.53	0.42	0.65	0.48
Revenue	0.49	0.40	0.38	0.35	0.48	0.33	0.43	0.47
Expenditure	-0.07	-0.05	0.00	-0.05	-0.05	-0.09	-0.22	-0.01
	LUX	NED	AUS	POR	FIN	DEN	SWE	EU15
Total	0.33	0.69	0.47	0.50	0.55	0.67	0.75	0.53
Revenue	0.30	0.45	0.50	0.42	0.48	0.56	0.61	0.44
Expenditure	-0.03	-0.24	0.03	-0.08	-0.07	-0.11	-0.14	-0.09

Source: Bouthevillain *et al*, 2001 (ECB).

The size of cyclical components depends on budget's cyclical sensitivity and the state of the economy. The results differ depending on research methods and that is why the results should be interpreted as an interval of where the actual figure potentially stands. In states that have larger automatic stabilisers, the effect of the budget cycle can be up to 3% of GDP. The EMU average is about 0.5% of GDP (see also Appendix 1).

One of the reasons why cyclical components vary so much from each other is the difference in above-mentioned sensitivity assessments. The other reason is that international organisations use different methods to assess GDP gap. The OECD, IMF and European Commission (EC) use the production function[6], while the European Central Bank (ECB) uses the Hodrick-Prescott's filter defined GDP trend[7]. The results of these two methods are out of step with each other.

The AFS functioning makes revenues and expenditures more volatile and thereby it is more difficult to keep budget balanced. Nevertheless, several studies have shown that the prescribed 3% limit allows sufficient room for automatic stabilisers to work without risking the stated boundaries, assuming that the structural budget is balanced or adequately overbalanced (Artis *et al*, 2000; Barrell *et al*, 2001; Dalsgaard *et al*, 1999; Dury *et al*, 2000). Artis and Buti (2000) indicate that Belgium, Denmark, Spain, Ireland, Luxembourg, the Netherlands, Portugal and the United Kingdom should keep their structural deficit between 0 and 1% of GDP. Germany, Greece, France, Italy and Austria could have a deficit that is even larger than 1%. Budgets in Finland and Sweden are relatively cycle-sensitive, and so in these countries the structural budget should be in surplus. Similarly, Barrel, Hurst and Pina (2002) claim that only Austria should keep their structural budget in balance in order to prevent automatic stabilisers increasing the deficit in excess of 3%, most EMU states may experience a deficit of 1% of GDP.

2. Estonia's Potential GDP and GDP Gap.

First step in finding a structural balance is to estimate the GDP gap, which is needed for both, estimating budget sensitivity and extracting budget's cyclical component. As mentioned in the first section, in the context of EMU, the correct GDP gap is most important determinant of the size of the cyclical component of the budget and that is why its measurement in the current context is critical. It should be also mentioned here that it is very complicated to measure GDP gap in Estonia, because available GDP time series covers only a little more than one business cycle.

Determining the GDP gap is based on an estimate of the potential GDP. There are two main options to estimate the potential output – using Hodrick-Prescott filter or production function, both of which are used in this paper.

2.1. Measuring GDP Gap Using the Hodrick-Prescott Filter

The main argument for using the Hodrick-Prescott filter is that with this method there is no need to assess production inputs. Because we lack highly reliable data on capital stock, a suitable approximation must be found for the factors used in the production function, which as a result, reduces the reliability of the estimate of the potential GDP. Following these considerations, the Hodrick-Prescott filter is used for estimating the potential GDP. The

[6] European Commission has used the production function to measure potential GDP since 2001. Previously they also used the Hodrick-Prescott filter.
[7] Bouthevillain *et al*, 2001, have written about using the HP filter for the measuring of potential GDP.

positive characteristics of the filter are its simplicity and transparency. According to Hodrick and Prescott (1997), a given time-series for real GDP (Y_t^r) is a sum of long run (Y_t^*) and cyclical (Y_t^c) components[8].

$$(1) \qquad Y_t^r = Y_t^* + Y_t^c \quad t = 1,...,T$$

and the smoothness of the long run growth path of real GDP (potential GDP) (Y_t^*) is the sum of the squares of its second difference:

$$(2) \qquad \min_{\{Y_t^*\}_{t=-1}^T} \left\{ \sum_{t=1}^{T} \left(Y_t^r - Y_t^*\right)^2 + \lambda \sum_{t=1}^{T} \left[\left(Y_t^* - Y_{t-1}^*\right) - \left(Y_{t-1}^* - Y_{t-2}^*\right)\right]^2 \right\}.$$

The estimate of the potential GDP and thereby also GDP gap is determined by the value of the filter's smoothing parameter (λ), the selection of which is subjective. The greater the value of smoothing parameter, the bigger is the extracted cyclical component (GDP gap) – as λ reaches infinity ($\lambda \to \infty$), long term component approaches a linear trend. Estimated trend follows the dynamics of time series when λ is zero.

Hodrick and Prescott suggest that the value of the λ should be 1600 when using quarterly data. But it might be better to take the value of the λ smaller in Estonian case, because there have been many structural shifts in Estonian economy and thereby structural changes are taken into account while generating the trend. This is why two different values of the λ have been used in this paper: 400 and 1600. There is no approved way to check the correctness of results; the only possibility would be to see how, while increasing and reducing the value of the λ, the estimate of the GDP gap changes.

Changing the smoothing parameter from 400 to 1600 does not influence the estimates of the GDP gap substantially; the difference between the GDP gap depending on the parameter used has varied between 0.003 and 0.3 percentage point in 1996 to 2001. The adequacy of the parameters (the extent to which the estimate of the gap is accurate) can be determined when we have the gap values calculated also on the basis of production functions.

2.2. Measuring GDP Gap Using Production Functions

Smoothing of time series is a simple and often used method in estimating the potential output level. Nevertheless, from the point of view of macroeconomic analysis it is too mechanical – it does not take into account structural peculiarities of the economy and limits imposed by production and other endogenous factors. Keeping the above-mentioned in mind, from the point of view of economic theory, the most favourable way of estimating the non-inflationary level of output is through an analysis of the production function. What follows in this section draws directly on the methodology of OECD (see for example Giorno *et al*, 1995).

The method used here is based on estimation of simple two-factor Cobb-Douglas production function for business sector using the average functional distribution of factor incomes. The obtained error term is smoothed and, as a result, provides an estimate of trend total factor productivity. The potential output of the private sector is then calibrated, using the same

[8] See Appendix 2 for the list of acronyms.

functional structure of the production function together with obtained estimate of total factor productivity, actual capital stock and previously calibrated estimate of full employment. The latter consists of an employment adjustment according to the gap between actual unemployment and the estimated NAWRU (Non-Accelerating Wage Rate of Unemployment). This is the main difficulty with production function analysis, since estimating the level of full employment is extremely difficult in every state, while in the case of Estonia the problems are intensified due to structural shifts and shortness of time series.

In detail, the method mentioned above follows next steps. Estimated business sector production function takes the following form:

(3) $$Y_t^{p,r} = \left(L_t^{\,p}\right)^{\alpha} K_t^{\,1-\alpha} G_t \ ,$$

where $Y_t^{p,r}$ denotes business sector output in constant prices, L_t^p is the actual employment level of the business sector, K_t is actual capital stock of the business sector, G_t is total factor productivity, and α is labour share (the functional distribution of factor incomes). The natural logarithms of respective variables are given using small letters.

(3’) $$y_t^{p,r} = \alpha l_t^{\,p} + \left(1-\alpha\right) k_t + g_t \, .$$

Given the value of α, which according to the average labour share of the period is 0.6 – the g_t series is calculated and smoothed using the Hodrick-Prescott filter. The obtained time series has been used as an estimate of total factor productivity (g_t^*). In estimating the production function it is extremely important to construct the time series of capital stock, and that has been done using the perpetual inventory method. The estimate of the end-point of capital stock draws on the comparison of international research findings in developed and developing countries. Accumulating data on fixed capital formation from the Summers-Heston database, it is possible to show that the capital-output ratio in developed countries is more than twice the respective ratio in developing countries (Mankiw, 1995). Taking into account that the capital-output ratio in industrial countries can be a maximum of over 3, in Estonia’s case the indicator can be a maximum of 1.5, which has been used in this article[9]. The capital stock of the business sector is then constructed in retrospect according to the above-mentioned perpetual inventory method. Leaving aside the problems originating from the identification of constant amortisation rate, net investments derived from national accounts have been used in capital accumulation.

The next step is to find the estimate for the business sector full or potential employment (L_t^{p*}). The following formula is used for this purpose:

(4) $$L_t^{p*} = LFS_t^*\left(1 - NAWRU_t\right) - L_t^{\,g} \ ,$$

[9] During the analysis, other *K/Y* ratios were also experimented with, which, however, did not yield so reliable results.

where LFS_t^* is the smoothed workforce (defined as the product of working-age population and the trend of participation rate), $NAWRU_t$ stands for the non-accelerating wage rate of unemployment, and L_t^g is employment in the public sector.

The estimate for $NAWRU_t$ is derived from an equation used by the OECD that assumes the change in wage inflation to be proportional to the gap between actual unemployment and $NAWRU_t$:

(5) $$\Delta^2(\ln W_t^{\,B}) = -a(U_t - NAWRU_t) \qquad a > 0 \quad ,$$

where Δ is the first difference operator, W_t^B and U_t are wage and unemployment levels, respectively. Assuming that $NAWRU_t$ is constant between two discretionary consecutive time periods, the estimate of a is given by:

(6) $$a = -\frac{\Delta^3(\ln W_t^{\,B})}{\Delta U_t}$$

that allows to express NAWRU with the following formula:

(7) $$NAWRU_t = U_t - \frac{\Delta U_t}{\Delta^3(\ln W_t^{\,B})}\Delta^2(\ln W_t^{\,B}) .$$

Obtained time series has been smoothed and is then used in the calculations[10] of the potential employment of business sector. Inserting the estimates of full employment (l_t^{p*}) and total factor productivity (g_t^*) to the initial production function and assuming that the capital stock is at its potential level, we can find the potential output of the business sector (y_t^{p*}):

(8) $$y_t^{\,p*} = \alpha l_t^{\,p*} + (1-\alpha)k_t + g_t^{\,*} .$$

The potential output of the economy can be found by adding the government sector's output to the business sector's potential output[11]. In Figure 2, two GDP gaps estimated with production function approach are compared with those obtained with HP smoothing. The first estimate treats government and agricultural sector as exogenous (or operating at their potential levels, see GDP gap (PF 1) on Figure 2). The second estimate only takes the government sector as exogenous (see GDP gap (PF 2) on Figure 2). The two GDP gaps estimated using the production function method are relatively similar, their dynamics and magnitudes of changes are logical when confronted with actual data.

[10] As Giorno *et al* (1995) mentions, the obtained short-term estimate for *NAWRU* follows the actual unemployment dynamics and can differ from the long-term *NAWRU* that would have been calculated based on constant unemployment rate (see, for example, Kearney *et al*, 2002).
[11] In other words, the presumption was that the government operates at its potential level; in some studies the same assumption also goes for the agricultural sector.

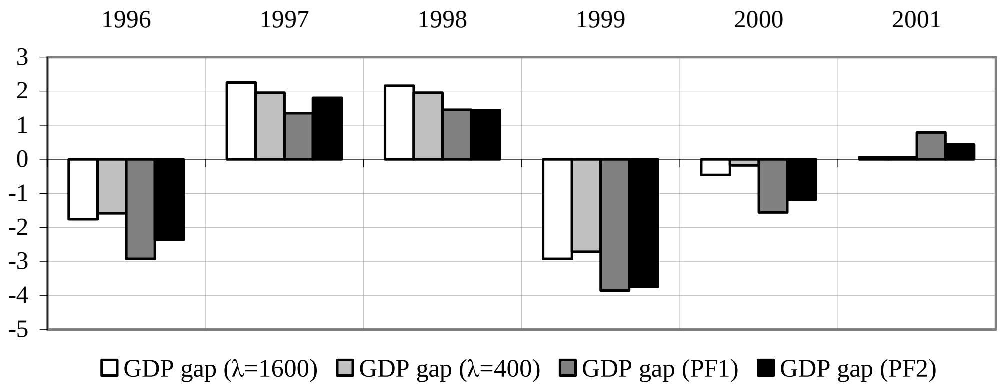

Figure 2. Estimates of GDP gap based on HP filter and production function

The variation of the GDP gap estimates is noticeable. Comparing the gaps obtained with the HP filter with those based on production function approach, we can see that estimates differ from each other on an annual basis by about 1 percentage points that can be considered as a reasonably small variation[12], caused by differences in methods. Since we lack criteria of favouring one estimate to another, all derived GDP gaps are used in calculations of structural balance. This allows us to determine the interval for the actual structural budget balance.

3. Cyclical Sensitivity of Budget Components

About 90% of the Estonian government's gross revenue comes from taxes and the remaining 10% is non-tax revenue. Government sector budget revenue (R_t) comes from personal income tax (T_t^P), corporate income tax (T_t^C), social tax (T_t^S), excises (T_t^E), value added tax (T_t^V) and non-tax revenue (NTR_t):

(9) $$R_t = T_t^P + T_t^C + T_t^V + T_t^S + T_t^E + NTR_t \, .$$

Public sector expenditures (E_t) are as follows: purchased goods and services (C_t^G) government sector transfers to households (TR_t^G), capital expenditures (I_t^G) and interest payments (i_t^G):

(10) $$E_t = C_t^G + TR_t^G + I_t^G + i_t^G \, .$$

Budget balance (B_t) equals revenues minus expenditures of the same period:

(11) $$B_t = R_t - E_t \, .$$

Similarly to GDP time series, also government sector revenue and expenditure consists of long term and cyclical components. The actual budget balance is the sum of the long-run balance, ie structural balance (B_t^s) and cyclical changes in it (B_t^c). Structural and cyclical

[12] As mentioned in section two, estimates of the cyclical components of budget in EMU member states differ by over 2% of GDP, depending on the method used.

components can be separated the same way in revenue (R_t^s and R_t^c, accordingly) and expenditure items (E_t^s and E_t^c):

(12) $$B_t = B_t^s + B_t^c = \left(R_t^s - E_t^s\right) + \left(R_t^c - E_t^c\right).$$

Structural balance is represented as follows (Hagemann, 1999):

(13) $$B_t^s = B_t - B_t^c = B_t - \sum_j B_t^{c,j} \ ,$$

where $B_t^{c,j}$ is the cyclical part of the budget's *j*-s component, dependent on macro indicator gap ($v_t^{c,j}$) and the sensitivity of the budget's *j*-s component to the influencing macro indicator (ε_{B^j,v^j}):

(14) $$B_t^{c,j} = B_t^{\ j} \times \varepsilon_{B^j,v^j} \times v_t^{c,j} \ .$$

Figure 3 illustrates how business cycle influences government budget revenue and expenditure and thereby overall budgetary balance. The expression $B_t^j / Y_t^* p_t^Y$ denotes the share of budget's *j*-s component (in nominal terms) in nominal GDP's long-run growth trend, which is defined as a potential (real) GDP (Y_t^*) multiplied by GDP deflator (p_t^Y). The term $Y_t^* p_t^Y$ is used instead of nominal GDP because the latter includes cyclical changes and is not thereby appropriate when assessing budget's cyclical component. $\overline{A}^j$ shows the share of budget's *j*-s component in nominal GDP's long-run growth path when output gap equals zero ($Y^r / Y^* = 1$).

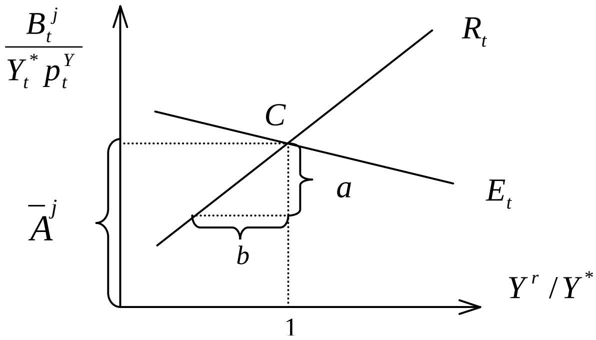

Figure 3. Sensitivity of budget items' share in nominal GDP long-run growth path to the output gap

The curve of budget revenue (R_t) is upward-sloping showing that growth in GDP gap causes an increase in revenue GDP ratio. This is because of a change in effective tax rate mainly. The slope angle of the curve R_t indicates aggregate sensitivity of revenue components. Aggregate sensitivity equals *a/b* and satisfies the condition:

(15) $$\sum_j \varepsilon_{R^j,v^j} \geq 0 \, ,$$

where ε_{R^j,v^j} is the sensitivity of revenues' *j*-s component to the GDP gap. In case of expenditures (E_t), the situation is vice versa. Condition (16) should hold as far as expenditure components are concerned, meaning that the share of expenditures in nominal GDP's long-run growth path falls when GDP gap increases.

(16) $$\sum_j \varepsilon_{E^j,v^j} \leq 0,$$

where ε_{E^j,v^j} denotes the sensitivity of expenditures' *j*-s item to the GDP gap. The effect comes from cyclical changes in unemployment, which increases in recession phase and decreases when there is a boom in economy. Government expenditure on unemployment compensation grows and diminishes, respectively, in counter-cyclical manner.

It can be shown that structural budget is balanced if the equivalence (17) is valid (*C* on Figure 3), otherwise not:

(17) $$R_t\left(R_t \middle| Y_t^r / Y_t^* = 1\right) = E_t\left(E_t \middle| Y_t^r / Y_t^* = 1\right).$$

Specifically we are interested in the spread between R_t and E_t when $\frac{Y_t^r}{Y_t^*} \neq 1$ – budget's cyclical component, depending on slope angles of the curves. This is why the equations of the curves must be defined. Equation (18) describes budget's *j*-s component's curve in general form, ie both for expenditure and revenue items. Again, ε_{B^j,v^j} should satisfy conditions (15) and (16).

(18) $$\frac{B_t^j}{Y_t^* p_t^Y} = \overline{A}^j + \varepsilon_{B^j,v^j}\left(\frac{Y_t^r}{Y_t^*} - 1\right).$$

Multiplying equation (18) by $Y_t^* p_t^Y$, we get:

(19) $$B_t^j = \overline{A}^j Y_t^* p_t^Y + \varepsilon_{B^j,v^j} Y_t^r p_t^Y - \varepsilon_{B^j,v^j} Y_t^* p_t^Y.$$

As real GDP multiplied by GDP deflator equals nominal GDP ($Y_t^r p_t^Y = Y_t$), we can write:

(20) $$B_t^j = \overline{A}^j Y_t^* p_t^Y + \varepsilon_{B^j,v^j}\left(Y_t - Y_t^* p_t^Y\right).$$

The first part in equation (20) shows the long-run growth path of budget's *j*-s item, the second one shows cyclical component affected by the gap between nominal GDP and its long-run growth path.

3.1. Sensitivity of Budget Revenues

Taxes can be divided into two groups according to their natural macroeconomic base: the first and largest group has nominal base (VAT, income tax, etc), the second category includes taxes with a real base (excises) – these are taxes that are imposed on the physical quantity of goods. Taking into account the unity of estimates and leaving aside possible price effects, the current article follows standard approach in using a nominal base on all taxes[13].

3.1.1. Personal Income Tax

Revenue from personal income tax rose from 4.5 billion kroons in 1996 to 7 billion in 2001. During this period, personal income tax made up about 23% of the government sector's taxation revenue. Incoming tax payments to the government sector can be shown as follows:

$$(21) \qquad T_t^P = tr^P \left(W_t^B - TF_t^P \right) L_t - \varphi \ ,$$

where L_t stands for employment, W_t^B is the average gross wage during the period, TF_t^P is the tax-free income, tr^P is the tax rate and φ shows other permissible deductions.

In order to find credible sensitivity estimates, the true reaction to changes in economic activity, we have to clear the time-series data of the influence of changing taxation policies, ie the influence of discretionary fiscal policy should be eliminated. It means we have to find an estimate of what the tax inflow would have been like if the changes had not been put into practice (the structural element would have grown along its potential long-term trajectory). Taking into account the Estonian government sector's gross revenue, the most influential discretionary policy has been the raising of the tax-free income for personal income tax[14].

The raising of the tax-free minimum and the subsequent change to received income tax can be represented as follows (presuming that the number of employed and the tax rate is constant and the division of wealth in the given period does not change):

$$(22) \qquad \Delta T_t^P = -L_t \times \Delta \underset{-}{TF_t^P} \times tr_t^P \ .$$

The influence of raising tax-free income in equation (22) was limited by fixing it to the year 2000. The resulting figure for the period in question equals 800 kroons. Therefore, if the taxation policy had been as it was in 2000, then from 1996 until 1999 inflow would have been 12% lower (15% at the beginning of the period, 8% at the end). In 2001, tax inflow would have been 5% higher on an average.

In Estonia, proportional personal income tax has been implemented. In most cases the lack of progressive taxation means that this tax does not work as an effective automatic fiscal stabiliser. But here we have to take into account the influence of personal tax-free income on the applicable size of the revenue.

When determining the sensitivity of adjusted personal income tax we use regression analysis. Ordinary least squares method is employed to estimate $\overline{A}^P$ and $\varepsilon_{T^P, \frac{Y^r}{Y^*}}$ in equation (23):

$$(23) \qquad T_t^P = \overline{A}^P Y_t^* p_t^Y + \varepsilon_{T^P, \frac{Y^r}{Y^*}} \left(Y_t - Y_t^* p_t^Y \right).$$

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[13] See, for example, Bouthevillain, 2001.

[14] From 1996 till 1999, tax-free income was 500, in 2000 it was 800 and since 2001 it has been 1,000 kroons a month.

We have used Hodrick-Prescott filter based potential GDP time series, with the smoothing parameter 400 in the estimation process. There was no noticeable difference when comparing these results with the ones got with the parameter 1600. This is due to the functional form, clearly seen in equation (18), where the long run growth of nominal GDP depends on potential GDP and thereby the estimate of sensitivity is not affected by the method used for potential GDP calculation (see Appendix 3). The sensitivity of personal income tax is 0.078, implying that an increase in GDP gap by one percentage point causes a raise in personal income tax revenues by 0.078 per cent of GDP.

3.1.2. Social Tax

The largest tax revenues for the government come from social tax. On average, this amounts to about 34–35% of the overall income. Incoming social taxes grew from 7 billion to 12 billion kroons between 1996 and 2001. The system concerning social taxes has remained stable. Changes to social policies have been relatively small and need not be separated from the data. Equation (24) is used to estimate cyclical sensitivity:

$$(24) \qquad T_t^S = \overline{A}^S Y_t^* p_t^Y + \varepsilon_{T^S, \frac{Y^r}{Y^*}} \left(Y_t - Y_t^* p_t^Y \right).$$

It appears that the sensitivity of social tax is 0.116 – when GDP gap increases by 1 percentage point, social tax revenue increases by 0.116 per cent of GDP.

3.1.3. Excises

Income from excises grew from 1.7 billion in 1996 to 3.5 billion kroons in 2001. Excises account for about 10% of government sector tax income. The regulations concerning excises have changed a lot during this period. However, it is problematic to describe the changes, mainly because of their large number and because they usually have a seasonal structure. In further analysis we have to assume that changing these taxes has had a little or no affect on their inflow to the general government budget. Again, the equation based on formula (20) is applied:

$$(25) \qquad T_t^E = \overline{A}^E Y_t^* p_t^Y + \varepsilon_{T^E, \frac{Y^r}{Y^*}} \left(Y_t - Y_t^* p_t^Y \right).$$

In case of excises, the cyclical sensitivity is 0.042.

3.1.4. Value-Added Tax

While in 1996 the inflow to government budget from VAT was 5 billion kroons, in 2001 it had risen to 8.5 billion kroons, making up 26% of budget income from taxes. During this period changes were made to the list of goods that attracted VAT, changes were also made to the tax rates, but the influence on incoming taxes was relatively small and there was no need to eliminate the factors resulting from discretionary policies to correct the sensitivity estimation (see Equation 26).

$$(26) \qquad T_t^V = \overline{A}^V Y_t^* p_t^Y + \varepsilon_{T^V, \frac{Y^r}{Y^*}} \left(Y_t - Y_t^* p_t^Y \right).$$

The value of $\varepsilon_{T^V, \frac{Y^r}{Y^*}}$ has been 0.096 during 1996–2001.

3.1.5. Corporate Income Tax

Budgetary revenue from corporate income tax has to be divided into two periods. The line between them is January 1, 2000. Starting from that day, no tax was required to be paid on accumulated profits; only dividends were a subject of taxation. Since then, budget income from corporate income tax has decreased to only 2% of government sector tax revenues. In 1998, tax revenues coming from corporate income tax were at their highest level – about 2 billion kroons. By the year 2001, this income had decreased to 0.7 billion kroons. We applied equation (27):

$$(27) \qquad T_t^C = \overline{A}^C Y_t^* p_t^Y + \varepsilon_{T^C, \frac{Y^r}{Y^*}} \left(Y_t - Y_t^* p_t^Y\right),$$

but no cyclical pattern in corporate income tax revenues could be detected. The conclusion here is that cyclical sensitivity of corporate income tax is zero.

3.1.6. Non-tax revenues

Cyclical sensitivity of non-tax revenue is estimated the same way as it was done in case of taxes (see Equation 28).

$$(28) \qquad T_t^{NTR} = \overline{A}^{NTR} Y_t^* p_t^Y + \varepsilon_{NTR, \frac{Y^r}{Y^*}} \left(Y_t - Y_t^* p_t^Y\right).$$

However, as already seen in case of corporate income tax, there was no evidence on clear cyclical impact on non-tax revenue.

3.2. Government Sector Expenditure

Half of all government sector expenditure goes on goods and services, of which 40 per cent are wages and 60 per cent other goods and services. Government expenditure on goods and services is not bound to economic growth directly and this is why it does not change automatically as a reaction to a shift in economic activity but the change is caused by political decisions, ie discretionary fiscal policy.

Transfers and subsidies make up about 40% of total expenditures, out of which transfers to households constitute a little more than 70%. About 70% of transfers are pensions, 13% are child support and 7% are illness compensations. Similarly, as these expenditure items were not bound to economic growth during 1996–2001, they were not dependent on business cycle either. The only component of expenditure, which reacts to business cycles, is unemployment compensation and living allowances, but these added together make up about 5% of all transfers. Even if unemployment compensation was highly dependent on GDP gap, its very small share in transfers indicates that the impact on total expenditure must be even less than modest. That is the reason why it can be concluded here that cyclical fluctuations should only influence household transfers marginally. Since in the case of government expenditure and transfers it can be assumed that sensitivity equals zero; this has not been measured separately[15].

4. Calculating the Structural Balance and the Size of Automatic Fiscal Stabilisers

The basis for calculating structural balance was given previously by equations (13) and (14). Since the only macro indicator in use is the GDP gap, the cyclical components of the revenue items (taxes and non-tax revenue) can be expressed as follows:

(29) $$R_t^{c,j} = \varepsilon_{R^j,\frac{Y^r}{Y^*}}\left[\left(\frac{Y_t^r}{Y_t^*}-1\right)\times 100\right]R_t^{\;j}$$

where $R_t^{c,j}$ is the cyclical component of *j-s* revenue item, R_t^j is it's actual value in period *t*, $\varepsilon_{R^j,\frac{Y^r}{Y^*}}$ is revenue's *j-s* item's sensitivity to the GDP gap. Cyclical component of all revenues is as follows:

(30) $$R_t^c = \sum_j \varepsilon_{R^j,\frac{Y^r}{Y^*}}\left[\left(\frac{Y_t^r}{Y_t^*}-1\right)\times 100\right]R_t^{\;j}\ .$$

Since, as previously shown, expenditures do not depend on GDP fluctuations, the cyclical sensitivity of budget forms on the basis of cyclical sensitivity of revenues:

(31) $$B_t^c = R_t^c + E_t^c = R_t^c \qquad E_t^c = 0, \qquad t = 1,...,T\ .$$

The sum of revenue sensitivity ($\sum_j \varepsilon_{R^j,v^j}$) is about 0.35, showing that there is a cyclical change in budget balance amounting to 0.35% of GDP when GDP gap increases by 1 percentage point. Using this indicator in regard to the business cycle, Estonia is at the same level as EMU countries with a less sensitive fiscal position (the EMU average is 0.5). It appears that the difference between the structural and actual budget balance has not exceeded 1.35% of GDP on any sample year. Even in 1999, when according to PF 1, GDP gap reached -3.9%, the cyclical component of the budget was found to be only -1.31% of GDP (see Table 2).

It can be said that, because of the low budget sensitivity in relation to GDP, the threat of exceeding the SGP 3% deficit limit is low. This is true even if structural deficit reaches 1% of GDP (then the GDP gap should exceed 5% and the criteria would be in danger).

[15] According to European Commission's opinion, the government sector expenditure in Germany, Greece, Spain, Italy and Austria is non-elastic towards cyclic fluctuations too (European Economy, 2000).

Table 2. Cyclical components of general government budget (% of GDP)

	GDP gap				Cyclical component			
	λ=400	λ=1600	PF 1	PF 2	λ=400	λ=1600	PF 1	PF 2
1996	-1.59	-1.76	-2.9	-2.4	-0.54	-0.60	-0.99	-0.80
1997	1.96	2.26	1.4	1.8	0.67	0.77	0.46	0.61
1998	1.95	2.17	1.5	1.4	0.66	0.74	0.49	0.49
1999	-2.72	-2.92	-3.9	-3.7	-0.92	-0.99	-1.31	-1.27
2000	-0.18	-0.46	-1.6	-1.2	-0.06	-0.16	-0.53	-0.40
2001	0.07	0.07	0.8	0.4	0.02	0.02	0.27	0.15

The variation of the cyclical component, depending on the research method, can be regarded as relatively small. The difference between minimum and maximum values is, on average, 0.35% of GDP. This is also why the estimates of structural budget balance are rather similar. Difference between actual and structural budget balance is formed according to whether the GDP gap is positive or negative and whether discretionary steps have caused a structural budget deficit or surplus. In a growth phase, the functioning of automatic fiscal stabilisers improves actual fiscal position when compared to structural balance. When the structural budget is in deficit, the current positive GDP gap reduces the actual budget deficit (see Figure 4, 1998). In case of structural budget surplus, the actual budget surplus turns out even larger (1997). Conversely, in an economic downturn, the actual budget position worsens when compared to the structural position (1996, 1999 and 2000).

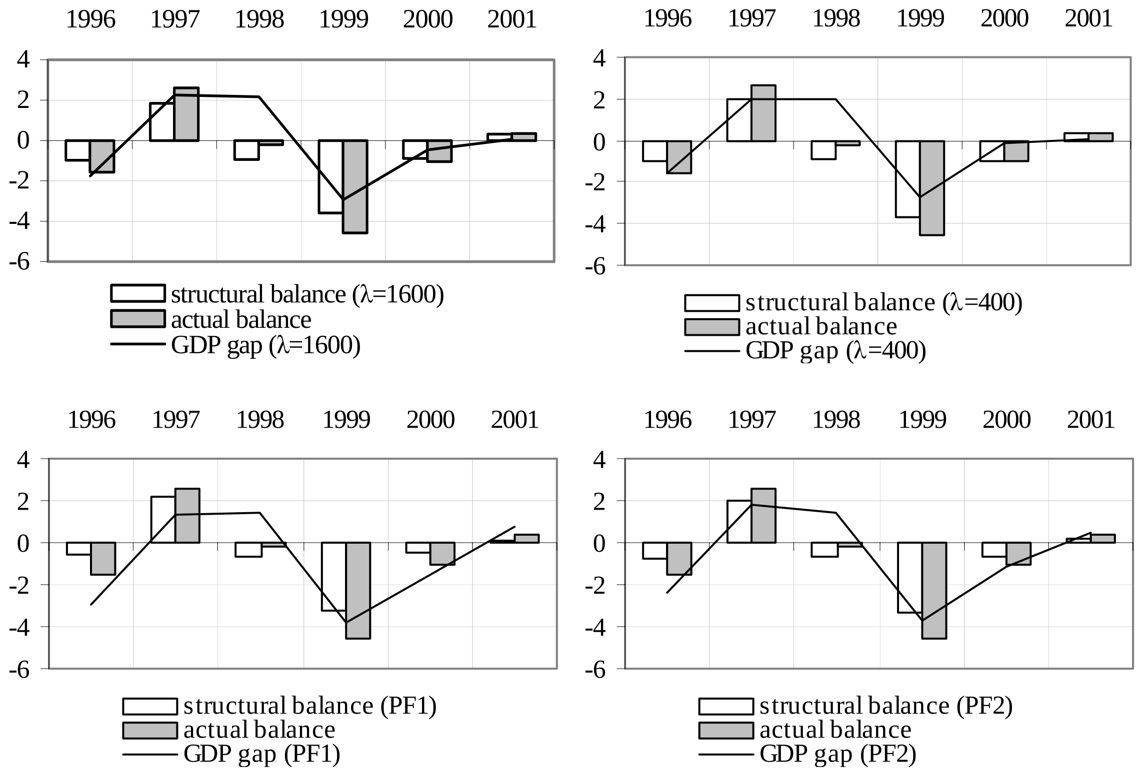

Figure 4. GDP gap (%), the actual and structural balance in case of different smoothing parameters and production functions (% of GDP)

It can be concluded from Figure 4 that the operation of automatic stabilisers has made Estonia’s government sector budgetary position more volatile (resulting directly from the nature of the stabilisers). This has been intensified by counter-cyclical steps of discretionary fiscal policy. Standard deviation of the actual budget balance in 1996–2001 was 2.4% of GDP and of the structural balance 1.7% of GDP. In 1997, when the actual surplus was 2.7% of GDP, the structural surplus, depending on the method used, was between 1.8 and 2.1% of GDP. In 1999, when there was a remarkable deficit and government sector expenditure exceeded revenue by 4.6% of GDP, the structural deficit between 3.3 and 3.6% of GDP was somewhat smaller.

Following the dynamics of the structural budget, we can clearly identify the tendencies in fiscal policy, ie whether the discretionary fiscal policy supports or hinders total demand. We can analyse fiscal policy tendencies by comparing current policy decisions with previous periods. To this end, the annual difference of structural budget balance is used for identifying the effects of discretionary fiscal policy. These differences in structural budget for different estimates of GDP gap are shown in Figure 5.

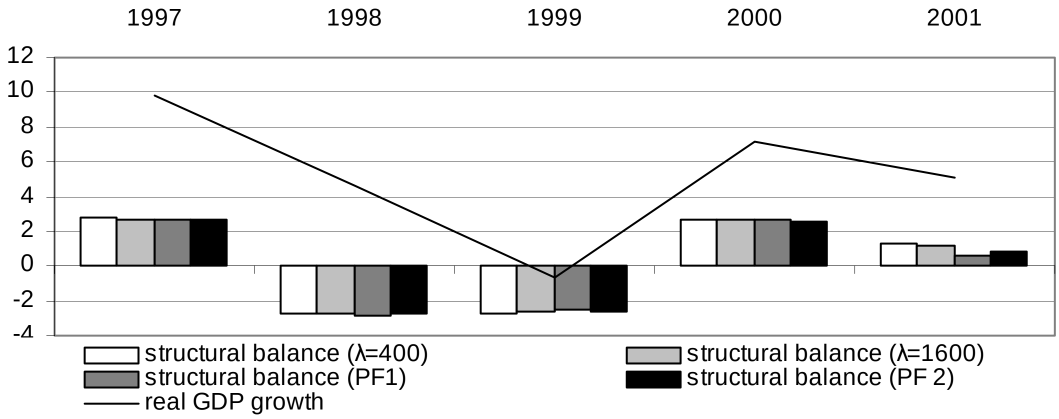

Figure 5. Differences in the structural budget balance compared to previous years (% of GDP) and the growth rate of actual GDP

As we can see, in 1998 and 1999, the annual difference of structural balance was negative inferring that compared to previous years the government had directed more resources to the economy and carried out expansive fiscal policies. Conversely, in 1997, 2000 and 2001 the fiscal policy was restrictive in nature. Comparing these results with the dynamics of GDP gaps we can conclude that, during the sample period, Estonian fiscal policy has been mainly counter-cyclical and directed at smoothing cyclical fluctuations in an economy.

Conclusion

In the current article we confirm the assumption that the Estonian tax framework and budget expenditure determine the modest size of our automatic fiscal stabilisers. Based on data from 1996 until 2001 and using the two-step method, the cyclical sensitivity of the budget was found to be only 0.35 (in EU countries the average is between 0.3 and 1.1). This means that when GDP diverges from its potential by 1%, budget balance will change accordingly by up to 0.35% of GDP. Since this method does not take into account reactions between the budget and the economy, actual cyclical sensitivity may be even smaller than the figure calculated. This means that, for example, in 1999 the economic downturn (negative gap 3.9%) caused a budget deficit of only 1.3% of GDP.

The positive aspect of such a low cyclical sensitivity is the limited danger of exceeding the SGP budget deficit limit of 3% of GDP. Calculations show that even in an extreme case, when the GDP gap reaches 5%, the Estonian government sector structural budget deficit could be up to 1% of GDP without putting the given criteria at risk.

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Appendices

Appendix 1. Cyclically adjusted budget balance in EU countries (comparison of cyclical components calculated based on the methods of ECB, EC, OECD and IMF)

	Cyclically adjusted budget balance in EU			**Size of the budgetary cyclical components (% of GDP)**											
				ECB			EC			OECD			IMF		
	'98	**'99**	**'00**	**'98**	**'99**	**'00**	**'98**	**'99**	**'00**	**'98**	**'99**	**'00**	**'98**	**'99**	**'00**
BEL	-0.6	-0.3	0.0	-0.3	-0.4	0.0	-0.5	-0.6	0.1	-1.2	-1.1	-0.3	-1.3	-1.1	0.1
GER	-1.7	-1.4	-1.0	-0.4	0.0	0.0	-0.6	-0.7	-0.2	-1.0	-1.0	-0.5	-1.0	-1.0	-0.5
GRE	-2.6	-2.0	-0.9	0.2	0.1	0.0	-0.4	-0.4	-0.1	-1.0	-0.8	-0.3	-1.8	-1.3	-0.6
SPA	-2.4	-1.4	-0.8	-0.2	0.2	0.5	-0.2	0.0	0.4	-1.0	-0.2	0.2	-0.7	-0.1	0.5
FRA	-2.1	-1.4	-1.5	-0.6	-0.2	0.1	-0.5	-0.3	0.0	-0.9	-0.4	0.1	-1.0	-0.8	-0.4
IRL	1.8	1.6	3.8	0.3	0.5	0.7	0.2	0.7	1.4	0.4	0.8	1.4	0.6	0.9	1.5
ITA	-2.8	-1.7	-1.6	0.0	0.0	0.1	-0.3	-0.6	-0.2	-0.8	-1.0	-0.6	-1.0	-1.2	-0.8
LUX	4.2	5.2	5.2	-1.0	-0.5	0.1	-1.3	-0.5	1.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NED	-0.6	0.6	0.9	-0.1	0.3	0.6	-0.1	0.3	0.6	0.1	0.5	0.6	0.3	1.0	2.1
AUT	-2.1	-2.1	-1.7	-2.1	-2.1	-1.7	-0.2	-0.2	0.0	-0.1	0.0	0.6	-0.6	-0.5	0.4
POR	-2.3	-2.7	-2.3	0.1	0.6	0.6	0.1	0.1	0.3	0.1	0.1	0.1	0.0	-0.1	0.0
FIN	0.0	0.5	5.5	0.5	1.3	1.2	0.5	0.6	1.6	-1.7	-1.3	0.1	-0.8	-0.6	0.0
EUR 12	-1.9	-1.2	-0.9	-0.4	0.0	0.2	-0.4	-0.4	0.0	-0.8	-0.6	-0.2	-0.8	-0.7	-0.2
DEN	0.3	2.4	2.2	0.6	0.6	0.3	0.6	0.3	0.6	0.1	0.3	0.7	0.5	0.8	1.2
SWE	2.3	1.0	3.2	-0.7	0.7	0.9	-0.7	0.2	0.7	-1.1	-0.1	0.3	-3.3	-2.2	-0.4
UK	0.2	1.0	2.0	0.1	1.0	2.0	0.1	0.0	0.1	0.1	0.1	0.3	-0.2	0.0	0.1
EU 15	-1.4	-0.8	-0.3	-0.3	0.1	0.2	-0.3	-0.3	0.1	-0.7	-0.5	-0.1	-0.8	-0.6	-0.1

Source: Bouthevillain *et al*, 2001.

Appendix 2. List of acronyms

Acronym	Explanation
Y_t^r	GDP in constant prices
Y_t^*	Potential GDP
Y_t^c	Cyclical component of the real GDP
Y_t	Nominal GDP
$Y_t^{p,r}$	Business sector's output in constant prices
p_t^Y	GDP deflator
λ	Hodrick-Prescott filter' smoothing parameter
L_t	Total employment
L_t^p	Actual employment of business sector
L_t^{p*}	Full (potential) employment of business sector
LFS_t^*	Smoothed time series of workforce
L_t^g	Employment of public sector
$NAWRU_t$	Non-accelerating wage rate of unemployment
W_t^B	Average gross wage
U_t	Unemployment level
K_t	Actual capital stock of the private sector
G_t	Total factor productivity
R_t	Government budget revenues
R_t^s	Government budget structural revenues
R_t^c	Government budget revenues' cyclical component
$R_t^{c,j}$	Cyclical value of *j*-s revenue item
T_t^j	Actual value of *j*-s tax
T_t^P	Personal income tax
T_t^C	Corporate income tax
T_t^S	Social security tax
T_t^E	Excises
T_t^V	Value-added tax
NTR_t	Non-tax revenue
E_t	Government budget expenditures
E_t^s	Government budget structural expenditures
E_t^c	Government budget expenditures' cyclical component
C_t^G	Government purchased goods and services

TR_t^G	Government transfers to households
I_t^G	Government capital expenditures
i_t^G	Government interest payments
B_t	Government budget balance
B_t^s	Government budget structural balance
B_t^c	Government budget cyclical component
$B_t^{c,j}$	Cyclical part of the budget's *j*-component
$v_t^{c,j}$	Macro indicator gap, influencing the budget's *j*-component
TF_t^P	Tax-free income (personal income tax)
tr^P	Personal income tax rate
ε_{B^j,v^j}	Sensitivity of the budget's *j*-component to the influencing macro indicator gap; general form
ε_{R^j,v^j}	Sensitivity of budget revenue's *j*-s component to GDP gap
ε_{E^j,v^j}	Sensitivity of budget expenditure's *j*-s component to GDP gap
$\varepsilon_{T^P,\frac{Y^r}{Y^*}}$	Sensitivity of personal income tax to GDP gap
$\varepsilon_{T^S,\frac{Y^r}{Y^*}}$	Sensitivity of social security tax to GDP gap
$\varepsilon_{T^C,\frac{Y^r}{Y^*}}$	Sensitivity of corporate income tax to GDP gap
$\varepsilon_{T^E,\frac{Y^r}{Y^*}}$	Sensitivity of excises to GDP gap
$\varepsilon_{T^V,\frac{Y^r}{Y^*}}$	Sensitivity of value-added tax to GDP gap
$\varepsilon_{NTR,\frac{Y^r}{Y^*}}$	Sensitivity of non-tax revenue to GDP gap
$\overline{A}^j$	Budget's *j*-component's share in nominal GDP long-run value when output gap equals zero; general form
$\overline{A}^P$	Share of personal income tax in nominal GDP long-run value
$\overline{A}^S$	Share of social security tax in nominal GDP long-run value
$\overline{A}^C$	Share of corporate income tax in nominal GDP long-run value
$\overline{A}^E$	Share of excises in nominal GDP long-run value
$\overline{A}^V$	Share of value-added tax in nominal GDP long-run value
$\overline{A}^{NTR}$	Share of non-tax revenue in nominal GDP long-run value

Appendix 3. Results of sensitivity estimation

		$\overline{A}^j$	ε_{B^j, v^j}	*DW*	R^2	R^2 *adj*
T_t^P	$\lambda = 400$	0.074*** (0.001)	0.078*** (0.019)	2.26	0.99	0.99
	$\lambda = 1600$	0.074*** (0.001)	0.079*** (0.018)	2.27	0.99	0.99
T_t^C	$\lambda = 400$	0.021*** (0.001)	0.082 (0.049)	1.72	0.60	0.56
	$\lambda = 1600$	0.021*** (0.001)	0.077 (0.046)	1.72	0.60	0.56
T_t^S	$\lambda = 400$	0.119*** (0.001)	0.116*** (0.035)	1.98	0.91	0.88
	$\lambda = 1600$	0.119*** (0.001)	0.116*** (0.032)	1.98	0.91	0.88
T_t^V	$\lambda = 400$	0.102*** (0.002)	0.096** (0.046)	1.45	0.80	0.76
	$\lambda = 1600$	0.102*** (0.002)	0.102** (0.043)	1.44	0.80	0.77
T_t^E	$\lambda = 400$	0.042*** (0.002)	0.042*** (0.014)	2.65	0.84	0.82
	$\lambda = 1600$	0.042*** (0.002)	0.043*** (0.015)	2.65	0.84	0.81
NTR_t	$\lambda = 400$	0.045*** (0.003)	0.292 (0.168)	1.60	0.49	0.45
	$\lambda = 1600$	0.045*** (0.003)	0.275 (0.157)	1.59	0.49	0.45