FILL THE GAP – MEASUREMENT OF THE CYCLICAL EFFECT ON THE BUDGET

Gábor P. Kiss and Gábor Vadas*

Abstract

Assessment of fiscal policy involves one of the most vivid discussions in every country. Since budgets are influenced by business cycles there is enormous interest in disentangling the underlying fiscal position from the effect of the business cycle. There are two distinguished methods advocated by international institutions to determine this cyclical factor. Apparently, neither is able to fulfil all requirements. In this paper we introduce a disaggregate methodology, which is not only able to incorporate theoretical considerations but also easily computable while not requiring unavailable data. Besides the derivation of the cyclical component we show that if the deflators of variables are different then the real cyclical component has to be corrected to obtain the nominal cyclical component. We show that the underlying, structural deficit can be obtained by employing unit elasticities between taxes and tax bases. Alternatively, discretionary measures can be re-calculated by estimating elasticities from the distribution of the tax burden in each year. We have found that specific features of tax and unemployment systems sometimes render the direct estimation of the cyclical component useless. In this case the cyclical component can be obtained as a residual by estimating directly the underlying trends of those budget items.

JEL Classification Number: H62, E32

Keywords: cyclically adjusted budget deficit, price gap, business cycles, constrained multivariate HP filter

Gábor P. Kiss: Principal Economist, Economics Department, Magyar Nemzeti Bank, kissg@mnb.hu

Gábor VADAS: Senior Economist, Economics Department, Magyar Nemzeti Bank, vadasg@mnb.hu

* I am indebted to Lajos Ábrahám, István Battyani and Miklós Kassai for their invaluable work and support.

I. Introduction

Methods of the cyclical adjustment seek to remove the cyclical effects from budget revenues and expenditures. This can be done in two different ways depending on the objective of such an indicator.

One approach focuses on measuring the degree of government activity. This approach requires removing exogenous effects from the deficit, including effects of the cycle, deflators, exchange rates and interest rates. The problem is that most of these effects can be influenced by government measures, in other words they are not entirely exogenous. Let us consider the case of government consumption, which directly affects both GDP in real terms and the GDP deflator. Other measures, for example changes in indirect tax rates have a direct and an indirect effect on inflation, consumption and profits at the same time.[1] Usually this approach focuses on a one-year definition of government activity instead of taking into account discretionary measures with multi-year impacts, for example designing automatic stabilisers in such a manner that budget responses are more than equiproportionate.

Another approach aims at identifying the structural, underlying component of the deficit. In this case temporary effects should be removed from the budget. Usually these efforts are concentrated on filtering out effects of cyclical fluctuations, temporary fiscal measures and interest rates, but fluctuations of deflators are not addressed. It is important to note that cyclical fluctuations and temporary measures can have overlapping parts since temporary budget spending automatically affects tax bases and revenues. Another issue is that budget responses should be assumed to be equiproportionate, since progressivity by definition has only temporary effects.

In practical application there are also two common methods of cyclical adjustment: the aggregate approach and the unconstrained disaggregate approach. The first one is advocated by the IMF, OECD and the European Commission, while the second is applied by the European Central Bank. Using data from the USA, Japan and 25 EU member countries, P. Kiss and Vadas (2005) demonstrate that both approaches have significant shortcomings, which could be the source of considerable bias. While the aggregate approach cannot cope with different shocks, the unconstrained disaggregate method involves systematic bias and does not contain theoretical consideration. In order to avoid these distortions they established an alternative framework, which is able to incorporate the advantages of both approaches. However, their method assumes an exogenously given output gap and ignores the effect of unemployment on the budget. Finally, none of the recent methods takes into consideration the effect of different deflators. Note that the computation of the cyclical factor involves several GDP elements in real terms, while the budget is evaluated in nominal terms. If the deflators of GDP elements are different then the real and nominal cyclical components are different as well.

In this paper we introduce a methodology that overcomes these limitations. We concentrate on measuring the underlying, structural position of the budget; therefore by definition unit elasticities are employed. Here we do not address the issues of temporary

[1] For a discussion of such direct and indirect effects see the Report on Inflation of Magyar Nemzeti Bank, August 2003.

fiscal measures and fluctuations of deflators, but our proposed method also reduces the potential distortions related to them.

II. Overview of recent approaches and their shortcomings

The cyclical position of the economy is a commonly cited and widely used concept in the evaluation of current states of affairs by both policy makers and analysts. Although the intuitive concept of the cyclical position is quite common among economists, the way it is measured provides grounds for discussion. This disagreement is induced by the nature of the cyclical component, namely it is unobservable and thus cannot be measured statistically.

There are several econometric ways to handle this problem, and practically all of them have been tested as possible candidates for measuring trends and cyclical positions. Due to the large number of approaches, we focus our overview only on two widely-used methods. Firstly, the aggregate approach proposed by the European Commission, IMF and OECD. As we will show, the aggregate approach could be misleading in certain cases. In order to avoid that, the European Central Bank (ECB) advocates the disaggregate approach. Nevertheless, disaggregation raises two essential issues: (1) the sum of parts should equal the total value, (2) different deflators are used in the case of different parts, which are not handled in ECB type disaggregation.

II. 1. Aggregated approach

As mentioned, this method is applied by the European Commission, IMF and OECD. The key idea of their approach is to focus on the aggregate output gap, deriving its effect on the budget. Denis et al. (2002) describe the Cobb-Douglas production function using neutral technological progress to estimate potential output:

$$Y_t^* = TFP_t \left[L_t(1-U_t^*)\right]^{\alpha} K_t^{1-\alpha} \tag{1}$$

where Y^*, L, K, U^* and TFP denote output, labour input, capital stock, trend unemployment rate and total factor productivity respectively. The trend unemployment rate is considered as NAIRU (the non-accelerating inflation rate of unemployment) and estimated by a state space model (see Denis et al., 2002) while TFP is computed as a Solow residual. Instead of estimating labour (α) and capital (1-α) shares, the EC suggests using national accounts to calibrate them. The output gap is computed in the usual way $OG_t = Y_t / Y_t^*$. The aggregated approach applies simple elasticities to compute the cyclical position of the relevant GDP components, such as private wages, consumption, corporate profit, etc. These elasticities are derived by estimating the co-movement between output and corresponding variables.

Unfortunately the aforementioned method has several drawbacks.

Firstly, estimating certain elasticities does not take into account and exploit the consequences of choosing the Cobb-Douglas production form, namely that the sum of the labour and capital income gap, weighed by labour and capital shares, should be equal to the aggregated output gap. Moreover, labour and capital shares cannot be assumed constant even in the case of developed economies, not to mention transition economies.

Secondly, the unemployment rates in transition economies have been influenced by several shocks and thus the standard relations and state space estimation yields inappropriate results.

Thirdly, capital stock and/or TFP are not available in several countries. Even if they are available, since they are not observable variables, their values are the results of an estimation process

Finally and more importantly, in some countries in some periods the disaggregated approach can be identified as the more appropriate way of cyclical adjustment, because the aggregate output gap and its composition can be considerably different. The significantly different budgetary implications of these kinds of 'atypical' circumstances were taken into account in some ad hoc analyses (European Commission, 2000), and a few new methods were introduced (Bouthevillain et al., 2001; P. Kiss, 2002; Braconier and Forsfält, 2004).

Boije (2004) argues that the aggregate output gap hides the underlying developments. While the same output gap can be made up from various components, this gap has different effects on the economy and the budget. However, the aggregate approach calculates exactly the same effect based on an identical aggregated output gap.[2] This phenomenon may explain Cronin and McCoy's results (1999). They found that the constant elasticities of budgetary revenue and spending on output were not plausible. However, these results may be attributed to the above-mentioned fact. Even if elasticities on disaggregated gaps are stable, elasticity on the aggregate differs if the shares of disaggregated gaps are not constant, which is likely to hold true for all countries.

P. Kiss and Vadas (2005) examined the potential bias of aggregation in the United States, Japan and 25 member countries of the EU. Excluding the USA, aggregation bias causes at least 0.1 of a percentage point error in the cyclical component in almost the entire sample. Serious bias, i.e. distortion is more that 0.5 per cent of GDP, occurs roughly in half the sample. The distortion becomes more policy-related if we consider the frequency of those cases when two methods, namely aggregated and the disaggregated one, provide different signs, i.e. a misleading cyclical indication for fiscal tightening or loosening. In the case of France the aggregate method provides a wrong indication in 33 per cent of cases. Actually this cannot be considered an extreme result, since the average of 27 countries is 15 per cent.

II. 2. ECB type disaggregated approach

Based on the foregoing, the ECB advocates a disaggregated method. Practically, Bouthevillain et al. (2001) estimate numerous gaps, such as private wages, employment, consumption, corporate profit and the unemployment gaps, using the univariate Hodrick-Prescott filter.

Although this helps to identify the various cyclical positions of relevant economic factors and is extremely easy to adapt, there are some problems weakening its acceptability.

The most trivial one is that using only one univariate method may result in an extreme solution that cannot be revealed, since there is no control method. Moreover, Darvas and

[2] For instance, suppose a fictive example in which the first economy is hit by a foreign demand shock, i.e. negative export gap, while the second economy faces a negative consumption shock. Since exports have a smaller direct effect on budget position than consumption, the cyclical effect on the budget is smaller in the first economy.

Vadas (2005) prove that better results can be achieved by using several methods. From the point of view of policy making, the stability of the output gap estimate is crucial. Methods which provide extensive revision in the estimated output gap cannot be used in policy decision making, since they may frequently render previous decisions inadequate. Using a revision-based weighting scheme, Darvas and Vadas (2005) found that a multiple-method approach provides a more stable output gap estimation than the adoption of a single method.

The most important and relevant objection to univariate HP filtering is that there is no theoretical relationship among variables. Bouthevillain et al. (2001) and Mohr (2003) argue that the linear nature of the HP filter ensures theoretical consistency among variables, as the weighted sum of disaggregated HP-filtered gaps equals the aggregate gap. Even though the HP filter is linear, this characteristic cannot be exploited in the field of economic time series, since economic time series should be log-transformed in the HP filter[3] and, as a consequence, aggregation constraint is not satisfied.[4]

P. Kiss and Vadas (2005) estimated the expected bias of not satisfied aggregation constraint. They argue that, due to the non-linear logarithmic transformation, ECB type disaggregation yields fairly asymmetric bias. According to their calculation the maximum effect of this bias on the cyclical component could be as high as 2 per cent of GDP. Apart from the USA and 10 new EU member countries, where the samples are quite short, the violation of aggregation constraint causes at least 0.1 of a percentage point error in the cyclical component in 16–84 per cent of the sample. Serious bias, i.e. distortion is more that 0.5 per cent of GDP, is presented roughly in 2–36 per cent of the sample. To put it briefly, unconstrained decomposition could be a considerable source of bias.

II. 3. Effect of different deflators

Hitherto we have considered variables in real terms; however, both tax bases and tax revenues are in nominal terms in reality. As a result, real and nominal cyclical positions may have different signs. Therefore, it seems necessary to introduce prices, that is, to use nominal variables.

To make it clearer, suppose that the real consumption gap determines the real cyclical position of indirect taxes. Nominal consumption is obtained by multiplying real consumption with the consumer price index, while indirect taxes are multiplied by the GDP deflator. If the consumer price index is higher than the GDP deflator then nominal indirect taxes are higher than their real counterpart induces.

For instance, consider the Hungarian economy in the mid 1990s. Due to the high inflation rate and tight fiscal policy, the consumption gap was negative in real terms, while the consumer price index was higher than the GDP deflator. As a result, despite the negative

---

[3] The general form of univariate HP filter is $\min\left[\sum (X - X^*)^2 + \lambda \sum (\Delta X - \Delta X^*_{-1})^2\right]$. Note that economic time series are generally exponentially growing, which means ΔX_t is also growing in time. As a consequence the second, smoothness term in the HP filter would give higher importance to the end of the sample. Log transformation renders the economic time series to I(1) series implying that Δx_t becomes constant and avoids this 'over-weighting'.

[4] It is apparent if $X + Y = Z$ and HP(X) + HP(Y) = HP(Z) then $x + y > z$, when X, $Y > 1$ thus HP(x) + HP(y) > HP(z), where small letters denote the logarithm of variables.

consumption gap, the nominal cyclical position of budget revenues was relatively favourable.

Based on P. Kiss and Vadas (2005), the price effect caused by the different GDP deflator and consumer price index could have a considerable impact in certain periods. For instance, in Portugal the price effect caused an approximately 6 per cent difference between real and nominal CAB.

III. A new method of measuring the cyclical position

In line with the ECB we do agree that aggregate output gap could hide relevant underlying processes. We also argue for the importance of the disaggregated approach; however, we insist on the theoretical foundation of output gap, the existence of a theoretical relationship among cyclical components and the satisfied aggregation constraint. In addition, we also suggest taking into account the effect of different deflators in the disaggregated method.

III. 1. Deriving the cyclical position

In this part we introduce an easily tractable method, which is capable of decomposing output gap obtained from production function and satisfies the aggregation constraint using time varying labour and capital income shares.

The use of production function can be favourable, since it is based on broader information content and factors, which define the aggregate gap. The main drawback of the application of the 'full-form' of production function as in equation (1) is that it involves several estimated variables, such as capital stock and TFP. Note that, since we need only the output gap, these uncertain variables are not necessary. The ratio of actual output to its potential counterpart can be computed by

$$\frac{Y_t}{Y_t^*} = \frac{K_t^{1-\alpha_t}\left[L_t(1-U_t)TFP\right]^{\alpha_t}(1+\varepsilon_{Y,t})}{K_t^{1-\alpha_t}\left[L_t(1-U_t^*)TFP\right]^{\alpha_t}(1+\varepsilon_{Y^*,t})} = \frac{(1-U_t)^{\alpha_t}}{(1-U_t^*)^{\alpha_t}}(1+\varepsilon_{gap,t}) \tag{2}$$

where we use Cobb-Douglas form with labour-augmenting technological progress.[5] Contrary to IMF, OECD and EC approach we apply more realistic time varying capital share, which can be obtained from either estimation[6] or national accounts. This specification allows us to avoid the assumption of constant labour and capital income share. Keep in mind also that these shares determine how to decompose aggregate output gap into its components. After simplifying and log-transforming of equation (2) we obtain:

$$y_t - y_t^* = \alpha_t\left[\ln(1-U_t) - \ln(1-U_t^*)\right] + \varepsilon_{gap,t} \tag{3}$$

where U^* and small letters denote the trend unemployment rate.[7]

---

[5] Neutral technological progress is not justified by empirical work.

[6] Kalman filter estimation of time varying capital share can be found in P. Kiss and Vadas (2004).

[7] Small letters denote the logarithm of corresponding variables.

Similar to the levels of incomes, the parameters of the production function also identify the relations among output gap $(y-y^*)$, labour $(w-w^*)$ and capital income $(\pi-\pi^*)$ gaps. The aggregate output gap equals the weighted sum of labour and capital incomes, where weights are wage (α) and capital shares (1-α). As a consequence, output gap can be decomposed in the following way:

$$y_t - y_t^* = \alpha_t(w_t - w_t^*) + (1-\alpha_t)(\pi_t - \pi_t^*) \tag{4}$$

where variables with superscript stars denote the potential or trend values of the corresponding variables.[8]

The above-mentioned criteria identify only the share of labour compensation and profit income gaps, not the magnitude of these gaps. Moreover, other real variables and their cyclical components should be determined. In order to achieve this we have to incorporate a behavioural equation to derive the necessary cyclical component, which is not determined by the parameters of production function.

Including behaviour equations is a solution for both the EC approach, i.e. it incorporates theoretical meanings and also ensures dynamic adjustment instead of simple elasticity, and the ECB approach, since it allows different disaggregated gaps. Obviously, several behavioural equations can be included. However, due to the fact that (1) the labour-compensation gap determines the direct tax on households, social security contributions and pensions, and (2) the profit gap determines direct tax on corporations, there are two potential budgetary elements left. One is the unemployment benefit, the other is indirect taxes on household consumption.

As far as unemployment benefit is concerned, the trend unemployment rate is estimated in line with the output gap (see equation (3)).

Indirect tax on households' expenditure is extremely substantial, therefore we incorporate a consumption function, which ensures that the potential values of wages and consumption are connected by theoretical consideration.

$$\Delta ce_t^* = \theta_1 + \theta_2\left(ce_{t-1}^* + \rho_1 + \rho_2 w_{t-1}^*\right) + \theta_3 \Delta ce_{t-1}^* + \theta_4 \Delta w_t^* + \varepsilon_{ce,t} \tag{5}$$

where *ce* denotes the log of private consumption expenditure and superscript stars continue to denote the potential of corresponding variables.

In order to incorporate the above equations into the decomposition and keep our approach tractable and easily reproducible we develop an alternative framework. Extending the ideas of Laxton and Tetlow (1992), Butler (1996) and St-Amant and van Norden (1997) with

---

[8] To understand the derivation of this constraint divide $Y_t^* = W_t^* + \Pi_t^*$ by Y_t and rearrange the right hand side to get

$$\frac{Y_t^*}{Y_t} = \frac{W_t}{Y_t}\frac{W_t^*}{W_t} + \frac{\Pi_t}{Y_t}\frac{\Pi_t^*}{\Pi_t}.$$

Note that labour and capital income shares enter into the constraint, namely $W_t/Y_t = \alpha_t$ and $\Pi_t/Y_t = 1-\alpha_t$. Using that $X_t/X_t^* - 1 \approx x_t - x_t^*$ if $x_t - x_t^*$ is small we obtain equation (4).

aggregation constraint, we apply a multivariate HP filter. Since the potential value of the wage and profit shares are constrained by equation (4), the entire system is influenced by theoretical equations (equations (3) and (5)). To achieve this, we embed the above-mentioned equations into the multivariate HP filter:[9]

$$\min_{\substack{y^*\pi^*w^*U^*ce^* \\ \theta_1\theta_2\theta_3\theta_4}} \left[\begin{array}{l} \omega_y \left[\sum_t (y_t - y_t^*)^2 + \lambda \sum_t (\Delta y_t^* - \Delta y_{t-1}^*)^2 \right] + \\ \omega_\pi \left[\sum_t (\pi_t - \pi_t^*)^2 + \lambda \sum_t (\Delta \pi_t^* - \Delta \pi_{t-1}^*)^2 \right] + \\ \omega_w \left[\sum_t (w_t - w_t^*)^2 + \lambda \sum_t (\Delta w_t^* - \Delta w_{t-1}^*)^2 \right] + \\ \omega_U \left[\sum_t (U_t - U_t^*)^2 + \lambda \sum_t (\Delta U_t^* - \Delta U_{t-1}^*)^2 \right] + \\ \omega_{ce} \left[\sum_t (ce_t - ce_t^*)^2 + \lambda \sum_t (\Delta ce_t^* - \Delta ce_{t-1}^*)^2 \right] + \\ \omega_{\varepsilon_y} \sum_t \left[y_t - y_t^* - \alpha_t \left[\ln(1-U_t) - \ln(1-U_t^*) \right] \right]^2 + \\ \omega_{\varepsilon_{ce}} \sum_t \left[\Delta ce_t^* - \left(\theta_1 + \theta_2 \left(ce_{t-1}^* - w_{t-1}^* \right) + \theta_3 \Delta ce_{t-1}^* + \theta_4 \Delta w_t^* \right) \right]^2 \end{array} \right] \tag{6}$$

subject to

$$y_t - y_t^* = \alpha_t (w_t - w_t^*) + (1 - \alpha_t)(\pi_t - \pi_t^*)$$

Only one question has been left open, namely, how to weight (ω_i) the different parts (lines) of the optimisation. In fact, there are two possible weighting schemes, which do not involve an arbitrary assumption. First, we leave every variable its own scale, i.e. $\omega_i = \omega_j, \forall i, j$. Second, every variable is normalized, which implies equivalent volatility. Instead of normalizing every variable we set ω_i as $\omega_i = 1/\sigma_i^2$, where σ_i^2 denotes the variance of i^{th} variable.[10]

---

[9] Based on empirical literature we restrict the cointegration vector to [1 –1] in the consumption equation. Note that other cointegration vectors would imply a plus or minus infinity saving rate, which is unacceptable from both a theoretical and an empirical point of view. However, it is technically possible to assume other cointegration vectors and estimate ρ_2 in line with the other parameters.

[10] To understand why this weighting scheme provides the same result as the normalisation, consider the normalized x_t

$$\tilde{x}_t = \frac{x_t - \bar{x}_t}{\sigma_x}$$

Now the minimization problem has the following form:

The solution to problem (6) provides the potential values of variables and the gaps.

III. 2. Correcting the effect of different deflators

Although there are several proposed methods[11] for capturing the trend or potential price level, the concept of potential price level is more dubious. In this paper we do not address the issue of price levels. However, another problem was identified, similar to the composition effect of real variables. We capture this composition effect by the difference between the consumer price index (CPI) and GDP deflator. In order to understand the basic idea of our method it should be noted that real variables are first deflated; however, the corresponding deflators differ variable by variable. For instance, corporate profit is usually deflated by the GDP deflator, while private wages and consumption are deflated by the consumer price index. Since budget deficit is compared to GDP, the GDP deflator is the relevant deflator.

To make the above more explicit, consider $BUD_{R,i} = BASE_{R,i}^{\beta}$ where *BUD*, *BASE*, *R* and β denote i^{th} budgetary revenue or expenditure, its corresponding base (e.g. personal income tax and wages), variables in real terms and the elasticity of budgetary revenue or expenditure to its base respectively. Note that the cyclical component is expressed relative to the output, thus the cyclical component in real terms (CC_R) can be obtained by

$$CC_R = \frac{BUD_{R,i}}{Y_R} = \frac{BASE_{R,i}^{\beta}}{Y_R} \tag{7}$$

Since the budget is evaluated in nominal terms equation (7) has to be reformulated. Presume that the tax base is deflated by the consumer price index. In this case $BUD_{R,i}P_Y = BUD_{N,i}$, $BASE_{R,i}P_{CPI} = BASE_{N,i}$ where *N* denotes variables in nominal terms and the cyclical component in nominal terms (CC_N) has the following form

$$\begin{aligned} CC_N &= \frac{BUD_{N,i}}{Y_N} = \frac{\left(BASE_{R,i}P_{CPI}\right)^{\beta}}{Y_R P_Y} \\ &= CC_R \frac{P_{CPI}^{\beta}}{P_Y} \end{aligned} \tag{8}$$

$$\min_{\tilde{x}_t^*}\left\{\sum_{t=1}^{T}(\tilde{x}_t - \tilde{x}_t^*)^2 - \lambda\sum_{t=2}^{T}(\Delta\tilde{x}_t^* - \Delta\tilde{x}_{t-1}^*)^2\right\}$$

Note that x_t^* can be estimated by $x_t^* = \sigma_x\tilde{x}_t^* + \bar{x}_t^*$, which results

$$\min_{x_t}\left\{\frac{1}{\sigma_x^2}\sum_{t=1}^{T}(x_t - x_t^*)^2 - \lambda\sum_{t=2}^{T}(\Delta x_t^* - \Delta x_{t-1}^*)^2\right\}$$

[11] For instance, Buti and Noord (2003), P. Kiss (2002) and Denmark in the annex of Bouthevillain et al. (2001). Based on their results, the Danish price gap from 1999 to 2000 could lift the cyclical component by 0.3 per cent of GDP.

Equation (8) reveals that the real cyclical component has to be corrected to obtain the nominal cyclical component if the deflators, in our case GDP deflator and CPI, are different.

Finally, those budget items which are influenced by this gap should be identified. Obviously, they are those which are determined by private wages and consumption, namely direct taxes on households, pension and social security contributions, and indirect taxes on households' consumption. Similar to the cyclical position of the real economy and budget deficit, the whole price gap effect is the weighted average of individual elements deflated by the consumer price index.

IV. Issues concerning fiscal elasticities

In the previous part we described how to estimate the cyclical components of different tax bases and unemployment. In order to derive the effect of gaps on the budget these components have to be multiplied by the respective budgetary elasticities.

IV. 1. Coverage of budget items

First of all, those tax receipts and some government expenditures should be identified which are influenced by cyclical fluctuations in the economic activity. For instance unemployment benefits are obviously connected to the business cycle. In some countries, other expenditures, such as pensions, are also directly influenced by cyclical fluctuations through different kinds of indexation techniques. At the same, time non-tax revenues and the majority of government expenditures are not directly affected by the cycle, or in other words they exhibit zero elasticities to the cycle.

The majority of government expenditures are also included in legal tax bases; therefore, they increase revenue automatically. The actual effects of discretionary spending can be measured by excluding their direct tax content. Both tax bases and revenues should be corrected by government outlays. The indirect taxes and contributions paid by the government and direct taxes and contributions paid by public employees are assumed to have zero elasticities, similarly to the corresponding expenditure items. In like manner, indirect tax revenues should be adjusted with the portion transferred to the EU, because this expenditure item is assumed to have zero elasticity. These data are available at the national level and the adjustments can be done by country experts. (ECB, 2001, annex) It would have been useful to obtain these internationally comparable data for our previous study; however the consolidation of budget data is unlikely to change our main results. (P. Kiss and Vadas, 2005)

Despite this issue of consolidation of budget data, indirect, or second-round effects of fiscal policy are still included in the revenue side, for example higher indirect tax revenue due to higher private consumption. In order to obtain a measure of the effect of fiscal policy on various macroeconomic variables, empirical models would be required in which the interrelationships of fiscal policy and economic behavior are specified.[12] Cyclical fluctuations affect the budget, which in turn has an influence on the cycle through

[12] Changes in private saving may partly offset changes in fiscal stance because temporary and permanent or anticipated and unanticipated measures probably affect demand in different ways.

spending programmes or changes in tax rules. Although taxes and tax bases can be easily consolidated with government expenditures, simultaneity cannot be corrected without empirical models.

IV. 2. Elasticities of budget items

After obtaining the coverage of the cyclically influenced budget items we have to identify the proper elasticities between them and the corresponding macroeconomic variables. This decision depends on the objective of our cyclically adjusted fiscal indicator.

Capturing the underlying, structural component of the deficit would require unit elasticities of the budget items. In order to identify discretionary measures taken in a given year, one should calculate elasticities for each year.

In a given year progressivity or degressivity of a tax system depends on the nominal elements, including brackets, ceilings and lump-sum taxes. As regards these nominal elements, the principle of "no policy changes" does not mean that nominal values should be fixed forever. In this extreme case, the bracket creeping effect[13] would qualify as a neutral policy. To be more realistic, the neutrality of the nominal elements can be achieved in two alternative ways.

If the government seeks to keep the tax burden unchanged, nominal values should be valorised by the expected per capita income each year. In this benchmark case, unit elasticity can be assumed even for personal income tax (PIT). This benchmark case is applicable not only for measuring the structural deficit but also for estimating effects of the multi-year discretionary measures.[14] For example, if the operated tax system is a progressive one, PIT could grow faster than income. The operation of this tax system requires a discretionary decision not only in the first year, but in the subsequent years, too. If we want to catch this multi-year impact, we have to use unit elasticities between taxes and tax bases. By calculating elasticities from tax codes in each year, our results capture only the effects of the discretionary actions of the year in question.

Another scenario is that the government keeps the tax burden unchanged over the cycle and therefore nominal values increase in line with medium-term trends in income. In this scenario, this would be the benchmark case for the no change policy, when the elasticity is higher than unity due to the built-in progressivity of the tax code. This built-in progressivity produces temporarily higher revenue in the case of expanding income in a self-reversing way. In other words, maintaining progressivity may qualify as a discretionary measure, but at the same time the bracket creeping effect of the progressive tax system may be excluded from the underlying fiscal position.

Although we assume unit elasticities between budget items and macroeconomic variables, this is not always a realistic assumption because of changing behaviour of tax payers and the legal framework of the tax and unemployment benefit system, which sometimes renders the operation of automatic stabilisers asymmetric. (See: P. Kiss and Vadas, 2004, p.16)

---

[13] In the case of increasing taxable income, nominally fixed (or not fully indexed) tax brackets generate revenues more than equiproportionately because of the higher marginal tax rates.

[14] Our assumption is that the passive policy would be reflected only in the operation of automatic stabilisers of the budget, but it would be possible to design automatic stabilisers in such a manner that budget responses are more than equiproportionate.

In the case of corporate taxation, elasticity depends on the severity of recession, i.e. it exhibits non-linear features. At a certain point (where there are no taxable profits at all) the elasticity becomes zero. Losses have a negative impact on the budget, but only on a deferred basis, as the profit has contrasting economic and legal definitions, and the latter allows for carry forward losses. Tax payers may also have options in reducing taxes in good years by timing their investment tax credits or increasing the deduction of depreciation.

The status of "entitled to unemployment benefits" is also different from the economic (ILO) definition of unemployment. If the period of entitlement to unemployment benefits is shorter than the business cycle, expansions do not significantly reduce expenditures (elasticity is close to zero), while recessions increase budget expenditures immediately.

In the case of corporate taxes and unemployment benefits there are no constant elasticities which can be applied between the macroeconomic bases and the budget items. One possible solution is estimating the underlying trends of the budget items and receiving the cyclical component as a residual in contrast to the usual approach, namely deducting the estimated cyclical components from actual figures in order to arrive at underlying trends as a residual value. Estimating the underlying trends of some budget items would allow us to calculate the hypothetical cyclical component. As we mentioned, this hypothetical component can be different from the actual one because of the impact of the legal framework and the behaviour of tax payers. In order to apply the standard unit elasticities without distortions we should complement the actual deficit with the difference of the hypothetical and actual cyclical component.

Direct estimation of the underlying trends of corporate taxes and unemployment benefits requires some information about discretionary actions. In the absence of measures the trend of these budget items would change in line with the trend of their corresponding macroeconomic variables. The effects of some measures can be easily estimated (e.g. changes in statutory tax rates or the entitlement period for unemployment benefits). More difficult to estimate are the effects of measures related to the "optional" elements of the tax code, which allow for the possibility of receiving investment tax credits, but which depend on the decisions of taxpayers.

One approach to the direct estimation involves a decomposition of the actual tax revenue or benefits into (i) a trend component adjusted by the estimation of the effects of changes in statutory rates or entitlement period for unemployment benefits and (ii) a residual component. These residuals represent the sum of effects of:

- Changes in the "optional" elements of tax code
- Built-in asymmetries of the legal framework
- Reactions of the tax payers or the unemployed.

If we calculate a moving average of these residuals we can estimate the underlying trends of taxes and benefits.

V. Summary

In this paper we have surveyed the official cyclical adjustment methods of relevant institutions, namely the aggregated approach of the European Commission, IMF and OECD, and the unconstrained disaggregate approach of the ECB.

Using production function and hence incorporating theoretical background in cyclical adjustment is the main advantage of the aggregate approach. However, it assumes that any other components, which are relevant in terms of budget revenue and expenditure, are in the same cyclical position as the output. Obviously this is rarely the case.

To handle the possibility of the different cyclical position of real variables the ECB suggests the disaggregated approach. Its method filters every relevant variable one by one using the single variable Hodrick-Prescott filter. The apparent criticism of this procedure is the lack of theoretical considerations. In addition, there are a serious implications involved with the application of the univariate HP filter. Since economic variables, due to their exponential nature, are log-transformed, the ECB type disaggregation cannot fulfil the aggregation criterion.

Since both theoretical foundation and disaggregation are essential in appropriate cyclical adjustment we introduced a method which is able to meet these requirements. First, we insist on the production function based output gap; however, this implies difficulties due to the availability of data. Fortunately, since we are only interested in the output gap rather than the full form of production function, the capital stock and TFP data are not needed in our method. Another important implication of production function is that the aggregation constraint not only should be satisfied but also the constraint is set by the capital and labour income share. In our approach we constrain the estimation procedure by using these shares. Finally, to derive the remaining cyclical component we applied another behavioural equation, namely a consumption function. The system is estimated by multivariate HP filter.

The above-mentioned methods derive the cyclical positions of real variables. However, they cannot cope with the effect of a different deflator. Note that in practice the budget is evaluated as the ratio of nominal budget balance to nominal output. It can be easily seen if the deflators of variables are different. Then the real cyclical component has to be corrected to obtain nominal cyclical component.

We showed that the underlying, structural deficit can be obtained by employing unit elasticities between budget items and real variables. Alternatively, discretionary measures can be re-calculated by estimating elasticities from the distribution of the tax burden in each year. We demonstrated that this direct estimation of the cyclical component can be faulted due to the specific non-linear features of tax systems and unemployment benefit schemes. In this case we suggest that the cyclical component should be obtained as a residual by estimating directly the underlying trends of those budget items.

References

Boije, R. (2004) 'The General Government Structural Budget Balance', Sveriges Riksbank Economic Review 1/2004, Sveriges Riksbank

Bouthevillain, C., Cour-Thimann, P., van den Dool, G., Cos, P. H., Langenus, G., Mohr, M., Momigliano, S. and Tujula, M. (2001) 'Cyclically Adjusted Budget Balances: An Alternative Approach', European Central Bank, Working Paper No. 77, September 2001

Braconier, H. and Forsfält, T. (2004) 'A New method for Constructing a Cyclically Adjusted Budget Balance: the Case of Sweden', NIER (National Institute of Economic Research) Working Paper No. 90, April 2004

Buti, M. and van den Noord, P. (2003) 'Discretionary Fiscal and Policy and Elections: The Experience of the Early Years of EMU', Economics Department Working Paper No. 351, OECD

Butler, L. (1996) 'A Semi-Structural Method to Estimate Potential Output: Combining Economic Theory with a Time-Series Filter. The Bank of Canada's New Quarterly Projection Model' Part 4, Technical Report No. 77, Bank of Canada.

Cronin, D. and McCoy, D. (1999) 'Measuring Structural Budget Balances in a Fast Growing Economy: The Case of Ireland', Technical Paper No. 4/RT/99, Central Bank of Ireland

Darvas, Zs. and Vadas, G. (2005) 'A New Method for Combining Detrending Techniques with Application to Business Cycle Synchronization of the New EU Members', MNB Working Paper No. 5/2005, August 2005, Magyar Nemzeti Bank

Denis, C., M. K, and Röger, W (2002) 'Production Function Approach to Calculating Potential Growth and Output Gaps – estimates for the EU Member States and the US', European Commission, Directorate-General for Economic and Financial Affairs, Economic Papers No. 176, September 2002

European Commission (2000) 'Public finances in EMU – 2000', Report of the Directorate for Economic and Financial Affairs, May 2000

Laxton, D. and R. Tetlow (1992) 'A Simple Multivariate Filter for the Measurement of Potential Output', Technical Report No. 59, Bank of Canada

Mohr, M. (2003) 'Cyclically Adjusted Budget Balances: An Alternative Approach', Presentation at Frankfurt University, 3 June 2003

P. Kiss, G. (2002) 'A fiskális jelzőszámok új megközelítésben', Közgazdasági Szemle, 2002/4 in Hungarian

P. Kiss, G. and Vadas, G (2004) 'Mind the Gap - Watch the Ways of Cyclical Adjustment of the Budget Balance', MNB Working Paper No. 7/2004, June 2004, Magyar Nemzeti Bank

P. Kiss, G. and Vadas, G (2005) 'Mind the Gap - International Comparison of Cyclical Adjustment of the Budget', MNB Working Paper No. 4/2005, July 2005, Magyar Nemzeti Bank

St-Amant, P. and van Norden, S. (1997) 'Measurement of the Output Gap: A Discussion of Recent Research at the Bank of Canada', Technical Report No. 79, Bank of Canada