# INDICATORS OF THE CYCLICALLY ADJUSTED BUDGET BALANCE

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**Abstract**

Cyclically adjusted government budget balances have become increasingly popular as a means of analysing the fiscal situation and changes in policy that result from the intentional actions of the government. As the actual budget balances are affected both by cyclical factors ('automatic stabilisers') and structural ('discretionary') measures, they may not, in general, be very useful when seeking to assess the orientation of underlying fiscal policy and possible structural imbalances in the budget balance. The problem however is that there is no generally accepted method of calculating cyclically adjusted (structural) budget balances. The results tend to be fairly noisy and sensitive to the method of calculation. The purpose of this article is to highlight these issues by reviewing three estimation methods used by the Bank of Finland – GDP smoothing based on the Hodrick-Prescott trend estimation method, the production function approach and Blanchard's method – and the corresponding estimates of the cyclically adjusted budget balances for Finland.

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## 1. Introduction[1]

Cyclically adjusted government budget balances have become increasingly popular as a means of analysing the fiscal situation and changes in policy that result from the intentional actions of the government. As actual budget balances reflect both cyclical developments and discretionary measures, they are not very useful when seeking to assess the orientation of underlying fiscal policy and possible structural imbalances in the budget balance. Hence, in policy analysis cyclically adjusted budget figures are used to construct indicators of the structural budget balance and the discretionary element of fiscal policy. In addition, as policy decisions very often tend to have multi-year implications for public finances, a change in the cyclically adjusted government budget balance can be used to provide an early warning of the need for budgetary adjustment and changes in the future course of policy[2].

Recently, the use of the cyclically adjusted budget balance as an indicator of the underlying situation of public finances has gained in importance, especially in the context of European Monetary Union and the related Stability and Growth Pact. Cyclically adjusted government balances are calculated by eg the European Commission to assess whether the prevailing fiscal situation in individual EU countries is sufficient to comply with the requirements of the Stability and Growth Pact. On the basis of these calculations the Commission determines whether the current situation is strong enough to provide for a safety margin and guarantee that the actual budget deficit does not exceed the threshold of 3 per cent of GDP during a cyclical downturn.

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[1] A revised version of the paper presented at the Banca d'Italia Workshop on Indicators of the Structural (Cyclically Adjusted) General Government Budget Balance in Perugia on 27–28 November 1998. We are grateful to Juhana Hukkinen for valuable comments and contribution to the estimation of Blanchard's indicator.

[2] A good discussion on the uses and abuses of the cyclically adjusted balance is given in Blanchard, O. (1990), Suggestions for a New Set of Fiscal Indicators, OECD Working Paper, No. 79, and Chouraqui J.C., R.P. Hagemann and N. Sartor (1990), Indicators of Fiscal Policy: A Reassessment, OECD Working Paper, No. 78.

The problem is that there is no generally accepted method of calculating what part of the current budgetary balance reflects short-term transitory influences caused by cyclical factors and what part structural measures taken by fiscal authorities. Since the indicators are far from being exact and may be sensitive to the method of calculation, reliance cannot be placed wholly on a single measure. When using such measures for the evaluation of fiscal stance, they should be treated with caution and attention paid to the strengths and weaknesses attached to the methods used. The purpose of this article is to highlight these issues by focusing on the Finnish experience.

The rest of the paper is organised as follows. Three estimation methods used by the Bank of Finland – GDP smoothing based on the Hodrick-Prescott trend estimation method (HP filter), the production function approach and Blanchard's method – are reviewed in Chapter 2 and their respective strengths and weaknesses are evaluated. Comparative results for the corresponding estimates of the cyclically adjusted budget balances for Finland are discussed in Chapter 3. Chapter 4 presents the estimates of cyclically adjusted balances of the IMF, the OECD and the European Commission. Chapter 5 provides some concluding remarks.

## 2. Estimation methods

Generally, the measurement of the cyclically adjusted budget balance proceeds in three steps. The first step involves the construction of a reference path for real GDP to obtain estimates for output that could be obtained in the absence of cyclical fluctuations. The difference between the actual output level and estimated reference output gives a measure of the output gap in a particular year.

In the second step these output gaps, together with the government revenue and expenditure elasticities, are used to calculate what government revenues and expenditure would have been had output been at the reference path level. It is important to correct for cyclical changes because the budget balance tends to deteriorate endogenously during recessions as

a result of automatic stabilisers and progressive tax systems[3]. The resulting cyclically adjusted budget balance corresponds to the underlying budgetary position implied by the reference output path.

In the third step, changes in the underlying policy orientation are derived from the changes in the estimated cyclically adjusted budget balances. The main drawback in this kind of residual approach is that in many cases it may over- or under-estimate the true degree of discretionary action.

The biggest problem in the calculation of the cyclically adjusted balance is related to the estimation of the reference output path. Although a variety of methods exists for calculating trend or potential output and corresponding output gaps, none of them are without major shortcomings. For this reason all output gap estimates, and hence also the corresponding measures of the cyclically adjusted budget balances, are subject to considerable uncertainty. A less serious problem is related to the estimation of the GDP elasticities of government revenues and expenditures. In principle, the measurement of the responsiveness of these budget items to GDP is quite straightforward. The possible instability of the elasticities over time or over the cycle may, however, hamper the reliability of average elasticities.

*Hodrick-Prescott trend estimation method*

The first method used by the Bank of Finland for calculating potential output involves smoothing actual output using a Hodrick-Prescott trend estimation method4. The basic idea of the HP filter is to fit a smooth trend through all the observations of actual GDP by means of weighted moving averages. With this method, deviations of actual output from estimated trend output are symmetric over the entire cycle regardless of any structural breaks that might have occurred.

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[3] Typically, government tax revenues are rather sensitive to changes in real GDP, but of the expenditures only unemployment-related items respond closely to cyclical fluctuations.

[4] For further details, see Annex 1.

The advantage of this statistical method is its simplicity and parsimony, since it requires data on actual GDP only. It is easy to apply and involves little judgement by the researcher. The trend estimates can be reproduced quickly in the event of discretionary changes in fiscal policy. A criticism often made about this approach is the arbitrary choice of smoothness of the resulting trend. Structural breaks are typically smoothed over by the HP filter, which moderates the break when it occurs and spreads its effects over several years. As a consequence, it is difficult to single out large and sudden changes in the level of output with the HP filter.

Moreover, the symmetry property that guarantees that output gaps and hence also the cyclical components of the budget sum up to zero over time may lead to serious misrepresentation of rapid structural changes in the economy. Although in principle this could be regarded as a desirable property, in practice cyclical developments are not regular, nor are they symmetric. Developments that initially could be considered cyclical in nature may become structural over time because of inertia and hysteresis, eg in labour markets. This is even more likely during sudden structural breaks. It should also be noted that because of structural changes actual output could deviate from potential output for other than purely cyclical reasons.

Another major problem encountered with the HP filter is generally referred to as the end-point problem: the trend will follow the actual GDP more closely at the beginning and end of the estimation period than in the middle. The trend will be pulled downwards towards the path of actual output if the latest available observations on GDP show a pronounced recession, and it will be pulled upwards if the latest observations show a vigorous expansion. This clearly constitutes a problem for policymaking where the correct interpretation of the present situation and near future is of crucial importance. In the Bank of Finland the end point problem is dealt with by adding medium-term forecasts of GDP[5] to the series to be analysed. This is, of course, only a partial solution since the accuracy of

[5] Forecasts are produced twice a year utilising the Bank of Finland's large marcoeconometric model BOF5 with forward looking expectations. See Willman, A. – Kortelainen, M. – Männistö, H.L. – Tujula M. (1998), The BOF5 Macroeconomic Model of Finland, Structure and Equations, Bank of Finland Discussion Papers, 10/98.

the trend estimates depends on the accuracy of GDP forecasts. The end-point problem was particularly pronounced in the first half of the 1990s, as the Finnish economy first plunged into an exceptionally deep and protracted recession and then began to grow strongly.

From the point of view of policy considerations the most important limitation of this statistical method is that it is mechanistic and carries no information about the constraints and limitations on production posed by the availability of factors of production or other endogenous influences. Thus, the trend output growth projected by time series methods may be inconsistent with what is known about changes in capital stock, labour supply or total factor productivity, or it may be unsustainable because of inflationary pressures. In Finland this has constituted a clear problem in the latter half of the 1990s. Trend estimates produced by the HP filter suggest that the output gap had already been closed by 1996, despite very low inflation, high unemployment and spare production capacity.

*Production function approach*

The second method, the production function approach, attempts to overcome the shortcomings related to the HP filter. This approach has a firm basis in economic theory and tries to estimate potential output on the basis of the production function and the factor inputs available to the economy. It is less mechanical and, in principle, more directly relevant to macroeconomic assessment. Since potential output is derived in the framework of the Bank of Finland's quarterly econometric macromodel BOF5[6], the outcome is broadly consistent with the prevailing macroeconomic situation, capacity utilisation rates, labour supply and inflationary pressures.

Notwithstanding the exact framework used – a macromodel or a partial analysis – the production function approach requires considerably more data and more assumptions about economic relationships and is more time consuming than the HP trend estimation method. Under this approach, trend factor productivity, capital stock, full employment labour input and the structural unemployment rate (or NAIRU) must be estimated

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6 See Annex 1 for further details.

and incorporated into the production function to obtain potential output estimates. The drawback of this procedure is that the estimates involve several sources of uncertainty and estimation errors, which, of course, hamper the reliability of the potential output and output gap estimates.

As was the case with the HP trend estimation method, the reliability of the estimates of potential output and hence also cyclically adjusted budget balances is particularly troublesome during periods of a major structural change in the economy. In particular, one cannot assume that unemployment fluctuates around some stable, or slowly changing, value for NAIRU, or that the production function itself remains stable over time[7]. Despite the apparent difficulties information on structural breaks (eg changes in productivity, technology, production structure, capital stock, labour markets) can be more flexibly incorporated in the production function framework than is the case with the HP trend estimation method.

Major structural breaks in the Finnish economy occurred in the late 1980s and early 1990s (Chart 1). In the latter half of the 1980s liberalisation of capital movements speeded up structural changes in the financial markets and contributed to serious overheating of the economy and bottlenecks in labour markets. On the other hand soaring unemployment in the early 1990s and the persistence of a high unemployment rate thereafter have made it extremely difficult to assess what part of unemployment is structural and what part is cyclical. The same problem arises with regard to the measurement of the capital stock. The collapse of Soviet trade in the early 1990s made productive capital in several industries obsolete and a considerable part of the investment in real estate during the boom years resulted in a permanently redundant capital stock. At the same time, the extensive change in the production structure and the rapid increase in industrial production led to more intensive use of capital and labour in the manufacturing industries. It is extremely difficult to quantify the effects of these changes in order to obtain the 'true' capital stock available to the economy.

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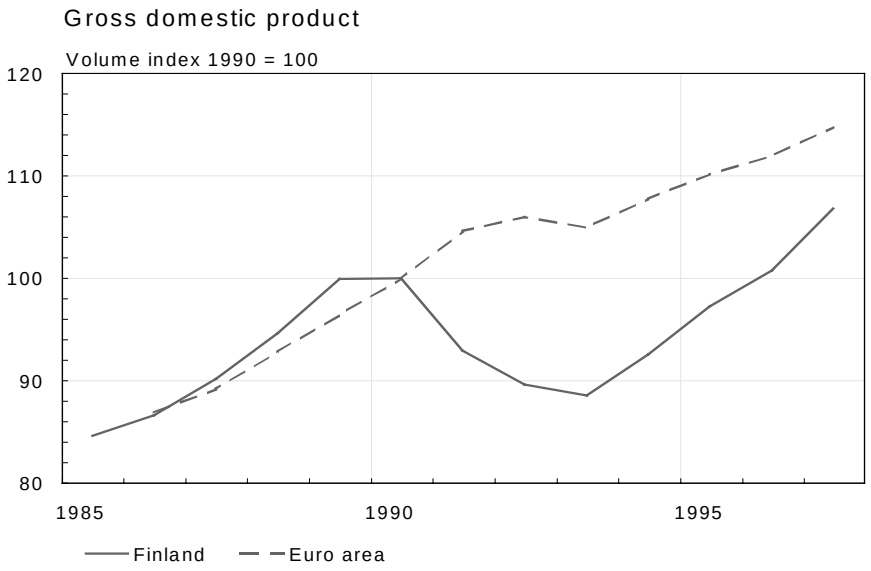
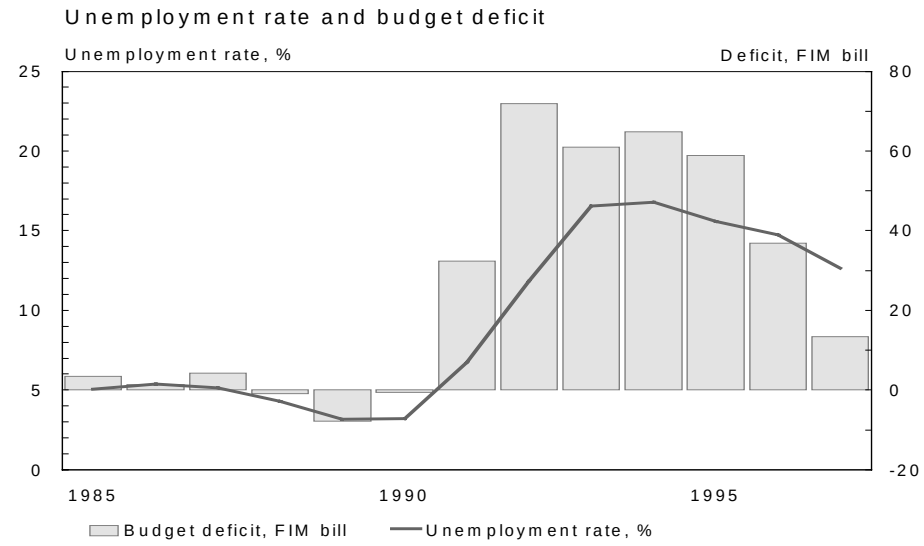
[7] Due to considerable difficulties related to the estimation of NAIRU in Finland, no attempt to include NAIRU considerations strictly in the derivation of potential output is made (see Annex 1 and Rasi, C.-M. and J.-M. Viikari (1998), The Time-Varying NAIRU and Potential Output in Finland, Bank of Finland Discussion Papers, 6/98).

**Chart 1**

**GDP, unemployment rate and budget deficit in Finland 1985–1997**



*Blanchard's indicator for fiscal impulse*

As the reliability of the reference output and output gap estimates is to a large extent questionable, especially so during periods of structural breaks, the Bank also uses Blanchard's indicator for fiscal impulse to assess changes in fiscal stance and policy-mix. Blanchard[8] has offered a simple and transparent measure for assessing fiscal stance that avoids many of the problems related to the measures of the cyclically adjusted government balance.

To derive the cyclical and non-cyclical components of the change in the government budget balance without resorting to highly uncertain estimates of the reference output and output gaps, Blanchard suggests estimating what government expenditures and revenues would be in any given year if the unemployment rate had remained the same as in the previous year. Since Blanchard's indicator focuses on the discretionary changes in the underlying fiscal stance, the previous year's budgetary position and economic conditions can be used as the benchmark. This avoids the problem of choosing a base year when actual output was supposedly at its potential level.

A clear advantage of Blanchard's indicator over other methods is the fact that the results concerning the past orientation of fiscal policy do not change in the course of time provided that the sensitivity of government revenues and expenditures with respect to changes in unemployment are fairly stable over time[9]. The estimates of the cyclically adjusted government balance based on the HP trend estimation method and production function approach may exhibit considerable variability depending on the estimation period. Specifically, as time passes and new estimations containing the latest information are made, both the 'history' and the interpretation of the course of past fiscal policy may change.

The construction of Blanchard's indicator is easy and presents no conceptual difficulties. The inflation adjustment and adjustment for changes in real interest rates can be done easily by focusing on the primary

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8 Blanchard, O. (1990), Suggestions for a New Set of Fiscal Indicators, OECD Working Paper, No. 79.

9 In the case of Finland this seems to hold; see Annex 1, Chart 2A.

balance (ie the overall balance excluding net interest payments). Moreover, instead of using total revenues and total expenditures, the elasticities can be estimated separately for various revenue and expenditure components. Instead of unemployment it is also possible to use the change in real GDP and estimate what government expenditures and revenues would have been had real GDP remained unchanged from one year to the next[10]. In the case of Finland the results have been fairly robust regardless of whether total revenues and total expenditures or their subcomponents are used or whether the change in real GDP is used instead of the unemployment rate.

## 3. Bank of Finland estimates for output gaps and cyclically adjusted government balances

Cyclically adjusted balances are generally calculated for the general government, although discretionary policy actions in many countries are mainly carried out through the central government. Since the central government plays a key role in the formulation and implementation of fiscal policy in Finland, the assessment of fiscal stance in the Bank of Finland involves both the general and central government. Another reason for this is that in Finland social security funds have large structural surpluses, and the inclusion of these surpluses in the calculations of cyclically adjusted balances may give a somewhat misleading picture of the possible structural imbalances in the government budget or of the orientation of fiscal policy.

Moreover, cyclical adjustment is made both for the overall balances and primary balances. Since interest rates are not under the direct control of the fiscal authorities, budgetary changes due to movements in debt interest payments or interest income cannot be regarded as purely discretionary. Therefore the changes in primary budget balances have been considered a better measure of discretionary fiscal change. However, for reasons of international comparability only results concerning the overall balances are reported here.

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[10] Further modifications are also possible; ie forecasts of real GDP and/or the average real GDP gowth rate can be used.

It should also be noted that the fiscal data are adjusted to take into account the effects of temporary and extraordinary items, such as exceptional timing of tax refunds and reforms in value added and corporate taxation[11].

Estimates of the output gaps and cyclically adjusted general government overall balances based on HP filter and production function approaches are depicted in Chart 2[12]. It is worth noting straightaway that the qualitative conclusions regarding the estimates of output gaps and cyclically adjusted balances[13] are not overly sensitive to the choice of method until the early 1990s. In most years prior to the 1990s, the choice of reference output makes little difference to the apparent orientation of fiscal policy in Finland. The main turning points and broad developments are the same irrespective of the method used, though this is also a reflection of the major peak and trough in the growth of actual GDP.

Despite the apparent similarities there are also important differences. From 1989 onwards there are marked divergences in terms of the level but not in the direction of the two policy indicators. Unusually large discrepancies occur in 1992–1997, which is a period of major structural change and economic adjustment. The difficulty of accounting for these structural changes becomes evident when the underlying reference output paths and the respective output gap estimates are compared. The production function approach gives consistently larger negative output gap estimates than the HP filter during the 1990s[14]. The HP filter-based estimates, on the other hand, generate the largest positive output gap for the late 1980s, implying substantial overheating of the

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[11] Further details are given in Annex 1.

[12] The corresponding figures for the central government are given in Charts 2A and 2B in Annex 2.

[13] The output gap is positive when actual output is higher than reference output, and the cyclically adjusted balance will show a larger deficit (smaller surplus) than the actual deficit (surplus). The output gap is negative when actual output is lower than reference output, and the adjusted balance will show a smaller deficit (larger surplus) than the actual deficit (surplus). When the output gap is zero, the actual and adjusted balances coincide.

[14] Essentially, the larger the negative output gap, the smaller the cyclically adjusted deficit.

economy. Moreover, the output gap based on the HP filter seems to have already vanished by 1996. If this were really the case, the actual budget deficit in Finland, as too the high unemployment level, would have to be regarded as entirely structural in nature[15]. The differences in outcomes are mainly due to the fact that the production function based method can be more readily extended to incorporate auxiliary information concerning structural change than can the HP trend estimation method. The projections produced by the HP filter may also be biased upwards because of the end-point problem discussed earlier.

Secondly, the estimates of the cyclically adjusted overall balance presented in Chart 2 accord reasonably well with general perceptions of the shifts in policy that took place during the period 1980–1998. In particular, both indicators reflect the fact that there was a discretionary relaxation in the budgetary stance in 1990–1992. However, the estimates indicate that the policy tightening started only in 1995, although important consolidation efforts were already undertaken from 1992 onwards. Exclusion of net interest payments, ie indicators based on primary balances, are more in line with this view since they indicate that considerable progress in budgetary adjustment was made in 1993 (Chart 3). Over the period of more immediate concern – 1998 and the projections for 1999 and 2000 – the estimates suggest that retrenchment measures have been quite substantial in 1998 and that fiscal consolidation will continue in the coming years, albeit at a somewhat slower pace.

Blanchard's indicator[16] (Chart 4) gives roughly the same results for the fiscal stance and direction of discretionary policy actions as those based on cyclically adjusted budget balances. The only notable differences in the recent past occur in 1993 and 1994. Contrary to the measures based on changes in cyclically adjusted overall balances, Blanchard's indicator confirms the view that fiscal tightening started already in 1993. Except for the year 1997, fiscal consolidation after 1992 has continuously reduced imbalances in general government budgets.

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[15] The estimates of the structural unemployment or NAIRU for Finland ranged from 8 per cent to some 12 per cent in 1997. The actual unemployment rate in 1997 was 12.6 per cent.

[16] The interpretation of a change in Blanchard's indicator is as follows: fiscal stance tightens when the change in the estimated discretionary part of fiscal policy is negative and becomes expansionary when it is positive.

**Chart 2**
**Output gap and general government cyclically adjusted balance 1980–2000**

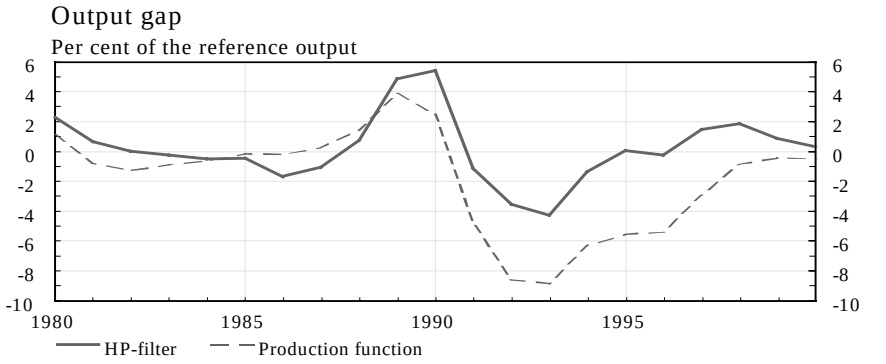




**Chart 3**

**General government cyclically adjusted primary balance 1980–2000**

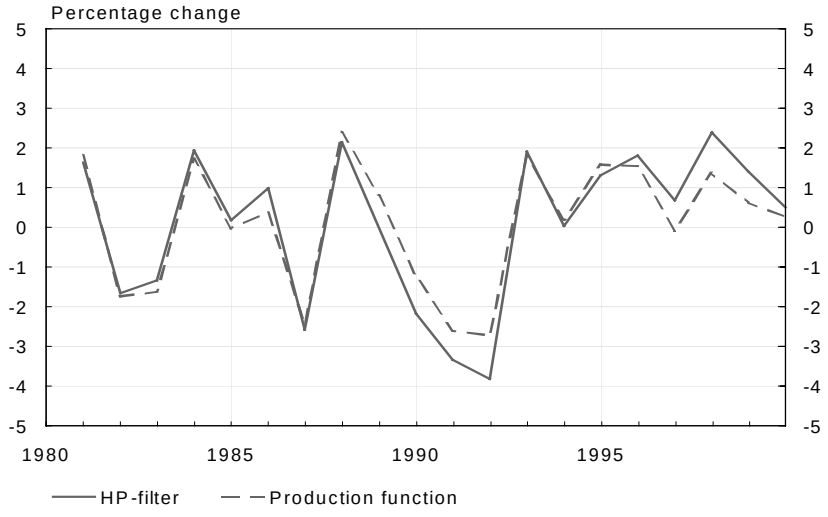
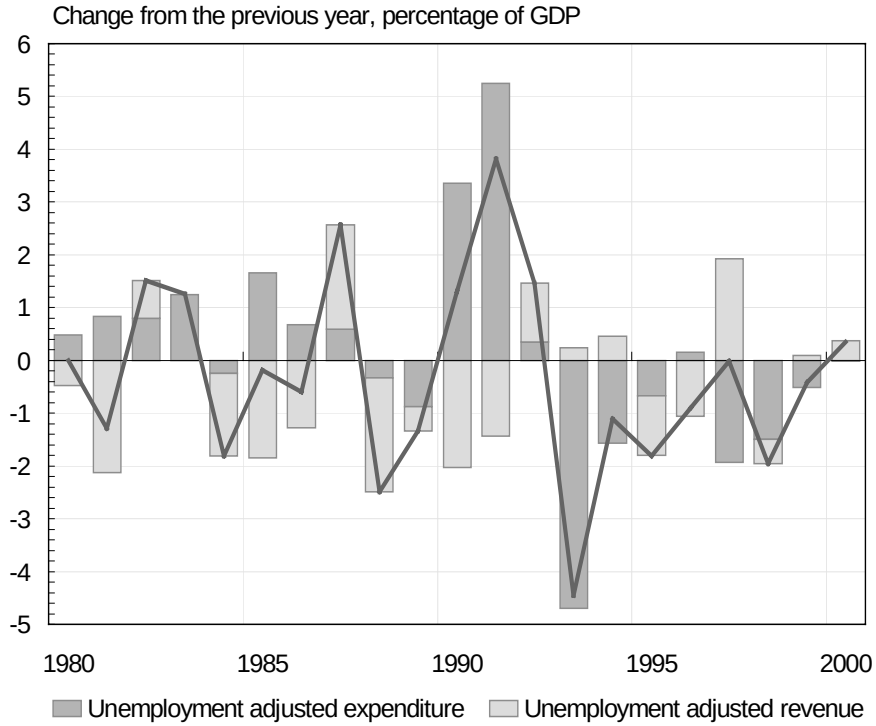



**Chart 4**

**Blanchard's indicator for fiscal impulse 1980–2000**




Blanchard's indicator can also be used for the analysis of the composition of discretionary fiscal policy actions. The relaxation of the fiscal policy stance and deterioration in the unemployment adjusted government balance in 1990–1991 were mainly due to marked increases in the unemployment adjusted government expenditures as revenue increases offset only a part of higher expenditure. The subsequent tightening in 1993–1994 took place almost entirely on the expenditure side whereas in 1995–1996 consolidation focused on higher unemployment adjusted revenues.

## 4. Estimates of the cyclically adjusted balance by the European Commission, the IMF and the OECD

Various international organisations such as the European Commission, the IMF and the OECD regularly publish estimates of the cyclically adjusted budget balance for the general government sector. The European Commission bases its output gap calculations on the HP trend estimation method (HP filter)[17]. The OECD and the IMF use the potential output approach[18]. Comparisons based on recent projections of output gaps for Finland by the Commission, the IMF and the OECD are shown in Chart 5. Again, the negative output gap based on the production function approach (OECD and IMF) is larger than that based on the HP filter (Commission). Moreover, both the Commission and OECD calculations indicate that the output gap vanished by 1997, whereas the IMF expects it to disappear some time in 2000. These differences mainly reflect differences in methods and problems that arise when the economy undergoes major non-cyclical or structural changes.

The estimates of adjusted budget balances roughly follow the pattern suggested by the output gap calculations (Chart 5). In general, the OECD and the Commission tend to be much more pessimistic, viewing the large public sector deficits of the 1992–1995 as being in large part structural. By contrast, the estimates of the IMF suggest that the large general government deficits during 1992–1995 were mainly due to business cycle fluctuations.

For Finland, the estimates provided by the IMF show a deteriorating structural deficit position between 1994 and 1995 despite increasing expenditure cuts and consolidation efforts by the government in 1995. The picture of deteriorating fiscal balances during 1995 changes drastically when account is taken of temporary and extraordinary items, such as exceptional timing of tax refunds and reforms of value added and corporate taxation (see Chart 2).

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[17] European Economy, 1995 Broad Economic Guidelines, No 60, European Commission 1995.

[18] OECD Economic Studies No. 24, 1995/1 and OECD Economic Outlook, December 1995; IMF World Economic Outlook, October 1993 and October 1995.

## 5. Concluding remarks

It is widely recognised that all measures of output gaps are subject to considerable uncertainty and for this reason cyclically adjusted budget balance figures need to be interpreted with caution. The uncertainty related to these estimates is generally greatest in periods of major structural change in the economy. As Finland has undergone and is still undergoing an extensive economic adjustment in which the underlying structures are changing rapidly, both the output gap estimates and the cyclically adjusted budget balances involve a considerable risk margin.

When the main focus is on the level of cyclically adjusted balances the production function based method seems to produce more reliable estimates than the Hodrick-Prescott trend estimation method – at least during times of large structural changes. Furthermore, within the production function framework, the assessment of fiscal imbalances and inflationary pressures can be made in a consistent manner. If the main interest is in changes in fiscal policy stance from one year to another or assessing the proper policy-mix, there is not much difference in the results produced by the various methods. In this case, however, Blanchard's indicator surpasses the other methods because of its simplicity and transparency. Moreover, Blanchard's indicator is internationally comparable and fair, and it can easily be constructed for the whole euro area.

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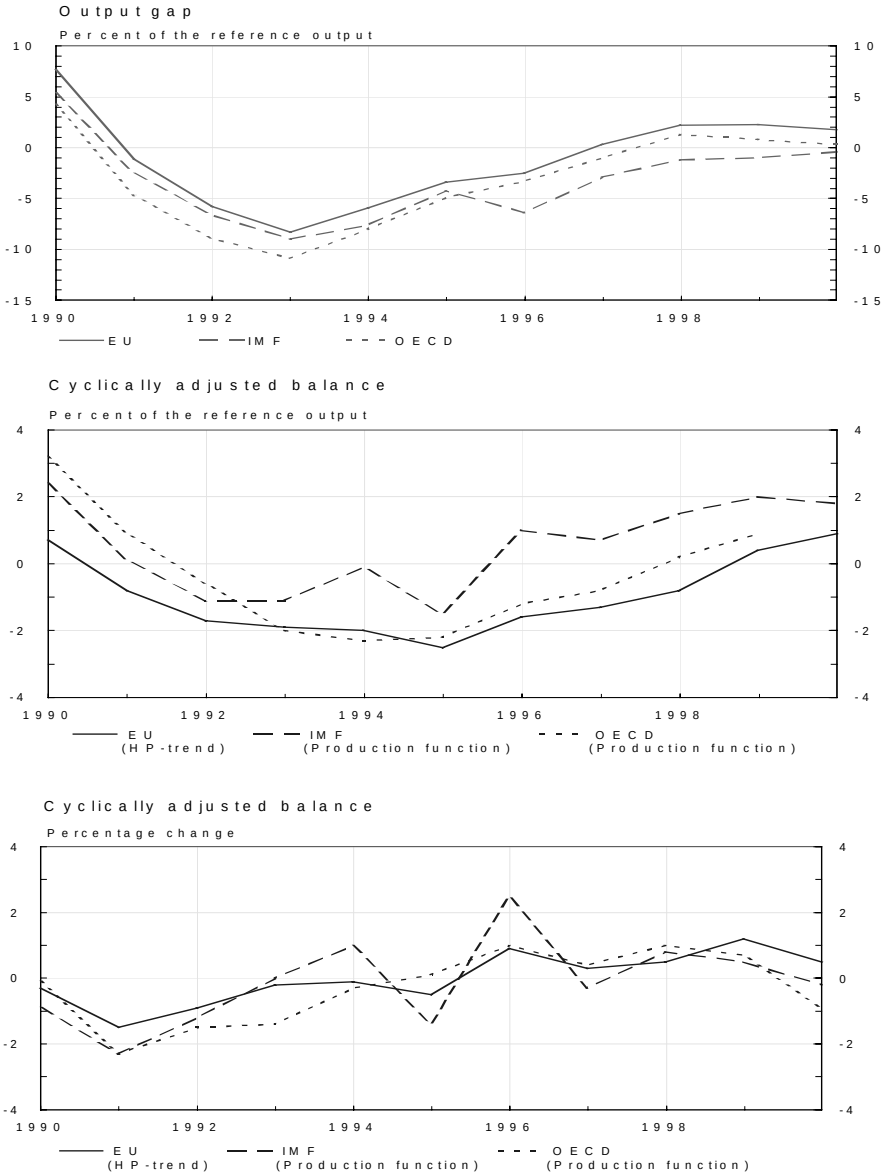
In many cases uncertainties related to the level of potential output may be so great that focusing on the changes in the policy stance rather

**Chart 5**

**Output gap and general government cyclically adjusted balance 1990–2000**



than the level of the cyclically adjusted balance seems to be more warranted. Specifically, conclusions about the necessary budgetary adjustment might become highly misleading, if such a measure is used as a benchmark figure when evaluating whether the current fiscal position of individual EMU countries complies with the requirements of the Stability and Growth Pact and whether the structural budget balance is strong enough to leave sufficient room for cyclical volatility in the government budget balance without breaching the deficit limit of 3 per cent of GDP. The measures of cyclically adjusted government balances do not yield any information on the possibility of future real GDP shocks, and thus on the probability distributions of the evolution of the deficit ratio in the medium term. A useful approach in this respect would be to apply stochastic simulations with forward-looking expectations to evaluate the required safety margins for individual member states and thereby ensure that actual deficits do not exceed the 3 per cent of GDP threshold.

An apparent limitation in the applicability of the cyclically adjusted balance as a primary indicator for the underlying fiscal stance stems from the fact that variations in budget balances do not differentiate the nature or composition of fiscal policy actions. Quantitatively equivalent improvements in the budget balances in two different periods may be the result of fundamentally different policy orientation if in one period the change is due to expenditure cuts while in the other it is due to tax increases. The composition of policy actions contributes significantly to the success of fiscal consolidation, as shown in the recent studies by Alesina and Perotti[19].

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[19] Alesina, A. – R. Perotti (1995), Fiscal expansions and adjustments in OECD countries, Economic Policy, Vol. 21, Alesina, A. – R. Perotti (1997), Fiscal Adjustments in OECD countries: Composition and Macroeconomic Effects, IMF Staff Papers, Vol. 44, and Alesina, A. – S. Ardagana (1998), Tales of Fiscal Adjustment, Economic Policy, Vol. 27.

# ANNEX 1

## GDP elasticities of government expenditures and revenues

The estimated elasticities of central and general government revenues and expenditures in relation to a one per cent change in real GDP growth are derived from simulations of the macroeconometric model BOF5. The model includes a detailed and highly disaggregated public sector and tax structure. Tax parameters have direct links to their respective tax bases and macroeconomic variables and thus to central and local government and social security funds revenues. Accordingly, it is always possible to take into account the most recent changes in taxation in the model and assess the effects of these changes and/or of different kinds of demand and supply shocks on central and general government finances[20]. The elasticities obtained for various budget items are roughly in line with those of the European Commission, the IMF and the OECD.

*Revenue elasticities:*

| | |
|---|---|
| • household sector direct taxes | 1.3 |
| • corporate sector direct taxes | 1.0 |
| • indirect taxes | 0.9 |
| • employers' and insured persons' contributions to social security schemes | 1.1 |
| • compulsory fees, fines and penalties | 1.0 |

*Expenditure elasticities:*

| | |
|---|---|
| • unemployment-related outlays[21] | 2.4 |

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[20] For more details, see Willman, A. – Kortelainen, M. – Männistö, H.L. – Tujula, M. (1998), The BOF5 Macroeconomic Model of Finland, Structure and Equations, Bank of Finland Discussion Papers, 10/98.

[21] Paid by the central government and social security funds. Unemployment-related outlays include basic unemployment allowance, labour market support and the government-financed share of the earnings-related unemployment compensation.

Tax elasticities and the elasticity of social security contributions with respect to GDP were calculated by running a balanced growth simulation in which all demand items were exogenously increased by one per cent. The shocks were unanticipated and started in the first quarter of 1998. No attempts were made to improve the elasticity estimates by using data on income distribution. Moreover, the lagged tax base for corporate taxes was not taken into account, since lagging corporate taxes did not have a significant effect on the cyclically adjusted budget balance.

In addition to balanced growth shocks, pure domestic and export demand shocks were run in simulations. In these simulations the differences in the revenue elasticity estimates were relatively small compared to the respective elasticity estimates obtained in the balanced demand shock simulation[22]. Simple linear regressions were also conducted to check the results of the model simulations. Here the estimation period was 1976q1–1997q4 and the estimates obtained were as follows: household sector direct taxes (1.1); corporate sector direct taxes (1.2); indirect taxes (1.2); employers' and insured persons' contributions to social security schemes (0.9); and total revenue (1.0).

On the expenditure side only unemployment-related outlays were assumed to be sensitive to cyclical changes. The long-run elasticity of the number of unemployed with respect to GDP was –3.0 in the balanced growth simulation. The estimated elasticity of unemployment-related expenditure with respect to the number of unemployed was 0.58 for the central government and 0.76 for the general government sector. Hence, the GDP elasticity of unemployment-related expenditure lies within the range of –2.2 to –2.4. The estimate –2.4 was used in the calculations of the cyclically adjusted government balance. Other expenditures and/or revenues are not assumed to react to changes in real GDP growth.

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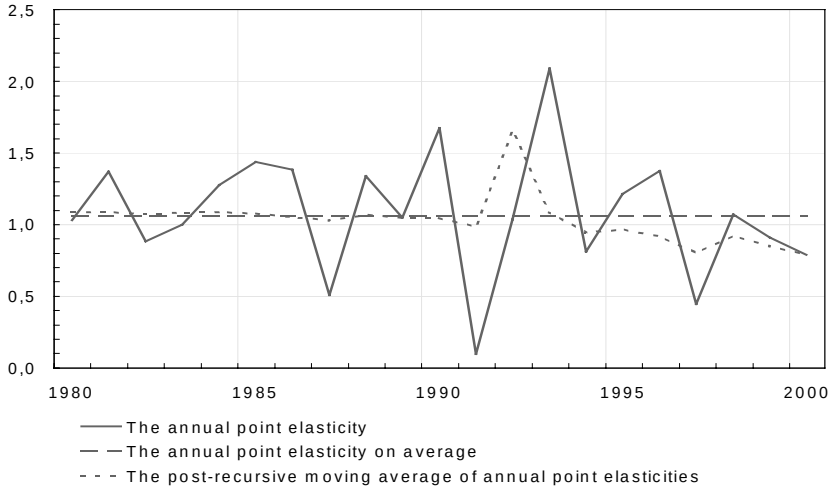
[22] According to the BOF5 model simulations the general government financial balance in relation to GDP (ESA95) deteriorates by 0.6 percentage points in a balanced demand shock, about 0.7-0.8 percentage points in a pure domestic demand shock and some 0.4-0.5 percentage points in a pure export demand shock compared to the baseline. In all shocks real GDP growth is decreased by one per cent (Kortelainen, M. – Männistö, H.L. – Tujula, M. (1998), The Cyclical Sensitivity of Government Budgets: BOF5 Model Simulations, Bank of Finland Economics Department Memorandum, KT 57/98).

The robustness of the elasticity estimates over time was further examined by computing annual point elasticities for general government revenues in the period 1975–2000. The annual point elasticities correspond closely to the model-based elasticity estimates on average (see Chart 1A). The same applies to the aggregate elasticity and its sub-categories. The annual variation of aggregate point elasticity has, however, been relatively large in history and even larger in the case of various sub-categories of revenues (except for indirect taxes). The point elasticities for the current period and the immediate future nevertheless correspond however very closely to the estimated aggregate point elasticity and its sub-categories.

**Chart 1A**

**General government total revenue elasticities 1980–2000**




The large annual variation in the point elasticities is mainly due to different timing factors and major structural changes not entirely related to changes in taxation. The relatively small changes may also show up larger in separate revenue items than in different GDP components in per cent terms and may thus distort the results obtained somewhat. Hence,

assessing the effects of changes in GDP composition and in elasticities from year to year when calculating the cyclically adjusted government budgets may not be very useful, at least in the case of Finland. The cyclical sensitivity of general government revenues seems to have declined somewhat in Finland in recent years. This is mainly due to lower taxes on salaries and wages.

### Correction for timing in taxes and other transitory effects

In all estimations the quarterly data for government revenues are corrected for temporary and extraordinary effects. Corrections are made for temporary changes in the timing of tax collections and refunds, extra personal tax withholdings, retroactive value added tax refunds on non-manufacturing sector investment, the VAT reform related to EU membership in 1995, expiration of transitional provisions connected with the 1993 tax reform of capital income taxation and speeding up the payment of taxes by charging interest on tax arrears.

### Hodrick-Prescott trend estimation method

The HP filter is estimated by minimising the sum of squared deviations from actual GDP subject to a smoothness constraint:

$$\underset{\{\hat{y}_t\}}{Min} \sum_{t=1} (y_t - \hat{y}_t)^2 + \lambda \sum_{t=2} \left[ (\hat{y}_{t+1} - \hat{y}_t) - (\hat{y}_t - \hat{y}_{t-1}) \right]^2$$

where y is the actual time series of real GDP in logarithms and $\hat{y}$ is the trend (estimated real GDP trend) calculated subject to the smoothness constraint $\lambda$, which controls the variation around the trend series. The choice of the weight parameter $\lambda$ has a significant influence on the smoothness of the trend. Choosing a low value for $\lambda$ results in a trend that follows the actual output very closely whereas choosing a high value for $\lambda$

reduces the sensitivity of the trend to short-run changes in actual output. Hodrick-Prescott (1980)[23] suggest the use of $\lambda = 1600$ for quarterly data.

The HP-trend is estimated for the period 1975q1–2002q4. The end-point problem is partly avoided by extending the estimation period until 2002 using forecasts of real GDP for the years 1998–2002. The medium-term forecasts of real GDP, general government overall balance and government revenue and expenditure are based on the Bank of Finland's October 1998 forecast for the Finnish economy. The value of $\lambda$ is set to 1600 in the estimations[24].

To calculate the resulting cyclically adjusted budget balance, actual/projected tax revenues and unemployment related outlays are adjusted by their respective GDP elasticities, when actual/projected output deviates from the statistically estimated average trend output (for the revenue and expenditure elasticities, see above).

### Production function approach

Production function based calculations of the general government cyclically adjusted balances are generated by the Bank's quarterly econometric model BOF5, which is the main tool for forecasting and macro analysis. In the model, output gap is a post recursive equation, with no feedback to the rest of the model. Although it is derived from the estimated production function, there is no attempt to include NAIRU considerations strictly in the derivation of the potential output.

Potential output is simply defined as the level of production determined by the production function with labour input at its potential level and capital stock at its actual/projected level. Potential labour input (hours worked) is defined as actual/projected hours worked corrected for

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[23] Hodrick, R. – E. Prescott (1980), Post-War US Business-Cycles: An Empirical Investigation, Carnegie-Mellon University Working Paper.

[24] The robustness of the results under various assumptions on $\lambda$ are discussed in Andersen, K.G. and H.L. Männistö (1995), Output Gaps and the Government Budget Balance: The Case of Finland, Bank of Finland Discussion Papers, 27/95.

the unemployment rate. This upward correction is not full scale, as long-term unemployment (duration exceeding one year) and the cyclical peak minimum are excluded.

Potential output and the output gap in the BOF5 model of the Finnish economy

*Technical progress, private sector*

TECH = DSHIFT*0.743998*EXP(2.1135*TREND/100)

TREND = linear trend (1960q1 = 0.25, TREND = TREND(-1) +0.25)

DSHIFT has been adjusted after 1991q1 so as to take into account technological and structural changes in the manufacturing sector.

*Normal level of production with existing inputs, private sector (CES production function)*

```
GDPT = TECH*(0.81478*(KF(-1)**(-0.263818))
             + (1-0.81478)*(LH**(-0.263818)))**(-1/0.263818)
```

Elasticity of substitution = 0.7913

KF = net stock of fixed capital, private sector, millions of 1990 FIM

LH = actual number of working hours, private sector, millions of hours

*Potential labour input (hours), private sector*

LHPOT = LH*(1+(LHT/LH)*.01*(UR-ULR-2.5))

LHT = actual number of working hours, private and public sector, millions of hours

UR = unemployment rate, per cent

ULR = long-term unemployment rate, per cent

2.5 = minimum unemployment rate at cyclical peak (1990q1)

*Potential output, private sector*

GDPPOT = TECH*(0.81478*((KF(-1))**(-0.263818))

+ (1-0.81478)*(LHPOT**(-0.263818)))**(-1/0.263818)

*Notes*

Value added (GDP) is demand-determined in the short-run, and an I/O-table is used in BOF5 to allocate demand into value added of the various sectors.

In the equation for working hours (LH), an error correction term (GDPT/GDP) forces demand for labour to adjust towards the level determined by the production function.

The long-run growth path of the economy is supply-determined.

*Cyclically adjusted deficit*

The computations are done using the general government revenue and expenditure elasticities given above.

## Blanchard's indicator for fiscal impulse

Blanchard's indicator for fiscal impulse is calculated by estimating the equations

$$E_t = a + b*UR_t + c*T1 + u_t$$

$$R_t = d + e*UR_t + f*T2 + e_t$$

where

Et = general government expenditure as a percentage of GDP (excl. interest payments)

Rt = general government revenue as a percentage of GDP (excl. interest income)

URt = unemployment rate

T1, T2 = time trends

ut, et = residuals

The estimated equations for government expenditures and revenues for the period 1970-2000 with standard errors in parentheses are

$$E_t = 30.292 + .805*UR_t + .382*T + \hat{u}_t$$
$$(1.199) \quad (.206) \quad (.105)$$

$$R_t = 36.368 + .197*UR_t + .522*T2 + \hat{e}_t$$
$$(.781) \quad (.197) \quad (.522)$$

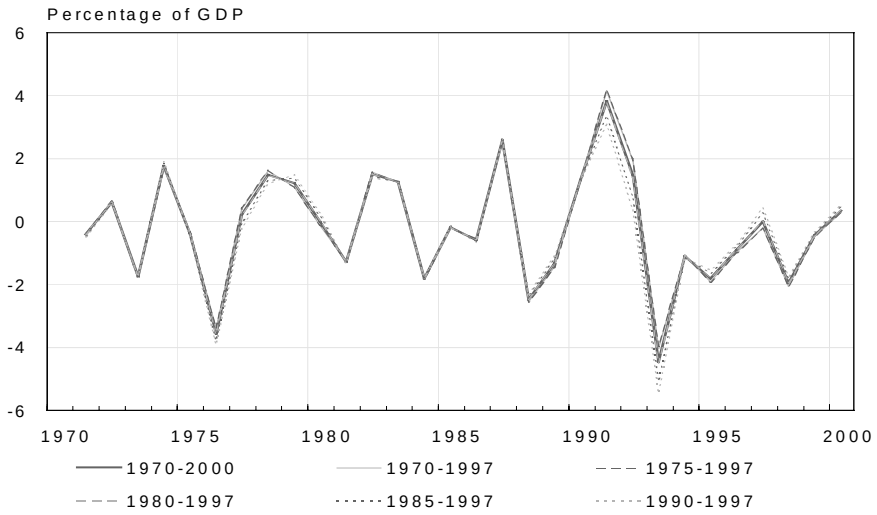
To compute what the expenditures would have been in period t had the unemployment rate remained the same as in the previous period t-1, the

previous period unemployment rate ($UR_{t-1}$) is inserted in the estimated equation. The same procedure is followed to adjust general government revenues $R_t$ to obtain $R_t(UR_{t-1})$. The measure for the government budget balance that would have prevailed in period t had the unemployment rate been equal to that in period t-1 is calculated using the computed values of $E_t(UR_{t-1})$ and $R_t(UR_{t-1})$. The indicator for fiscal impulse is constructed as the difference between this unemployment adjusted measure for government budget balance and the previous year's budget balance.

The results are surprisingly robust with respect to various estimation periods and various modifications concerning the cyclical adjustment of government revenue and expenditure (Chart 2A). The indicator was calculated by estimating what government revenue and expenditure would be in any given year, if GDP growth had remained 1) the same as in the previous year, 2) the same as the average growth rate of 2.5 per cent and 3) the same as forecast.

**Chart 2A**

**Time-varying estimates of Blanchard's indicator**
**1971–2000**




**Blanchard's indicator with various cyclical adjustments**
**1971–2000**

**Table 1A**

**General government cyclically adjusted balance**

*General government cyclically adjusted balance*
*1980–2000, % of GDP*

| | HP filter | Production function |
|---|---|---|
| 1980 | 2.5 | 2.9 |
| 1981 | 4.2 | 4.8 |
| 1982 | 2.5 | 3.0 |
| 1983 | 1.1 | 1.3 |
| 1984 | 3.0 | 3.0 |
| 1985 | 3.1 | 3.0 |
| 1986 | 4.2 | 3.5 |
| 1987 | 1.5 | 0.9 |
| 1988 | 3.7 | 3.3 |
| 1989 | 4.0 | 4.4 |
| 1990 | 2.4 | 3.8 |
| 1991 | -0.8 | 1.3 |
| 1992 | -4.7 | -1.5 |
| 1993 | -4.4 | -1.3 |
| 1994 | -5.9 | -2.6 |
| 1995 | -4.4 | -0.8 |
| 1996 | -3.2 | 0.0 |
| 1997 | -2.9 | -0.4 |
| 1998 | -0.2 | 1.3 |
| 1999 | 1.6 | 2.3 |
| 2000 | 2.3 | 2.8 |

*General government cyclically adjusted balance*

*1981–2000, percentage change*

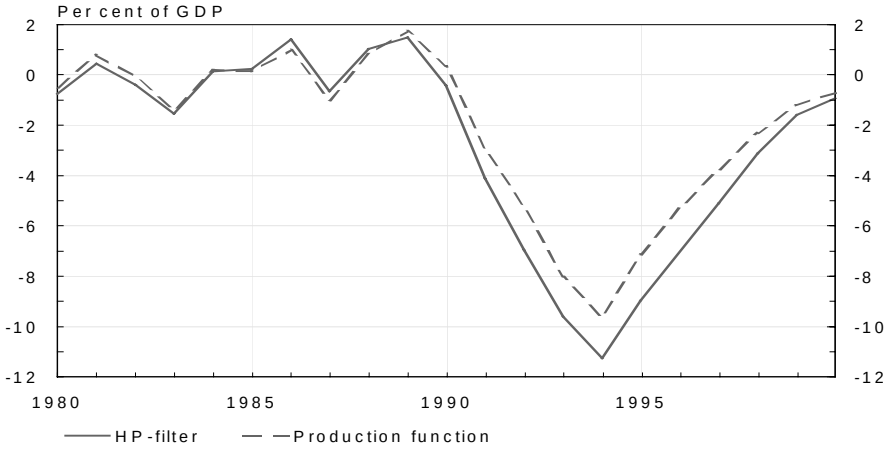
| | HP filter | Production function | Blanchard's indicator |
|---|---|---|---|
| 1981 | 1.7 | 1.9 | -1.3 |
| 1982 | -1.7 | -1.8 | 1.5 |
| 1983 | -1.4 | -1.7 | 1.3 |
| 1984 | 1.9 | 1.7 | -1.8 |
| 1985 | 0.2 | 0.0 | -0.2 |
| 1986 | 1.1 | 0.5 | -0.6 |
| 1987 | -2.7 | -2.6 | 2.6 |
| 1988 | 2.2 | 2.4 | -2.5 |
| 1989 | 0.3 | 1.1 | -1.3 |
| 1990 | -1.6 | -0.7 | 1.3 |
| 1991 | -3.2 | -2.4 | 3.8 |
| 1992 | -3.9 | -2.8 | 1.5 |
| 1993 | 0.3 | 0.1 | -4.5 |
| 1994 | -1.4 | -1.3 | -1.1 |
| 1995 | 1.5 | 1.8 | -1.8 |
| 1996 | 1.1 | 0.9 | -0.9 |
| 1997 | 0.3 | -0.4 | 0.0 |
| 1998 | 2.7 | 1.7 | -2.0 |
| 1999 | 1.7 | 0.9 | -0.4 |
| 2000 | 0.8 | 0.5 | 0.4 |

# ANNEX 2

## Central government cyclically adjusted balance

**Chart 2A**

**Central government cyclically adjusted balance 1980–2000**



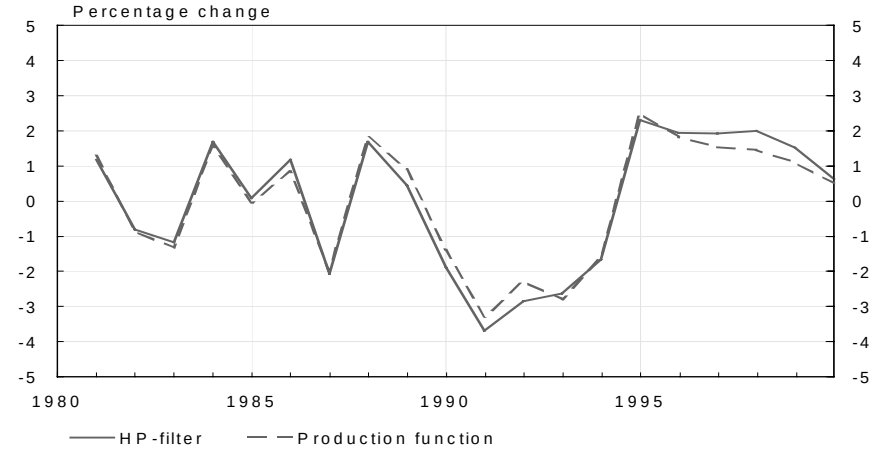



**Chart 2B**

**Central government cyclically adjusted primary balance 1980–2000**