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Output Gaps and the Government Budget Balance: The Case of Finland

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Abstract

The purpose of this paper is to find a suitable method for estimating output gaps and calculating the cyclically adjusted government budget balance for Finland. Several different approaches for estimating a reference trend are briefly evaluated and a calculation of the cyclically adjusted government budget balance is presented. We review the production function approach, the middle-expansion trend, the Hodrick-Prescott filter and a multivariate filter developed by Laxton and Tetlow. We conclude that the Hodrick-Prescott filter and the multivariate filter have some properties that make them well suited for routine analysis of discretionary fiscal policy. Income and expenditure elasticities are estimated using BOF4 model simulations and cross checked by simple regression analysis. The cyclically adjusted government budget balance is then calculated for both central and general government using the reference trends and the estimated budget elasticities. Measuring the cyclically adjusted budget balance for the central government has important implications, because surpluses of the large pensions funds have improved the general government budget balance, which has caused a serious misjudgment of the underlying fiscal stance. Our calculations suggest that Finland's present government deficit is more structural than cyclical.

Tiivistelmä

Selvityksessä vertaillaan Suomen aineistolla erilaisia tapoja arvioida pitkän aikavälin trendituotantoa, tuotantokapeikkoja ja suhdannevaihteluista puhdistettuja julkisen budjettijäämän mittareita. Bruttokansantuotteen trendin arviointiin käytetyissä erilaisissa menettelytavoissa vertaillaan tuotantofunktion avulla estimoitua trendiä, BKT:n huippukausien liukuviin keskiarvoihin perustuvaa trendin arviointia (middle-expansion), Hodrick-Prescotin suodinta sekä Laxtonin ja Tetlowin mallisuodinta. Vertailujen perusteella Hodrick-Prescotin suodin ja mallisuodin sopivat parhaiten tahdonvaltaisen finanssipolitiikan vaikutusten rutiinimaiseen analysointiin. Näihin suotimiin perustuvien laskelmien avulla selvityksessä tarkastellaan BOF4-mallin simuloituja tulo- ja menojoustoja. BKT:n trendiä ja laskettuja budjettijoustoja hyväksi käyttäen tutkimuksessa estimoidaan valtion ja kuntien suhdannevaihteluista puhdistetut budjettijäämät. Suomessa valtion suhdannetasoitetulla budjettijäämällä on erityistä mielenkiintoa, sillä viime vuosina eläkerahastojen säästäminen on selvästi parantanut julkisen talouden budjettitasapainoa. Tällä on ollut merkittävä vaikutus finanssipolitiikan viritystä mittaaviin budjettijäämiin. Estimointien perusteella Suomen nykyinen budjettialijäämä on pikemmin rakenteellista kuin suhdanneluontoista.

Contents

1 Introduction

During the last two decades, unanticipated business cycle developments have led to sharp increases in unemployment in many OECD countries. In the 1980s, persistent unemployment altered government budget balances and sustainability of the public debt has increasingly dominated the formulation of fiscal policy. The attention has especially been focusing on the medium-term implications of government budgets in order to monitor the economy's underlying fiscal stance.

The widespread effects of changes in fiscal policy made Blanchard (1990) suggest the need for several indicators of fiscal stance, even though a single indicator would be preferable. Chourqui et al. (1990) continued the discussion, by suggesting some basic characteristics of such indicators.

Indicators of government budget balance, adjusted for the transitory effects of cyclical changes, have become increasingly popular as a means of analyzing the macroeconomy. The cyclically adjusted budget balance indicates the underlying fiscal situation excluding the effects of business cycles.

Indicators of fiscal policy excluding the effects of real business cycle fluctuations are important for the design of fiscal policy. De Leeuw and Holloway (1985) summarize the procedure for constructing a cyclically adjusted budget as follows:

1. choosing a reference trend for GDP free from short-run fluctuations,
2. determining the responsiveness of each category of receipts and expenditures to short-run movements in GDP (e.g. cyclical tax elasticities),
3. applying these responses to gaps between trend GDP and actual GDP, and
4. adding the expenditures and receipts "gross-ups" from step 3 to the actual budget to obtain a cyclically adjusted budget.

This paper discusses several different approaches for constructing a reference trend, for use in measuring the output gap. Knowing the output gap, the cyclically adjusted deficit can be estimated. In section 2, we present several different approaches to estimating the reference trend. We describe the potential output trend based on the production function framework, using a simple Cobb-Douglas production function, proposed by the OECD[1]. Different econometric methods for estimating a reference trend are then presented. We distinguish between trend and potential output measures, however, both being used to characterize real business cycles. First, we present the middle-expansion trend proposed by De Leeuw and Holloway (1985), and secondly, the Hodrick-Prescott filter (1980), which recently has become a popular technique for estimating trend output. Finally, we present the multivariate filter developed by Laxton and Tetlow (1992). Two methods are applied and reference trends are estimated using Finnish data. Section 3 presents estimations of the responsiveness of the government budget items. In section 4, we apply these responses to obtain the trend adjusted government income and expenditure items, i.e. the cyclically adjusted budget balance. Finally, we conclude by addressing several critical issues related to the construction of a the cyclically adjusted budget balance.

[1] Giorno et al. (1995).

2 Choosing a reference trend

The first step in constructing the cyclically adjusted budget balance is to choose a reference trend for real GDP. The literature on real business cycles provides several possible choices. However, selecting a reference trend is subject to much controversy, since no single method is widely accepted. As De Leeuw and Holloway (1985) point out, the higher the reference trend, *ceteris paribus*, the smaller the cyclically adjusted deficit[2]. This implies that choosing a reference trend that is higher than the actual trend could result in systematic underestimation of the cyclically adjusted deficit.

2.1 The production function

The potential GDP trend is commonly used as reference trend for calculation of the output gap. Recently, the OECD has also adopted this approach, based on the production function framework, as their preferred method[3]. However, potential output can also be estimated directly from historical data by various econometric techniques.

Potential output is generally defined as level of output that would have prevailed if the economy had been experiencing equilibrium employment with normal utilization of capacity. In practice, the OECD measures "potential" employment as the supply of labour minus the non-accelerating wage inflation rate of unemployment (NAWRU).

Potential output can be estimated from the Cobb-Douglas production function, which is described in its simplest form in Giorno et al. (1995). They estimate the potential output of the business sector using factor productivity, actual capital stock and estimates of "potential" employment[4]. The simple production function has the following form:

$$Y = L^{\alpha}K^{1-\alpha} + \tau \tag{1}$$

Here Y is the value added in fixed prices at the factor costs, and L is the actual input of labour in the business sector, K is the capital stock of the business sector, and finally, τ is total factor productivity[5]. Potential output can then be written as:

$$\log Y^{*} = \alpha \log L^{*} + (1-\alpha)\log K + \tau^{*} \tag{2}$$

[2] We use the term cyclically adjusted deficit it refer to what Giorno et al. (1995) call the structural deficit.

[3] See Giorno et al. (1995), **Estimating Potential Output, Output Gaps and Structural Budget Balances**, OECD Economics Department Working Paper No. 152.

[4] OECD defines potential employment as the level of labour that could be employed without resulting in additional inflation. In practice, this is obtained by adjusting the actual labour input for the gap between actual unemployment and the estimated NAWRU level. However, there is uncertainty surrounding the NAWRU concept and the choice can have significant effects on the estimates.

[5] This is often also referred to as "Solow residual". Solow (1957) found that approximately two-thirds of output could not be explained by factor inputs.

To obtain total factor productivity (TFP), the OECD suggests a smoothing of the residuals, τ, using a Hodrick-Prescott filter for a given value of the labour share of output, α. The resulting trend is then substituted into the production function.

Potential output is not directly observable and its econometric modelling has proven to be quite difficult. The measurement of potential output is based on assumptions of high-employment levels of the labour force and productivity. Therefore, recent experience with many years of high and persistent unemployment have raised the question of whether it will indeed be possible to reach high-employment levels in the near future and hence whether it is meaningful to use potential output.

However, one advantage of potential output trend, estimated using the production function framework, is that it has a well established theoretical foundation. Hence, the rationale is not solely based on econometrics and, moreover, changes in relative factor prices and substitution of factors are possible to a large extent within the production function framework[6].

On the other hand, using a simple Cobb-Douglas production function results in a fixation of the substitution elasticities. Furthermore, estimation of the capital stock might be far from adequate in cases like the Finnish recession of the early 1990s. Finally, measuring the rate of technical progress constitutes another problem. It is often assumed that the residual, τ, from the above equation measures technical development. Bur this interpretation of is somewhat questionable, for example, (1) if firms engage in labour hoarding during a recession, the cyclical part of the Solow residual will be overstated, (2) if *price>MC*, the Solow residual will appear to be procyclical even if technology is unchanged, (3) if the production function is misspecified, the Solow residual will compound the effects of excluded variables, under-/overstating the technological progress.

2.2 GDP trend

An alternative to the potential output approach based on the production function framework is the statistical approach. There are several possible methods for estimating a reference trend. We shall distinguish between actual and potential GDP trends.

Generally, statistical methods have the advantage of being easy to apply and can be reproduced relatively quickly and cheaply in case of discretionary changes in the economy - e.g. changes in fiscal policy that affect forecasts of the deficit. However, they rely completely on econometric techniques and are often not founded on economic theory.

The simplest of these econometric methods is to estimate a simple linear trend from the time series. This, however, being very simple and mechanical, the result is a very rough simplification of the underlying trend[7].

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[6] Barrell and Sefton (1995).

[7] A graphical illustration of the linear trend can be found in the appendix, together with illustrations of some of the methods described below.

2.2.1 Middle-expansion GDP trend

A more advanced approach for estimation of the reference trend of real GDP is proposed by De Leeuw and Holloway (1985). They estimated a middle-expansion trend based on movements in actual real GDP. Middle expansion is defined as the twelve quarters beginning when real GDP passes its prerecession peak - unless a downturn begins during those twelve quarters. In that case, middle-expansion is simply the time from a prerecession peak to the next downturn[8].

The method classifies all data in the following four categories; recession, early expansion, middle expansion and late expansion. Each middle-expansion average for real GDP is then calculated and placed at the mid-point of its respective expansion period as a single reference point. These reference points are then connected by a constant-growth-rate line to complete the trend.

The advantage of this technique is that it treats each expansion peak as the maximum possible output level that the economy can achieve at that point in time. Therefor, the estimated trend will always be close to actual GDP, and potential output, in this sense, is possible to reach.

However, one of the major problems with this technique is defining the beginning of each period. The subjective judgement of the data by the researcher means that the middle-expansion trend approach is subject to a bias problem[9].

Moreover, the length of the business cycle might vary from cycle to cycle, so that the distances between pairs of reference points vary. Finally, this method of estimating a reference trend offers little information about the future, unless it is possible to forecast the next peak. The middle-expansion trend is therefore not an optimal choice for a reference trend, when interest is focused on the future. However, the middle-expansion trend provides historical valuable information.

2.2.2 Hodrick-Prescott filter

The Hodrick-Prescott filter (H-P filter) has recently gained popularity as an alternative approach for smoothing real GDP trends. OECD has reintroduced this method as a simple and fast procedure for estimating output gaps. The method has previously been used extensively in the US, in the real business cycles literature. The advantage of this method is that it is easy and cheap to reproduce and involves little judgement by the researcher.

The basic idea of the H-P filter is to fit a smooth trend through all the observations as if by an intuitive hand drawing. The HP-filter is a simple univariate filter that decomposes any time series into cyclical and growth components. The underlying assumption, is that supply shocks have permanent effects, whereas the effects of demand shocks are only of temporary character.

As Singleton (1988) points out, the difference between trend output estimated with the H-P filter and actual output must not be mistaken for an "output gap" in the

[8] De Leeuw and Holloway (1985).

[9] For further details on the four phases, see op. cit.

Keynesian sense, but should be seen as a deviation from output trend[10]. In practice, the H-P filter is estimated by minimizing the sum of squared deviations from actual GDP subject to a smoothness constraint:

$$\underset{\{\hat{y}_t\}}{Min} \sum_{t=1} (y_t - \hat{y}_t)^2 + \lambda \sum_{t=2} [(\hat{y}_{t+1} - \hat{y}_t) - (\hat{y}_t - \hat{y}_{t-1})]^2 \qquad (3)$$

Here y is the actual time series (real GDP) and $\hat{y}$ is the trend (estimated real GDP trend) calculated subject to the smoothness constraint λ, which controls variation around the trend series. The choice of the weight parameter λ has a significant influence on the smoothness of the trend. Choosing a low value for λ results in a trend that follows the actual output very closely. On the other hand, choosing a high value for λ reduces the sensitivity of the trend to short-run changes in actual output[11]. Hodrick and Prescott suggest the use of $\lambda = 1600$: "*Our prior view is that a five percent cyclical component is moderately large as is one-eighth of one percent change in the growth rate in a quarter. This led us to select* $\sqrt{\lambda} = 5/(1/8) = 40$ *or* $\lambda = 1600$ *as a value for the smoothing parameter*"[12].

King and Rebelo (1989) show that the H-P filter is an optimal inverse linear filter that is capable of rendering stationary any series up to the fourth order. This is subject to the assumption that the underlying time series are difference stationary stochastic processes. However, one problem with the H-P filter is generally referred to as the end-point problem: the trend will follow the actual series more closely at the end of the sample than in the middle. This constitutes a problem when the H-P filter is used for analyzing events close to the end of the sample, which is often the case with current events. In the middle of the sample, however, the filter is a two-sided symmetric filter.

Moreover, the time it takes the H-P trend to change direction makes it difficult to pick up large and sudden changes in the level of output. This may lead to underestimation of rapid structural changes in the economy, as has been the case in Finland in the early of the 1990s[13]. Finally, the H-P filter is likely to capture only a subset of the time series variation that is regarded as part of the cyclical fluctuation. If these cycles are longer than five years, the H-P filter will interpret them as permanent changes in trend output rather than as temporary business cycle-related movements.

[10] Output gap in a Keynesian sense is the deviation between potential output and actual output. Where potential output is defined as the output the economy could produce at full-employment given existing resources.

[11] Hodrick and Prescott (1980) propose $\lambda = 1600$ for quarterly data. However, they calculated the filter using several different values for λ.

[12] Hodrick and Prescott (1980), p. 5.

[13] This will be discussed in more detail in the next section.

2.2.3 Multivariate filter

Laxton and Tetlow (1992) have developed an alternative filter, which they call the *multivariate filter*. Basically, it applies the same technique as the H-P filter. But, instead of applying a filter on only one variable, the multivariate filter uses several variables, and the estimated trend is therefore based on the variables' variation and cointegration. The objective of the multivariate filter is to reduce the uncertainty of the estimated trend.

Laxton and Tetlow (1992) suggest that a potential output trend can be estimated from the output-inflation and output-unemployment relationships. They argue that these are well-established relationships and that the econometric techniques involved are linked to economic theory, so that the resulting trend is not solely based on econometrics. Laxton and Tetlow write the equations as:

$$\pi_t=\pi_t^e+B(L)(y_{t-1}-\tau_{y,t-1})+\varepsilon_{\pi,t} \tag{4}$$

$$U_t-\tau_{U,t}=C(L)(U_{t-1}-\tau_{U,t-1})+D(L)(y_{t-1}-\tau_{y,t-1})+\varepsilon_{U,t} \tag{5}$$

where

$$\pi_t^e=A(L)\pi_{t-1} \tag{6}$$

Here π_t is the inflation rate and expected inflation is denoted by π_t^e. The logarithm of output is denoted by y and unemployment by U, $\tau_{i,t}$ denotes the trend of the ith variable. Finally, the polynomial lag operator is denoted by J(L). In equation (4), inflation is determined by expected inflation and past output gaps.

In practice, we apply the multivariate filter using two variables rather than the three suggested in the above equations. We use real GDP and inflation to estimate the output trend. The bivariate filter thus minimizes the following generalized problem[14]:

$$\sum_{t=1}^{T}\alpha_t(y_t-\tau_t)+\sum_{t=3}^{T}\beta_t[\pi_t-\pi_t^*-\phi_1(y_{t-1}-\tau_{t-1})-\phi_2(y_{t-2}-\tau_{t-2})]' \tag{7}$$

λ is equivalent to the H-P smoothness parameter, which determines the sensitivity of the trend to fluctuations in the actual series. ϕ_1 and ϕ_2 are the Phillips' curve coefficients taken from an simple estimation of the Phillips' curve for Finland[15]. Finally, the weights for output and inflation are α_t and β_t respectively.

The bivariate filter can be regarded as an improvement of the H-P filter in the following ways: (1) it introduces gap weighing, which allows for time-variance, (2) it contains information about output and inflation. The bivariate filter can thus be

[14] We thank Geoffrey Loomer for providing us with a computer program that implements the bivariate filter in RATS and for useful assistance in applying the filter to Finnish data.

[15] The difference between actual and expected (H-P filtered) inflation was explained by lagged output gaps.

described as a compromise between simple univariate detrending and a more structural theoretical estimation of potential output based on the production function framework[16].

However, even though the bivariate filter of Laxton and Tetlow (1992) is based on the same technique as the H-P filter, more *a priori* information about these variables is needed. As for the H-P filter, the bivariate filter is also a mechanical smoothing of variations in the underlying series. This implies that large and sudden changes in the actual variables will not be captured by the estimated trend. Furthermore, as with the H-P filter, the degree of smoothness of the bivariate filter is determined by the arbitrary choice of λ, which acts as a penalty factor.

However, the potential advantage of the bivariate filter compared with the univariate filter is its ability to distinguish different types of shocks and cycles. This is especially useful in the Finnish case, where the symmetries of the H-P filter in the boom of the late 1980s and the recession of the early 1990s is an evident problem.

2.3 The chosen approach

Above we have described several different approaches to constructing and estimating a reference trend. However, many other methods exist. All the methods have advantages and drawbacks, and the choice therefore involves a weighing of the arguments presented above. We have chosen to estimate the reference trends using both the H-P filter and the multivariate filter, which we apply to Finnish data.

First we apply the Hodrick-Prescott filter. The data series are obtained from the BOF4 model[17]. We have estimated the H-P filter from 1960 to 2000 using quarterly data for real GDP. As a smoothing factor we used $\lambda = 1600$, as suggested by Hodrick and Prescott (1980) for quarterly data[18].

By using a forecast five years ahead, we overcome some of the difficulties involved with the end-point problem, discussed above. This is especially a serious problem in the case of Finland, because of the severe recession in the early 1990s, while recent data shows relatively strong growth in real GDP[19]. The trend is therefore increasingly dependent on the forecast, because, as we approach the end-point of the sample, the difference between estimated trend and actual (forecasted) GDP series will eventually vanish. The forecasts were run on the BOF4 model; they converge to the supply-side determined path in the long run.

The second approach we have chosen to use is the multivariate filter developed by Laxton and Tetlow. We have applied it in the form of a bivariate filter, meaning that we are using two variables to determine the output trend. We have estimated a reference trend using data for real GDP and inflation. The multivariate filter is

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16 Barrell (1995) suggests another multivariate econometric detrending method. He estimates a Vector Autoregression (VAR) model, subject to certain long-run restrictions, along the lines of Blanchard and Quah (1991) and King, Plosser, Stock and Watson (1991).

17 BOF4 is the Bank of Finland quarterly macroeconomic model. For details on the construction of the model, see *The BOF4 Quarterly Model of the Finnish Economy*, Bank of Finland, D:73, 1990.

18 Graphical illustrations of actual and filtered GDP are provided in the appendix.

19 See appendix for a graphical illustration of the real GDP trend.

estimated using quarterly data from 1960 until year 2000. As with the H-P filter, we use $\lambda = 1600$, which is also proposed by Laxton and Tetlow (1992).

We have chosen these statistical approaches to estimate the reference trend, even though, the production function approach has a better foundation in economic theory. The two shown mechanical filters that we have chosen are easily reproduced for new economic forecasts, and moreover, they can be easily used to analyze discretionary fiscal policy. Moreover, the production function approach tends to estimate the reference trend (potential output) very high, resulting in a very small cyclically adjusted deficit.

Finally, we do not apply the middle-expansion trend approach, as it demands subjective judgement by the researcher for separating out the different booms and recessions, even though, generalized rules are suggested by De Leeuw and Holloway (1985).

3 Elasticities

Government budget elasticities measure the responsiveness of government revenues and expenditures to changes in GDP. Government budget elasticities are divided into two parts; revenue elasticities and expenditure elasticities. Elasticities of the different budget items are calculated from a simulation of the large scale macroeconometric model BOF4. However, simple linear regressions were also conducted to check the results of the model simulation. Basically, the elasticities measure the sensitivity of each budget items to changes in economic activity. These are then applied to the output gaps.

3.1 Government revenue elasticities

On the revenue side, the government budget is again divided into four main items, for each of which an elasticity is estimated[20]. These four items are: (1) direct taxes on households, (2) corporate taxes, (3) social security contributions, and (4) indirect taxes. The reason for estimating separate elasticities for each item is that they respond differently to changes in GDP.

In practice, we obtained tax elasticities and social security contribution elasticities with respect to GDP by running a balanced growth simulation on the BOF4 model. In this simulation all demand items were exogenously increased by one per cent. Like the OECD, we also checked the elasticities by simple linear regression. Unlike the OECD, however, we did not try to improve our elasticity estimates by using data on income distribution[21].

In the results reported here, we did not take that into account that corporate taxes are based on a lagged tax base. However, the effect of lagging corporate taxes as in the BOF4 model was tested by the authors. Thus, 30 per cent of corporate tax revenue was lagged one year while 70 per cent was lagged two years. Nevertheless, we found

[20] OECD also divides government revenue into the same four categories.

[21] For further detail see Giorno et al. (1995).

that lagging corporate taxes had no significant effect on the cyclically adjusted budget balance. This is partly due to the fact that corporate taxes account for being less than 10 per cent of the total central government revenue and partly to the low elasticity that we obtained[22].

Table 3.1 shows the elasticities of central and general government revenue respectively. Central government is here additionally treated separately because it is of more relevance, in the case of Finland. This is due to the special situation here in which the general government includes pension funds, which currently run and in the future will run large surpluses. Furthermore, budget balances of local governments have not been affected by the recession to the same extent as the central government, so the local government sector is roughly in balance. All in all, this improves the balance sheet of general government compared to the central government, resulting in a distorted picture of the underlying fiscal stance - underestimating the cyclically adjusted budget deficit. Therefore, in order to measure the true underlying fiscal situation we have additionally monitored the central government separately.

For direct taxes on households, the elasticity obtained from the BOF4 simulation and from a simple regression analysis are slightly higher than the one OECD has estimated using the average and marginal income taxes[23]. On the other hand, the corporate tax elasticity assumed by the OECD is much higher than the one we estimated with BOF4 simulation and simple regression (0.8 and 1.0 respectively). Moreover, it is also much higher than the one estimated by OECD themselves[24].

Table 3.1 **Revenue elasticities**

Revenue items	Central Government		General Government	
	BOF4	Regression	BOF4	OECD
Income taxes	1.3	1.2	1.3	1.1
Corporate taxes	1.0	0.8	1.0	2.5
Social security contributions	1.0	1.1	1.1	0.8
Indirect taxes	0.9	1.0	0.9	1.0

Source: Giorno et al. (1995). BOF4 data bank: Own estimation
Note: The elasticities used where obtained from the balanced growth simulation by the BOF4 model (column BOF4).

[22] Chouraqui et al. (1990) explain the importance of lagging corporate taxes back to the year for which they are calculated. Giorno et al. (1995), on the other hand, do not report any lagging of corporate taxes in their latest report on structural deficit.

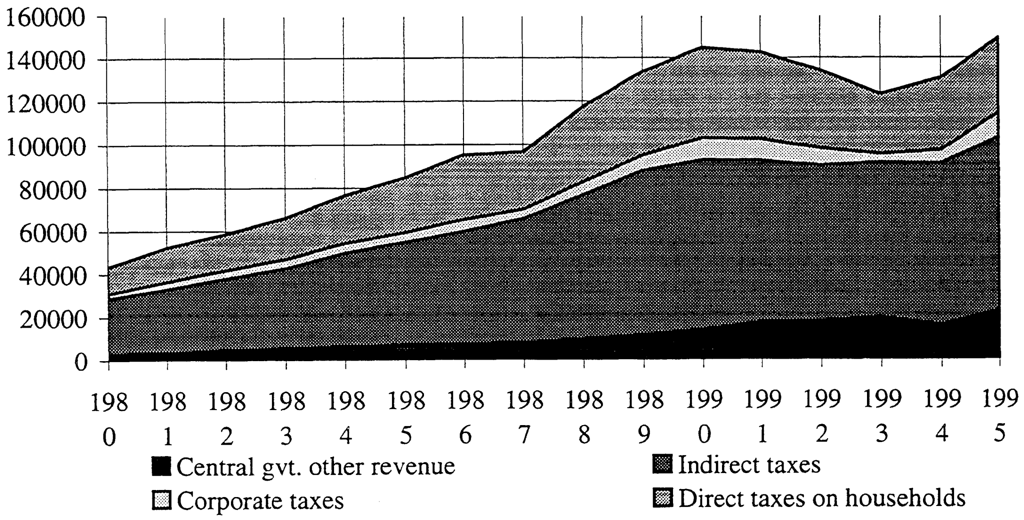
[23] The simple linear regression was preformed using the Cochrane-Orcutt procedure for the period 1960Q1 to 1994Q4. Estimates for the period 1975Q1 to 1994Q4 were very similar to those applied.

[24] Giorno et al. (1995) estimated the elasticity of corporate tax with respect to output by simple regression.

For indirect taxes we obtained an elasticity of 0.9 with the BOF4 simulation; using a simple regression, we found the elasticity to be 1.0, which is the same as OECD is using. Finally, with respect to social security contributions, the elasticity for the general government was found to be 1.1, which is slightly higher than the elasticity that OECD uses (0.8). The elasticities used in the calculation were found using a BOF4 balanced growth simulation. The elasticities are long-run elasticities calculated over 10 to 15 years.

Figure 3.1 shows central government revenue, which declined from 1990 to 1993, due to the deep recession. Revenue increased again in 1994 and is expected to follow the recovery in the near future. The two largest items in central government revenue are income taxes and the indirect taxes.

Figure 3.1 **Central government revenue**



Source: BOF4 data bank.

3.2 Government expenditure elasticities

Expenditure elasticities are also obtained from a BOF4 simulation and from a simple log-linear regression using data from BOF4 and BOF5. In calculating the adjusted deficit, only unemployment-related expenditure was assumed to be elastic. All other expenditures were treated as being perfectly inelastic. Because only unemployment-related expenditure is affected directly by business cycles changes. The same assumption has been applied e.g. by the cited OECD study and by Myhrman and Willman (1991).

When evaluating the elasticity of the unemployment-related expenditure with respect to GDP we gave more weight to the BOF4 model properties than to simple regressions. 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 found to be 0.58 for the central government and 0.76 for general government[25]. Thus, we find that the elasticity of unemployment-related expenditure with respect to GDP lies within the range of −2.2 to −2.5. The estimate −2.5 was used in the deficit calculations both for central and general government[26].

Table 3.2 **Expenditure shares and expenditure elasticities**

	1990	1991	1992	1993	1994	1995
Central gvt. unemployment-related exp./ total expenditure	3.8	5.0	7.4	**9.9**	9.4	7.7
General gvt. unempl.-related exp./total exp.				**11.0** (OECD)		
Central gvt. total expenditure/GDP	25	31	34	36	35	35
Central gvt. unempl.-related exp./GDP	0.9	1.6	2.5	3.6	3.3	2.7
General gvt unempl.-related exp./GDP	1.4	2.7	4.8	**6.7** **6.9** (OECD)	6.2	5.0
Expenditure elasticities						
Unemployment-related exp. with respect to GDP		BOF4 Central and general gvt. −2.5		OECD General gvt. −0.1*11 e.g. about −1		

Source: OECD, Employment Outlook, Paris, July 1994. BOF4 and BOF5 data bank: Own estimations. The elasticities are obtained from a balanced growth simulation in the BOF4 model.

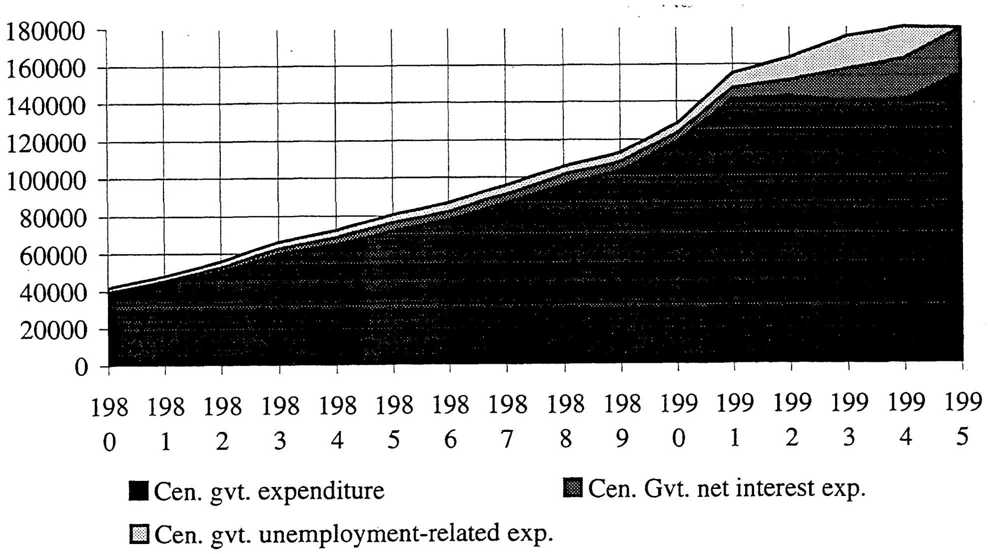
To compare our elasticity with that of the OECD study, we note that unemployment expenditure was 11 per cent of total general government expenditure in 1993; hence the OECD elasticity comparable to our elasticity is close to −1 (−0.1*11; see table 3.2). The OECD elasticity seems rather low, also when compared to the results for other OECD countries in the cited OECD study.

Figure 3.2 below, shows the main items of Finnish central government expenditure that were discussed above. The increase in unemployment-related expenditure in 1992 to 1994 is clearly seen. Net interest expenditure has also increased substantially and will continue to rise in the future.

[25] The estimation was again a log-linear Cochrane-Orcutt OLS for the period 1980Q1 to 1994Q4.

[26] However, for the forecast period 1995Q1 onwards, unit elasticity was assumed in the baseline for unemployment expenditure with respect to the number of unemployed, since this relationship is not estimated in the BOF4 model.

Figure 3.2 **Central government expenditure**



Source: BOF4 data bank.

4 The cyclically adjusted budget

Adjusting government budget balances for the effects of business cycles reveals the status of the underlying fiscal stance. The cyclically adjusted budget measures government revenue and expenditure, net of the effect of business cycles. With the elasticities estimated above, we adjust each revenue and expenditure item of the budget by the ratio of trend output to actual output the relevant elasticity.

4.1 Budget balance

The government budget balance is total government revenue less total government expenditure. Adjusting for the cyclical effects, we get the government budget balance adjusted for business cycles:

$$B^A = \sum T_i^A - \sum G_i^A$$

where B^A is the adjusted government budget balance, T_i^A is the cyclical adjusted income for the ith category of receipts, and finally, G_i^A is the cyclical adjusted expenditure of the ith category of expenditure. As discussed above, the revenue side of the budget is relatively sensitive to output gaps estimated as the difference between actual and trend output.

From table 4.1, we see that the actual general government deficit for Finland, forecasted by the OECD, is more optimistic than that forecasted by the BOF4 model. Looking at the cyclically adjusted deficit, OECD has calculated a small surplus for the general government budget in the boom years in the end of the 1980s. However, our calculation shows a larger surplus in 1990 than that calculated by OECD. In the following recession years, the adjusted deficit on the general government budget balance as calculated by the OECD is substantially smaller than by our calculations. The OECD estimation of the cyclically adjusted budget balance is thus more optimistic than our estimation, indicating that the large government deficit is mainly due to fluctuations in business cycles. This is especially the case in the years 1993–1995, where OECD estimates the "structural deficit" to be between 2 and 4 per cent of GDP while our estimation using the H-P filter suggest the deficit to be between 4 and 6 per cent of GDP. Furthermore, using the bivariate filter, the deficit estimate varies around 6 per cent of GDP, which is significantly different from the deficit estimated by OECD. Even if we take into account the differences caused by the uncertainty with respect to the forecast of the actual budget deficit, the differences are still very large.

However, in cases like Finland it is more relevant to monitor the underlying fiscal stance of the central government rather than general government. This is because, as mentioned above, the definition of general government includes pension funds, which in Finland are currently running large surpluses and their portfolio allocation affects the general government deficit. Therefore, analyzing the underlying fiscal stance of the central government gives a more reliable picture of the economic situation in Finland.

For the central government, we additionally find, that the deficit as a percentage of the GDP is larger than for general government. Table 4.2 shows the budget balance of the central government calculated according to the SNA definition. The actual central government deficit is significantly larger than the general government deficit. Moreover, the cyclically adjusted budget balance of the central government shows that the underlying fiscal stance is clearly distorted by focusing on the general government rather than central government.

Table 4.1 **Actual and cyclically adjusted general government budget balance (SNA), per cent of GDP**

Year	Actual budget general government	Adjusted budget H-P filter ($\lambda = 1600$)	Adjusted budget bivariate filter ($\lambda = 1600$)	Actual budget OECD general government	Adjusted budget OECD Production function
1987				-1.1	-0.8
1988				4.1	0.7
1989				6.3	1.2
1990	5.4	2.6	4.0	5.4	0.7
1991	-1.5	-0.9	-0.7	-1.5	-2.0
1992	-5.9	-3.8	-4.9	-5.8	-3.7
1993	-7.8	-4.8	-6.5	-7.1	-3.4
1994	-5.6	-4.4	-5.6	-4.6	-1.7
1995	-5.6	-5.9	-6.3	-5.1	-3.7

Source: BOF4 and BOF5: Own estimations and Giorno et al. (1995).

Table 4.2, shows that the choice of λ has a large influence on the calculation of the cyclically adjusted budget balance. Choosing a larger λ, *ceteris paribus*, results in our case, in a smaller cyclically adjusted deficit because the trend output does not follow actual output very closely. This implies that the arbitrary choice of λ is significantly reflected in the final cyclically adjusted budget balance[27]. The result with $\lambda = 12800$ is a smaller cyclically adjusted deficit in the 1990s. It is evident that the choice of penalty factor λ has a significant impact on the cyclically adjusted budget deficit, since fluctuations are being smoothed out.

Table 4.2 **Actual and cyclical adjusted central government budget balance, per cent of GDP**

Year	Actual budget central government	Adjusted budget H-P filter $\lambda = 1600$ SNA	Adjusted budget H-P filter $\lambda = 12800$ SNA	Adjusted budget bivariate filter ($\lambda = 1600$)
1990	1.2	-0.3	-0.8	0.5
1991	-4.5	-4.2	-4.2	-4.1
1992	-7.6	-6.6	-6.0	-7.1
1993	-11.3	-9.8	-8.9	-10.6
1994	-10.7	-10.1	-9.1	-10.7
1995	-10.0	-10.2	-9.4	-10.3

Source: BOF4 and BOF5 data bank: Own estimation.

Nevertheless, using the bivariate GDP trend results in a larger deficit in the years 1992–1995, whereas it estimates a surplus in 1990. Hence, these results show that adding inflation to the estimation of output trend provides additional information about the large changes in the Finnish economy from the boom years in the late 1980s through the recession in the early 1990s.

Looking at central government, we find that the deficit is a much larger share of GDP than it is for general government. From table 4.3, we see that the actual central government deficit is a much larger share of GDP calculated using the net borrowing requirement (NBR) than the deficit calculated according to the SNA definition. Hence, the deficit in 1992 according to the net borrowing requirement definition amounted to 14.9 per cent of GDP, while according to the SNA definition it was only 7.6 per cent of GDP. This is mainly because the net borrowing requirement of the government also include support for the banking sector, which has been substantial from 1992. As a result of the larger net borrowing requirement, the cyclically adjusted government deficit of the central government is also larger, amounting to 10.7 per cent of GDP in 1995, which is 0.5 per cent of GDP higher than using budget balance according to the SNA definition.

[27] Graphical illustrations of actual and adjusted deficits are provided in the appendix.

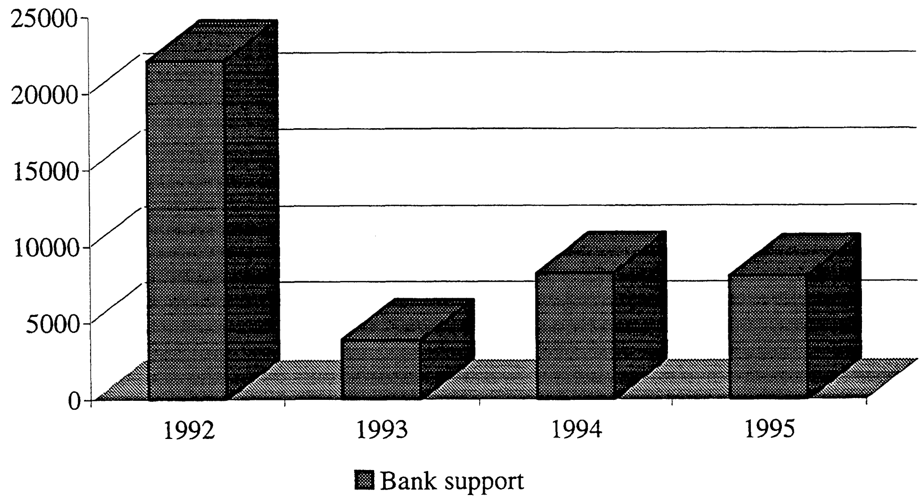
Table 4.3 **Actual and adjusted central government budget balance, per cent of GDP**

Year	Actual budget central government, SNA	Adjusted budget $\lambda = 1600$, SNA	Actual budget central government NBR	Adjusted budget $\lambda = 1600$, NBR	Adjusted budget bivariate filter ($\lambda = 1600$)
1990	1.2	-0.3	0.1	-1.3	-0.6
1991	-4.5	-4.2	-6.6	-6.3	-6.2
1992	-7.6	-6.6	-14.9	-9.2	-9.7
1993	-11.3	-9.8	-12.6	-10.3	-11.3
1994	-10.7	-10.1	-12.8	-10.6	-11.2
1995	-10.0	-10.2	-12.0	-10.7	-10.9

Source: BOF4 and BOF5 data bank: Own estimation.

Figure 3.3 shows annual bank support from the central government. The bank support increased started in 1992. This bank support can be regarded as a special situation, which is only temporary. We have in our calculations treated bank support as cyclical.

Figure 3.3 **Bank support**



Source: BOF4 databank.

Finally, from the above tables it can be observed that the deficit calculated on the bivariate output trend is larger than the one calculated on the H-P filter. This is due to the fact that the bivariate filter follows the actual real GDP more closely than does the H-P filter. It is our view that the trend estimated by the bivariate filter represents a better approximation of the boom years of the late 1980s. During the recession years in the early 1990s, however, it is our view that the trend should be somewhat further above actual GDP, implying that the output gap is larger than that suggested by the bivariate and H-P filter, due to Finland's deep recession of the early 1990s.

5 Conclusions

Monitoring the underlying fiscal stance of the economy has in recent years become increasingly important, and much research has been done in to develop new methods of estimating the effects of business cycles on the government budget balance. The procedure for calculating the adjusted budget balance has been laid out in Chouraqui (1990), but, the choice of a reference trend has been subject to much debate. No method of estimating the reference trend is generally accepted as the right method, thus OECD recently evaluated their previous method in comparison with certain alternative approaches. This resulted in the adoption of a new method based on the production function approach and the potential output trend.

In this paper, we have described and evaluated several theoretical and statistical approaches to constructing a reference trend. We find that the potential output approach based on the production function is perhaps better founded theoretically, but is not a simple and straightforward method that can be adopted as a handy tool for analyzing discretionary fiscal policy.

We have chosen to apply two approaches for estimating the reference trend - the Hodrick-Prescott filter and the multivariate filter. These two filters are chosen because they are simple and easy to apply when analyzing discretionary fiscal policy. Furthermore, both of them are based on econometric techniques, and hence no subjective judgement by the researcher is needed. However, these techniques have also their shortcomings which should not be overlooked. Nevertheless, we have tried to overcome some of the most significant problems, for example the end-point problem.

The result of our estimation of the cyclically adjusted government budget balance is quite obvious. The deep and long recession that hit the Finnish economy in 1990, has led to a large cyclically adjusted deficit, implying that even if the economy returned to the output trend level there would persist a deficit on the government budget balance that is not to be removed without discretionary action.

For general government, we estimated the cyclically adjusted deficit to increase until 1993, then to stabilize in 1994 and to increase again in 1995. The OECD results are approximately the same, but their estimation of the deficit is not as large as ours. More interesting, we estimated the cyclically adjusted central government deficit using the SNA definition to increase to approximately 10 per cent in 1995. Using the net borrowing requirement (NBR) instead worsens the situation, since that additionally includes government support for the financial sector.

More important, however, is that according to our calculations the economy will in 1995 return to its trend level, indicating that the entire government budget deficit will be of a cyclically adjusted character. In OECD report No. 152 this is refered to as *"the structural deficit"*, implying that structural constraints in the economy - especially in the labour market - seem to prevent the economy from returning to a high-employment level and balance on the government budget, so that only discretionary policy can improve the situation.

The resulting cyclically adjusted government budget balance is dependent on the choice of estimation method for the reference trend. It is our view that both the H-P filter and the bivariate filter serve as good methods for extracting reference trends. In particular, we find that the trend estimated using the bivariate filter fits in very well with our *a prior* intuition of the trend in the late 1980s, while it is our believe that the trend in the beginning of the 1990s should have been somewhat higher, indicating a somewhat smaller cyclically adjusted deficit.

Considering the estimation techniques, this report clearly demonstrates the large effect of the arbitrary choice of method for estimating the reference trend – whether it is an actual or potential output trend. The results presented in this report should therefore be judged keeping in mind the uncertainty surrounding the estimation of the reference trend, as well as the uncertainty regarding the estimation of the adjusted budget balance. Naturally, the results also depend on macroeconomic forecasts, i.e. on the baseline GDP and the deficit forecasts.

Finally, this type of analysis of the fiscal stance can be taken further by running actual budget and neutral budget simulations with a macro model following Myhrman and Willman (1991). The dynamic effects of each year's budget could thus be traced for all of the model's endogenous variables. This would shed more light on the stance of fiscal policy than does our simple categorization of the budget deficit into cyclical and cyclically adjusted parts.

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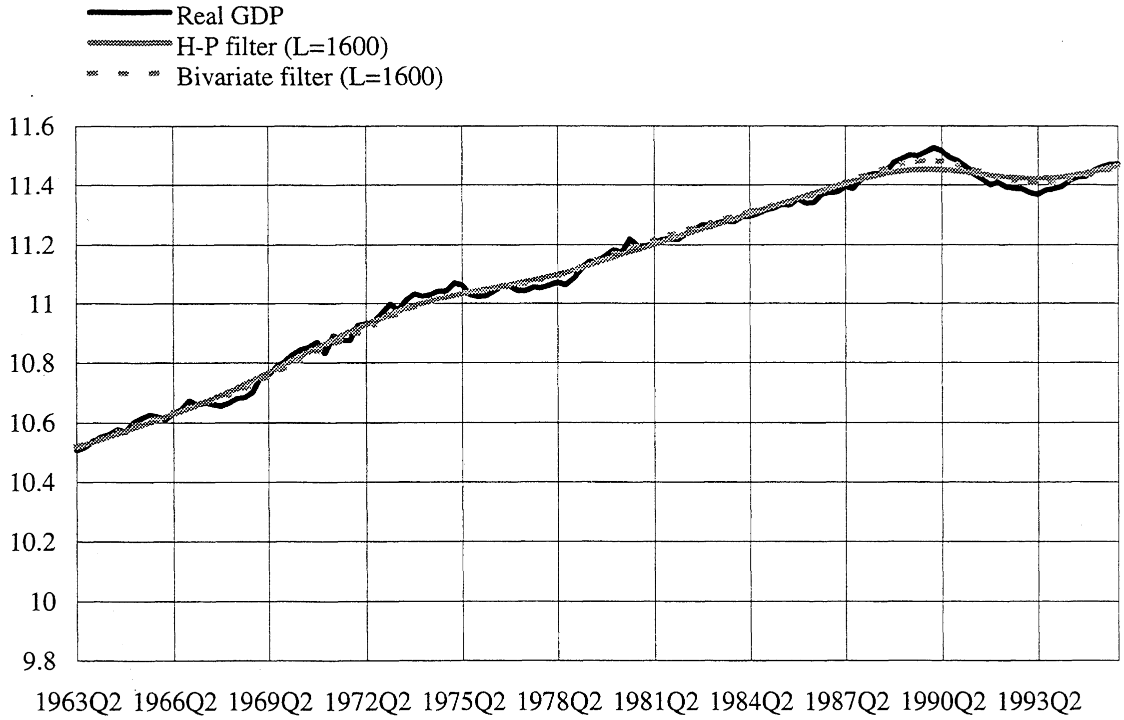
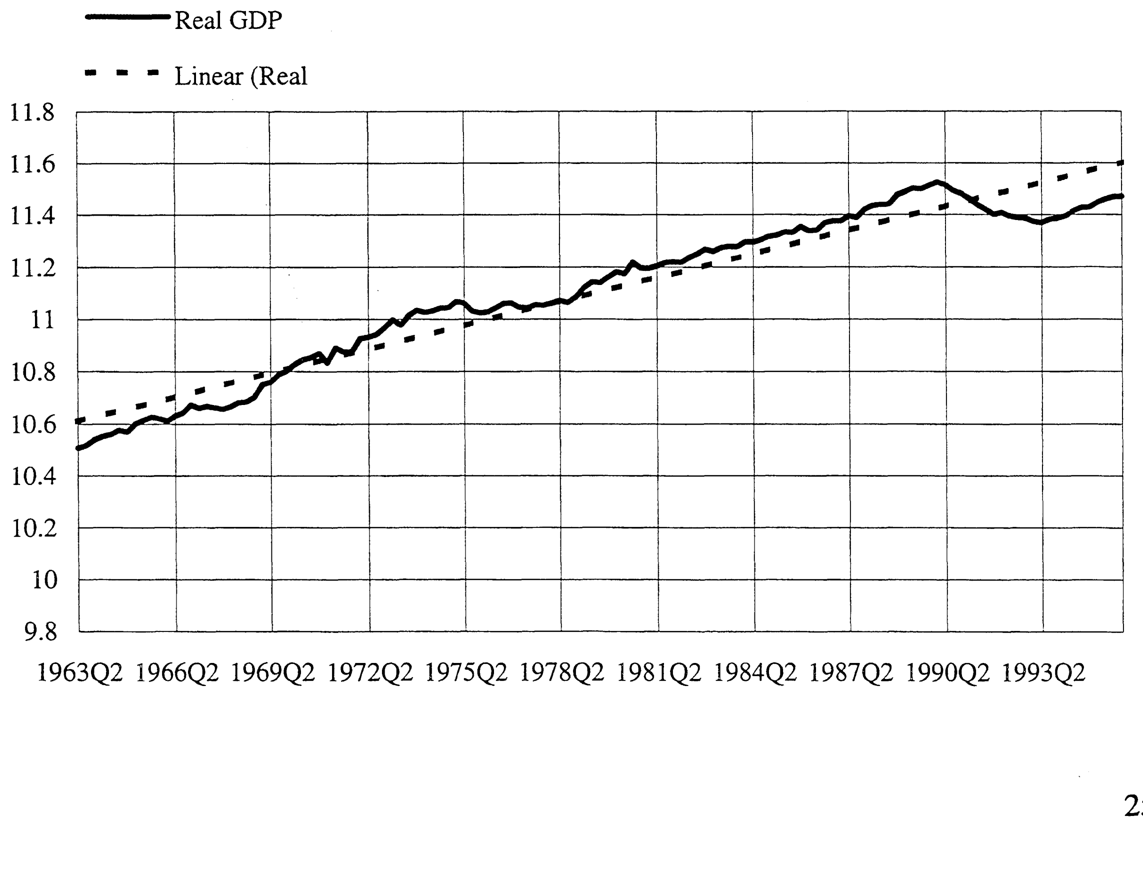
Appendix

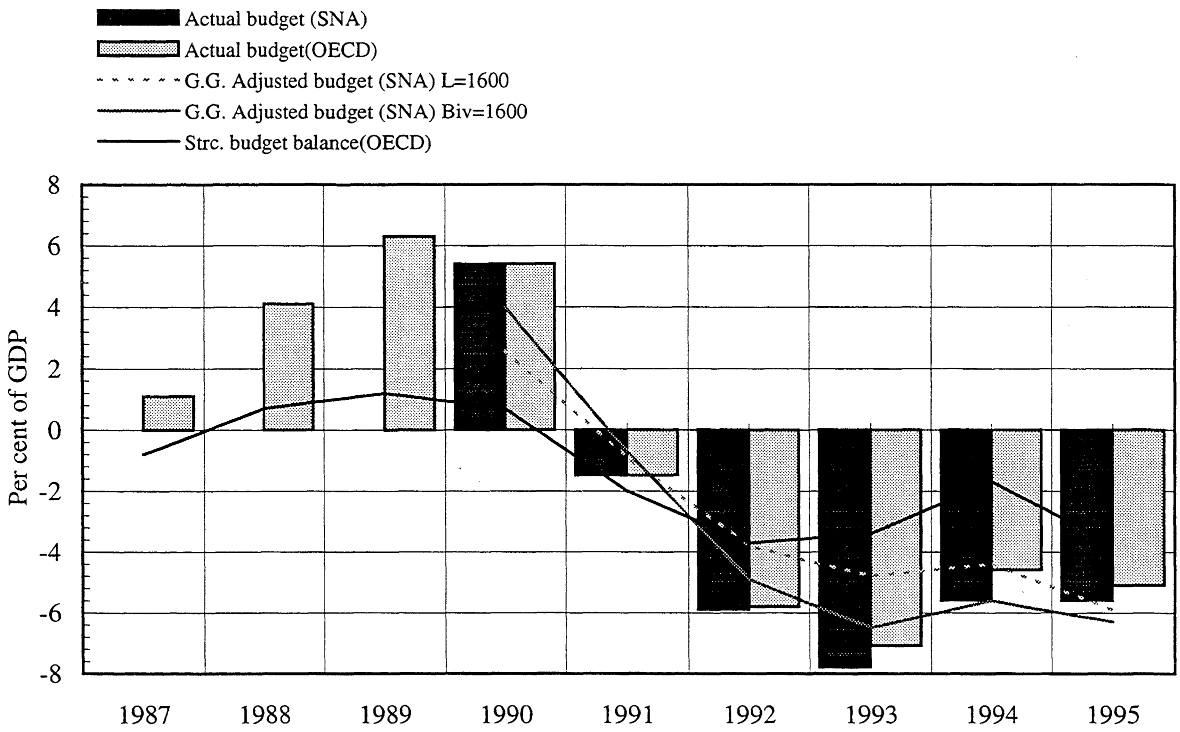
Real GDP and trends



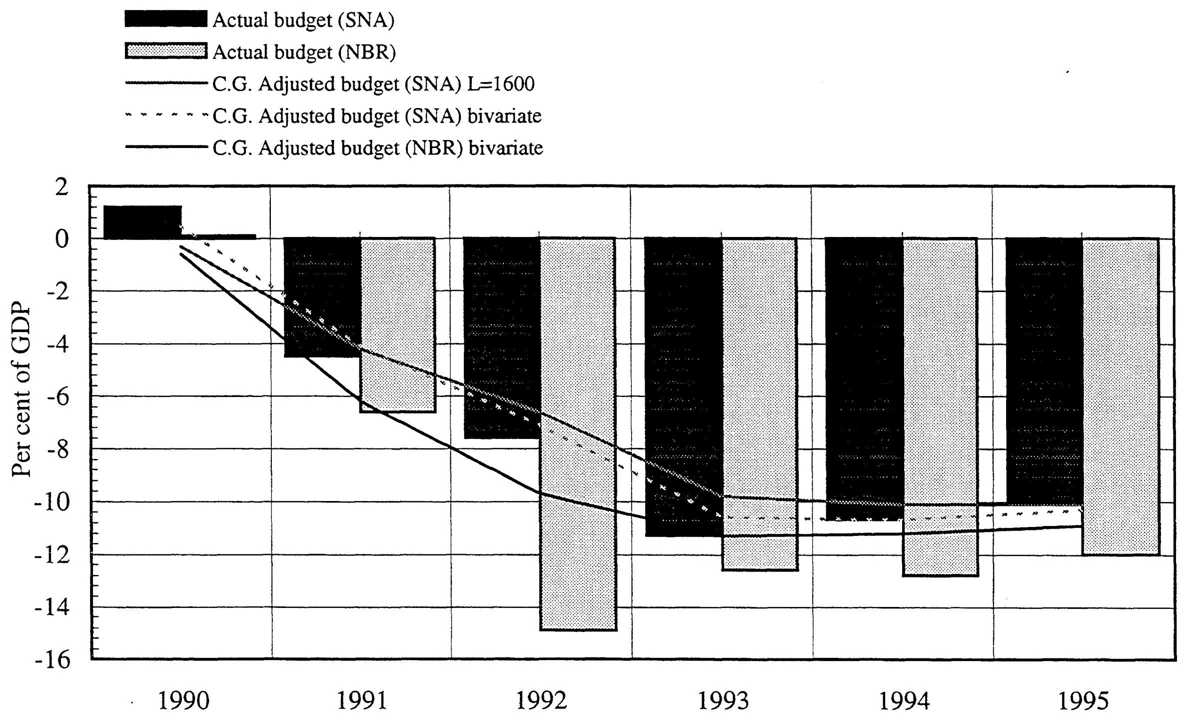
Real GDP and the linear trend



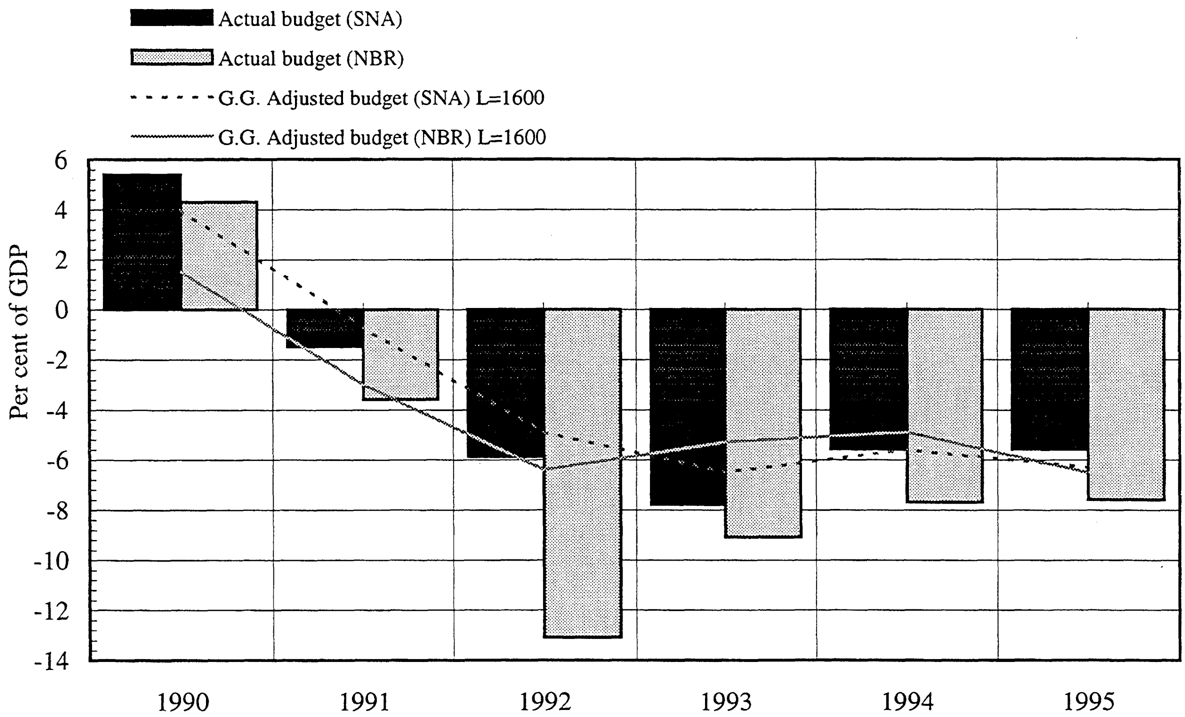
Actual and adjusted general government budget balance, per cent of GDP



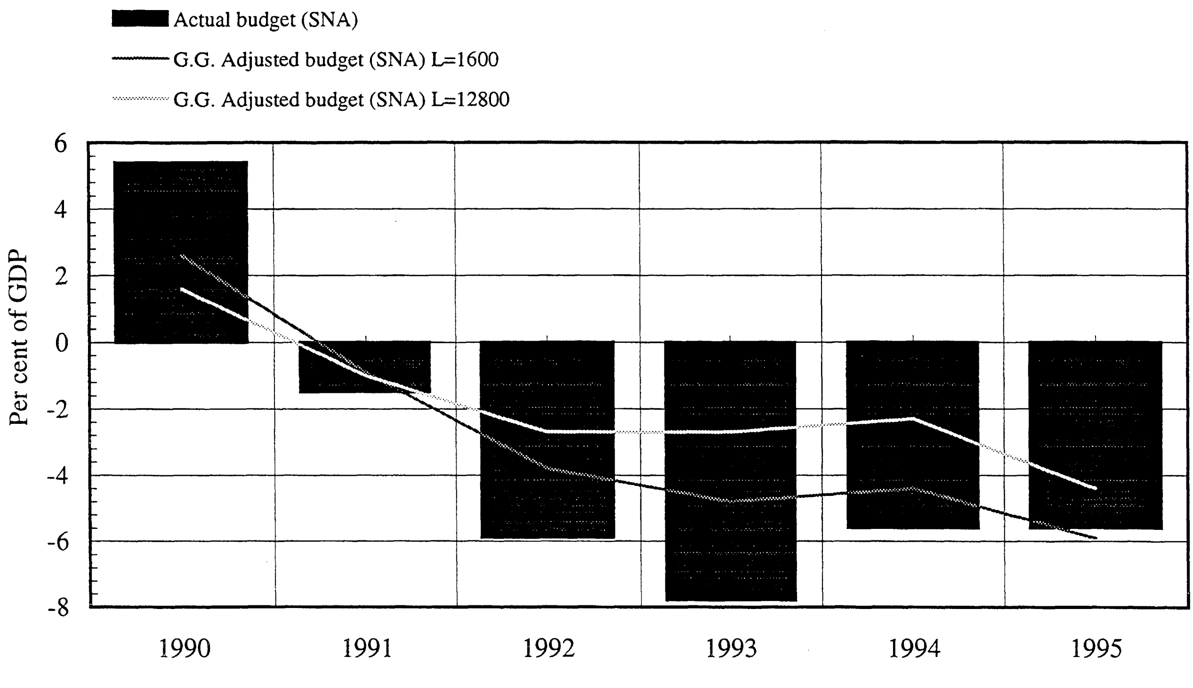
Actual and adjusted central government budget balance, per cent of GDP



Actual and adjusted general government budget balance, per cent of GDP



Actual and adjusted general government budget balance, per cent of GDP



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