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The public budget balance -

fiscal indicators and cyclical sensitivity in the Nordic countries *

by

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* The paper is written under a project financed by the Nordic Council of Ministers and the National Institute of Economic Research (Sweden). The aim of the project is to (i) describe the methods used by the Nordic ministries of finance, as well as international organisations like the OECD, the IMF and the EU-Commission, for calculating the cyclical sensitivity of public budgets, (ii) suggest a method for calculating the cyclical sensitivity of public budgets for the Nordic countries, that can be used at a regular basis by the Nordic ministries of finance and (iii) investigate empirically how sensitive the public budgets in the Nordic countries are to business cycles. The description and discussion of the existing fiscal indicators, as well as the construction of a new fiscal indicator, is primarily the work of Holden. The empirical analysis is mainly undertaken by Braconier. We are grateful to Lars Calmfors, Robert Hagemann, Ingemar Hansson, Per Mathis Kongsrud, Paul Van den Noord, Carl J Nordén, Werner Roeger, Asbjørn Rødseth, Arent Skjæveland, Paul Söderlind, Svante Öberg, and Lars-Erik Öller, as well as to participants of the seminar held in Stockholm, March 1999 for useful comments to an earlier draft.

Summary in English

This paper analyzes the relationship between the budget balance and the cyclical situation of the economy. There are two main purposes. In the first analysis, we develop a method for decomposing the change in the budget balance into discretionary changes, due to changes in economic policy, and induced changes that arise due to changes in the economy. The discretionary component of the change in the budget balance measures changes in fiscal stance and can be used as a fiscal policy indicator. As a measure of changes in fiscal policy, the proposed indicator has two advantages over existing indicators used by international organizations. First, the adjustment of changes in the economy is attached to important tax bases, rather than to the GDP, leading to higher accuracy when tax bases are not perfectly correlated with GDP. Second, unlike most previous indicators, the discretionary policy component does not include the effect on the budget balance of structural changes in the economy (as measured by potential output), that are not directly related to fiscal policy.

The induced change component can be used to evaluate the cyclical sensitivity of public finances with respect to changes in the economy, when fiscal policy is unchanged. We also suggest how a decomposition of the level of the primary budget balance into a structural and a cyclical component can be conducted.

The second main purpose of the study is to empirically investigate the cyclical sensitivity of public finances in the Nordic countries. The analysis focuses on the period 1980 to 1997. We use three different methods for evaluating the sensitivity of public finances. Overall, public finances in all the Nordic countries are sensitive to cyclical changes in the economy. The estimated sensitivity of the budget balance as a share of GDP with respect to GDP growth is 0.6-0.8 for Sweden, 0.5-0.75 for Denmark, 0.4-0.6 for Finland and Norway and 0.2-0.6 for Iceland, given constant fiscal policy. It is likely, however, that our estimates are biased downward as data problems lead us to underestimate the sensitivity while countercyclical fiscal policy may lead to even more sensitive public finances.

In the empirical analysis we also study how different types of shocks affect public finances. The results show that a domestic savings shock has the strongest effect on public finances, while an aggregate demand shock affects public finances less and an export shock has the smallest effect on public finances.

We conclude the paper by discussing the problems associated with analysing the effect of fiscal policy on the economy by use of simple indicators, as well as a few brief remarks on the normative question of how sensitive the budget should be to economic fluctuations.

1 Introduction and main conclusions

Public sector budgets are sensitive to the cyclical situation of the economy. This has been well known for decades, and the strength of the sensitivity has been amply documented by the recent experiences of the Nordic countries. Previously, the cyclical sensitivity of the budget was considered a virtue, by working as an automatic stabiliser of the overall economy. However, while the stabilising effect on the economy is still a virtue, recent experiences have also illustrated the associated problems. In a severe downturn of the economy, the budget balance may deteriorate sharply. Within fairly short time, this may result in public debt at high and increasing levels.

In this paper, we present two types of analysis on the relationship between the budget balance and the cyclical situation of the economy from two perspectives. In the first analysis, we suggest a **new fiscal indicator**. The basis here is a decomposition of the actual change in the budget balance into:

- **Discretionary changes** that are the effect of changes in the fiscal policy.
- **Induced changes** that arise as a consequence of changes in the economy; these are the changes that would take place even if fiscal policy were constant.

The decomposition of the change in the budget balance into discretionary and induced changes can be used in the evaluation of past and current fiscal policy. The discretionary change in fiscal policy is an indicator of the direction in which fiscal policy is heading. Even though the major changes in policy can be monitored directly, this index provides a useful quantitative estimate that captures the total effect of all changes, large and small.

We use the fiscal indicator to do this decomposition of the budget balance for each of the Nordic countries for a period from the 1970s to 1997. This illustrates the method that is used, as well as shedding light on the evolution of the budget balances over the last decades.

The second analysis is aimed at shedding light on **the sensitivity of the budget balance in the Nordic countries to fluctuations in the economy**, in particular in GDP, when fiscal policy is unchanged. This analysis, which is based on data from 1980 to 1997, is aimed at illustrating the exposure of the public finances to economic uncertainty. We also analyse whether this sensitivity has changed over time and study the relative impact of different types of macroeconomic shocks on budget balances in the Nordic countries. In the analysis, we make use of the decomposition from the first part of the paper. In order to check the robustness of the empirical results we use a variety of methods to analyse the impact of fluctuations in GDP on budget balances. The estimated sensitivity of the primary balance as a share of GDP with respect to changes in GDP (growth) is 0.6-0.8 for Sweden, 0.5-0.75 for Denmark, 0.4-0.6 for Finland and Norway and 0.2-0.6 for Iceland. In the case of total budget balances, the sensitivity is even larger for Sweden, Denmark, Finland and, to some extent Iceland.

Our estimates of how public finances are affected by changes in GDP growth are likely to be on the conservative side for two reasons. Firstly, data problems may lead us to understate the costs associated with increasing unemployment due to lower GDP growth. If proper data on unemployment-related expenditure were available, the estimated sensitivity would probably be higher. Secondly, counter-cyclical fiscal policies would also make budget balances more sensitive to swings in GDP growth.

International organisations and many national governments have for years constructed fiscal indicators similar to those suggested here. These fiscal indicators are used for several other purposes than the ones mentioned above. They are used as a measure of the fiscal policy in the medium term, to see whether current fiscal policy is viable. They are sometimes also used as a measure of the effect of fiscal policy on aggregate demand. Finally, they serve as a definition of neutral fiscal policy, sometimes with a normative connotation. The merits and problems of these applications are discussed in this paper.

The various uses of the fiscal indicators, and the variety of concerns that are relevant in their construction, imply that there exists no ideal, all-purpose fiscal indicator. The most important consideration is clearly the exact purpose of the indicator. However, the user's trade-offs between practical considerations like accuracy, simplicity, information requirement and the need for judgmental intervention, are also crucial.

An important difference between the indicator suggested here and previous indicators, is that most previous indicators are based on decomposition into a cyclical and a non-cyclical component. The non-cyclical component is often interpreted as an indicator for the change in fiscal policy. This implies that the effect of structural changes in the economy is bunched together with discretionary changes in fiscal policy, which confounds the measurement of discretionary changes in fiscal policy.

An additional weakness of the indicators used by the international organisations is that the adjustment is only attached to movements in GDP. This leads to inaccuracies when important tax bases evolve differently than does GDP. In the decomposition suggested below, adjustments are linked directly to the main tax bases. On the other hand, adjustments directly related to GDP have the advantage that their measurement requires less information, as it is not necessary to make forecasts for the tax bases.

A possible further step would be to decompose either or both of the discretionary and induced changes into cyclical and non-cyclical parts. However, while a reliable decomposition of this kind would be of great interest, it involves important theoretical and empirical problems. It is often very difficult to assess to what extent a change in the economy is transitory or permanent, so decomposition between cyclical and non-cyclical changes in the budget balance is bound to be highly uncertain.

The paper is organised as follows. Section 2 elaborates on the motivation for the study, and discusses the criteria an indicator should meet. The fiscal indicators used by international organisations and the Nordic ministries of finance are described and evaluated in Section 3. Section 4 contains our own suggestion for a fiscal indicator, based on a decomposition of the change in the budget balance into discretionary policy, cycles and trend. The historical decomposition for the Nordic countries, based on the method in Section 4, is presented in Section 5. Section 6 provides an analysis of the sensitivity of the budget balance to economic fluctuations. In Section 7, we discuss the interpretation of fiscal indicators as a measure of the effect of fiscal policy on the economy. In Section 8, we very briefly touch upon the possible policy implications of the empirical findings.

The indicators that we suggest and use for the historical decomposition are fairly crude, and they are the same for all countries. This makes the results more transparent, and facilitates inter-country comparisons, but at the costs of accuracy. However, the indicators are easy to extend, so as to make them more detailed in general, and to take into account issues that are important in each country. The ministries of finance in the Nordic countries are probably well advised to use more detailed indicators.

2 Fiscal indicators: Motivation and choice-criteria

2.1 Motivation

The present study aims at facilitating fiscal policy along two lines;

- assessment of past and current changes in fiscal policy by use of a simple quantitative indicator;
- evaluation of the sensitivity of the budget balance with respect to economic fluctuations.

The first part involves a decomposition of the change in the budget balance into discretionary fiscal policy and induced changes. The need for such an indicator is due to the fact that the budget balance is affected by a large number of changes, of varying importance and in both directions. Many of the items are caused by changes in the economy, while others arise as a consequence of changes in fiscal policy. In policy evaluation it is useful to distinguish between changes that are caused by changes in the economy (induced changes) and changes in fiscal policy (discretionary changes). The latter is an index of the direction in which fiscal policy is heading. If the government has an intention to improve the budgetary position, the discretionary change in fiscal policy is important as a benchmark. For example, in a strong upswing of the economy, there is a risk that fiscal policy becomes too lax, because an expansionary change in the fiscal policy is "hidden" by the increase in tax revenues. In this case the index of discretionary change may reveal the true change in fiscal policy, thus helping to prevent procyclical fluctuations.

The second analysis, on the sensitivity of the budget balance with respect to fluctuations in the economy, is a reflection of the large uncertainty that is attached to the future evolution of the economy. Knowledge of the effect of this uncertainty on the public budget balance provides an indication of the need for a flexible policy strategy. For example, if the budget balance is considered too sensitive to fluctuations in the economy, the government may want to change rules and practices. It is important for the government to retain room for adjustment so that negative consequences of a future fiscal tightening are minimised. A case in point is the choice between making public services or transfers an individual right by law (in which case the budget costs are determined by the number of eligible individuals, and where there is little room for adjustments in the short run), or to allocate a certain sum in the budget for that purpose.

The sensitivity of the budget balance with respect to fluctuations in the economy is of additional policy relevance for countries participating in the Economic and Monetary Union, as the Maastricht criterion states that member states shall avoid excessive government deficits (defined to be a public-sector net borrowing in excess of 3 per cent of GDP). At what level should the surplus/deficit be in normal situations, to ensure that the budget balance is consistent with the rules of the Maastricht treaty even in a severe downturn of the economy?

Knowledge about the sensitivity of the budget balance may also illustrate the uncertainty of long run projections. By their nature, these are highly dependent on the assumptions that are made about the future evolution of crucial variables. If these assumptions are too optimistic, weaknesses in the present policy may be hidden. In particular, these questions are important, as medium-term fiscal policy strategies have become the rule in most industrial countries. In contrast, the analysis of sensitivity of the budget balance to economic fluctuations involves a sharper focus on the risk and consequences of large shocks.

2.2 Criteria for the choice of indicator

One criterion for an indicator is that it must be **simple**, both in calculation and in the presentation of the results. The indicator may be calculated as part of the government budget process several times per year, often under strict time limits and with a requirement of using the latest available information. Thus, the calculation must not require too much work. Regarding simplicity of presentation, it must be possible to explain the results of the indicator to people with a limited understanding of economics.

A second criterion is that the indicator should be **accurate** and **reliable**. This is of obvious value in itself; if the indicator is inaccurate, it may cause more harm than good. Accuracy is also important in the presentation. If additional qualifications are necessary in the presentation of the indicator, this may confuse outsiders and can reduce the trust and confidence that outsiders have in the indicator.

A third criterion is that in the calculation of the indicator, the need for **judgmental intervention should be kept to a minimum**. When judgmental intervention is required, the additional assumptions that are made should be made explicit. Furthermore, it should be possible to evaluate the importance of the intervention. One reason for avoiding judgmental intervention is the time constraints that may govern the calculation of the indicator. More importantly, judgmental intervention may reduce the users' (both within the government and outside) understanding of the results of the indicator, and it may reduce outsiders' confidence in the indicator.

A fourth criterion is the **information requirement**. The indicator can only be based on information that is available at the time of construction, which may restrict how detailed the indicator can be. Furthermore, it is an advantage to avoid making forecasts of additional variables.

The importance of the various concerns may differ between international organisations and national government bodies. International organisations may have to choose the same method for all countries. Furthermore, it is important that there is little use of judgmental intervention. These concerns suggest mechanical approaches, without detailed adjustments. National governmental bodies must also take into consideration that the indicators can be subject to detailed scrutiny in discussion and analysis of economic policy. To avoid the need for many additional explanations and qualifications, national governmental bodies may prefer to make more elaborate adjustments. On the other hand, national governments must also take into consideration that from outsiders' point of view, detailed adjustments provide scope for changing the value of the indicator in the direction that suits the government, thus it may reduce their confidence in the indicator.

3 Fiscal indicators used by international organisations and national governments

In this Section we present and discuss the fiscal indicators used by the OECD, the IMF, the EU Commission, as well as by the ministries of finance in the Nordic countries. The discussion is based on the description of the fiscal indicators provided in Giorno et al (1995) (OECD), IMF (1993) and EU (1995), Finansredegørelsen 1996, Appendix 2 and 3 to Chapter 2 (Denmark), Revidert Nasjonalbudsjettet 1999, (Norway), in addition to material supplied by the ministries of finance in Finland, Norway and Sweden. A more precise description of the fiscal indicators used by the international organisations is provided in Appendix 1.

3.1 Indicators used by international organisations

The OECD and the IMF both calculate an indicator which they refer to as the structural budget balance. This indicator is estimated in two steps.

1) Calculation of the potential output of the economy, which loosely can be defined as the short-term production capacity of the economy that is consistent with stable inflation.[1] The **output gap** is then defined as the difference between actual output (real GDP) and potential output, measured in percent of potential output. Note that actual output may exceed potential output, rendering the output gap positive.

2) The structural budget balance is obtained by adjusting the actual budget balance for the effect of the output gap, by use of estimated elasticities for various sorts of revenues and expenditure with respect to the output gap.

The structural budget balance is thus the budget balance that would have prevailed if actual output were equal to potential output, that is, if the output gap were equal to zero. Thus, the output gap is used to identify and isolate the impact of cyclical factors on the budget.

The cyclical adjustment of the government budget balance undertaken by the EU Commission is also similar to that of the OECD, except for one important difference: the output gap is calculated on the basis of trend, rather than potential, output. All these organisations, the OECD, the IMF and the EU Commission, publish both levels and changes of these indicators.

The structural budget balance and the cyclically adjusted budget balance (for simplicity we shall refer to both by the abbreviation CAB) are used to provide information on several issues. In Giorno et al (1995), IMF (1993) and EU (1995), the following applications are distinguished.

- The level of the CAB is an indicator of the medium-term fiscal position, detecting a possible "trend towards unsustainable public debt positions, …".
- The change in the CAB is used as an indicator of "discretionary actions towards consolidation, …".
- The change in the CAB "provide some indication of the degree of stimulus or restraint that government provides to demand over and above that given by the automatic stabilisers" (the effect of fiscal policy on the economy).

[1] Potential output is derived by estimating a production function (of Cobb-Douglas type) with labour and capital as inputs, and then inserting potential employment and actual capital (assumed to be equal to potential capital) in the estimated production function. Potential employment is derived by deducting an estimate of equilibrium unemployment (based on the Non-Accelerating Wage Rate of Unemployment, NAWRU, -indicator) from the smoothed labour force.

In this section we shall give a brief account of how OECD indicator is constructed (the IMF indicator is essentially the same), and in Section 3.2 we evaluate the indicators. The government budget surplus is

(1) $B = S - iD = T - G - iD$

where B is the budget balance, D is government debt, G is government spending on goods and services, T is taxes net of transfers, i is the nominal interest rate, and the primary surplus is $S = T - G$.

To isolate the effect of the cycle on the budget balance, one makes use of the output gap, defined as the difference between actual output (real GDP, Y) and potential output Y*, measured in percent of potential output.

(2) $GAP = (Y - Y^*)/Y^*$.

Taxes are assumed to be increasing in output, with a constant elasticity, so the ratio of potential to actual taxes is

(3) $T^*/T = (Y^*/Y)^{\alpha}$

where $\alpha > 0$ is the elasticity of tax revenues with respect to output. (3) abstracts from that fact that the OECD distinguishes between four different taxes (corporate, personal, indirect, and social security), each with a different elasticity α. The cyclical component of taxes as a ratio to potential output is given by[2]

(4) $$t - t^* = a \frac{T}{Y} GAP,$$

where $t = T/Y^*$ and $t^* = T^*/Y^*$.

On the expenditure side, changes in the economy are assumed to only affect expenditure on unemployment benefits, G_U. Again, a constant elasticity relationship is assumed. Thus, the ratio of expenditure on unemployment benefits if output is equal to its potential value, G_U^*, relative to the actual value, is

(5) $G_U^*/ G_U = (Y^*/Y)^{\beta}$, $\beta < 0$.

[2] (4) is essentially a first order Taylor expansion, which can be derived as follows: Taxes are assumed to be a constant elasticity function of actual output, $T = k_0 Y^{\alpha}$, (so that $T^* = k_0(Y^*)^{\alpha}$). Differentiating taxes as a ratio to potential output with respect to actual output gives us

$$\frac{dt}{dY} = a k_0 Y^{a-1} \frac{1}{Y^*} = a \frac{T}{Y} \frac{1}{Y^*}.$$

Multiplication by the cyclical deviation Y-Y* results in (4).

The cyclical component of expenditure on unemployment benefits, as a ratio to potential output, is given by[3]

$$(6) \qquad g_U - g_U^* = b\frac{G}{Y}GAP,$$

where $g_U = G_U/Y^*$ and $g_U^* = G_U^*/Y^*$. As expenditure on unemployment benefits is the only type of expenditure that is cyclically adjusted, $g - g^* = g_U - g_U^*$, where $g = G/Y^*$.

The structural budget balance, that is, the budget balance that would have prevailed if actual output were equal to potential output (i.e. no output gap), as a ratio to potential output, is

$$(7) \qquad b^* = B^*/Y^* = t^* - g^* - id,$$

where ($d = D/Y^*$), or

$$(8) \qquad b^* = b - \left(a\frac{T}{Y} - b\frac{G_U}{Y}\right)GAP.$$

(8) shows that the structural budget balance is the actual budget balance, *b*, adjusted for the effect on revenues and expenditures of the output gap.

The change in the structural budget balance as a ratio to potential output is (as an approximation)[4]

$$(9) \qquad \Delta b^* = \frac{\Delta B}{Y^*} - \left(a\frac{T}{Y} - b\frac{G_U}{Y}\right)\Delta GAP - b^*\frac{\Delta Y^*}{Y^*}.$$

Thus, the change in the structural budget balance is the actual change in the budget balance, less the effect on the budget balance of a change in the output gap, and less the structural budget balance times growth in potential output (this latter term reflects that b* is a ratio, that diminishes when the denominator increases). Of the variables in (9), Y*, GAP, α and β have to be estimated, while for the other variables one can use actual values.

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[3] (6) is also essentially a first order Taylor expansion. It can be derived by assuming G_U to be a constant elasticity function of the rate of unemployment, $G_U = k_1 U^a$, (where k_1 and a are positive constants). Furthermore, unemployment is assumed to be a decreasing function of output relative to potential output, with a constant elasticity c (so c is the inverse of the Okun coefficient), $U = k_2 (Y/Y^*)^{-c}$, where k_2 and c are positive constants. Substituting out for U, we obtain

$$G_U = k_1 k_2^a Y^{-ac} (Y^*)^{ac} = k_3 Y^\beta (Y^*)^{-\beta}, \qquad \text{where } k_3 = k_1 k_2^a, \text{ and } -ac = \beta.$$

The remainder follows fn 2.

[4] Recall that for marginal changes, the change in the budget balance, measured as a ratio to GDP, is

$$\Delta\left(\frac{B}{Y}\right) = \left(\frac{\Delta B Y - B\Delta Y}{Y^2}\right) = \frac{\Delta B}{Y} - \left(\frac{B}{Y}\right)\frac{\Delta Y}{Y}.$$

3.2 Evaluation of the indicators used by the international organisations

In this Section we shall discuss the use of the change in the CAB as an indicator of discretionary changes in fiscal policy, and use of the level of the CAB as an indicator of the medium-term fiscal position (is current fiscal policy sustainable?). The discussion draws upon Blanchard (1993) and Bowitz et al (1993). The use of the change in the CAB as an indicator of the effect of fiscal policy on the economy is discussed in section 7 below.

The international organisations are aware of the problems and weaknesses associated with the fiscal indicators that are discussed here, cf. e.g. the caveats mentioned in the information on sources and methods that supplements the OECD Economic Outlook (see www.oecd.org/eco/out/sources.htm). However, the indicators are used not only by the international organisations themselves, but also by national governments, independent policy analysts, and in the business sector, where the understanding of these issues may be more limited. Therefore, we think it is useful to provide a more extensive discussion of the problems associated with the indicators in the various applications.

As an **indicator of discretionary changes in fiscal policy**, the change in the CAB involves two types of problems; it is incomplete, and the use of estimated potential output as a benchmark is problematic. First **incompleteness**; the adjustment that is made in the construction of the change in the CAB is incomplete in the sense that there are many other important changes in the economy that are not included. For example, if the nominal interest rate increases, this may have a considerable impact on the budget balance of a government with large debt. On the OECD measure, this will appear as a change in fiscal policy, while it in reality is a change in the economy. (This suggests that an indicator for discretionary changes in fiscal policy should be based on the primary budget balance, where interest payments are excluded, rather than the entire budget balance, as does the CAB.) Furthermore, important tax bases, like the wage bill or private consumption, may evolve differently from the GDP, in which case the adjustment will be inaccurate. These inaccuracies imply that the indicator may give a misleading picture of the true changes in fiscal policy.

On the other hand, attaching the entire adjustment to one variable, the output gap, has the advantage that the indicator becomes simple and transparent, and less data intensive. It may also be an advantage that the cyclical adjustment of the budget balance is directly related to the output gap.

A second problem is the use of **potential output as a benchmark**. One reason for this is that the estimate is highly uncertain, in particular at the end-of-sample, that is, for the latest years. The uncertainty of the estimate of the potential output is reflected directly in uncertainty in the change in the structural budget balance. Moreover, Δy^* is really a measure of the change in the estimate of the potential output, which is different from the actual change in the potential output.

More importantly, using potential output as a benchmark implies that year to year fluctuations in the growth of potential output affect the index of discretionary changes in fiscal policy. An adverse change in potential output will show up as an expansionary change in fiscal policy; this can even happen in a situation where fiscal policy is, in fact, tightened. This is probably not a good background for constructive discussion about economic policy.

The characteristics of the change in the CAB as an index of discretionary changes in fiscal policy can also be viewed from a different angle. Any calculation of discretionary changes in fiscal policy requires a definition of constant fiscal policy, to be used as a benchmark for changes. The definition of constant policy that is implicit in the use of the change in the CAB is fairly involved. Consider first the simplest case, where there is no initial debt (i.e. no net interest payments), the budget is balanced initially, and taxes are proportional to GDP. In this case there is no change in the CAB (i.e. fiscal policy is constant) if government expenditure grows at the rate of growth in potential output. In other words, fluctuations in the growth of potential output involve fluctuations in the room for increased government expenditure that is consistent with unchanged policy. Alternatively, the government may choose to exploit the growth in potential output to reduce tax rates, and the CAB would still indicate unchanged policy. If there is initial debt, and interest payments increase (due to a rise in nominal interest rates or in nominal debt), there is less room for a rise in government expenditure at unchanged policy.

A formal treatment may illustrate the implicit definition of constant policy more precisely. Let the change in actual taxes be decomposed into the effect of output growth and changes that are not associated with movements in the GDP, denoted ΔT_0. Likewise, the change in public expenditure is decomposed into the effect of changes in deviation of actual from potential GDP (i.e. changes in the rate of unemployment) and changes that are not associated with movements in the rate of unemployment, denoted ΔG_0:

$$\Delta T = a\,\frac{T}{Y}\Delta Y + \Delta T_0$$

(10)

$$\Delta G = b\,\frac{G_U}{Y}\left(\Delta Y - \Delta Y^*\right) + \Delta G_0$$

Substituting out for (10) in (9) gives us (as an approximation)

$$\Delta b^* = \frac{1}{Y^*}\left(\Delta T_0 - \Delta G_0 + \Delta i\, D + i\,\Delta D\right) + a\,\frac{T}{Y}\frac{\Delta Y^*}{Y^*} - b^*\frac{\Delta Y^*}{Y^*}. \qquad (11)$$

Fiscal policy is defined as unchanged if $\Delta b^* = 0$. As is apparent from the large number of terms in (11), unchanged policy is not equivalent to constant expenditure and constant tax rules ($\Delta G_0 = \Delta T_0 = 0$). In general, growth in potential output leads to higher tax revenues (the term $\alpha(T/Y)\Delta Y^*/Y^*$), providing room for an increase in government expenditure, $\Delta G_0 > 0$, or other tax reductions $\Delta T_0 < 0$ (lower tax rates).

The use of the level of the CAB as an **indicator of sustainability of fiscal policy** is heavily criticised by Blanchard (1993), for two reasons. First, it is incomplete by neglecting other factors than the cyclical movement that also affect the sustainability of public budgets. An obvious illustration is given by Norway, where large oil revenues, excluded from the OECD indicator, imply that short and medium term sustainability of public budgets is not an issue. (The long term sustainability of the public budget is an issue in Norway, too, due to demographic trends, but the structural budget balance is not suitable as an indicator of this.) A second illustration is the absence of inflation adjustment; for a country with a large debt, a reduction in inflation and nominal interest rates will involve an improvement of the CAB, but if real interest rates are unaffected, the improvement is nothing but money illusion. (If the reduction in seignorage is taken into account, the direct effect on the budget balance of lower inflation may even be negative.)

Secondly, as sustainability depends on the future evolution of the economy, the structural budget balance as an indicator of sustainability implicitly involves estimating potential future output. This would be a reasonable assumption if the economy could be seen as subject to regular fluctuations around a constant trend. However, this assumption is dubious (cf. Romer, 1996, 4.8, for a recent discussion). Blanchard (1993) argues that one should instead use forecasts for the future evolution of the economy in an analysis of sustainability (see Blanchard et al, 1990, for a suggestion of indicators of sustainability of fiscal policy).[5]

The OECD and the IMF calculate **potential output** rather than **trend output** so as to exploit additional information on structural constraints in the economy. The use of additional information is in general an advantage. However, there are two disadvantages. First, there is a risk that the resulting estimate is given too much prominence. In spite of the additional information, the estimate of the potential output is likely to be highly uncertain (and to our knowledge no quantitative assessment of the uncertainty exists). An important source of uncertainty is the use of the NAWRU in the calculation of the potential output (the problems attached to the NAWRU-method are discussed in Holden and Nymoen, 1999). A satisfying analysis of the supply constraints of an economy probably requires a more thorough analysis than the one underlying the potential output. Using trend output as a benchmark has the advantage of being less pretentious. Secondly, the calculated potential output growth rates seem to fluctuate more from year to year than do trend growth rates (Giorno et al, 1995), involving more noise in the measure of discretionary changes in fiscal policy.

In addition, of course, any indicator based on a short-term analysis is bound to miss the importance of long term trends arising from demographic changes, pension system, etc., which are crucial for the long run sustainability of the public budget. (Thus, this weakness also applies to the indicators that we suggest below.) A fiscal indicator can at best supplement the long-term analysis, and never replace it. Therefore, both national governments and the international organisations undertake extensive studies of the long-term challenges of public finances.

[5] To avoid a possible misunderstanding: The international organisations use forecasts of future variables in the construction of trend that is the basis of the cyclical adjustment of the contemporaneous budget balance. In contrast, Blanchard suggests using forecasts of future variables directly.

It is difficult to evaluate the accuracy of the adjustments that are made by the OECD and other organisations. There is little documentation of the precise way the elasticities are derived. There is hardly any information on data, estimation methods, test statistics, etc. Generally, the estimated elasticities do not appear unreasonable. A possible surprising feature is the fairly large differences across countries, or between estimates from different organisations, cf. Table 3.1.

Table 3.1 Tax elasticity estimates for Nordic countries used by OECD and EU

	Den_{OECD}	Den_{EU}	Fin_{OECD}	Fin_{EU}	Nor_{OECD}	Swe_{OECD}	Swe_{EU}
Direct tax	0.7		1.1		1.2	1.4	
Indirect	1.0		1.0		1.0	1.0	
Social sec	0.6		0.8		0.9	1.2	
Corporate	2.2		2.5		2.5	2.4	
Weighted		0.78		0.97			1.24
Okun coef	2.5	1.17	3.3	2.46	5.0	5.0	1.7
$El_{GDP}G$	-0.2	-0.26	-0.1	-0.05	-0.1	-0.1	-0.21

$El_{GDP}G$ is the elasticity of public expenditure G with respect to GDP. Sources: Giorno et al (1995), EU-Commission (1994).

3.3 Indicators used in the Nordic countries

The ministries of finance in all Nordic countries calculate cyclical adjustments of the budget balance. However, the methods that are used differ considerably. In Denmark, revenues and expenditures are adjusted on the basis of an estimate of the output gap. The Danish Ministry of Finance derives the output gap using an estimate for potential output, calculated by a method similar to that of the OECD. The Swedish Ministry of Finance adjusts revenues and expenditures according to the deviation between actual real GDP growth and a baseline annual growth rate of 2 percent. The Finnish Ministry of Finance makes cyclical adjustments that are related to changes in the rate of unemployment.

There are also important differences concerning how the adjustment with respect to the cyclical situation is calculated.[6] In Denmark, elasticities are estimated on a fairly detailed level (five types of revenue, two types of expenditure); the estimations are done on the basis of aggregate time series, where revenues and expenditures are first corrected for the effect of changes in tax rates, etc. In Sweden, the elasticity of the budget balance with respect to GDP is calculated on the basis of simulations on micro data, where one has investigated the effect on the budget balance of an increase in employment, and a corresponding decrease in unemployment. In Finland, the adjustment of a change in the rate of unemployment is based on the use of a rough rule-of-thumb.

[6] As for the international organisations, it is difficult to get hold of a proper documentation of the derivation of the elasticities.

The Swedish Ministry of Finance makes additional cyclical adjustments, not related to movements in the GDP, e.g. for a change in the ratio of important tax bases to GDP (wage income, private consumption, and transfers), which are then multiplied by the relevant tax rates.

The Norwegian Ministry of Finance changed the method of cyclical adjustment as of Revised National Budget 1999, and the adjustment is no longer related to the GDP. Rather, the Ministry calculates trends for important tax bases and the rate of unemployment, and then computes the cyclical adjustment on the basis of the gap between actual and trend values. The trend development is obtained by smoothing the actual series by use of a Hodrick-Prescott filter. The cyclical corrections of direct taxes, social security contributions and payroll taxes, are all linked to employment. Separate trends are also calculated for business taxes, consumption of goods, consumption of goods excluding cars, mainland business investment, production in the service sector, purchases of cars, and unemployment. For example, the adjustment of taxes on sales of cars are based on a calculation of a trend for first-time registration of cars, with corresponding cyclical deviation, which is multiplied by average tax per car. In addition, the Ministry of Finance adjusts for all revenues and expenditures connected to the petroleum activity.

In contrast to the international organisations, the Danish and Swedish ministries of finance focus on the primary surplus, by excluding net interest payments, and other capital income. The Finnish Ministry of Finance appears to make no such adjustment. The Norwegian Ministry of Finance appears only to adjust for net interest payments to the central bank and to foreign creditors/debtors, but not to domestic creditors/debtors. This distinction probably reflects that the indicator is also used to assess the effect of fiscal policy on the economy, where the difference between foreign and domestic creditors/debtors is of importance. From the point of view of distinguishing the effect of changes in the economy on the budget balance from discretionary policy (i.e. the view taken here), the distinction between foreign and domestic creditors/debtors is irrelevant.

The ministries of finance in Denmark, Norway and Sweden also make adjustments for other specific items (one-off items). It is difficult to compare the adjustments that are made, but it appears that the most detailed adjustment is made in Denmark. In Finland, the only additional adjustment is for the timing of tax revenues.[7]

The Danish Ministry of Finance also calculates discretionary changes in fiscal policy directly, according to a fairly detailed definition of neutral (constant) fiscal policy. This makes it possible to decompose the annual change in the structural budget balance into five components: fiscal policy, specific items, structural unemployment, labour force, and residual.

[7] The Swedish Ministry of Finance adjusts for one-off items, like capital transfers and bank support, and for the timing of tax revenues. The Norwegian Ministry of Finance adjusts for specific items, for example net transfers to the central bank, or changes in accounting rules. The Danish Ministry of Finance adjusts for Operating and capital transfers, real interest rate tax (realrenteavgift), corporate tax from the financial sector, etc.

A further issue is that the adjustment by the Norwegian Ministry of Finance includes most of central government and the social security system, while the OECD (and, we believe, all others) include general government. The motivation for only including central government is that the indicator plays an important role in the discussion about the government budget. However, one can also argue that it is the balance of the overall government that really matters, both for long-term sustainability and for discretionary stimulus to the economy.

3.4 Evaluation of the indicators used by the Nordic ministries of finance

The indicators used by the Nordic ministries of finance to some extent share the weaknesses of those used by the international organisations. The adjustment in Denmark and Sweden is related to the GDP, in Finland it is based on the rate of unemployment, which is less accurate than relating it directly to the tax bases. In Sweden, this is to some extent compensated for by additional adjustments not related to GDP. It is difficult to evaluate the precise way these adjustments are undertaken. For Sweden, an open question is whether the output elasticity should be modified when one adjusts for changes in the tax bases as a ratio to GDP.[8]

All countries make adjustments for other specific items that are likely to increase the accuracy of the indicator, but there is a trade-off between accuracy on one hand and complexity and transparency on the other hand.

Both Denmark and Norway use potential output as a benchmark in the calculation of the adjustments, implying that the changes in the adjusted balance are affected by year-to-year changes in potential output. In principle, this involves a measurement error when the change in the adjusted balance is used as a measure of discretionary changes in fiscal policy. In practice it is probably not important. In Norway, trend growth exhibits very little year-to-year fluctuations by construction (a fairly high smoothing factor λ in the Hodrick-Prescott filter). In Denmark, one also calculates discretionary changes in fiscal policy directly. There are no year-to-year fluctuations in the benchmarks used in Sweden and Finland, so this problem does not apply there.

Neither Finland nor Sweden publishes the level of the cyclically adjusted budget balance. The Norwegian Ministry of Finance focuses on the change in the cyclically adjusted balance, but the level is also published occasionally.

4 Suggestions for new indicators

In this section we shall discuss various aspects of fiscal indicators, and end up with a suggestion for a new indicator. We want our indicator to give an answer to a question posed by Blanchard (1993):

"Changes in policy: Of the changes in the fiscal position (taxes, transfers, spending), what part is due to changes in the economic environment and what part is due to change in policy?"

[8] If the tax bases as a ratio to the GDP are correlated with the GDP itself, the estimate of the elasticity of revenues with respect to GDP (the output elasticity) may easily include the effect of cyclical changes in tax bases as ratio to GDP. However, in the Swedish method, adjustments are made for changes in the ratio of the tax bases to GDP, hence the output elasticity should not include the effect of these cyclical changes.

The identification of discretionary changes in fiscal policy requires a definition of what one means by constant or unchanged fiscal policy. An immediate interpretation would be that discretionary changes in fiscal policy are changes associated with new decisions. This is the starting point of Bowitz et al (1993), that define policy as unchanged "as long as the laws and rules governing taxes and expenditure are unchanged". On the revenue side, this definition is fairly straightforward, the important choice concerns the level of detail.[9]

On the expenditure side, there are many components that are not governed by laws or regulations, for which the issue is more involved. The notion that discretionary changes are associated with new decisions is vague, and may easily end up in subtle distinctions. For the purpose of constructing a fiscal indicator, one would have to make a simple definition of what is meant by unchanged policy for such expenditure components. One such simple definition of unchanged policy is that public expenditure components that are not determined by laws or regulations are constant in real terms. Another simple definition is that these expenditure components are constant as a share of trend GDP. As revenues will grow with real GDP, the budget balance will improve over time under the former definition of constant policy, where expenditures are constant in real terms. The improvement is dampened, however, by the fact that the price on public consumption generally increases at a higher rate than the price on GDP.

The probably most correct decomposition of changes in the fiscal position would involve following the definition of Bowitz et al (1993) as far as possible, leading to a detailed analysis, probably using an empirical model of the economy. One would then estimate the discretionary changes in fiscal policy directly, e.g. by calculating the revenue effect of each change in tax rates, etc. As mentioned above, the Danish Ministry of Finance undertakes an analysis of this type. In the following, we shall propose a cruder approach, where the discretionary changes in fiscal policy are calculated in an indirect way. The advantage of the cruder approach is that it does not require a detailed knowledge of tax rates and other policy changes. If such knowledge is available, it should be used to obtain higher precision.

Note that in the calculation of discretionary changes, one takes output, inflation, real interest rates, etc. as given. Thus, one neglects that, say, an increase in government expenditure may induce higher output and thus higher tax revenues, dampening the negative change in the budget balance. In this sense the indicator exaggerates the effect on the budget balance of discretionary changes in fiscal policy.

4.1 A new indicator

The focus in the approach that is suggested below is on the components that are of considerable quantitative importance. On the revenue side, important taxes are related to proxies for their respective tax bases. For expenditure, one would want to distinguish important expenditure components that are governed by entitlement rules; in practice it may be difficult to specify other items than unemployment benefits.

By use of a crude definition of constant policy, we can calculate the changes in public sector revenues and expenditures that would prevail if fiscal policy were constant from one year to the next (which we shall refer to as induced changes). The difference between the actual and induced changes will then be our estimate of discretionary changes in fiscal policy.

[9] In a detailed analysis, there are of course questions like whether unchanged policy involves adjustment of tax rules for inflation, or perhaps for average wage growth, etc.

Note that the discretionary change in fiscal policy is measured at the time that actual expenditures and revenues change, and not when the decisions are taken. For example, if parliament one year decides to undertake a reform involving much higher public expenditures in later years, this will be measured as discretionary changes when the expenditures increase, and not when the decision is taken. This is trivial from a theoretical point of view, but it is important that it is also remembered in practice. The use of a fiscal indicator as the one presented below may add to the general tendency that more attention is paid to the immediate consequences of policy decisions than to future consequences.

4.1.1 Decomposition into induced and discretionary changes in the budget balance

In the first part of the decomposition, we focus on the primary balance (the effect on the net interest payments will be dealt with afterwards). More specifically, we define constant fiscal policy to entail:

Revenues:

- Direct taxes are constant as a share of pre-tax household income.
- Social security contributions are constant as a share of the wage bill.
- Indirect taxes are constant as a share of private consumption.
- Other revenues are constant as a share of GDP.

For the first three groups, tax revenues are thus attached to a variable that is fairly close to the actual tax base. The fourth group, other revenues, is quantitatively less important, and corresponds to ten percent or less of total revenues for all the Nordic countries, cf. Table 6.1.3. The definition of constant policy implies that for each tax type, the tax system is assumed to be essentially proportional in the aggregate. Note however, that even if e.g. the income tax system is progressive as viewed from the individual tax earner, this does not necessarily imply non-proportionality in the relationship between the size of the tax base and tax revenues. An increase in tax base for income taxes may derive from more income earners or higher income for the existing income earners (Rødseth, 1984, Giorno et al, 1995). Under a a progressive tax system, the elasticity of tax revenues with respect to the tax base will be above unity if the latter effect dominates.

To increase accuracy, one would want much more detailed calculations. For example, corporate taxes could be treated separately, direct taxes could also depend on transfers, indirect taxes also depend on investments, and revenues from sales taxes on new cars could be treated separately (important for Norway and Denmark). However, this is outside the scope of our study.

For Norway, revenues (and expenditures) associated with the petroleum sector must be excluded.

Expenditures:

- Public expenditures are constant as share of trend GDP.
- Unemployment benefits are proportional to the rate of unemployment.

Under this definition of constant policy, the budget balance will be largely constant under constant policy (assuming that revenues grow at the rate of GDP). In Appendix 3 we present another method (alternative B) of decomposing changes in the budget balance based on a different definition of constant expenditure-policies.

Box 4.1
Ideally, one would want a more detailed treatment. We mention two examples here:

- The spending on active labour market programmes ALMP.

Spending on ALMP is discretionary in the sense of not being governed by rules, which would suggest that it should not be included in the adjustment for changes in the economy. However, one can also see the cyclical variation in the spending on ALMP as an integrated part of the fiscal policy in the medium term. In this perspective, it is appropriate to distinguish between a rise in spending on ALMP and a discretionary rise in spending on another component. The crucial difference is that the rise in spending on ALMP is likely to be reversed when the cyclical situation changes, whereas this does not automatically apply to a rise in other discretionary components.

A possible argument for not adjusting for a change in the use of ALMPs is that ALMP is perhaps the main policy instrument against a rise in unemployment, thus a change in ALMP should be measured as discretionary policy, and not be viewed as an automatic policy response. However, this is really a question of choice of benchmark, where adjusting for changes in the ALMP involves choosing this as a benchmark. If unemployment falls, a failure to reduce the expenditure on ALMP in proportion to the reduction in unemployment, would then be interpreted as a change in policy.

- Other expenditures on unemployment-related transfers

Expenditure items like disability benefits, rehabilitation benefits, supplementary benefits and sickness allowances for long term sickness are often the consequence of unemployment. According the empirical macromodel MODAG of Statistics Norway, an increase in unemployment causes an increase in the other labour related transfers of about the same size as the increase in unemployment benefits in five years (Bowitz et al, 1993). However, then it would be necessary to estimate the effect on expenditure of a rise in unemployment. As these transfers often arise without being caused by unemployment, it would not be reasonable to assume expenditures on unemployment-related transfers to be proportional to unemployment.

We have not included these adjustments, primarily due to lack of satisfying data.

From these definitions, annual observations of the induced changes can be calculated as the change in public sector revenues and expenditure under constant fiscal policy. Subtracting the induced changes from a historical series of the actual change then yields annual observations of the effect of discretionary changes in the fiscal policy.

Formally, the induced change in revenues can be calculated as

(12) $\Delta T^I = \Delta(inc)T_{D,t-1} + \Delta(wl)T_{S,t-1} + \Delta c\, T_{I,t-1} + \Delta y\, T_{O,t-1}$,

where $T = T_D + T_S + T_I + T_O$ is total revenues, and the subscripts denote Direct, Social security contributions, Indirect, and Other taxes, subscript t-1 indicates the previous year, inc is log of household pre-tax income, wl is log of total wage income and c is log private consumption, y is log GDP, all in nominal terms (so Δc is approximately the percentage change in private consumption). The induced change in tax revenue is thus the effect arising from growth in the tax bases.

The discretionary change in revenues is

(13) $\Delta T^D = \Delta T - \Delta T^I$,

From (13) and (12) we see that there is a discretionary increase in taxes if tax revenues increase above the growth in the tax bases.

The induced change in expenditure is

(14) $\Delta G^I = (\Delta U/U_{t-1})G_{U,t-1}(1+\Delta p_{cp}) + (\gamma+\Delta p_y)G_{t-1}$,

where G is total expenditure, G_U is expenditure related to unemployment (both in nominal terms), U is the rate of unemployment, p_{cp} is the private consumption deflator, p_y is the GDP deflator (both in logs), and γ is the trend rate of growth in real GDP.[10] The discretionary change in expenditure is

(15) $\Delta G^D = \Delta G - \Delta G^I = \Delta G - (\Delta U/U_{t-1})G_{U,t-1}(1+\Delta p_{cp}) - (\gamma+\Delta p_y)G_{t-1}$,

The change in the budget balance, including net interest payments

(16) $\Delta B = \Delta S^D + \Delta S^I - \Delta(i\,D)$,

(where $\Delta S^j = \Delta T^j - \Delta G^j$, j = D,I, is the part of the primary surplus associated with discretionary and induced changes).

The discretionary change in the budget balance, as a ratio to GDP, is equal to the discretionary change in the primary balance as a ratio to GDP.

[10] Computing the trend rate of growth involves important theoretical and practical problems, cf. brief discussion in Section 4.1.3. Here we shall only observe that the trend should not be too flexible, so as to avoid considerable year-to-year fluctuations in the induced change in expenditure.

(17) $$\left(\Delta\frac{B}{Y}\right)^{D}=\frac{\Delta S^{D}}{Y_{t-1}}=\frac{\Delta T^{D}-\Delta G^{D}}{Y_{t-1}}$$

As seen from the definitions of ΔT^D and ΔG^D in (13) and (15), a positive discretionary change in the budget balance may reflect that tax revenues grow in excess of the growth in the tax bases ($\Delta T^D > 0$), or that public expenditure, less the effect of changes in unemployment, grows at a rate lower than trend GDP ($\Delta G^D < 0$).

The induced change in the budget balance is calculated as a residual:

(18) $$\left(\Delta\frac{B}{Y}\right)^{I}=\Delta\left(\frac{B}{Y}\right)-\left(\Delta\frac{B}{Y}\right)^{D}$$

or, as an approximation,

(19) $$\left(\Delta\frac{B}{Y}\right)^{I}=\frac{\Delta T^{I}-\Delta G^{I}-\Delta(i\,D)}{Y_{t-1}}-\left(\frac{B}{Y}\right)_{t-1}\left(\frac{\Delta Y}{Y_{t-1}}\right)$$

The induced change in the budget balance reflects the induced change in revenues and expenditure, as well as the change in net interest payments. The latter is made up of two parts, the effect of the change in the interest rate and the effect of the change in debt; $\Delta(i\,D) = i_{t-1}\,\Delta D + D_{t-1}\,\Delta i$. In addition, the change in the denominator, growth in GDP, affects the budget balance as a ratio to GDP. A positive induced change in the budget balance relative to GDP may reflect growth in the tax bases that is higher than the induced growth in expenditure (which is equal to growth in trend GDP, in addition to the effect of changes in unemployment). A positive induced change may also reflect a reduction in net interest payments.

4.1.2 Calculations over longer horizons

In calculations over a longer horizon, it would be of interest to take into consideration the effect of discretionary policy on the net debt service. One way to do this would be for each year to calculate an interest rate on government debt as the ratio of net interest payments to net debt. Then one can calculate a time series for the effect of discretionary policy on net interest payments by multiplying the interest rate by a series for the cumulated effect of discretionary fiscal policy on the primary surplus.

Formally, the actual change in the primary budget surplus Δs_t, (measured as a ratio to GDP) can be decomposed into induced and discretionary changes

(20) $\Delta s_t = \Delta s^I_t + \Delta s^D_t$,

The cumulated effect of discretionary changes in the primary budget surplus, from year 1 till year t, is

(21) $z_t = \Sigma_{j\#t}\Delta s^D_j$.

The effect of discretionary changes on net government debt, measured as a ratio to GDP, from year 1 till year t, denoted d^D_t, can now be calculated as

(22) $d^D_t = d^D_{t-1} (1+i_t - (\gamma+\Delta p_y)) + z_t$,

where i_t is the calculated nominal interest rate on government debt. The term $(\gamma+\Delta p_y)$ is included to adjust for trend growth in public expenditure. (21) and (22) are calculated recursively, starting from $d^D_0 = z_0 = 0$ and $z_1 = \Delta s^D_1$. Note that the interest rate is treated as exogenous, neglecting that the interest rate may be affected by the budget balance.

4.1.3 Decomposition into cyclical and structural components

As mentioned in the introduction, a possible further step could be to decompose budgetary changes into cyclical and non-cyclical (structural) changes. This decomposition could be done both for discretionary and induced changes. In both cases, important theoretical and empirical problems would be involved.

In Appendix 3, we present an alternative definition of constant policy, where the associated induced changes in the budget balance are further decomposed into cyclical and non-cyclical changes. However, under the definition of constant policy in the main text, a similar decomposition of induced changes in cyclical and non-cyclical would not yield much, as the cyclical induced changes essentially only would be due to changes in the debt.

In the remaining of this subsection, we discuss a decomposition of the level of the primary budget surplus into a cyclical and structural component. Such decomposition requires an estimate of the output gap. However, the output gap is a difficult concept. From a theoretical point of view, the distinction between cycle and trend is far from uncontroversial. There are reasons to believe that many macroeconomic variables are better thought of as subject to stochastic trends, in which case the distinction between trend and cycle is less clear. If the growth rate falls below the historical average, one does not know whether the loss will be recovered, or whether the economy will eventually recover the historical growth rate without recovering the intermediate loss, or perhaps that the economy will continue to grow at the lower rate. Thus, any derivation of an output gap, based on decomposition between cycle and trend, is bound to be highly uncertain.

Furthermore, as argued by Blanchard (1993), if one wants an indicator for the sustainability of the public budget, it would be better to use forecasts of the future budget balance than cyclical adjustments of the present. Tentatively, we nevertheless suggest decomposition in levels due to the considerable demand there is for such a concept, although we stress that any such decomposition is highly uncertain, and should be used cautiously.

The decomposition is based on the calculation of trend output. One could apply the Hodrick-Prescott filter to the log of real GDP, with weighting coefficient $\lambda = 100$ (perhaps also try other values), and where the series is extended with forecasts to reduce endpoint bias. Trend nominal GDP, Y^T, (not in logs) is then derived by use of the GDP deflator. Likewise, we find the trend value for private consumption, pre-tax household income, and the wage income, all as a share of GDP, and for the rate of unemployment, by use of Hodrick-Prescott filter: $(C/Y)^T$, $(INC/Y)^T$, $(WL/Y)^T$, U^T. The trend values for the tax components, indirect (I), direct (D) and other (O), as well as trend expenditure related to unemployment, are derived as follows:[11]

$$(23) \quad T_I{}^T = \frac{\left(\frac{C}{Y}\right)^T Y^T \, T_I}{C}$$

$$(24) \quad T_D{}^T = \frac{\left(\frac{INC}{Y}\right)^T Y^T \, T_D}{INC}$$

$$(25) \quad T_S{}^T = \frac{\left(\frac{WL}{Y}\right)^T Y^T \, T_S}{WL}$$

$$(26) \quad T_O{}^T = \frac{Y^T}{Y} T_O$$

$$(27) \quad G_U{}^T = \frac{U^T}{U} G_U$$

The trend (structural) value of the primary budget surplus is thus

$$(28) \quad S^T = T_I{}^T + T_S{}^T + T_D{}^T + T_O{}^T - G - (G_U - G_U{}^T).$$

4.2 Comparison with the structural budget balance

There are several differences between the decomposition suggested above and the change in the structural budget balance as calculated by the OECD. Consider first the cyclical adjustment. There are three main differences:

(i) The adjustments of revenues are attached directly to the main tax bases, rather than to GDP.

(ii) It is adjusted for changes in the interest rate.

[11] Alternatively, one could have calculated the trends in consumption, pre-tax household income and wage income directly, and not indirectly as shares of GDP that are attached to trend GDP. A motivation for the procedure that is chosen is to try to ensure that the trends for the various components are consistent.

(iii) Our decomposition assumes taxes to be proportional to their tax bases, while the OECD estimates the elasticities, thus allowing for non-proportionality (elasticity different from unity).

The first two differences contribute to our indicator being the more accurate as a measurement of changes in fiscal policy. The third difference may work in the other direction. The importance of the third difference depends on the degree of non-proportionality in the tax system, and how precisely the possible non-proportionality is estimated. As observed in section 4.1.1 above, it is not clear that the tax system is non-proportional. Furthermore, the estimate of this elasticity is likely to be highly uncertain; we do not know how much, in part because detailed information on estimation results is not publicly available. An additional point is that a possible non-proportionality between tax revenues and GDP may be reduced by our attaching the adjustment directly to the tax bases, rather than to the GDP.

Concerning the discretionary fiscal policy component, there are three main differences:
(i) The difference in cyclical adjustment implies a corresponding difference in the discretionary policy component.
(ii) Changes in net interest payments are excluded from the discretionary fiscal component.
(iii) The OECD measure does not distinguish the effect of structural changes / trend from the discretionary fiscal policy component.

Over a longer horizon, the failure to distinguish between structural changes and discretionary policy in the OECD method may not be of great importance, as the difference probably over the years have an average close to zero. However, this indicator is used to measure discretionary changes in fiscal policy on annual basis, where there is a clear difference. The OECD indicator is subject to additional noise arising from year to year fluctuations in the growth in potential output. For our indicator, there are no year to year fluctuations in the benchmark on the revenue side. Concerning expenditures, the benchmark is affected by annual fluctuations in the trend growth rate of GDP. As mentioned above, the calculated potential output growth rates seem to fluctuate more from year to year than do trend growth rates (Giorno et al, 1995), involving less noise in our measure of discretionary changes in fiscal policy, even for expenditures.

Now, one can argue that it is not necessary to distinguish between discretionary fiscal policy and the effect of structural changes to the economy because, due to long term sustainability of the public budgets, governments should undertake discretionary changes in fiscal policy that compensate for the effect of changes in potential output. As a long run restriction on fiscal policy, this view is correct. However, it is a weak argument for mixing discretionary policy with the effect of changes in the estimate of potential output, in the construction of an annual indicator. First, it is difficult to see any reasons why discretionary policy changes should be undertaken in the same year as the estimate of potential output changes. More importantly, however, mixing up discretionary fiscal policy and structural changes yields a misleading picture of both the economy and of economic policy. This may make it more difficult to pursue an appropriate fiscal policy.[12]

These differences imply that the decomposition suggested here probably constitutes a more accurate measure both of the discretionary changes in fiscal policy, and of the budget effect of cyclical fluctuations in the economy, than does the structural budget balance. The greater accuracy reflects the direct attachment to the tax bases (rather than to the GDP) and that the measure of discretionary fiscal policy is not confounded with the effect of structural changes (that is, fluctuations in potential output). As an important use of the indicator of discretionary changes in the fiscal policy is to facilitate the decision process of the public budgets, we think that it is important that the indicator measures that effect of politicians' decisions as accurately as possible.

[12] Consider a country that is hit by a large negative shock, with a large negative impact on potential output. Furthermore, assume that the government tightens its fiscal policy, but not sufficiently to compensate for the negative effect on potential output. Thus, the structural budget balance deteriorates. In this situation, the argument that fiscal policy has become more expansionary, and thus must be tightened, may be met with understandable disbelief from politicians and voters. A much better approach would be to say that an adverse change in the economy has taken place, so that a further tightening of fiscal policy is required.

5 Historical decomposition

In this section, we show how changes in budget balances are decomposed into discretionary and induced changes for the Nordic countries. The decomposition in the main text is based on the method described on p. 17-20 (alternative A). Finally, we compare the computed discretionary change in the budget balance to the change in the structural budget balance computed by the OECD.

5.1 Method and Data

The decomposition is based on equations 17 to 19 in section 4. The decomposition is made in the self-contained spreadsheet *DecompositionXX*, where *XX* denotes the country in question. The spreadsheets are available at http://www.ihb.se/iui/staff/HenrikBraconier. Data from 1970 to 1997 has been used for the five countries and are either from national statistical authorities or from the OECD database *Economic Outlook* (1998). See individual spreadsheets for further details. The decomposition presented in the paper is based on changes in the total budget balance with net interest payments included. A similar decomposition of changes in primary balances is conducted in the spreadsheets.

In *Table 5.1.1* we show some preliminary statistics for the Nordic countries. All figures and estimates for Norway are based on data on the mainland economy, i.e. all offshore activities have been excluded. The absence of a rising trend in the relative price of government consumption for Norway reflects that the Norwegian National Accounts impute a 0.5 per cent growth in labor productivity per year in the public sector.

Table 5.1.1. Preliminary Statistics for the Nordic Countries

Country	Total Revenues / GDP		Total Expenditure / GDP		Average GDP growth	Unemployment rate		P_{co}/P_y	P_{cp}/P_y
	1971	1997	1971	1997		1971	1997	1997 (1971=1)	1997 (1971=1)
Denmark	0.46	0.56	0.41	0.55	0.022	0.013	0.083	1.11	1.04
Finland	0.36	0.53	0.28	0.53	0.027	0.019	0.145	1.28	1.03
Iceland	0.32	0.37	0.32	0.37	0.039	0.006	0.037	1.12	1.08
Norway	0.49*	0.57	0.50*	0.54	0.021	0.019	0.041	1.02	1.00
Sweden	0.51	0.63	0.46	0.64	0.017	0.015	0.080	1.14	1.12

Note: * indicates that figures are for the year 1978. P_{co} , P_{cp} and P_y are deflators for government consumption, private consumption and GDP respectively.

In order to construct a measure of household income before tax, which is the tax base to which we tie direct taxes, we add direct taxes to household disposable income. Finally, relevant interest rates on public debt and public financial assets are implicitly computed with the help of stocks of debt / assets and interest-payments and income.

5.2 Decomposition of Budget Balances in the Nordic Countries

Figure 5.2.1 to *5.2.5* shows the decomposition of changes in the budget balance to GDP ratio into discretionary and induced changes in the five Nordic countries.

Fig 5.2.1. Decomposition of Changes in the Budget Balance in Denmark, 1972-1997

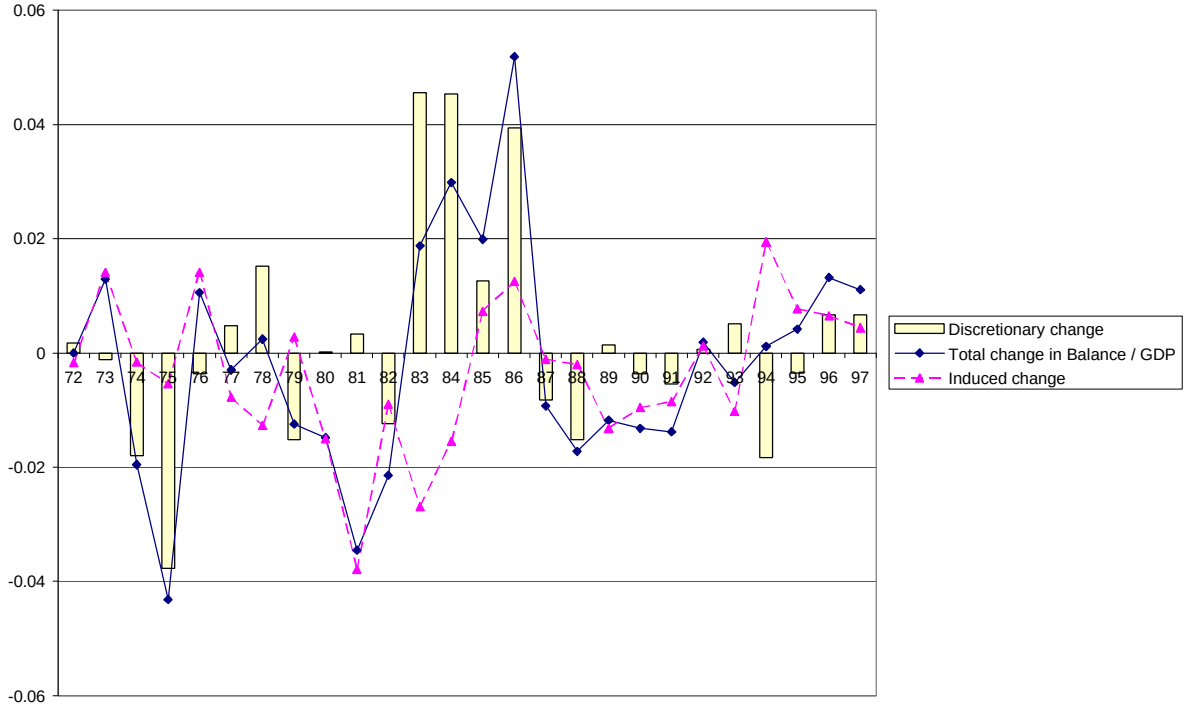


Fig 5.2.2. Decomposition of Changes in the Budget Balance in Finland, 1976-1997

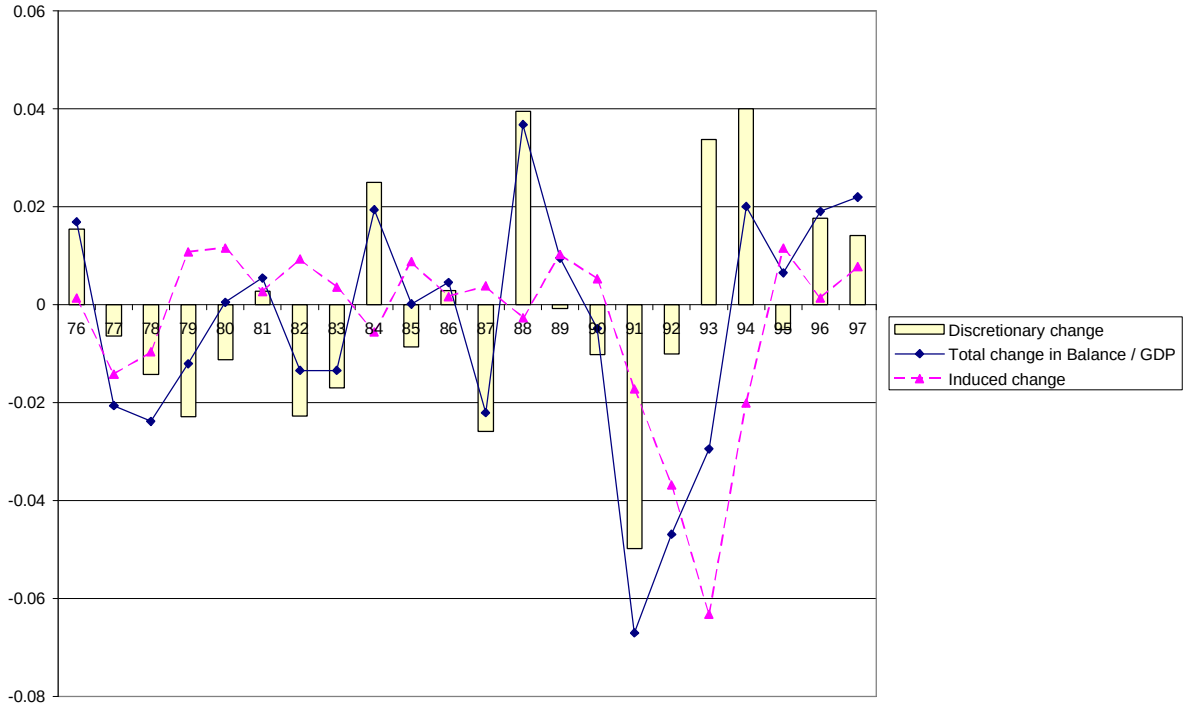


Fig 5.2.2. Decomposition of Changes in the Budget Balance in Iceland, 1981-1997

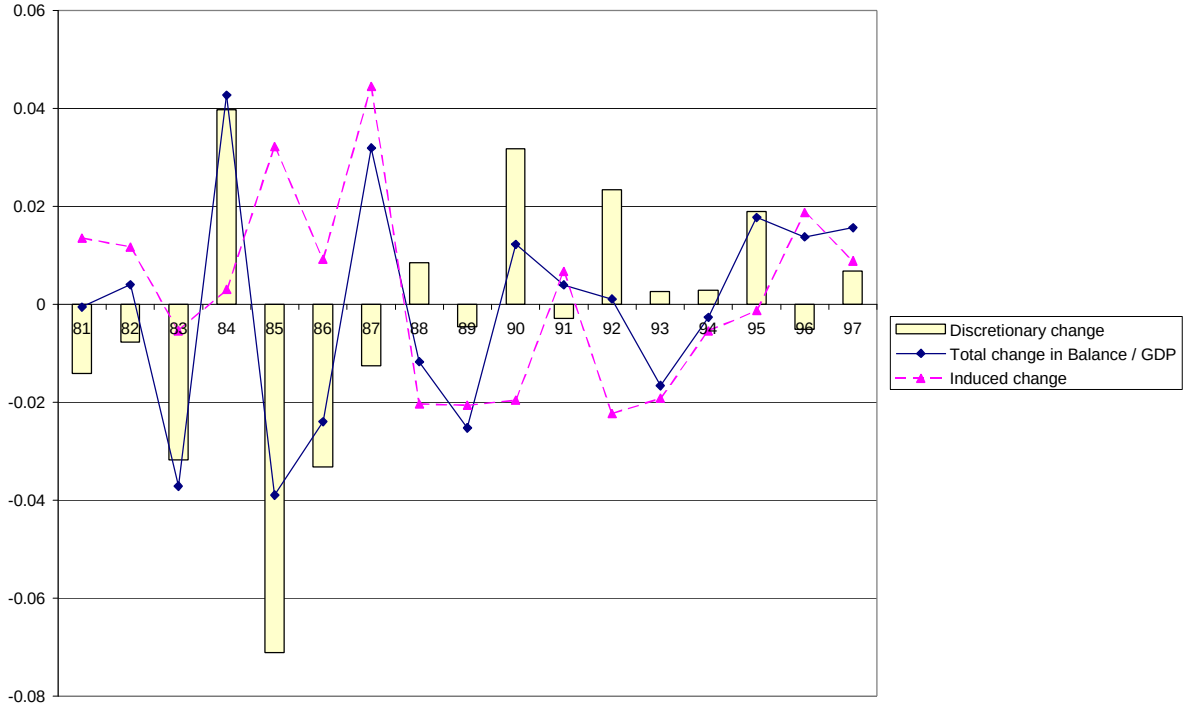


Fig 5.2.4. Decomposition of Changes in the Budget Balance in Norway, 1979-1997

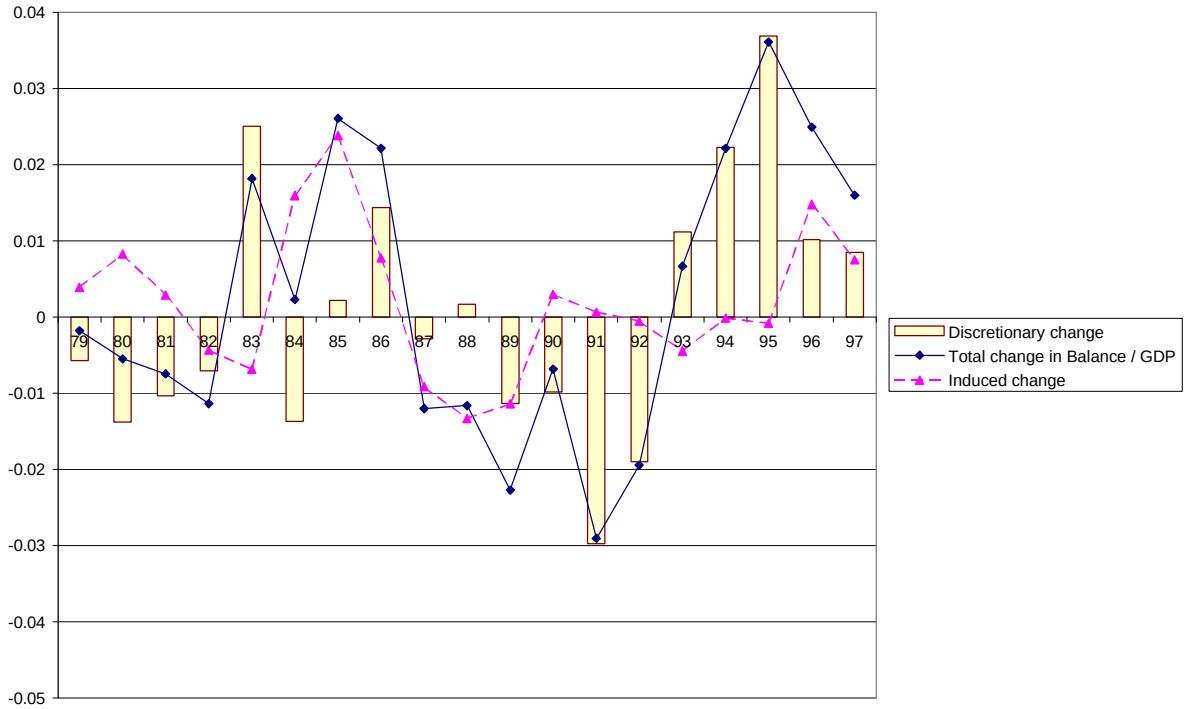
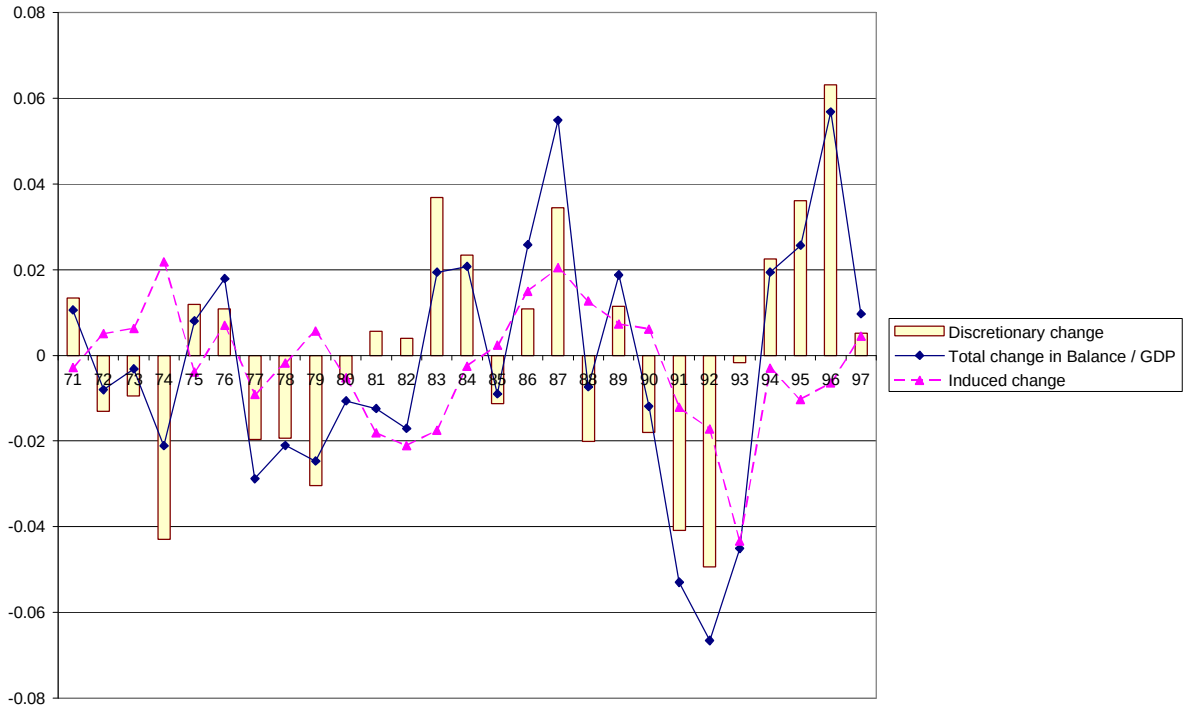


Fig 5.2.5. Decomposition of Changes in the Budget Balance in Sweden, 1971-1997



5.3 Comparing Discretionary Changes to Changes in the Structural Budget Balance Computed by the OECD

In this section, we compare the discretionary change in budget balances to the change in the structural budget balance as computed by the OECD.[13] [14] When the OECD computes structural and cyclical components of the budget balance, the elasticity of all revenues are computed with respect to GDP, whereas we connect taxes to their main tax bases. It is useful to modify our approach by tying all tax categories to GDP in order to see to what extent the difference between our results and the OECD's results is due to the fact that we tie revenues to specific tax bases. If the results are similar to those obtained when taxes are tied to their respective bases, there is an argument for using the simpler approach. In *Figures 5.3.1* to *5.3.4* we show the discretionary change in total budget balances for Denmark, Finland, Norway and Sweden computed earlier as well as when taxes are tied to GDP.[15] We also show the results for the change in the structural budget balance as measured by the OECD. (*Economic Outlook*, 1998)

[13] To be precise, we take the OECD's estimate of the structural balance and study the change in this variable as a share of GDP.
[14] There are, of course, other estimates of effects of policy changes on public finances. See e.g. Ohlsson and Vredin (1994).
[15] The OECD produces no figures on the structural budget balance for Iceland.

Figure 5.3.1. Discretionary Change in Budget Balances and Change in Structural Budget Balance in Denmark, 1981-1997.

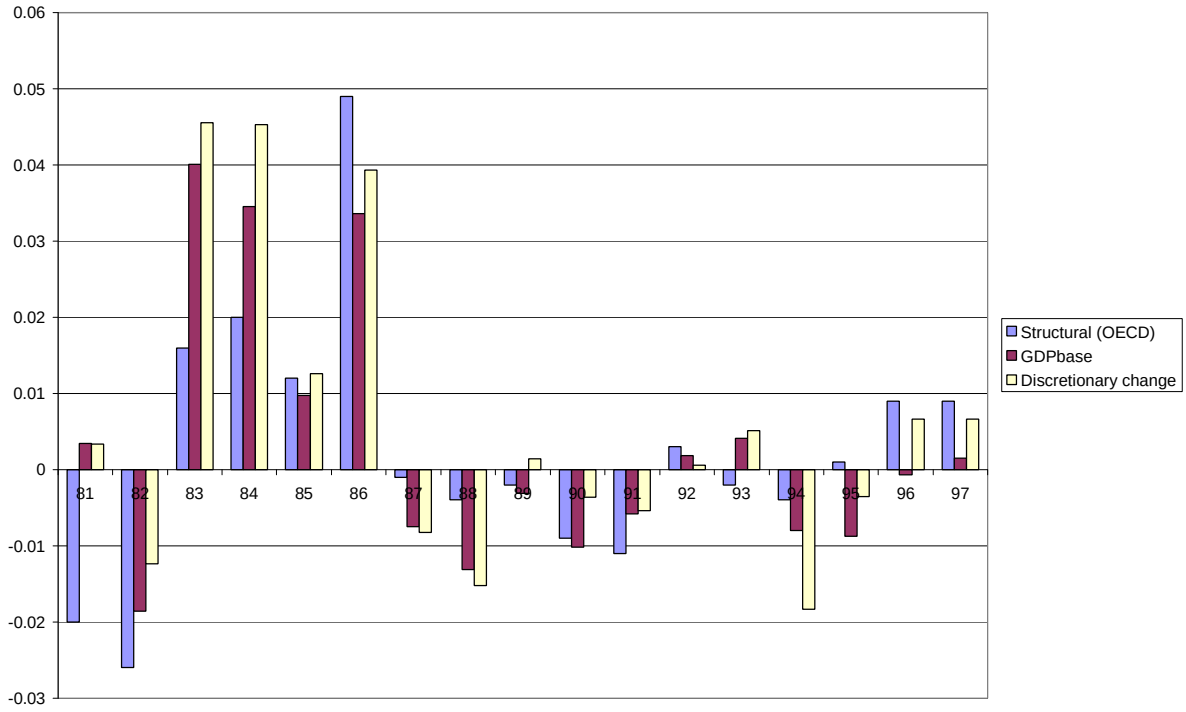


Figure 5.3.2. Discretionary Change in Budget Balances and Change in Structural Budget Balance in Finland, 1981-1997.

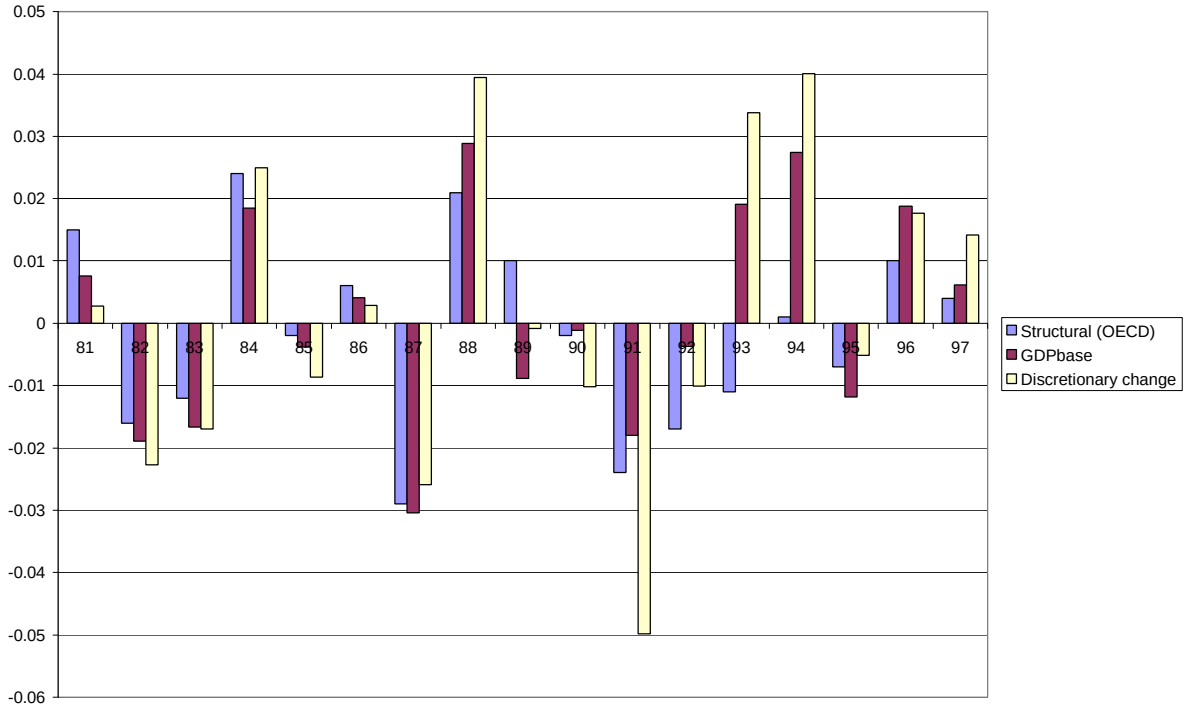


Figure 5.3.3. Discretionary Change in Budget Balances and Change in Structural Budget Balance in Norway, 1981-1997.

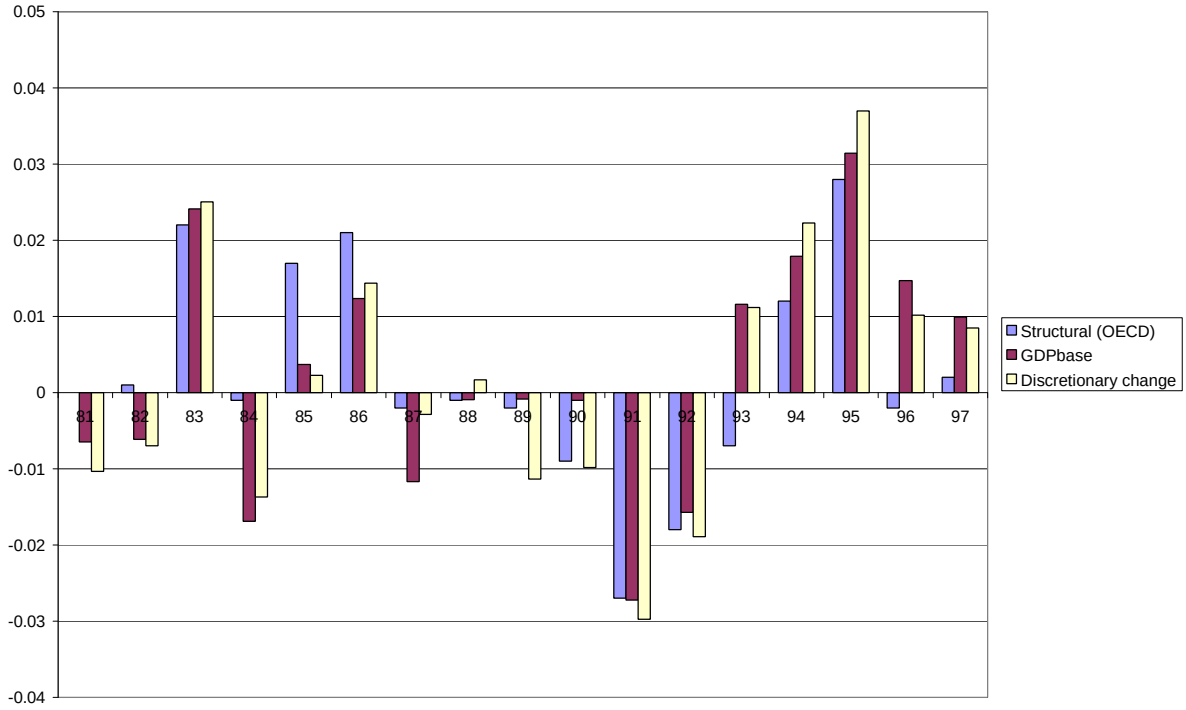
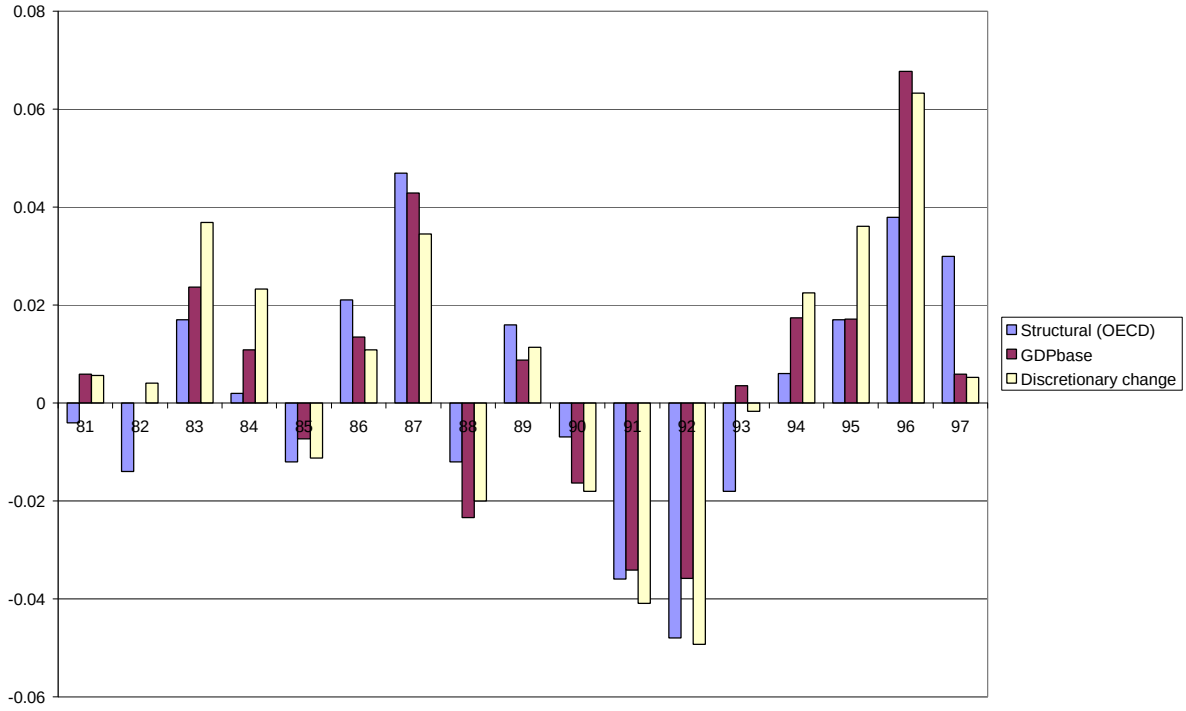


Figure 5.3.4. Discretionary Change in Budget Balances and Change in Structural Budget Balance in Sweden, 1981-1997.



We present simple correlations between the three different measures in *Table 5.3.1*. For all four countries we find that *Discretionary Change (GDP)* is highly correlated with *Discretionary Change* and hence, the results are quite insensitive to whether we use specific tax bases or GDP. The correlation between *Discretionary Change (GDP)* and *Discretionary Change* on one hand and *Structural Change (OECD)* on the other hand is lower, although it is still high. We find that by using GDP as the base instead of tax bases, the results becomes somewhat more similar to the OECD's results. Hence, a small part of the difference between our results and the OECD's computations is explained by the use of specific tax bases rather than GDP but most of the difference is due to other factors.

Table 5.3.1. Simple Correlations between Indicators of Discretionary Changes in Budget Balances and Changes in the Structural Budget Balance

	Discretionary Change	Discretionary Change (GDP)
Denmark		
Discretionary Change (GDP)	0.97	-
Structural Change (OECD)	0.76	0.78
Finland		
Discretionary Change (GDP)	0.92	-
Structural Change (OECD)	0.69	0.73
Norway		
Discretionary Change (GDP)	0.96	-
Structural Change (OECD)	0.70	0.79
Sweden		
Discretionary Change (GDP)	0.96	-
Structural Change (OECD)	0.85	0.87

6 The sensitivity of the budget balance to fluctuations in the economy

A central part of this study is to shed light on the sensitivity of public budgets to cyclical changes in the economy. The analysis will focus on how economic cycles affect public budgets if fiscal policy is constant. This is not because we believe that fiscal policy is or should be unaffected by the cyclical situation. However, it is important to distinguish the effect of changes in the economy on the budget balance, under constant policy, from the effect on the budget balance of the policy response. In section 6.4 we further discuss the relationship between changes in fiscal policies and business cycles.

We use three different methods of assessing the historical and current sensitivity of public budgets with respect to changes in the economy when fiscal policy is constant. In section 6.1, we use regression analysis to study the relationship between induced changes in the budget balance and changes in economic growth. In the analysis we estimate the semi-elasticity of budget balances with respect to GDP growth for the studied period for both the primary and the total budget balance. The results are based both on the decomposition in section 4 as well as on the alternative specification (B) in Appendix 3. Furthermore, we try to analyze whether any changes in the sensitivity during the last few years have occurred. The method also yields an estimate of the trend improvement in the balance, given constant fiscal policies. Note that the results of this method will be highly dependent on our calculation of induced changes in the budget balance. A more accurate measurement of the induced changes, as discussed in section 4 above, would facilitate the interpretation of the results of this method.

In section 6.2 we compute the effect on the budget balance of different types of stylized shocks, under unchanged policy. The analysis highlights how the sensitivity of the budget balances in the Nordic countries has evolved over time and also enables us to analyze how the sensitivity relates to both the size as well as to the composition of the public sector. Furthermore, the importance of the source of the shock for the effect on the budget balance is illustrated.

In section 6.3, we present results from simulations in macroeconomic models for the Nordic countries. The economies are being exposed to the same type of shocks as we analyzed in section 6.2. Compared to the analysis in section 6.2, the richer specification enables us to analyze secondary effects as relative-price changes etc. The analysis is forward-looking and three different types of shocks are analyzed.

We discuss the robustness of our results in section 6.4. Specifically, we try to estimate how our results would be affected by using a more extensive adjustment, based on a broader definition of unemployment-related expenditure, and not only unemployment benefits. Furthermore, we provide some indications of how discretionary changes in the budget balance co-varies with GDP growth in order to see whether changes in fiscal policies are correlated with GDP growth. Finally, we present a qualitative assessment of how the sensitivity of public balances has been affected by recent changes in tax- and expenditure-systems, based on a questionnaire sent out to the Ministries of Finance in the Nordic countries.

6.1 Regression Analysis

The regression analysis is based on the series of induced changes in the budget balance from the decompositions made in section 5, as well as on the alternative specified in Appendix 3. We focus on the period 1981 to 1997. We want to estimate how the budget balance as a share of GDP is affected by changes in the growth rate of GDP. A useful specification of the econometric model is

$$(29) \qquad \Delta\left(\frac{B_t}{Y_t}\right)^i = b_0 + b_1\left((\Delta y_r)_t - (\Delta y_r^*)\right) + b_2\left((\Delta y_r)_{t-1} - (\Delta y_r^*)\right) + e,$$

where $\Delta(B_t/Y_t)^i$ means the induced change in the budget balance as a share of GDP.[16] $(\Delta y_r)_t$ and (Δy_r^*) means actual growth in real GDP in *t* and trend growth in GDP during the studied period.[17] b_0 shows the trend change in the budget balance when the growth rate is equal to the trend growth rate and fiscal policy is held constant. b_1 and b_2 show how deviations in the growth rate during *t* and *t-1* affects the budget balance in *t* if fiscal policies remains unchanged. $b_1 + b_2$ shows how the budget balance as a share of GDP has changed year *t* when the growth rate has changed one percentage unit in *t-1*.[18] The reason for including lagged GDP growth is that adjustment in tax bases as e.g. consumption may only be partial. Note that the results depend on our method of decomposition into induced and discretionary changes. This implies, for example, that we do not capture possible lags in tax and expenditure systems, as the effects of such lags would be treated as discretionary changes. Furthermore, the relative size of first- and second year effects is not estimated with any precision and, hence, we focus the discussion on the estimated total effect. Equation 29 is estimated with OLS.

Results and Analysis

Table 6.1.1. Effects of GDP growth on the budget balance as a share of GDP under constant fiscal policy. OLS regressions for 1981 to 1997.

Country	Expenditure Alternative	Effect on Primary Balance	Effect on Total Balance
Denmark	A	0.56	0.62
	B	0.75	0.83
Finland	A	0.48	0.53
	B	0.58	0.62
Iceland	A	0.58	0.59
	B	0.40	0.43
Norway	A	0.40	0.42
	B	0.50	0.49
Sweden	A	0.63	0.75
	B	0.76	0.88

Note: The complete regression results are presented in Appendix 4. For expenditures, alternative A refers to the decomposition in the text and alternative B refers to the decomposition in Appendix 3.

[16] Although we do not formally derive the induced change in the primary budget balance as a share of GDP, it can easily be computed from equations (17) to (19).

[17] The trend rate of growth has been set equal to the average growth rate during the studied period (1981-1997). The estimated elasticity of the budget balance is not affected by which trend growth rate that we assume, but the trend change in the balance for a constant fiscal policies - which is measured by b_0 in table A6.1- will be affected by the assumed trend growth rate. Furthermore, changes in the trend growth rate within the studied period would affect the results.

[18] We also tried to extend equation (29) in order to allow for a non-linear relationship between the dependent variable and GDP growth. We found little evidence of non-linearities and the quantitative effects where small.

There are three central features of the results presented in *Table 6.1.1*. Firstly, the effect on the total balance tends to be larger than the effect on primary balances, with the exception of Norway. Secondly for all countries except Iceland, Alternative B of expenditures yields a higher estimated sensitivity of public finances than alternative A, as relative prices are less sensitive to business cycles than nominal GDP is. Thirdly, based on the results in *Table 6.1.1* one could rank the Nordic countries according to the sensitivity of public finances with respect to business cycles. Sweden is most sensitive, with Denmark following closely whereas Finland and Iceland forms a middle group and Norway has the least sensitive public finances. This ranking is valid both for primary balances as well as for total balances.

From our decomposition method, the induced changes in the budget balance are proportional to the change in the respective tax bases, as well as to changes in the rate of unemployment. The regression coefficient (i.e. the sensitivity) captures to what extent changes in the tax revenues (unemployment benefits) arising from changes in tax bases (the rate of unemployment) are associated with deviations in GDP growth from trend. It follows that the size of the coefficients primarily reflects four aspects:

- the overall expenditure to GDP ratio, (higher expenditure-ratio yields higher coefficient, i.e. higher sensitivity).
- cyclical fluctuations of the expenditure to GDP ratio arising from correlation between expenditure on unemployment benefits and GDP (higher correlation yields higher coefficient).[19]
- the correlation between the tax bases and GDP (higher correlation yields higher coefficient).
- The correlation between net interest payments and GDP (higher positive correlation yields higher sensitivity).

On the first aspect, we see from *Table 6.1.2* that Sweden has the highest primary expenditure to GDP ratio, followed by Norway, Denmark, Finland and Iceland. This would suggest that Norway's public finances should be more sensitive than Denmark's, Finland's and especially Iceland’s. Hence, other explanations to the relative sensitivity of Danish, Norwegian and Icelandic public finances have to be found.

On the second aspect, fluctuations in expenditures, a lower GDP leads to more unemployment and larger unemployment benefits. In *Table 6.1.2* we show estimates of the elasticity of unemployment with respect to GDP for the Nordic countries from Giorno *et al* (1995). For Denmark, the elasticity is relatively high, indicating a high sensitivity to business cycles, whereas the estimates for Norway are relatively low. Unfortunately, Iceland was not included in the study.

[19] For alternative B, changes in the relative price on public and private consumption in relation to the GDP deflator also affects the sensitivity (higher sensitivity if the relative price on public and private consumption increases in booms).

Table 6.1.2. Primary Revenues and Expenditures as a Share of GDP (Average 1981-1997)

Country	Primary Revenues / GDP	Primary Expenditures / GDP	Elasticity of Unemployment with respect to GDP	Unemployment Benefits / GDP	Net Interest Payments / GDP
Denmark	0.50	0.48	0.4	0.03	0.04
Finland	0.43	0.41	0.3	0.02	-0.01
Iceland	0.34	0.35	-	0.00	0.01
Norway	0.46	0.49	0.2	0.01	-0.02
Sweden	0.54	0.55	0.2	0.02	0.02

Sources: Own calculations and Giorno *et al* (1995).

On the third aspect, the correlation between tax bases and GDP, the structure of taxation is important. Because different tax bases have different correlation to GDP (e.g. for the studied period, we find that the wage bill fluctuates more over the business cycle than does pre-tax income), the sensitivity will tend to be low in countries that rely on tax bases with low correlation to GDP. There may also be differences among the countries regarding how the various tax bases evolve over the business cycle. However, such comparisons should be treated with care, as tax- and expenditure systems are interdependent.[20] Still it may be instructive to see how the structure of taxes and movements in tax bases affects the sensitivity of public finances, given expenditure systems. In *Table 6.1.3*, we show the importance of different sources of primary revenues for the different countries. Iceland gets almost 60 percent of primary revenues from indirect taxes, while all the other countries get roughly a third of their revenues from indirect taxes. Denmark stands out by earning a majority of revenues from direct taxes and very little from social security contributions. As direct taxes are related to income, which varies much less over the business cycle than the wage bill does, this should tend to make Danish revenues less sensitive to business cycles than the other Nordic countries.

Table 6.1.3. Sources of Revenues as Shares of Primary Revenues (Average 1981-1997)

Country	Direct Taxes (pre-tax income)	Social Security Contr. (wage bill)	Indirect Taxes (priv. consump.)	Other Primary Revenues (GDP)
Denmark	0.54	0.03	0.33	0.10
Finland	0.37	0.28	0.32	0.03
Iceland	0.34	0.06	0.57	0.02
Norway	0.32	0.27	0.37	0.05
Sweden	0.38	0.25	0.28	0.09

As we see in *Table 6.1.4* however, the sectoral decomposition effect of taxes is dominated by the variability of tax bases. In *Table 6.1.4* we show partial correlations (elasticities) for the different tax bases with respect to GDP for the different countries. The results indicate that revenues, given the expenditure systems and the overall level of government revenues, tend to be more sensitive in Denmark and Norway than in Sweden and Finland for a given change in GDP. In the case of Iceland, the results clearly show that tax bases, and hence revenues, are highly sensitive to business cycles. This explains the higher than expected sensitivity of Icelandic public finances with respect to swings in GDP growth.

[20] It is for example evident that one explanation to why the correlation between GDP and pre-tax income is smaller than the correlation between GDP and the wage bill is that expenditure systems leads to higher transfers in slumps than in booms.

Table 6.1.4. Partial Correlation between Tax Bases and Nominal GDP (1981-1997)

Country	Income	Wage bill	Consumption	Unweighted Average	Weighted Average
Denmark	0.80	0.93	0.94	0.89	0.86
Finland	0.73	0.88	0.74	0.78	0.78
Iceland	1.04	0.94	1.04	1.01	1.02
Norway	0.56	1.16	0.93	0.88	0.86
Sweden	0.69	0.94	0.75	0.79	0.78

Note: Partial correlation estimated through equation $\Delta base_t = a_0 + a_1 \Delta y_t$, where $\Delta base_t$ denotes the percentage change in the tax base, Δy_t is the percentage change in nominal GDP and a_1 is the estimated partial correlation (elasticity). The unweighted average is the average of columns 1 to 3. Weighted average is the average of columns 1 to 3 times their respective shares in *Table 6.1.3*, excluding Other Revenues.

To conclude, we find that for a given size of government expenditures, there is evidence that Iceland and Denmark should have higher sensitivity of public finances with respect to business cycles than Finland, Norway and Sweden. There is however relatively little evidence that the budget balance in Norway is less sensitive to business cycle variations for a given size of government expenditures.

6.2 Stylized shocks and the sensitivity of primary balances

Based on the decomposition method presented in section 4, we can analyze how different stylized shocks affect the budget balances in the Nordic economies. The aim is to obtain an interval for the elasticity of the budget balance with respect to GDP in order to illustrate how the elasticity depends on the source of variation in GDP. The analysis will highlight how three different types of shocks affect the sensitivity of primary balances: an export shock, a domestic savings shock and an aggregate demand shock. The analysis will show how the structural composition of government revenues and expenditures affects the sensitivity to different shocks. It allows for inter-country comparisons, as well as shedding light on how the sensitivity has changed over time. The analysis is based on a number of crude assumptions, which makes the results less accurate, but more transparent. The analysis will not, however, enable us to analyze the structural flexibility in the different economies regarding price- and wage adjustment etc. In order to study these issues, we have to use large-scale simulation models as is done in section 6.3.

The elasticities of the budget balance with respect to fluctuations in GDP are based on the definitions of constant policy in section 4.1.1 above. We consider three different shocks, differing regarding the source of fluctuation: a domestic saving shock, an export shock and an aggregate demand shock. For all shocks, real GDP is assumed to fall below actual real GDP by one percentage point. Thus, the deviation (indicated by the symbol *d*) from the actual path is

(30) $dy = -0.01$.

For several components of the budget balance, the effect is assumed to be the same for all shocks:

- Pre-tax household income and the wage bill are reduced in proportion to the reduction in GDP.
- The increase in the rate of unemployment is given by the estimated elasticities of Giorno et al (1995), except for Iceland where we have assumed an elasticity of 0.2.

None of these assumptions are entirely realistic. However, they are imposed due to the absence of other alternatives that are both simple and more "realistic".

Under unchanged policy the deviation in expenditures from the reference case is

(31) $dG_t^S = (dU / U_t)G_{U,t}$,

where dU/U$_t$ is the deviation in the unemployment rate compared to the reference case.

We now turn to the revenues. Consider first an aggregate shock. The effect on revenues under unchanged policy is proportional to the deviation in GDP (superscript AS indicates aggregate shock)

(32) $dT_t^{AS} = dyT_t$

The associated effect on the primary surplus is

(33) $dS_t^{AS} = dT_t^{AS} - dG_t^S$.

Then consider a shock due to a downturn in the domestic private sector, where the reduction in GDP reflects reduction in private consumption. The reduction in private consumption is thus the inverse of the proportion of private consumption to GDP, i.e. 0.01 times Y/C. Under the shock the deviation in private consumption is thus

(34) $dc_t = -0.01(Y_t / C_t)$.

If policy is kept unchanged when the Domestic Shock (DS) occur, indirect taxes are assumed to change in proportion to the deviation in private consumption, while other revenues change in proportion to the deviation in GDP, so that the deviation in total revenues is

(35) $dT_t^{DS} = dcT_{I,t} + dy(T_t - T_{I,t})$.

Finally, consider a shock to export demand, where exports is assumed to be reduced by amount corresponding to one percentage point of GDP. All other components are assumed to be unaffected. This latter assumption is not meant to be realistic, for example, a reduction in GDP clearly will have a negative impact on private consumption. However, the motivation for the assumption is to focus on the effect of a downturn in exports.

More precisely, we assume that indirect taxes are unaffected by the shock, while other revenues are affected in proportion with the deviation in GDP (at the cost of less transparency, one could have assumed that also other types of revenues were less affected).

(36) $dT_t^{ES} = dy(T_t - T_{I,t})$.

Based on equations (30) to (36) we compute the semi-elasticity of the primary balance as a share of GDP with respect to the deviation in real GDP

(37) $$e_t^i = d\left(\frac{S}{Y}\right)_t^i \Big/ dy_t = d\left(\left(\frac{T}{Y}\right)_t^i - \left(\frac{G}{Y}\right)_t^i\right) \Big/ dy_t \text{, where } i = ES, DS, AS .$$

Results

The effect on the budget balance of a shock depends on:

- The amount of government expenditures as a share of GDP.
- The size of the tax bases that are affected by the shock (as a share of GDP).
- The effect of the shock on the tax bases.
- The elasticity of unemployment with respect to GDP.

The first and second of these components vary across years, countries, and shocks; the third varies across shocks; the fourth varies only across countries.

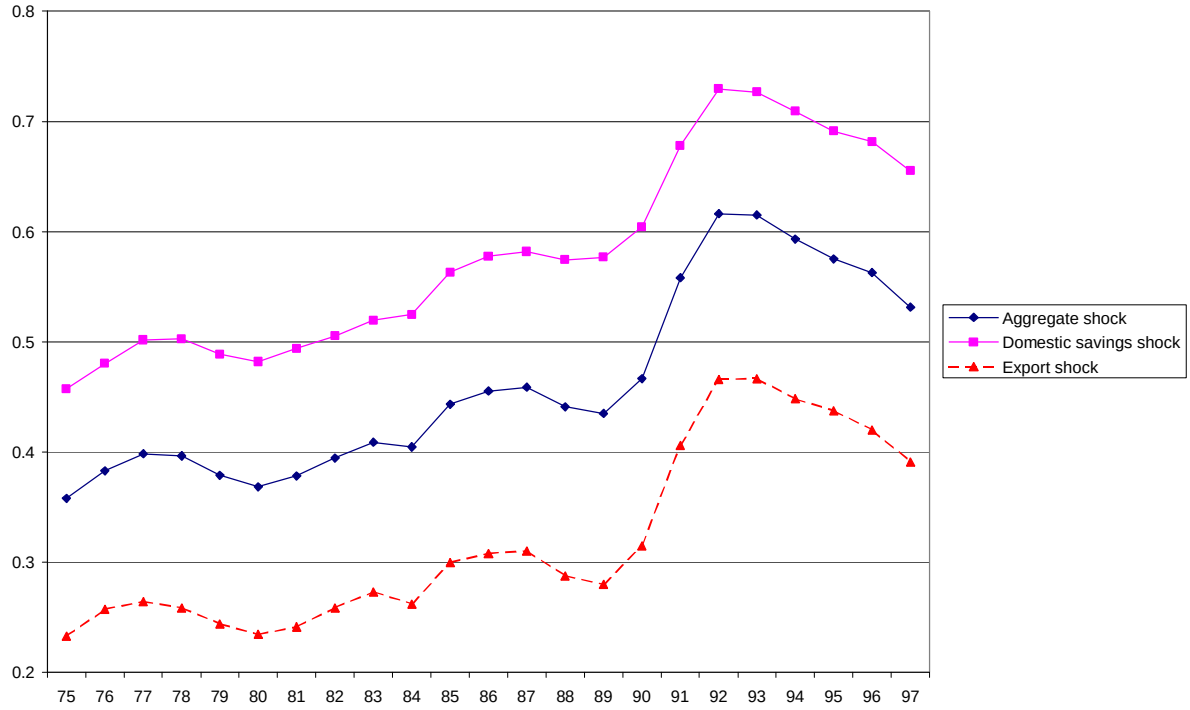
Compared to the regression results in section 6.1, the effects may differ for two main reasons. Firstly, the regression results reflect the within-sample correlation between GDP growth and tax bases, while the stylized computations here are based on specific assumptions concerning the relationship between GDP and the tax bases (assumptions that vary across shocks). Secondly, in the stylized computations, any variation in relative prices are neglected, while the regressions capture the correlation between relative prices and fluctuations in GDP growth that took place over the sample period.

Figure 6.2.1 shows the simulated semi-elasticity of the primary balance as a share of GDP for Denmark. In general, a domestic savings shock has the largest impact on the primary budget balance, an export shock affects public finances the least and an aggregate demand shock leads to an intermediate effect. The elasticity with respect to all types of shocks increases up to the early 1980s and then fluctuates around a somewhat lower level.

Figure 6.2.1. Simulated Semi-Elasticity of the Primary Balance with Respect to GDP (Denmark, 1971-1997)

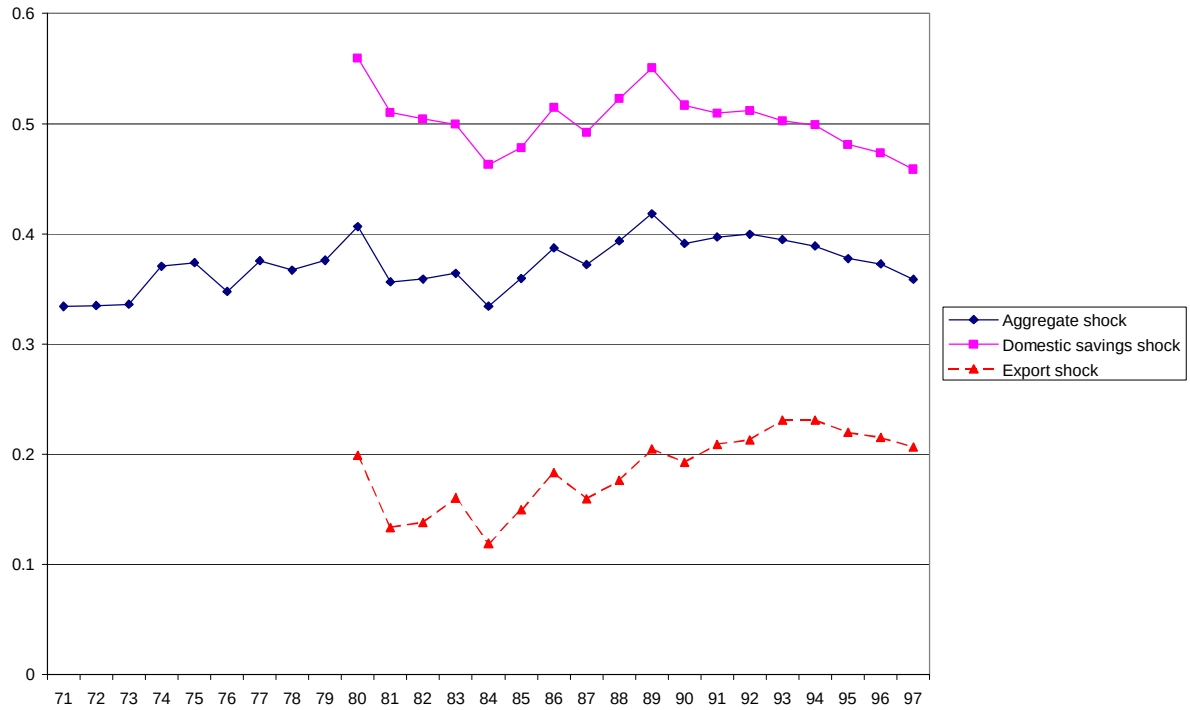
The general pattern where a savings shock has the largest impact, an aggregate demand shock has an intermediate impact and an export shock has the smallest impact on the primary balance also holds for Finland (*Figure 6.2.2)*. The general tendency in the Finnish case is a continuous increase in elasticities from 1975 and onwards and with very large increases during the crisis in the early 1990s. This tendency can to a large extent be explained by the fast growth of the public sector expenditures as a share of GDP. After 1993, the sensitivity has decreased.

Figure 6.2.2. Simulated Semi-Elasticity of the Primary Balance with Respect to GDP (Finland, 1975-1997)



In the case of Iceland, the estimated elasticities shown in *Figure 6.2.3* indicate no major changes in the sensitivity of public finances with respect to swings in GDP. As both revenue- and expenditure-shares have stayed more or less constant over the period 1971 to 1997, this result is not surprising. Based on this method, the sensitivity of Iceland's public finances are fairly insensitive to swings in GDP compared to the other countries.

Figure 6.2.3. Simulated Elasticity of the Primary Balance with Respect to GDP (Iceland)



The tendency of increasing sensitivity of the primary balance as a share of GDP with respect to changes in GDP growth is also clear in the Norwegian case, shown in *Figure 6.2.4*, although the growth rate in the sensitivity is much slower than in the Finnish case. Especially between 1986 and 1992, there is a strong tendency of increasing sensitivity. The sensitivity has decreased since 1992.

Figure 6.2.4. Simulated Semi-Elasticity of the Primary Balance with Respect to GDP (Norway, 1978-1997)

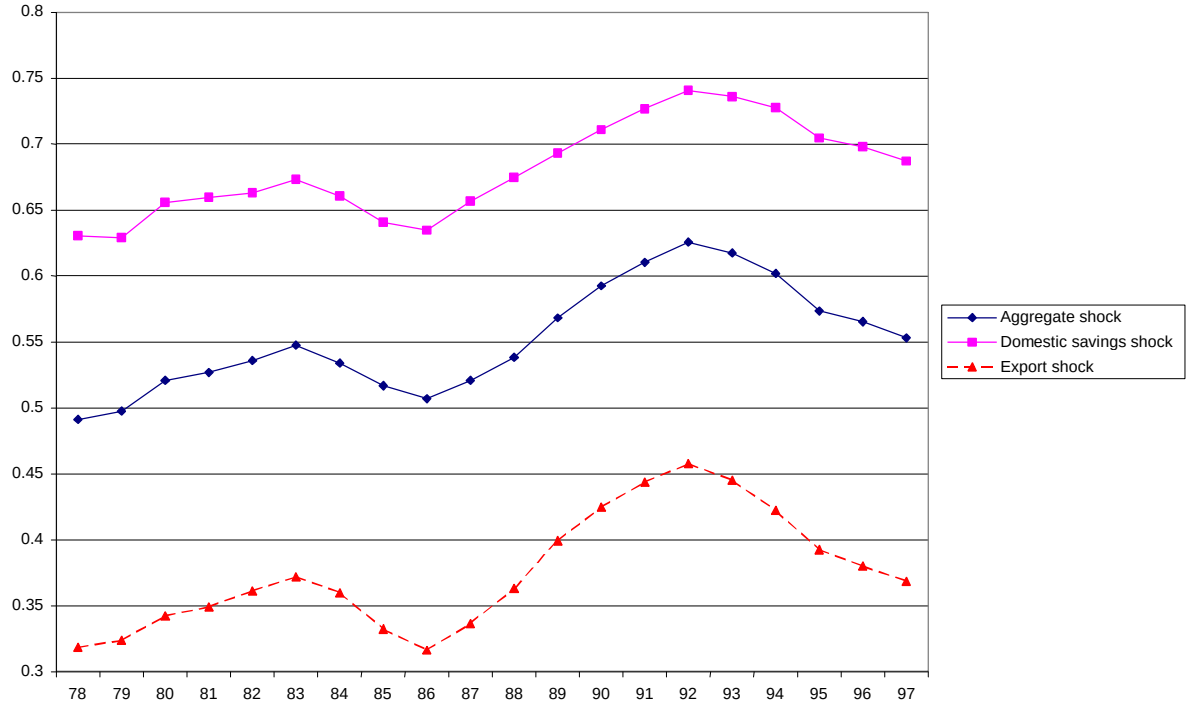
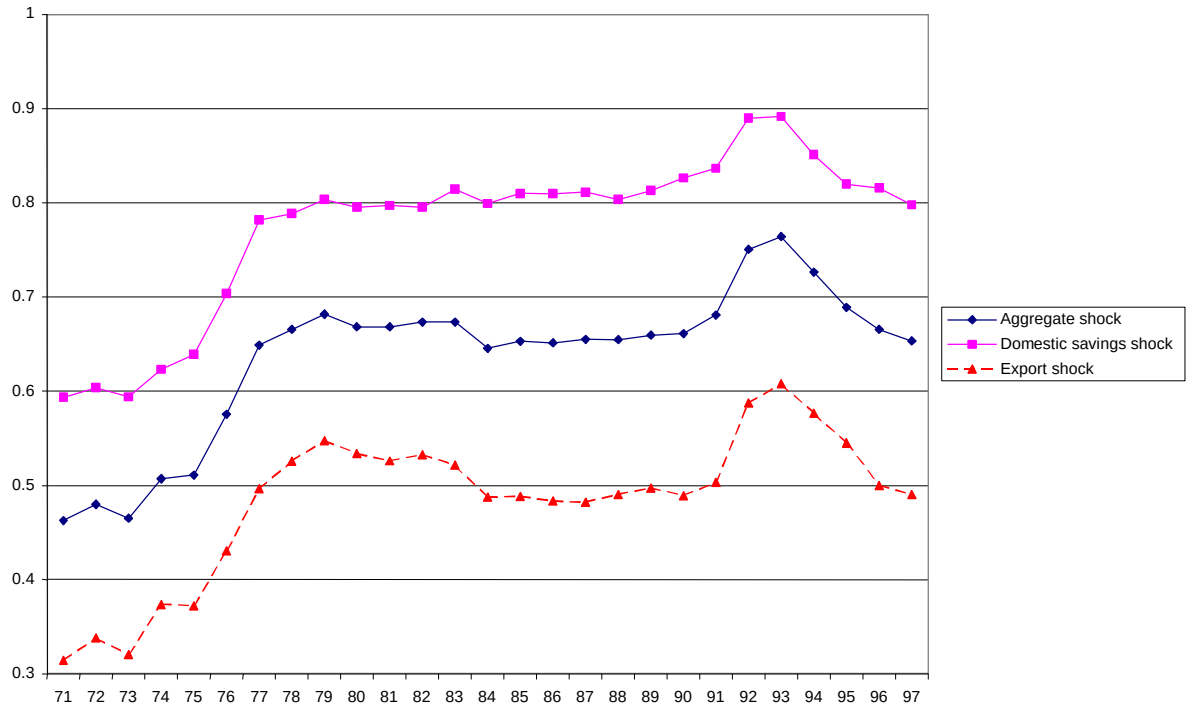


Figure 6.2.5 shows the simulated semi-elasticity of the primary balance as a share of GDP for Sweden. The general impact follows the patterns from the other countries. The time profile suggests that the sensitivity increased from the 1970s to the 1980s while they stayed roughly constant during the 1980s. During the early 1990s, the sensitivity increased sharply, while the sensitivity decreased significantly from 1993 and onwards.

Figure 6.2.5. Simulated Semi-Elasticity of the Primary Balance with Respect to GDP (Sweden, 1971-1997)



The general conclusion from the stylized simulations is that the sensitivity of public finances for all the Nordic countries seems to have increased over the period from 1980 to 1997, with the exception of Sweden and Iceland. The increases are smallest in the countries that initially had the most sensitive public finances (Sweden and Denmark). Although Finland and Norway has seen faster increases in the sensitivity, the results for 1997 still indicate that the primary balance in Sweden and Denmark is much more sensitive to fluctuations in GDP than it is in Finland and Norway. Thus, the stylized simulations confirm the results from the regression analysis.

6.3 Macroeconomic Simulations

In this section we use macroeconomic simulation models to analyze how specific demand shocks affects public finances in the Nordic countries.[21] Three different shocks are analyzed: a decrease in the export volume, an increase in domestic savings (decrease in domestic consumption) and an overall decrease in aggregate demand. All shocks are dimensioned in such a way that GDP is decreased with one percentage unit in the initial year. Under the aggregate demand shock, the components private consumption, exports and investment are all decreased such that each component decrease aggregate demand with 1/3 percentage unit.[22] The simulations are based on deviations from the base scenario for 1998 in the different models. The shocks take place in 1998 (year 0) and the shock prevails over the studied period, that is 1998 to 2001. Thus the initial disturbance is left unchanged over the period. Still, growth rates during 1999 to 2001 may differ across simulations due to different adjustment mechanisms in the models.

[21] The models used are ADAM (Ministry of Economic Affairs, Denmark), KESSU (Minstry of Finance, Finland), the National Economic Institutes macro model (Iceland), MODAG (Royal Ministry of Finance and Custom, Norway) and FIMO/KOSMOS (National Institute of Economic Research, Sweden).

[22] It should be noted that the volume of government consumption is being kept constant. Endogenous changes in prices and wages however mean that consumption in nominal terms may change.

The computed elasticities are defined as

$$(38) \qquad e_t = \left(\left(\frac{B}{Y} \right)_{1998+t} - \left(\frac{B'}{Y'} \right)_{1998+t} \right) \Bigg/ \left(\frac{\left(Y^{R}_{1998+t} - Y^{R'}_{1998+t} \right)}{Y^{R'}_{1998+t}} \right) \quad t = 0 \text{ to } 3,$$

where *B*, *B'*, *Y*, *Y'* denote the simulated budget balance, the budget balance in the reference case, simulated nominal GDP and nominal GDP in the reference case. Y^{R} and $Y^{R'}$ denotes real GDP (i.e. in constant prices) in the simulation- and the reference case respectively. The reader should note that the effect on the budget balance is related to the deviation in real GDP at the same point in time, and not to the initial shock to real GDP. Thus, the question that we try to answer is how the budget balance is affected by a change in real GDP that follows from a specific shock. Alternatively, one could relate the effect on the budget balance after one and three years to the initial shock. However, a problem with this alternative would be that the result would be highly dependent on to what extent the deviation in GDP is reduced over time; an aspect that we believe is highly model-dependent.

The motivation for the use of empirical macromodels is to obtain an analysis of the effects of economic shocks on the budget balance that has a solid empirical foundation. Thus, these simulations capture more effects than the computations in section 6.2 above, and the quantitative assessment is based on equations that are derived on the basis of historical experience.

Table 6.3.1. Deviation from Reference Real GDP after Aggregate Demand Shock.

Country	Deviation from reference GDP		
	year 0	year 1	year 3
Denmark	-0.011	-0.017	-0.023
Finland	-0.012	-0.012	-0.009
Iceland	-0.010	-0.010	-0.010
Norway	-0.010	-0.010	-0.011
Sweden	-0.009	-0.010	-0.010

A central problem with the use of different simulation models for the different countries is that differences in the *structure* of the models may drive the results rather than e.g. differences in parameter values. Differences between models are likely to be largest in modeling the responses in the economy to a specific shock, whereas the effect of fluctuations in different components of GDP on the budget balance is likely to be less important. In *Table 6.3.1* we show how real GDP evolves after the initial aggregate demand shock. We find that after the initial shock in 1998, ADAM predicts further losses in GDP relative to the benchmark in Denmark the following years while for Finland, KESSU predict a (weak) convergence back towards the benchmark. It seems likely that these qualitatively different responses to a large extent are due to model differences rather than differences between the two economies. A further problem is that the exact timing of responses is also likely to differ across models. This would lead to the conclusion that we should put more emphasis on the long-run (year 3) results. On the other hand, the three-year results will probably depend more on long-run steady-state characteristics that are model-specific. We present the simulated elasticities after year 1 and year 3 in *Tables 6.3.2* to *6.3.6*.

Table 6.3.2 shows the computed semi-elasticities derived from ADAM for Denmark. Firstly, the computed elasticities are insensitive to whether we choose the one-year or the three-year perspective. Secondly, the type of shock seems to have little bearing on the effect on the computed semi-elasticity, although the export shock has a somewhat larger effect on the budget balance. Finally, the effect on the total budget balance is larger than the effect on the primary balance.

Table 6.3.2. Simulated Effect of Different Macroeconomic Shocks on the Budget Balance as a Share of GDP (Denmark)

Variable of Interest	Type of shock	Semi-Elasticity (1 year)	Semi-Elasticity (3 years)
Primary Balance	Exports	0.5	0.5
Total Balance	Exports	0.6	0.7
Primary Balance	Domestic Savings	0.5	0.5
Total Balance	Domestic Savings	0.5	0.6
Primary Balance	Aggregate Dem.	0.6	0.5
Total Balance	Aggregate Dem.	0.5	0.6

Note: Simulations have been conducted with the help of the macroeconomic model ADAM by Økonomiministeriet (Ministry of Economic Affairs), Denmark. The results are computed as deviations from the benchmark forecast made in 1998 for the years 1998 to 2001 when the appropriate shock has been introduced.

In *Table 6.3.3* we show the results for Finland based on KESSU. The three-year effect tends to be somewhat larger than the one-year effect, although differences are marginal. The domestic savings shock has the largest impact on the budget balance while the export shock affects the budget balance the least. There are no discernable differences between the effects on the total balance and the primary balance.

Table 6.3.3. Simulated Effect of Different Macroeconomic Shocks on the Budget Balance as a Share of GDP (Finland)

Variable of Interest	Type of shock	Semi-Elasticity (1 year)	Semi-Elasticity (3 years)
Primary Balance	Exports	0.4	0.4
Total Balance	Exports	0.4	0.4
Primary Balance	Domestic Savings	0.5	0.6
Total Balance	Domestic Savings	0.6	0.6
Primary Balance	Aggregate Dem.	0.4	0.5
Total Balance	Aggregate Dem.	0.4	0.5

Note: Simulations have been conducted with the help of the macroeconomic model KESSU(5) by Valtiovarainministeriö/Finansministeriet (Ministry of Finance), Finland. The results are computed as deviations from the benchmark forecast made in 1998 for the years 1998 to 2001 when the appropriate shock has been introduced.

We show the results for Iceland in *Table 6.3.4.* Compared to the other Nordic countries the simulated semi-elasticities are quite low. Just as we found for Finland, the domestic savings shock has the largest impact on public finances while the export shock has the smallest impact.

Table 6.3.4. Simulated Effect of Different Macroeconomic Shocks on the Budget Balance as a Share of GDP (Iceland)

Variable of Interest	Type of shock	Semi-Elasticity (1 year)	Semi-Elasticity (3 years)
Primary Balance	Exports	0.2	0.2
Total Balance	Exports	0.2	0.2

Primary Balance	Domestic Savings	0.3	0.3
Total Balance	Domestic Savings	0.5	0.3
Primary Balance	Aggregate Dem.	0.3	0.2
Total Balance	Aggregate Dem.	0.3	0.3

Note: Simulations have been conducted with the macro model from the National Economic Institute by the Ministry of Finance, Iceland. The results are computed as deviations from the benchmark forecast made in 1998 for the years 1998 to 2001 when the appropriate shock has been introduced.

Table 6.3.5 shows the results for Norway as derived from MODAG. The one-year semi-elasticity is larger than the three-year elasticity as relative GDP continues to fall over the whole period while the budget balance to GDP ratio improves from year one to year three. Just as in the Finnish case, the savings shock has the largest impact on the budget balance while the export shock has the smallest impact. The effects on primary balances are somewhat larger.

Table 6.3.5. Simulated Effect of Different Macroeconomic Shocks on the Budget Balance as a Share of GDP (Norway)

Variable of Interest	Type of shock	Semi-Elasticity (1 year)	Semi-Elasticity (3 years)
Primary Balance	Exports	0.4	0.3
Total Balance	Exports	0.4	0.3
Primary Balance	Domestic Savings	0.7	0.5
Total Balance	Domestic Savings	0.6	0.4
Primary Balance	Aggregate Dem.	0.5	0.4
Total Balance	Aggregate Dem.	0.4	0.4

Note: Simulations have been conducted with the help of the macroeconomic model MODAG by Det Kongelige Finans- og Tolldepartement (Royal Ministry of Finance and Custom), Norway. The results are computed as deviations from the benchmark forecast made in 1998 for the years 1998 to 2001 when the appropriate shock has been introduced.

In *table 6.3.6* we show the result from FIMO/KOSMOS for Sweden. Short-run elasticities are larger than long-run elasticities as the gap in GDP compared to the benchmark shrinks during year two. In the short run, the savings shock has a very large impact on the budget balance while the effect from an export shock is smaller. In the long run, elasticities are similar across shocks. The effect on the primary balance is smaller than the effect on the total balance.

Table 6.3.6. Simulated Effect of Different Macroeconomic Shocks on the Budget Balance as a Share of GDP (Sweden)

Variable of Interest	Type of shock	Semi-Elasticity (1 year)	Semi-Elasticity (3 years)
Primary Balance	Exports	0.6	0.6
Total Balance	Exports	0.8	0.8
Primary Balance	Domestic Savings	1.2	0.5
Total Balance	Domestic Savings	1.5	0.8
Primary Balance	Aggregate Dem.	0.8	0.6
Total Balance	Aggregate Dem.	1.0	0.8

Note: Simulations have been conducted with the help of the macroeconomic model FIMO/KOSMOS by Konjunkturinstitutet (National Institute of Economic Research), Sweden. The results are computed as deviations from the benchmark forecast made in 1998 for the years 1998 to 2001 when the appropriate shock has been introduced.

6.4 Robustness

So far, we have derived a number of estimates of the sensitivity of public finances with respect to business cycles. In *Table 6.4.1* we give a brief summary of the effects on the primary balances of the various types of analysis that we have undertaken. In the first column we report the point estimates from the regression analysis in section 6.1. In columns 2 and 3 we report the results of computations of stylized shocks in section 6.2 (aggregate demand shock) for the period 1981 to 1997 (col. 2) and for 1997 (col. 3). In column four we report the interval for the aggregate demand shock (year 1 to year 3) produced by the simulation of the empirical macromodels from section 6.3.

Table 6.4.1. Comparing Results from Different Methods.

	Regression Analysis (1981-1997)	Stylized Shock (Aggregate demand 1981-1997)	Stylized Shock (Aggregate demand 1997)	Simulated Shock (Aggregate demand)
Denmark	0.56-0.75	0.63	0.61	0.5-0.6
Finland	0.48-0.58	0.49	0.53	0.4-0.5
Iceland	0.40-0.58	0.38	0.36	0.2-0.3
Norway	0.40-0.50	0.56	0.55	0.4-0.5
Sweden	0.63-0.76	0.68	0.65	0.6-0.8

The results in *Table 6.4.1* convey a picture where the primary balance in Sweden is the most sensitive to business cycles with Denmark as number two. Finland, Norway and Iceland have less sensitive public finances. Looking at the period 1981 to 1997, the estimated effect of the stylized demand shock is within the range defined by the regression method for all countries, except Norway and Iceland.

If we compare the results from the stylized shocks for 1997 to the results from the macroeconomic simulations, they seem to be quite similar, although the macroeconomic simulations tend to yield somewhat smaller semi-elasticities. No clear patterns emerge with respect to whether short-run or long-run effects from the macroeconomic simulations are most similar to the results derived from the stylized shocks. Altogether, the estimated sensitivity for Denmark, Finland and Sweden is similar across methods of computation. For Iceland, the regression analysis yields a significantly higher sensitivity than the other two methods, which may be attributed to the very high correlation between movements in GDP and tax bases as was discussed in section 6.1. For Norway, the stylized shock method produces higher semi-elasticities than the other methods.

The European Commission, the IMF and the OECD regularly publish estimates of the sensitivity of public finances with respect to GDP for all countries in our study except Iceland. To put our estimates in perspective we report estimates from the three organizations in *Table 6.4.2.* All results are for the general government budget balance and should, hence, be compared to the regression results in *Table 6.1.1.* For Finland (0.53-0.62) and Sweden (0.75-0.88) we find that our estimates are within the range defined by the international organizations' estimates. Our estimates for Denmark (0.62-0.83) encompass those of the international organizations', while our estimates for Norway (0.42-0.49) are significantly lower than those reported in *Table 6.4.2.* It should also be noted that the estimates for individual countries differ substantially between the three organizations. It is also evident that the Nordic countries have public finances that are more sensitive to business cycles than the EU-average and the average for the OECD area.

Table 6.4.2. Estimates of the Sensitivity of the Overall Budget Balance as a share of GDP with respect to changes in GDP.

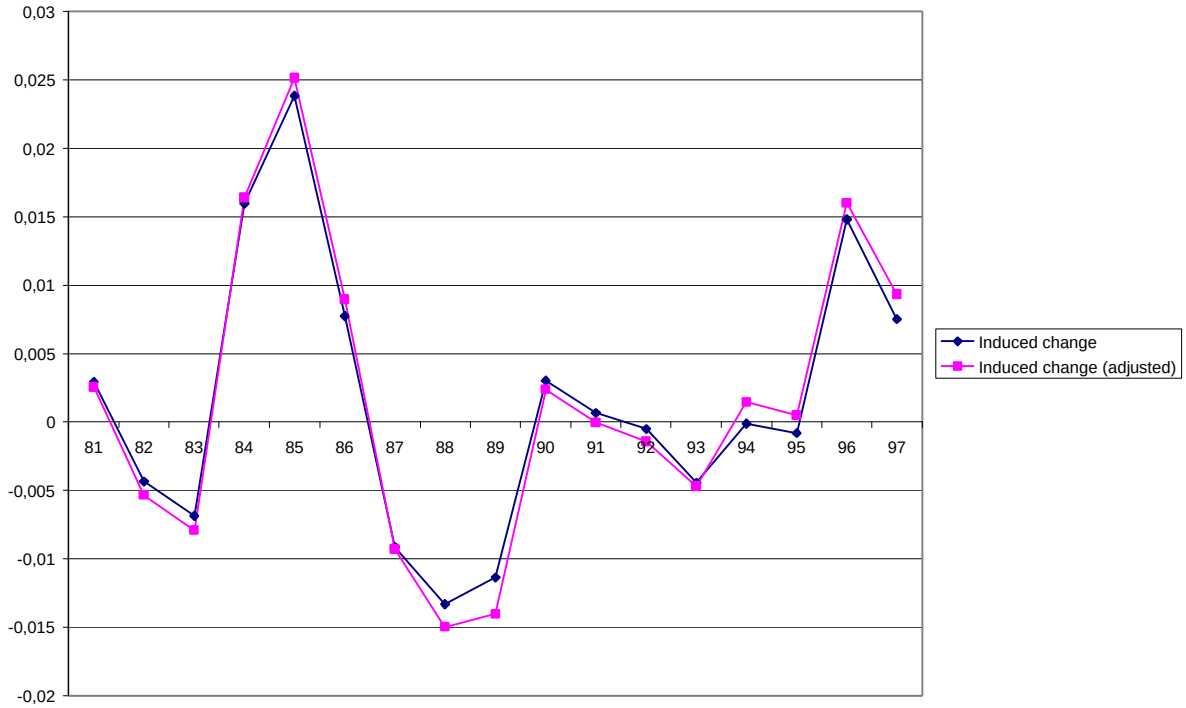
	European Commission (1994)	IMF (1999)	OECD (1993)
Denmark	0.71	0.75	0.65
Finland	0.66	0.59	0.53
Iceland	--	--	--
Norway	--	0.64	0.65
Sweden	0.86	0.93	0.74
EU 15	0.54	--	--
OECD	--	--	0.50

Note: The sources are EU (1995), IMF (1999, WEO data) and OECD (1993).

Unemployment-Related Expenditures

As we argued in *Box 4.1*, the data on unemployment benefits only partially covers total unemployment-related expenditures. Thus, by only adjusting for changes in unemployment benefits, we will tend to underestimate the induced change in budget balances and thus also the sensitivity of public finances with respect to business cycles. In this section we will try to evaluate how much this will affect the results. Due to data limitations, we take a very crude approach and simply assume that unemployment-related expenditures are twice as large as unemployment benefits.[23] The induced change in total budget balance for Norway is shown in *Figure 6.4.1*.

Figure 6.4.1. Induced Change in Total Budget Balance in Norway 1981 to 1997 based on Unemployment benefits and Unemployment-Related Expenditures (adjusted).



The results in *Figure 6.4.1* shows that the variance is somewhat larger if we base the computations on the adjusted measure. Although the difference may seem small, we ran a similar regression for induced change in total balance in Norway as we did in section 6.1. The point estimate increased from 0.42 to 0.48, which means that the estimate is six percentage points larger than those presented in *Table 6.1.1*. We find it likely that the data limitations may lead us to under-estimate the sensitivity of public finances in a similar way for the other Nordic countries.

[23] A motivation for this assumption is that according the empirical model MODAG of Statistics Norway, an increase in unemployment causes an increase in the other labour related transfers of about the same size as the increase in unemployment benefits after five years (Bowitz et al, 1993).

Endogenous Fiscal Policy

Up to this point we have assumed that changes in fiscal policy (discretionary policy changes) are independent of the business cycle, i.e. exogenous. Thus we have studied how variations in GDP growth affects the budget balance, given no changes in fiscal policies. It is however likely that government may try to use an active stabilization policy to dampen the swings in GDP growth or keep unemployment low. Hence, we would expect expansionary fiscal policies in downturns and vice versa in upturns. If fiscal policies are countercyclical, then the induced effect from swings in GDP growth would be accompanied by discretionary changes in fiscal policies that affect the budget balance in the same direction. Thus, the total effect of changes in GDP growth may be larger than the induced effect as fiscal policy changes over the business cycle. To clarify the discussion we run the following regression:

$$(39) \qquad \Delta\left(\frac{B}{Y}\right)_t^D = g_0 + g_1\left((\Delta y_r)_t - (\Delta y)^*\right) + g_2\left((\Delta y_r)_{t-1} - (\Delta y)^*\right) + e,$$

where $(B/Y)_t^D$ is the discretionary change in the total budget balance. The results are presented in *Table 6.4.2*. For Denmark, Finland, Norway and Sweden we find a significant positive correlation between changes in fiscal policies and GDP growth. For Iceland, there is no significant relationship. Adding up the estimates from *Table 6.1.1* and *Table 6.4.2* shows the possible magnitude of how GDP growth affects the overall primary balance. Thus, except for Iceland, there is a clear tendency that fiscal policy has been countercyclical, to the extent that the cycle can be measured by the deviation of GDP growth from trend.

It should however be noted that equation (39) probably does not capture the effects from swings in GDP growth on the discretionary change in the budget balance (fiscal policy) correctly. Presumably, changes in fiscal policies affect GDP growth too and hence equation (39) is likely to suffer from endogeniety problems, This is confirmed by econometric testing. A priori we cannot determine whether the elimination of the endogeniety problem would affect the estimated coefficients in *Table 6.4.2* positively or negatively. Furthermore, some of the variation in the overall budget balances that we would like to attribute to induced changes may, due to data problems, be captured in the series for discretionary changes. Two examples are unemployment-related expenditures and lags in tax systems. Hence the results in *Table 6.4.2* should only be seen as to indicate that there is a possibility that contracyclical fiscal policies may imply that public finances are even more sensitive to swings in GDP growth than our main results indicate.

Table 6.4.2. Results from Regressing the Discretionary Change in the Budget (Primary) Balance as a Share of GDP on Deviations from Trend Growth (1981-1997)

Country	First-year coefficient	Second-year coefficient	Total coefficient
Denmark	0.50	-	0.50
	0.23	0.47	**0.70**
Finland	**0.31**	-	**0.31**
	0.47	-0.28	0.19
Iceland	-0.19	-	-0.19
	-0.12	-0.24	-0.37
Norway	**0.30**	-	**0.30**
	0.08	0.36	**0.45**
Sweden	**0.93**	-	**0.93**
	0.91	0.05	**0.96**

Note: Coefficients in bold are significantly different from zero. See Appendix 4 for regression results.

Qualitative Analysis of the Sensitivity of Public Finances with Respect to Business Cycles during the 1990s

In a questionnaire that was sent out to the different Nordic Ministries of Finance, the Ministries were asked to define major changes in revenue- and expenditure systems as well as institutional changes during the 1990s and evaluate the likely impact of these changes on business cycle sensitivity. Below we give a brief summary of the answers to these questionnaires.

In Denmark, the tax reforms of 1994 and 1998 had two main ingredients. Firstly, marginal tax rates were lowered while tax bases were widened. Furthermore, tax rates on labor income were lowered while environmental taxes increased. Both types of changes are likely to have decreased business cycle sensitivity of revenues. On the expenditure side, structural reforms in the labor market are likely to have decreased the business cycle sensitivity of expenditures. Furthermore, institutional changes regarding the relationship between central and local government are likely to have decreased the business cycle sensitivity of local government expenditures.

In Finland, lower marginal tax rates and inflation-indexation of income tax brackets have decreased the business cycle sensitivity of government revenues. From 1994, the VAT tax base was extended in order to include a larger share of the service sector, which means that VAT revenues have become less sensitive to business cycles. On the other hand, corporate taxes have become more sensitive to business cycles. Regarding expenditures, cyclically sensitive transfers - such as unemployment benefits and housing support – have been curtailed. Privatization of state owned companies have most likely decreased the sensitivity to business cycles. Institutional changes of the budget process have tended to focus planning on the medium-term.

Recent tax reforms in Iceland have focused on harmonisation and lower marginal rates. Social security taxes for different industries have been harmonised, and personal income tax rates have been lowered. At the same time benefit payments (child benefits and interest rebates) have become more means-tested. Finally, there has been a complete overhaul of capital income taxation. The overall impact of these changes has been to make the tax system less sensitive to the business cycle. As for the changes in the personal income tax system the lowering of tax rates have led to less cyclical impact, whereas increased means testing has worked in the other direction. On the expenditure side, the cyclical sensitivity is mostly related to unemployment benefits and recent changes in rules on benefits have led to less cyclical sensitivity. Finally, the recent and on going privatisation of public enterprises may make public finances less sensitive to changes in the business cycle.

The tax reform in Norway in 1992 led to a broadening of the tax base and lower marginal tax rates, which is likely to have made revenues less sensitive to business cycles. A stronger link between profits and corporate taxes have increased the sensitivity for this tax category. Regarding expenditures, local government spending are likely to have become less sensitive to business cycles as budget restrictions have become less binding. It is also likely that transfers have become less sensitive to business cycles. Budget procedures have become stricter from 1998 and expenditures have therefore become less sensitive to business cycles.

In Sweden the tax reform of 1990/1991 lead to lower marginal tax rates and inflation-indexation of tax brackets which have lead to lower sensitivity of revenues with respect to business cycles. The overall tax increases during 1995 to 1998 have increased the sensitivity of revenues to business cycles. On the expenditure side, lower benefit levels have implied that transfers have become less sensitive to business cycles. At the same time, stricter rules on borrowing for local government have increased the sensitivity of local government expenditures. Long-term caps on central government spending have decreased the business cycle sensitivity of expenditures.

7 Indicators for the effect of fiscal policy on the economy

Fiscal indicators, as those discussed in Section 3 above, are often used to measure the effect of fiscal policy on the economy. In this Section we discuss some of the problems that are involved in this respect. However, as this issue is somewhat outside the main focus on the project, we have chosen not to go into deep water by suggesting which indicator or indicators one should use for this purpose. Part of the discussion follows Blanchard (1993).

On the interpretation of the indicator

Measuring the effect of fiscal policy on the economy by use of a simple indicator involves several problems of interpretation. One problem concerns which effects that are measured. Fiscal policy affects the economy in two ways. First, public consumption and investment have a direct one-for-one effect on aggregate demand. Secondly, there is an indirect effect of fiscal policy via the effect on the behaviour of private agents. This effect goes through two channels. First, the financing of public expenditure (current taxes and debt, the latter resulting in expectations of future taxes) affects aggregate demand via the income effect on private consumption. This effect would arise even if all taxes were lump-sum. Secondly, taxes, subsidies, rules etc. involve substitution effects that affect individuals' choice between work and leisure, consumption and saving, regarding the timing of investments, etc. While most of these effects are to the supply side of the economy (e.g. income taxes affect the labour supply decision), some may concern the demand side. For example, a specific timing of taxes (e.g. a transitory increase in indirect taxes) may have large effect on private demand for both investment and consumption.

The fiscal indicators that are discussed in the present paper only captures the direct effect and the first channel of the indirect effect (the indirect effect of lower disposable private income). The second channel of indirect effect (the substitution effect) would be impossible to capture by a simple indicator aimed at measuring the two former mechanisms.

A second problem is that such indicators usually neglect the difference in the effects of various tax and expenditure components. Regarding taxes, the effect of a tax rise depends on the marginal propensity to consume of the agents that are affected by the tax rise. Regarding expenditure, the effect on demand facing domestic firms depends on the import share of the products that are purchased. An indicator that is not subject to this weakness is "the fiscal impact" ("finanseffekten") calculated by the Danish Ministry of Finance. In the construction of this indicator, the effects of changes in various tax and expenditure components are derived by use of multipliers from the empirical macroeconomic model ADAM.

A third problem concerns the measurement scale; what values of the indicator correspond to an expansionary budget, and what values correspond to a tight budget? This clearly requires a reference level or benchmark, of which there are several alternatives. One alternative is to have a constant benchmark for the indicator (e.g. that fiscal policy is expansionary if there is a deficit). Another alternative is to compare with the fiscal policy of the previous year, so that the sign of the change determines whether a budget is expansionary (e.g. that the budget is expansionary if the deficit increases). A third alternative is to take into consideration that the "optimal" fiscal stance depends on the cyclical situation of the economy, and then evaluate the actual budget by comparing with the "optimal" policy; a budget is expansionary if it stimulates aggregate demand more than does the optimal policy. All these three alternatives have obvious weaknesses. The first involve an arbitrary benchmark; there is no clear justification for the view that public financial saving should be on average zero (Blanchard, 1989), even neglecting the fact that the budget deficit is an imperfect measure of public financial saving. The second depends on the implicit assumption that the fiscal policy that was undertaken last year, wisely or unwisely, is a good benchmark for the fiscal policy for the current year. The third depends on the uncertainty and complexity associated with defining an "optimal" fiscal policy.

A fourth problem is related to interpretation of the effect that is measured. Ideally, one would want to have an indicator for the final effect on the economy. That is, one would want to compare the actual state of the economy with how the economy would have been under an alternative fiscal policy. However, this is a too ambitious goal for a simple indicator. To what extent an increase in aggregate demand results in a rise in output depends on the time horizon of the analysis, and on the supply conditions of the economy. If there is spare capacity, a rise in aggregate demand may induce a similar rise in output. If the economy is already close to its capacity constraints, the output effect is likely to be considerably smaller. Thus, the fiscal indicator should probably only aim at capturing the impact effect of the fiscal policy, i.e. the effect of fiscal policy on aggregate demand given income, interest rates, exchange rates. An assessment of the final effects requires an analysis beyond what can be captured by a simple indicator. Simulations on large empirical macromodels would be required to shed light on these effects (see Buiter, 1985, and Blanchard, 1993, on the necessity of a model to evaluate the final effect of fiscal policies on the economy).

A simple indicator cannot solve these problems. Regarding the first, second and fourth, one must remember that the fiscal indicator only measures the impact effect of fiscal policy, it excludes the substitution effect of taxes and benefits, and it neglects the difference among various tax and expenditure components. Regarding the third, care must be taken when using an indicator to label a policy expansionary or tight.

The effect of taxes on consumption

A crucial issue in the construction and interpretation of an indicator for the impact effect of fiscal policy is how taxes and public debt affect private consumption. Various economic theories yield different predictions regarding this relationship. Within traditional Keynesian analysis, consumption depends on disposable income; taxes affect consumption to the extent that they affect current disposable income. Current taxes thus have a fairly strong effect on consumption, although the effect is less than that of public spending (as the marginal propensity to consume is less than one). Thus, a balanced increase in both taxes and spending is expansionary, one implication being that the budget surplus is not a sufficient indicator for the fiscal stance.

Within the life-cycle hypothesis, consumers distribute their consumption optimally over the life cycle, under the constraint that total consumption over the life-spell is equal to total income less total taxes. Current taxes have much less impact on current consumption than within the traditional Keynesian theories. The important issues are total current and expected future taxes, expected income from social security and pensions, etc. The effect of a change in taxes thus depends on whether it is viewed as temporary or permanent.

The Ricardian Equivalence hypothesis extends the life-cycle hypothesis by assuming that consumers take into consideration the taxes that must be paid by future generations. Under this hypothesis, it does not matter whether government spending is financed by taxes or borrowing, because in the long run, all government spending must sooner or later be reflected in corresponding taxes. In other words, discounted average annual taxes are equal to discounted average annual spending. Private consumption then depends on consumers' expectations regarding discounted average annual public spending. A possible indicator for the effect on demand could be current spending relative to discounted average annual spending. Unusually high levels of spending today increase aggregate demand.

In spite of considerable theoretical and empirical research, these issues are not settled. Blanchard (1993) concludes that there is substantial evidence that consumption depends on expectations of future income, but not to the extent implied by the life-cycle hypothesis or the Ricardian equivalence hypothesis. A relevant example is the reduction in tax withholding implemented in the US in 1992, implying that taxpayers paid $29 less per month in 1992, but correspondingly higher taxes in 1993. According to the life-cycle hypothesis, consumption should not be affected. However, Shapiro and Slemrod (1995) document that 43 percent of those who responded to a telephone survey said they would spend most of the extra take-home pay. This estimate is similar to the estimate of Campbell and Mankiw (1989) that 50 percent of income goes to "rule-of-thumb" consumers, i.e. consumers that base their spending on current income.

The structural or cyclically adjusted budget balance

The structural or cyclically adjusted budget balance (CAB) are sometimes used as measures of the effect of fiscal policy on the economy. At first glance, this is surprising, because the distinction between induced and discretionary changes in taxes and public expenditure that is crucial in the construction of the CAB, is by itself irrelevant for private consumption. Consumption depends on the taxes that are paid, and expected to be paid in the future, irrespective of whether the tax revenues evolve over time according to discretionary changes in fiscal policy, or they follow automatically from cyclical fluctuations in the economy. To give an example, consider two countries, one with strong automatic stabilisers but no additional discretionary fiscal policy, the other with weaker automatic stabilisers combined with discretionary counter-cyclical fiscal policy. Measured by the CAB, the first country would pursue a neutral fiscal policy, while the second country would pursue a counter-cyclical policy. However, the evolution of taxes over time may well be the same in both countries, in which case private consumption is also likely to evolve in a similar fashion in both countries.

There are nevertheless several arguments in favour of cyclical adjustment in the measurement of the effect of fiscal policy on the economy. First, it may be defended as a rough approximation to the life cycle or permanent-income hypothesis, by implying an adjustment if tax revenues are unusually high or low due to the cyclical situation of the economy. One problem is that one can question the rationale for making a cyclical adjustment of public expenditures; unemployment benefits are likely to have a considerable effect on aggregate demand, by providing higher income to groups that may easily be credit constrained. Furthermore, the cyclical adjustment of taxes is a very crude way to capture the idea that private agents make expectations about future taxes. To avoid the latter problem, Blanchard (1993) suggests exploiting forecasts of future taxes. More precisely, he suggests to use the "adjusted deficit", defined as government spending on goods and services, plus the real interest payments on government debt[24], less the average of current and the forecast of next two years of tax revenues, all as a ratio to GNP. However, it is not clear that the government forecasts of future taxes are closer to consumers' idea of permanent taxes than are the taxes paid in previous years.

A second argument in favour of using the CAB as a measure of the effect on the economy is that the cyclical adjustment can be seen as a crude adjustment in the direction of the "optimal" policy. The idea is that to decide whether a given fiscal policy is expansionary or contractionary, one should also consider the situation of the economy. For example, in a boom, the actual budget is likely to be in surplus. However, it may nevertheless be misleading to view the fiscal policy as contractionary, because the "optimal" policy may involve a larger surplus. Cyclical adjustment involves one step in the right direction, because the budget surplus is adjusted downwards in booms (when a surplus usually is required), and upwards in recessions (when a deficit usually is warranted).

[24] Presumably one should only include interest payments to domestic lenders, although Blanchard does not mention this point.

However, in comparison between countries, the use of the CAB as a measure of the effect of fiscal policy on the economy appears problematic. Consider again two countries, one with strong automatic stabilisers, and the other with weak. Now assume that both countries keep the CAB constant over the business cycle. As measured by the CAB, both countries pursue the same fiscal policy. Yet there is reason to believe that the automatic stabilisers in the first country will have a stabilising effect that is not present in the second.

Level or change of the indicator

Sometimes, the effect of the fiscal policy is measured by the change in the CAB. The remarks above concerning the level of the CAB are relevant here too. In addition, the use of the change of the indicator is by itself problematic. As is apparent from the discussion above, aggregate demand depends on the **levels** of spending and taxes, both current and expected future levels, and not on the changes.

A possible rationale for using the change in the CAB could be based on the presumption that from the supply side of the economy there is room for a certain rate of growth. The change in the CAB would measure to what extent fiscal policy affects growth in aggregate demand, which then could be compared to the growth potential of the economy. Whether to use the change or level of the budget balance should then depend on whether one is interested in the growth or level of aggregate demand. This question depends again on whether the macroeconomic variables of interest to policymakers depend on growth or levels of aggregate demand. Presumably, the costs of unemployment (lost output, reduced well-being for the unemployed) are primarily related to the level of unemployment, which again is related to the level of aggregate demand. The welfare of the population presumably depends on the levels of private and public consumption. Finally, the budget balance itself clearly depends on the level of the tax bases, not the changes. These considerations suggest that one should use the level of the budget balance as the indicator. To the extent that there are “speed limits”, e.g. the rate of wage growth depends on the change in the rate of unemployment, as well as the level, the change of the budget balance is also of some importance (to the extent that the change in unemployment is affected by the change in the budget balance).

A second justification for using the change in the CAB as an indicator is that it captures the direction and speed of the change in the fiscal policy. This may be important in the political process, because the political debate is often about changes compared to previous policy. This does not necessarily imply that the indicator itself should be the change in the CAB, as the evolution of the level of the CAB over time clearly also provides information about the change in the CAB. However, there is reason to believe that an indicator based on changes will be of more political significance than an indicator based on levels, because the change indicator has zero as the natural benchmark. For example, it may be easier to argue for the importance of 1/2 percent tightening, if the change indicator moves from, say, minus 1/4 percent to plus 1/4, than if the levels indicator moves from a deficit of 2 percent to a deficit of 1 1/2 percent.

Note that the distinction between change and level of the budget balance is of large practical importance when used in the evaluation of whether a certain fiscal policy is expansionary, because of a striking difference in the timing these two measures. If the CAB were a continuous function, it would be when the level of the CAB is at either of its extreme points (largest surplus or deficit) that the change in the CAB is zero. [25]

To be concrete, consider a country where the budget balance initially has a stable surplus, then deteriorates for some years, for finally to be in constant deficit. Using the level of the budget balance as the indicator, the fiscal policy would initially be contractionary, for then gradually to become expansionary. However, using the change in the budget balance as the indicator, the fiscal policy would initially be called neutral, expansionary as long as the budget balance is deteriorated, for then again to be neutral. It seems pretty clear that it cannot be correct to only focus on the change in the indicator in this example, because using the same label on the initial surplus and the eventual deficit would be highly misleading. On the other hand, focussing solely on the level of the budget balance neglects the political importance of the status quo. It is definitely easier to pass a tight budget if the budget in the previous year also were tight, than if the previous budget were lax so that large cuts are necessary.

8. Concluding remarks

In this section we shall briefly touch upon the possible policy implications of the empirical findings. Our analysis and empirical findings so far is consistent with previous view that there is a considerable sensitivity of the public budget balance to fluctuations in the economy. A possible reaction is that the sensitivity is too great, and that measures should be taken to reduce sensitivity. However, there are strong economic reasons that the budget balance should vary with the cycle. The theory of tax smoothing (Barro, 1979) suggests that income tax rates should be held constant over time in order to minimise the excess burden of taxes over time. With constant tax rates, tax revenues clearly vary with the cycle. Andersen and Dogonowski (1999) carry this argument even further, showing that the optimal income tax should be pro-cyclical, in order to smooth working hours, and thus leisure, over time. This would make the budget balance even more pro-cyclical.

Pro-cyclical revenues would not affect the budget balance if expenditures moved accordingly. However, as there presumably are significant adjustment costs also when it comes to public expenditure, efficiency reasons suggest that expenditures should not vary much over the cycle. Regarding public employment, the existence of adjustment costs is pretty obvious. But also for other public purchases, as well as transfers, there are reasons to avoid large fluctuations.

The preceding arguments reflect the more general view that automatic stabilisation basically is a consequence of arrangements that are chosen for other reasons. For example, unemployment benefits are mainly motivated as insurance and for egalitarian reasons, and the stabilising effect on the overall economy is a desirable additional effect. But other reasons clearly also suggest limits to the extent of stabilisation. Large unemployment benefits provide even more stabilisation, but at the cost of adverse incentive effects. Likewise, stabilisation is increasing in the overall tax level, but high taxes also have adverse efficiency effects.

[25] Mathematically oriented readers may note that if the budget surplus follows a regular cycle over time, the change in the budget surplus also follows a regular cycle, but the timing of the cycles differ. If the budget surplus follows e.g. $B(t) = \sin t$, the change in the budget surplus is given by $B'(t) = \cos t$.

Turning to the aggregate consequences of automatic stabilisation, there is the traditional Keynesian argument that fiscal policy should to some extent be used with the aim of stabilising the economy. Empirical research suggest that this strategy contributes to economic stability; Gali (1994) finds that budget sensitivity to economic fluctuations is increasing in the size of government, and that there is a negative correlation between government size and macroeconomic volatility.

On the other hand there is a considerable risk associated with strong "cyclical" movements in the budget balance if shocks are persistent. If a permanent negative shock is countered with expansionary fiscal policy, the result might be a persistent budget deficit leading to serious debt problems. But one must also have in mind that the persistence of a shock may be endogenous. Due to hysteresis effects, a transitory shock may turn out to be persistent if it is met with strict economic policy.

The time dimension of the automatic stabilisers is also of importance. To avoid excessive fluctuations in the short run (with ensuing persistent negative consequences) it is probably wise to have a considerable amount of automatic stabilisation. On the other hand, it is important to have more flexibility in the medium term, so that fiscal policy can adapt if the downturn is more persistent. It is also important to avoid types of automatic stabilisation that has persistent negative effects on the supply side of the economy, e.g. arrangements where individuals who lose their job end up in non-employment, as long-term unemployed, disabled or retired.

A related issue is to what extent the fluctuations in the budget balance should be automatic or discretionary. Or put differently, what is preferable of weak automatic stabilisers supplemented with discretionary fiscal policy, or stronger automatic stabilisers. The latter alternative has the advantage that it is more predictable, in the sense that fiscal policy follows well-defined rules. It is probably also an advantage that fiscal policy is automatic, so that one avoids decision and implementation lags. (This clearly depends on the timing of the automatic stabilisers.) However, strong automatic stabilisers may turn out to be problematic if there are important permanent, negative shocks. In this case a strategy where weak automatic stabilisers are combined with discretionary actions would be more flexible. A further issue is that in downturns, discretionary fiscal policy can be undertaken in the form of increased public investments with potentially high social return, as there is little alternative use of the exploited labour.

Appendix 1: Indicators of the structural budget balance

OECD: (Giorno et al, 1995)
The structural budget balance is estimated in two steps. In the first step, one estimates the **potential output** of the economy, which loosely can be defined as the short-term production capacity of the economy that is consistent with stable inflation. The **output gap** is then the difference between actual and potential output, measured in percent of potential output. In the second step, one obtains the structural budget balance by adjusting the actual budget balance for the effect of the output gap, by use of estimated elasticities for various sorts of revenues and expenditure with respect to the output gap. More precisely, the method is as follows:

First, the estimated business-sector production function is assumed to be of the form

(a1) $y^B = \alpha n^B + (1-\alpha)k^B + e^B$

where lower-case letters indicate natural logarithms, superscript B indicate business-sector, y is value added, n employment, k capital stock, e total factor productivity, α the average labour share parameter in the business sector ($0 < \alpha < 1$). For a given value of the labour share α (I assume that the OECD uses actual figures for the labour share in each country, for a certain year or average over a period of years, but this is not said explicitly), the e series is calculated and then smoothed using a Hodrick-Prescott filter to provide a measure of trend factor productivity, e^B*. Next, the trend factor productivity series, e^B*, is substituted back into the production function along with actual capital stock, k^B, and "potential" employment, n^B*, to provide a measure of the log of the business-sector potential, y^B*, as

(a2) $y^B* = \alpha n^B* + (1-\alpha)k^{\mathbf{B}} + e^B*$.

The level of potential employment in the business sector, N^B*, is calculated as:

(a3) $N^B* = LFS\ (1-NAWRU) - EG$,

where LFS is smoothed labour force (the product of the working age population and the trend participation rate), NAWRU is the estimated non-accelerating wage rate of unemployment (estimated according to the method of Elmeskov and MacFarland, 1993, and modified by OECD Secretariat country experts where additional country information was available), EG is employment in government sector.

Potential output for the whole economy, Y*, is obtained by adding actual value added in the government sector, Y^G, to business-sector potential output:

(a4) $Y* = Y^B* + Y^G$.

The output gap is now the ratio of actual and potential output (approximately the difference between actual output and potential output, as percent of potential output).

(a5) $GAP = \ln(Y/Y*) = y - y*$.

In the second step, one adjusts the actual budget balance for the effect of the output gap. Thus,

(a6) $B* = \Sigma_j T^j* - G* -$ net interest payments,

where B* is the structural budget balance, T^j* is the structural tax revenues for the ith category of tax, and G* is structural government expenditures (excluding net interest payments). The structural tax revenues and government expenditures are calculated as

(a7) $t^j* = t^j - \alpha_j$ GAP,

(a8) $g* = g - \beta$ GAP,

where α_j is the elasticity of ith tax category with respect to output, and β is the elasticity of current government expenditures with respect to output.

Taxes are divided into four categories - corporate taxes, personal income taxes, social security contributions and indirect taxes, with different elasticities α_j for each category. The country-specific elasticities are presented in Table 3 in Giorno et al (1995). The calculation of the elasticities for personal income taxes and social security contributions is in two steps. The first step is to derive the elasticity of taxes with respect to earnings on the basis of country-specific micro data; this step is discussed in the appendix. The second step is to estimate the elasticity of earnings with respect to output; this step is based on estimates of the output-elasticity of employment and the employment elasticity of wages taken from Elmeskov and Pichelman (1993) (the country-specific elasticities are presented in their Table A2).

For indirect taxes, a unit elasticity is assumed for all countries. The elasticities for corporate taxes are taken from Chouraqui et al (1990). In Chouraqui et al (1990), it is stated that "For the remaining taxes [which include corporate taxes], elasticities were derived from sensitivity analysis of the econometric model INTERLINK, based on the comparison of historical data of the examined variable with the values obtained after the tax base was allowed to change. The value of the elasticity of direct taxes paid by the business sector is greater than one because of the high sensitivity of business income to change in economic conditions." Chouraqui et al (1990) include lags in the collection of business taxes, but these lags are not mentioned in Giorno et al (1995).

On government expenditure, one only takes into consideration the effect of the output gap on the expenditure on unemployment benefits. The elasticity of expenditure on unemployment benefits with respect to output is calculated as the elasticity of the unemployment rate with respect to output (the inverse of the Okun coefficient) multiplied by the elasticity of unemployment benefits with respect to unemployment. These elasticities are estimated, but no information on the estimation method or the data that is used is provided.

The tax elasticities vary considerably among the countries. On corporate income, the variation is from Spain 2.1, most countries about 2.5, Japan 3.7 and the UK 4.5. On personal income, Italy has 0.4, Denmark 0.7, up to Sweden and France 1.4 and Spain 1.9. On social security, Italy has 0.3, many countries have 0.5-0.8, Spain 1.1 and Sweden 1.2.

The elasticity of current primary government expenditure to output (unemployment benefits) varies from 0.0 in Italy to -0.3 in Canada and Spain. The underlying variation in Okun coeffients (the elasticity of output with respect to unemployment) is from 1.7 in Spain, 2.0 in the US, the UK and the Netherlands, to 5.0 in Italy, Austria, Norway and Sweden, and 6.7 in Japan.

Giorno et al (1995) summarise the adjustments as follows: "Typically, if the estimated output gap were 1 percentage point of GDP smaller, the estimated structural component of the actual budget balance would be larger by around 1/2 percentage point of GDP. … tax revenue adjustments far outweigh the effect of expenditure adjustments, which make up only about 10 to 20 percent of the adjustment."

The European Union (EU, 1995):

The basic method is the same as that of the OECD. The differences are as follows. Rather than calculating the potential output, the EU calculates a trend output by use of the Hodrick-Prescott method (which is explained in the note; $\lambda = 100$). To reduce the endpoint bias, one extends the series of actual output with mechanical projections obtained via a univariate statistical procedure.

The EU uses the same tax elasticities as that of the OECD. However, these tax elasticities are weighted together by use of the relative shares of each revenue category, this implies that it is not necessary to have detailed information per revenue category, which is often missing in budget figures for the current year or for forecasts. In addition, for some countries the EU corrects for lags in the collection of corporate taxes. These lags have been estimated by the OECD (it is referred to Chouraqui et al, 1990, where these lag coefficients are presented, with a further reference to OECD, 1983).

The EU uses basically the same method as the OECD to derive the cyclical component of the budget expenditure. One only adjusts for expenditure on unemployment benefits, and the elasticity of expenditure on unemployment benefits with respect to output is calculated as the elasticity of the unemployment rate with respect to output (the inverse of the Okun coefficient) multiplied by the elasticity of unemployment benefits with respect to unemployment. These elasticities are estimated by regressions, but no further information on the estimation method or the data that is used is provided. The elasticities differ from those obtained by the OECD. The Okun coefficient used by the EU and the OECD, respectively, are 2.5 and 1.93 (Denmark); 3.3 and 2.46 (Finland); 5.0 and 1.7 (Sweden); 5.0 (OECD for Norway).

As an illustration, in 1994 the cyclical components of the government budget balance, as percent of GDP, were (EU, 1995, and the OECD, Giorno et al, 1995, respectively): -0.6 and -1.2 (Denmark); -4.1 and -2.9 (Finland); -3.0 and -2.7 (Sweden); -1.5 (OECD for mainland Norway).

Appendix 2: Adjustment based on deviations in the GDP or deviations in the tax base[26]

This appendix attempts to illustrate the difference between adjustment based on deviations in the GDP or deviations in the tax base. The basis conclusion is that when there is less than perfect correlation between the tax base and the GDP, the optimal cyclical adjustment based on the GDP is smaller than the cyclical fluctuations arising from fluctuations in the tax base. Consider the following simple example. Let the revenue of a specific tax type be given by

(a9) $T = tC$

[26] The following section draws heavily on the analysis of the use of imperfect forecasts in Johansen (1978, section 8.9). Note that the in the analysis, trend growth in the variables is neglected, which may affect the conclusions.

where T is tax revenue, t is the tax rate, and C is the tax base. For simplicity, we assume that the tax rate is constant over time, and that all variation in the tax base, C, of cyclical nature. Thus, all variation in T is also of cyclical nature, and should be adjusted for. In this simple example, with a proportional relationship between the tax base and the tax revenue, it is possible to implement a perfect cyclical adjustment, simply by multiplying the cyclical deviation of C by the tax rate t.

Consider, in contrast, the implications of a cyclical adjustment based on another variable, Y. The cyclical adjustment requires that one specifies the tax revenue as a function of Y, for simplicity assumed to be linear.

(a10) $T^* = \delta_0 + \delta_1 Y,$

where δ_0 and δ_1 are parameters to be determined. The values of the parameters are assumed to be chosen with the aim of minimising the expectation of the mean square error, $E[(T^* - T)^2]$. By substituting out for (a9) and (a10), and using the formula for the expected value of a squared variable, the expression to be minimised reads

(a11) $E[(T^*-T)^2] = \{ (\delta_0 + \delta_1 EY - ET)^2 + \delta_1^2 \sigma_Y^2 + \sigma_T^2 + 2\delta_1 \sigma_{YT} \},$

where σ_Y^2 and σ_T^2 are the variance of Y and T, while σ_{YT} is the covariance between the same variables. Any covariance between Y and T is a consequence of a covariance between Y and the tax base C; more precisely we have $\sigma_{YT} = t\,\sigma_{YC}$. The first order conditions with respect to δ_0 and δ_1 are

(a12) $\partial E[.]/\partial\delta_0 = 2(\delta_0 + \delta_1 EY - ET) = 0,$ and

(a13) $\partial E[.]/\partial\delta_1 = 2(\delta_0 + \delta_1 EY - ET)\,EY + 2\delta_1 \sigma_Y^2 + 2\sigma_{YT} = 0.$

(a12) can be rewritten as

(a12') $\delta_0 = ET - \delta_1 EY.$

Substituting out for (a12) in (a13), (a13) can be solved for

(a14) $\delta_1 = \sigma_{YT}/\sigma_Y^2 = t\,\sigma_{CT}/\sigma_Y^2.$

From (a14) we cannot say which parameter is the greater of t and δ_1, as this will depend on the ratio σ_{CT}/σ_Y^2. However, the extent of cyclical adjustment can be illustrated by a further elaboration. Inserting for (a12') and (a14) in (a11), we obtain

(a15) $T^* = (ET - \delta_1 EY) + (t\,\sigma_{CT}/\sigma_Y^2)\,Y.$

The variance of T* is (the variances, covariances and expectations are assumed to be known)

(a16) $\text{var } T^* = t^2 (\sigma_{CT}/\sigma_Y^2)^2 \sigma_Y^2$

In contrast, the variance of the actual tax revenues is

(a17) $\text{var } T = t^2 \sigma_C^2.$

The ratio of the two variances are

(a18) $\text{var } T^*/\text{var } T = t^2 (\sigma_{CT} /\sigma_Y^2)^2 \sigma_Y^2 / t^2 \sigma_C^2 = r_{CY}^2$,

where $r_{CY} = \sigma_{CY}/\sigma_C\sigma_Y$ is the correlation coefficient between C and Y (and σ_C is the standard deviation of C). As the correlation coefficient is bounded between -1 and 1, being equal to unity only if C and Y are perfectly correlated, it is clear that the variance of T* is smaller than the variance of T. In other words, if C and Y are less than perfect correlated, the optimal cyclical adjustment based on Y is smaller than the correct cyclical adjustment (which in this example is the adjustment based on C). The intuition here is that the noise that is involved when the cyclical adjustment is based on Y, implies that one should make smaller adjustment from the unconditional expectation. The intuition is perhaps easiest to understand in the extreme case when there is no correlation between C and Y, i.e. that $r_{CY} = 0$. In this case knowledge of Y provides no information whatsoever for T, and no cyclical adjustment can be based on Y. Thus, the variance of T* must be zero.

Appendix 3: Alternative Expenditure Measure

In this appendix we present the results of using an alternative definition of constant fiscal policy

Expenditure-Alternative B:

- Public consumption is constant in real terms (deflated by the deflator for public consumption).[27]
- Unemployment benefits are proportional to the rate of unemployment.
- Other public expenditures are constant in real terms (deflated by the deflator for private consumption).

Thus (neglecting variation in unemployment and revenues), alternative B implies that constant policy involves public expenditure being constant in real terms. In contrast, alternative A in the main text implies that constant policy involves public expenditure to increase at the rate of trend GDP, both in nominal terms. Thus, while trend growth in GDP allows public expenditure to increase under constant policy under alternative A, the real growth in public expenditure will be less if the price of public consumption increase relative to the GDP deflator.

Under alternative B, the induced change in expenditure is

(a19) $\Delta G^I = \Delta p_{co} G_{C,t-1} + (\Delta U/U_{t-1}) G_{U,t-1}(1+ \Delta p_{cp}) + \Delta p_{cp}(G - G_C)_{t-1}$,

while the discretionary change in expenditure is[28]

[27] The idea is that constant policy should roughly correspond to constant public employment. The Norwegian National Accounts impute a productivity growth of 0.5 percent per year to labour in the public sector since 1984. Thus, from that year constant policy for Norway should probably be defined as a real growth in public consumption of about 0.3 percent per year (equal to 0.5 times the wage share which is about 0.6). This is not the case for the other Nordic countries.

[28] An imputed productivity growth of η (for Norway, $\eta = 0.003$, calculated as the rate of growth in labour producitivity 0.005 multiplied by the wage share, approximately 0.6) could be allowed for as follows: $\Delta G^D = \Delta G - (\Delta p_{co} + \eta) G_{C,t-1} - \Delta U/U_{t-1}\, G_{U,t-1}(1+ \Delta p_{cp}) - \Delta p_{cp}(G - G_C)_{t-1}$.

(a20) $\Delta G^D = \Delta G - \Delta G^I = \Delta G - \Delta p_{co} G_{C,t-1} - (\Delta U/U_{t-1}) G_{U,t-1}(1+\Delta p_{cp}) - \Delta p_{cp}(G - G_C)_{t-1}$,

where G is total expenditure, G_C is public consumption, G_U is expenditure related to unemployment (all in nominal terms), U is the rate of unemployment, p_{co} is the public consumption deflator and p_{cp} is the private consumption deflator (both in logs). Under alternative B, unchanged policy allows for adjustment of public expenditure to price growth and change in the rate of unemployment; any increase above this adjustment is interpreted as discretionary.

Decomposition of induced changes in cycle and trend

A decomposition between cyclical and trend changes requires that one specifies a trend in the variables used in calculation above. One the revenue side, one could specify a trend in each of the tax bases. However, this might make the analysis less transparent, and there might also be a problem with consistency of the different trends. A possibly better approach is to attach the trend change to the GDP. Presumably there is no trend in the wage bill or private consumption as shares of GDP in the really long run (however, over limited periods, a trend may exist). Thus, the trend changes in the primary budget surplus could be derived simply by assuming that revenues increase at the trend rate of growth of real GDP (which could be 2 percent, as assumed by the Swedish Ministry of Finance; in a historical decomposition one could use the average growth rate over the sample period). If a more detailed adjustment is chosen, e.g. including tax revenues on the sales of new cars, it is probably necessary to use separate trends, and not the trend of real GDP.

On the expenditure side, the best approach is probably to first specify the cyclical changes, which would be the changes attached to a change in the rate of unemployment. Any other induced changes in expenditure would then be interpreted as due to trend.

Formally, the trend change in revenues can be calculated as

(a21) $\Delta T^T = (\gamma + \Delta p_y) T_{t-1}$,

The cyclical change in expenditure is

(a22) $\Delta G^C = \Delta U/U \; G_{U,t-1}(1+\Delta p_{cp})$.

The final components are calculated as residuals, by

(a23) $\Delta T^C = \Delta T - \Delta T^D - \Delta T^T$,

and

(a24) $\Delta G^T = \Delta G - \Delta G^D - \Delta G^C$.

The change in the budget balance, including net interest payments

(a25) $\Delta B = \Delta S^D + \Delta S^C + \Delta S^T - \Delta(i\,D)$,

(where $\Delta S^j = \Delta T^j - \Delta G^j$, j = D,C,T, is the part of the primary surplus associated with discretionary, cyclical and trend changes).

This change in the budget balance as a ratio to GDP may be decomposed into discretionary, cyclical and trend, the latter as a residual, as follows. The discretionary change in the budget balance, as a ratio to GDP, is equal to the discretionary change in the primary balance as a ratio to GDP.

$$\text{(a26)} \quad \left(\Delta \frac{B}{Y}\right)^D = \frac{\Delta S^D}{Y_{t-1}}$$

The cyclical change in the budget balance is equal to the cyclical change in the primary balance, both as ratios to GDP, adjusted for cyclical movements in the denominator Y. In addition, the effect of a change in the nominal interest rate (the term $\Delta(i\,D) - i_{t-1}\Delta D)$) is interpreted as cyclical, while the effect of higher debt (the term $i_{t-1}D$) is viewed as trend, cf. (a29); this distinction is somewhat arbitrary.

$$\text{(a27)} \quad \left(\Delta \frac{B}{Y}\right)^C = \frac{\Delta S^C - \left(\Delta(i\,D) - i_{t-1}\Delta D\right)}{Y_{t-1}} - \left(\frac{B}{Y}\right)_{t-1}\left(\frac{\Delta Y}{Y_{t-1}} - (g + \Delta p_y)\right)$$

The trend, or non-cyclical, change in the budget balance is calculated as a residual

$$\text{(a28)} \quad \left(\Delta \frac{B}{Y}\right)^T = \Delta\left(\frac{B}{Y}\right) - \left(\Delta \frac{B}{Y}\right)^D - \left(\Delta \frac{B}{Y}\right)^C .$$

Using (a26) and (a27), we obtain

$$\text{(a29)} \quad \left(\Delta \frac{B}{Y}\right)^T = \frac{\Delta S^T - i_{t-1}\Delta D}{Y_{t-1}} - \left(\frac{B}{Y}\right)_{t-1}(g + \Delta p_y).$$

(a29) shows that the trend change in the budget balance as a ratio to GDP is equal to the trend change in the primary balance as a ratio to GDP, adjusted for the trend growth in the denominator Y.

Appendix 4: Regression results

Table A6.1. Effects of GDP growth on the budget balance as a share of GDP under constant fiscal policy. OLS regression, sample period 1981-1997.

Country	Dependent variable	Type	Trend-change (b_0)	First-year effect (b_1)	Second-year effect (b_2)	Total effect $b_1 + b_2$	$\overline{R^2}$
Denmark	Primary balance	A	**-0.003 (SE 0.001)**	**0.56 (SE 0.10)**	-	**0.56**	0.68
Denmark	Total balance	A	-0.004 (SE 0.003)	0.38 (SE 0.23)	0.23 (SE 0.23)	**0.62**	0.28
Denmark	Primary balance	B	**0.007 (SE 0.001)**	**0.75 (SE 0.10)**	-	**0.75**	0.75
Denmark	Total balance	B	**0.007 (SE 0.003)**	**0.54 (SE 0.24)**	**0.28 (SE 0.16)**	**0.83**	0.42
Finland	Primary balance	A	-0.003 (SE 0.002)	**0.18 (SE 0.05)**	**0.30 (SE 0.07)**	**0.48**	0.76
Finland	Total balance	A	-0.005 (SE 0.002)	**0.10 (SE 0.05)**	**0.43 (SE 0.12)**	**0.53**	0.69
Finland	Primary balance	B	**0.005 (SE 0.001)**	**0.32 (SE 0.05)**	**0.26 (SE 0.04)**	**0.58**	0.91
Finland	Total balance	B	0.003 (SE 0.002)	**0.23 (SE 0.04)**	**0.39 (SE 0.09)**	**0.62**	0.84
Iceland	Primary balance	A	**0.003 (SE 0.002)**	**0.42 (SE 0.07)**	**0.15 (SE 0.08)**	**0.58**	0.66
Iceland	Total balance	A	0.002 (SE 0.003)	**0.45 (SE 0.09)**	0.14 (SE 0.10)	**0.59**	0.59
Iceland	Primary balance	B	**0.012 (SE 0.002)**	**0.40 (SE 0.08)**	-	**0.40**	0.56
Iceland	Total balance	B	**0.010 (SE 0.003)**	**0.43 (SE 0.09)**	-	**0.43**	0.53
Norway	Primary balance	A	0.001 (SE 0.001)	**0.54 (SE 0.06)**	**-0.14 (SE 0.06)**	**0.40**	0.82
Norway	Total balance	A	0.002 (SE 0.001)	**0.42 (SE 0.07)**	-	**0.42**	0.61
Norway	Primary balance	B	**0.012 (SE 0.001)**	**0.41 (SE 0.03)**	**0.09 (SE 0.04)**	**0.50**	0.92
Norway	Total balance	B	**0.012 (SE 0.001)**	**0.34 (SE 0.10)**	0.15 (SE 0.09)	**0.49**	0.65
Sweden	Primary balance	A	-0.003 (SE 0.002)	**0.47 (SE 0.12)**	0.16 (SE 0.10)	**0.63**	0.61
Sweden	Total balance	A	-0.005 (SE 0.003)	**0.47 (SE 0.15)**	**0.28 (SE 0.10)**	**0.75**	0.45
Sweden	Primary balance	B	**0.004 (SE 0.002)**	**0.57 (SE 0.12)**	**0.19 (SE 0.10)**	**0.76**	0.68
Sweden	Total balance	B	0.002 (SE 0.003)	**0.57 (SE 0.16)**	**0.31 (SE 0.12)**	**0.88**	0.51

Note: The dependent variable is the induced change in the total- or primary budget balance as a share of GDP. SE denotes the standard error in the estimate and are based on White's (1980) heteroskedasticity-consistent method. The LM-test suggested by Godfrey (1978) rejects the hypothesis of first-order serial correlation for all the regressions. The Haussman test for exogeniety / misspecification yields no results that indicate endogeniety- or misspecification-problems. Figures in bold indicates that the estimated coefficient is significantly different from zero at the 5 percent level.

Table A6.2. Results from OLS Regressions of the Discretionary Change in the Budget (Primary) Balance as a Share of GDP on Deviations from Trend Growth (1981-1997)

Country	First-year coefficient (g_1)	Second-year coefficient (g_2)	$g_1 + g_2$	$\overline{R^2}$
Denmark	0.50 (SE 0.26)	-	0.50	0.10
	0.23 (SE 0.35)	0.47 (SE 0.27)	**0.70**	0.16
Finland	**0.31 (SE 0.15)**	-	**0.31**	0.14
	0.47 (SE 0.13)	-0.28 (SE 0.15)	0.19	0.20
Iceland	-0.19 (SE 0.16)	-	-0.19	-0.02
	-0.12 (SE 0.18)	-0.24 (SE 0.19)	-0.37	-0.00
Norway	**0.30 (SE 0.13)**	-	**0.30**	0.05
	0.08 (SE 0.14)	0.36 (SE 0.20)	**0.45**	0.10
Sweden	**0.93 (SE 0.29)**	-	**0.93**	0.29
	0.91 (SE 0.30)	0.05 (SE 0.40)	**0.96**	0.24

Note: Coefficients in bold are significantly different from zero.

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Svensk sammanfattning

Denna studie analyserar sambandet mellan budgetsaldot och konjunkturläget i de nordiska länderna. Studien har två huvudsyften. För det första utvecklar vi en metod för hur förändringar i budgetsaldot kan dekomponeras i en diskretionär (politikberoende) och en inducerad (ekonomiberoende) komponent. Den diskretionära komponenten visar på förändringar i finanspolitiken och kan således användas som en indikator på finanspolitikens inriktning (s.k. *fiscal stance*). Jämfört med de indikatorer som används av olika internationella organisationer har denna indikator huvudsakligen två fördelar. För det första knyts de offentliga finansernas utveckling till viktiga skattebaser snarare än till BNP, vilket medför en större precision i dekomponeringen. För det andra påverkar inte strukturella förändringar i ekonomin (i termer av potentiell BNP) den föreslagna finanspolitiska indikatorn, vilket är fallet med de flesta andra indikatorer. Den inducerade förändringen i budgetsaldot kan användas för att analysera konjunkturkänslighehet i de offentliga finanserna, givet att finanspolitiken hålls konstant. Vi föreslår också en metod för hur nivån på budgetsaldot kan dekomponeras i en strukturell och en cyklisk komponent.

Det andra huvudsyftet med studien är att empiriskt studera hur konjunkturkänsliga de offentliga finanserna är i de nordiska länderna. Analysen fokuserar på perioden 1980 till 1997. Konjunkturkänsligheten analyseras med hjälp av tre olika metoder, vilka alla visar på en hög konjunkturkänslighet i de nordiska ländernas offentliga finanser. Den uppskattade känsligheten i budgetsaldot visar att en enprocentig minskning i BNP medför att budgetsaldot som andel av BNP försämras med 0.6-0.8 procentenheter i Sverige, 0.5-0.75 i Danmark, 0.4-0.6 i Finland och Norge samt 0.2-0.6 i Island, givet en konstant finanspolitik. I studien visas också att dessa uppskattningar snarast underskattar konjunkturkänsligheten i de offentliga finanserna då dataproblem och en kontracyklisk finanspolitik leder till ännu högre känslighet.

I den empiriska analysen visar vi också hur olika typer av chocker påverkar de offentliga finanserna. Resultaten visar att en inhemsk sparchock tycks ha den största påverkan på budgetsaldot, medan en övergripande efterfrågechock och, framför allt, en exportchock påverkar saldot mindre.

Studien avslutas med en diskussion om de problem som uppstår när finanspolitiken analyseras med hjälp av enkla indikatorer. Här finns även en kort diskussion angående den normativa frågan om hur känsliga de offentliga finanserna bör vara för konjunktursvängningar.