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# Alternatives for Measuring Structural Budgetary Position

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## Foreword

This study has been funded from appropriations for assessment and research activities in support of the Government's decision-making. The results have been commented on by the steering committee of the study, i.e. the sub-committee of sustainable public finances that belongs to the working group coordinating the Government's research, forecasting and assessment operations. The study has also been presented in two seminars within the Ministry of Finance. In particular, I would like to thank the following persons for their expert comments: Marketta Henriksson, Harri Kähkönen, Jenni Pääkkönen, Tuomo Mäki and Veli-Arvo Tamminen. In addition, ETLA, the Research Institute of the Finnish Economy, provided me with a great deal of help during my work on this study. I am especially grateful to Hannu Kaseva for his assistance in the collection of materials on the changes in the revenue basis, and to Markku Kotilainen for managing the programme. In addition, I am grateful for the comments I have received in various phases from Niku Määttänen, Tarmo Valkonen, Vesa Vihriälä and the seminar audience during internal seminars within ETLA. The author assumes sole responsibility for the contents of this report and any errors therein.

Tero Kuusi





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# 1 Introduction

One of the greatest challenges faced by counter-cyclical economic policy lies in recognising the nature of shocks affecting the economy. Economic policy should react to permanent structural shocks in a different manner than to temporary shocks of a cyclical nature. It is often sensible to counteract cyclical challenges by temporarily adjusting public expenditure and debt. The effect of such adjustments on the sustainability of public finances can be neutralised as the shock dissipates. On the other hand, a structural shock has long-term effects on the production potential of the economy or the sustainability of public finances (see for example Aguiar and Gopinath, 2007), and therefore requires immediate action, albeit action that takes account of the general sustainability of the current public finances and the multiplier effects of fiscal policy. Uncertainty about the nature of shocks may lead to conflicting policy recommendations, which in the worst case scenario can paralyse financial policy. For example, when the nature of a shock is cyclical, the reaction to an economic downturn should be expansive. If the shock is structural, the reaction should be contractionary.

The structural budgetary position (SBP<sup>1</sup>) measures the budgetary position of the public finances, when the effects of economic cycles and one-off expense and income items are eliminated (Mourre et al., 2013; Havik et al., 2014). In principle, the use of this indicator clarifies the execution of financial policy and its control. Shocks of a cyclical nature trigger automatic stability measures in the public finances, and in principle, such measures should be allowed to work in spite of the short-term costs inflicted on the public finances. However, if the SBP worsens, the related change in financial policy can be interpreted as independent of economic cycles, and should be corrected at least in cases where the sustainability of the public economy is in danger. Thanks to its clear principles, SBP plays a central role in the EU's Stability and Growth Pact: in the SGP's corrective arm, SBP helps to guide the elimination of excessive deficits, and in the preventive arm it defines the medium-term objective (MTO) for budgetary positions in the public finances.

In this report, I assess the challenges in the European Commission's method of calculating SBP based on an output gap. The perspective adopted is that of recent Finnish history. I also examine alternative indicators that might serve as inputs for tuning financial policy. In spite of its conceptual clarity, SPB based on an output gap is challenging to measure in practice, since the method requires an assessment of several quantities that are difficult to measure. First, the output gap must be defined, i.e. the difference between actual financial activity and potential financial activity must be estimated. The structural budgetary balance is calculated next, taking account of the historical sensitivity of tax revenue and public expenditure to fluctuations in the output gap. The resulting assessments of the effects of financial cycles on the budgetary position of public finances in different countries have been criticised as inadequate during the recent financial and debt crisis. If this is the case, financial policy reliant on such indicators is in danger of becoming procyclical<sup>2</sup>.

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<sup>1</sup> This translation of the report uses abbreviations derived from the English terms. An exception is made in the case of procedures and methods for which an abbreviation does not yet exist.

<sup>2</sup> For example, Lane (2012) and others estimate that, prior to the Eurozone crisis, financial policy was excessively based on output gap estimates without taking account of the risks associated with external imbalances, credit expansion, debt overhang in various sectors and housing price trends. On the other hand, after the crisis broke out, concerns were expressed that the output-gap-based assessment of the correction needed for SBP had not produced the correct picture of adjustments made in the public finances (European Commission, 2013B).

In this paper, I have calculated historical estimates for two key components of the output gap in particular: structural unemployment and the potential level of total factor productivity in 1984–2014. I have examined the statistical plausibility of the Commission’s current estimates by comparing them to observations in earlier literature. Furthermore, I have evaluated the method on a real-time basis for various periods, i.e. without using information on the development of the economy in subsequent years.

Based on the results, it seems that the applications of the output gap method should be developed further. It appears that the model currently used by the Commission is hypersensitive to changes in economic trends, particularly concerning structural employment. This is apparent, at least when viewing the greatest financial crisis to affect Finland in recent history: the depression of the early 1990s. In my view, the primary explanation for such hypersensitivity lies in the statistically problematic parameter limitations used in the application of the method. This report recommends that the parametrisation of the method used for calculating structural unemployment be changed to better correspond to a plausible model based on the earlier literature and observations outside the model.

On the other hand, the results indicate that, despite the methodological improvements I suggest, the use of output-gap-based SBP to guide financial policy can lead to a procyclical financial policy. For example, it seems that financial policy guided by an output-gap-based SBP would not have reacted in a contractionary manner during the economic upswing in the 1980s and early 2000s. Instead, the policy might have been expansive. Besides, an output-gap-based SBP indicator might have ignored the fairly strong contractionary measures in financial policy implemented in the early 1990s crisis, which could have led to even stronger contractionary measures in economic policy. Thus, alternative methods are needed.<sup>3</sup>

In this paper, I review methodological alternatives to the output gap method, the alternatives being other financial policy assessment methods used within the EU rules framework: the expenditure rule in the preventive arm of the Stability and Growth Pact (SGP) and the bottom-up assessment method in the corrective arm. From a methodological point of view, it is important to review alternative methods, since they measure the budgetary position using fairly different criteria. As a result, they provide an opportunity to assess the reliability of the various methods and the significance of their underlying assumptions. Unlike the SBP, both the expenditure rule and the bottom up assessment evaluate potential production in the medium-term; cyclical expenditure items are subtracted from public expenditure more directly than in assessments based on an output gap or standard cyclic elasticity, and the revenue trend is measured based on the observed decisions on the revenue basis and assessments of their effects.

Alternative indicators already form part of the EU’s control of financial policy. Understanding of the practicality of the various methods is also needed due to the fact that the EU rules on financial policy leave much room for selecting the indicator used to guide financial policy (although the output gap method still plays a fairly central role within the rules). In the preventive arm of the SGP, the actualisation of the MTO is assessed not only by output-gap-based SBP, but also by the expenditure rule. According to the expenditure rule, public expenditure may only grow at the same rate as the potential medium term GDP used as the reference.<sup>4</sup> In the procedure for excess deficit, the effectiveness of corrective measures is assessed not only via the SBP, but also in terms of the number of discretionary measures in question. In practice, such an assessment is based on a method that very closely resembles the expenditure rule. Using this method, cyclical items are eliminated from the expenditure trend, which is then compared to the medium term growth of potential production, taking account of changes in the revenue basis (bottom up assessment).

For the analysis of alternative methods, I have collected a new historical time series on the effects of the changes on the revenue basis of the entire public economy (the state, local administration and social funds). Using this time series, I review the operation of the alternative methods over the last three decades.

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<sup>3</sup> A similar conclusion is presented by e.g. Hetemäki (2015).

<sup>4</sup> In addition, in countries where the medium-term goal set for SBP has not been met, the rate of expenditure increase must remain lower. If the rate of expenditure increase is faster than the reference, the excess amount must be compensated for with discretionary measures affecting revenue.



The results produced by the application of the expenditure rule and bottom up assessment methods are encouraging. Financial policy based on them could have been more countercyclical than that based on output-gap-based SBP. Financial policy based on the expenditure rule would have been contractionary, especially during the lead up to the 1990s crisis, which could have helped to alleviate the crisis and increase the margin for recovery measures during the crisis. On the other hand, based on a discretionary bottom-up assessment, the contractionary financial policy practised from 1992 onwards would have been sufficient, and unlike the output-gap-based SBP, the method would not have generated additional contractionary pressures. Furthermore, in spite of their different assumptions, the methods provide a fairly uniform view of the magnitude of discretionary measures.

In sum, it appears that parallel indicators are needed, even though their use maintains the current complexity of the rules and increases the margin for their interpretation. The effects of individual policy changes and the development of the long-term growth potential of the national economy should be assessed when measuring financial policy, even if such measurement includes challenges. On the other hand, there is no reason to ignore established methods of analysing economic under-utilisation, especially by means of inflation, even though methodological challenges have been encountered when such methods have been applied in practice. Long-term growth estimates calculated using discretionary methods do not offer as clear a reference for the assessment of the cyclical state of the national economy as the non-accelerating-inflation rate of unemployment (NAIRU) used in the measurement of the output gap.

This paper is structured as follows: Chapter 2 provides background information about the study. I will first investigate the previous literature on the challenges associated with the measurement of output-gap-based SBP, the significance of the uncertainty of the indicators for financial policy and alternative indicators offered in the EU rules for financial policy. Chapter 3 presents the methodology of the European Commission's output gap method and its alternatives. Chapter 4 evaluates the Commission's way of measuring output-gap-based SBP and presents assessments calculated using historically alternative methods. Chapter 5 presents estimates of the number of discretionary measures based on various assumptions, compares the discretionary estimates to estimates of financial policy changes based on the output gap, and assesses the significance of this difference from the viewpoint of the EU's rules on financial policy. Chapter 6 contains the conclusions of the report.



## 2 Challenges in the measurement of structural budgetary position (SBP) and financial policy

This chapter forms the basis of the analysis presented in the subsequent chapters, by presenting a general review of recent literature on the measurement of the output-gap-based SBP as well as alternative methods, with a special emphasis on the methodological challenges involved. After this, the chapter investigates the significance of the uncertainty in the measurement of SBP from the perspective of financial policy, as well as the role of alternative methods in the EU rules on financial policy.

### 2.1 Methodological challenges associated with traditional SBP

The following examination begins with the traditional output-gap-based SBP which is used, for example, by the European Commission. Based on this method, the SBP is calculated as a cycle-neutral budgetary balance where individual expenditure and revenue items have been eliminated, i.e. as the budgetary balance of the public finances if output was at its potential level at any given moment. The assessment of the SBP is based on the assessment of the output gap. The output gap measures how far the actual financial activity is from its potential level when all economic resources are fully utilised.

After the output gap is estimated, the SBP is calculated next, taking account of the historical sensitivity of tax revenue and public expenditure to fluctuations in the output gap. This is assessed as the difference between the actual financial position and cyclic effects divided by GDP:

$$RRA_t = \frac{R_t - G_t}{Y_t} - \epsilon * OG_t - OO_t,$$

where  $R_t$  is public sector revenue,  $G_t$  is public sector expenditure and  $Y_t$  is the nominal GDP at year  $t$ . The cyclic correction is the product of the output gap ( $OG_t$ ) and the elasticity between the output gap and budgetary balance  $\epsilon$ . In the method used by the Commission, the output gap is determined in proportion to the production potential of the entire national economy, and elasticity  $\epsilon$  is assumed to be a constant. In addition, the budgetary balance is adjusted in proportion to GDP by using the effect of certain one-off revenue and expenditure items ( $OO_t$ ).

#### Challenges in the measurement of the output gap and potential production

Traditionally, the calculation of the output gap has been based on production trends. The balanced development of the economy is assessed by forecasting the long-term growth trend of the economy and then comparing actual economic development to this trend. The methods used for measuring the trend are highly diverse (see e.g. Murray, 2014). The production trend can be calculated using unidimensional statistic methods; alternatively, it can be estimated through multivariate methods based on, for example, the use of inflation (Phillips curve), unemployment (Okun's law), the capacity utilisation rate, and many other variables as auxiliary variables. The information used can be filtered by various methods that utilise cycle frequencies (e.g. Hodrick-Prescott filter, bandpass filter) or other informa-

tion-selecting methods such as principal component analysis, or the advance aggregation of auxiliary variables into indices.

The large variety of models has not yielded a solution to the problem of determining the output gap. On the contrary. As Murray (2014) and several other studies show, the various statistical models produce varying results on the magnitude of the output gap, and these results can deviate considerably from each other. Since the output gap is never observed in practice, the great unanswered question on trend measurements is related to model selection. On what grounds should the model, trend and eventually the output gap be selected?

Currently, most institutions (OECD, IMF, European Commission) calculate potential production using the production function method, which enables maximally efficient utilisation of the available research information on production technology and the behaviour of various factors of production during the assessment of the cyclic phase of the economy. The idea is to aggregate a comprehensive view of the production capacity of the economy (potential production function), based on an economic theory and observations of the state of the various components. Although the evaluation of the various elements of the production function still requires statistical methods, the output gap method offers a benefit – since it is based on an economic theory, there is an opportunity to consider how reasonable the different output gap estimates are.

In the European Commission's output gap method central to this study, the key element has been elasticity, which is sensible considering the importance of model selection (Havik et al., 2014) For example, when modelling the cyclic component of unemployment, the idea has been that the empirical model contains various known operating models of the labour market as special cases. On the other hand, allowing flexibility is not without problems. The more flexible a statistical model is, the more choices its user must make between economic theories. In most cases, the results of the model refer to the operation of a theoretical mechanism; when accepting the results, a statistician must decide whether the economic mechanism that corresponds to the observed results is a sensible one, or whether the result is indicative of the problems associated with statistical inference.

If the mechanism behind the crisis is well-known, it is obvious that the theoretical model selection criteria can help in estimating the output gap. On the other hand, the more uncertainty there is concerning the selection of economic theories, the less useful the theoretical criteria are. In the worst case scenario, false beliefs about the operations of economic mechanisms during financial crises may lead to major biases in statistical inferences.

For example, the use of the European Commission's output gap method is problematic in this respect, because economists are still disputing economic mechanisms during crises. In particular, price stickiness in major economic crises due to anchored inflation expectations or pressures not to lower wages have turned out to be problematic (IFAC, 2013; Wren-Lewis, 2013; Krugman, 2013). If the models take insufficient account of price stickinesses – or if they do not identify them correctly – the result could be excessive estimates, especially about the trend in structural unemployment during economic crises. In such a case, the output gap is underestimated, since an increase in structural unemployment (unemployment that is not directly cyclical or that permanently weakens the production capacity of the economy) does not increase the output gap.

All-in-all, the estimation of the output gap is highly sensitive to changes in estimates over time, both due to genuine uncertainty and to the difficulty of selecting the right model (e.g. (Orphanides and van Norden, 2002; Rünstler, 2002; Planas and Rossi, 2004; Golinelli, 2008; Marcellino and Musso, 2010; Bouis et al., 2012). The application of the Commission's method in the current crisis confirms this rule. For example, Virkola (2014) reviews the revisions made to the European Commission's output gap methods, and reports that the changes to output gap estimates in 2000–2013 were 1.5 percentage points on average,<sup>5</sup> and even greater at the turn of the cycle.

In practice, the change in the estimates is also a major political problem. The more the estimates change later, the more the method may be subjected to criticism of its reliability. We therefore need

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<sup>5</sup> Calculated from estimates for the current year in relation to the latest estimate.

more stable indicators. The tuning of financial policy should, in principle, be independent of economic cycles, but if tuning changes continuously during economic cycles without the making of obvious underlying decisions, it is difficult to justify its use as an indicator of cycle-independent financial policy – or at least as the only indicator.

Instead, in the methodological alternatives reviewed in this study (expenditure rule and bottom up assessment), the starting point is the growth rate of long-term potential production (European Commission, 2013A; European Commission, 2013B; Carnot and de Castro, 2015). On the other hand, the Commission's method of measuring potential production is applied in the creation of these long-term estimates. This could still present a problem, especially since the output gap method includes an assumption on the closing of the output gap, which could also generate biased forecasts in the medium term (Timmermann, 2006).

An alternative method of measuring potential production could, for example, lie in the long-term growth forecasting method used by the US Congressional Budget Office (CBO) (Schackleton, 2013; Hetemäki, 2015). In the case of Finland, on the other hand, shocks have often occurred at sector level. Thus, it may be sensible to consider an alternative whereby the development of production is estimated from the sector level upwards, using growth accounting or sector-level growth models (Pohjola, 2011; Kuusi, 2013; Fernald, 2014).

### **Changes in the SBP during financial cycles and alternatives to measuring budgetary position**

Challenges associated with the calculation of the output-gap-based SBP are not limited to the difficulty of measuring the output gap, but also relate to the difficulty of modelling the reactions of the public economy to cyclic shocks. The criticism presented below is aimed in particular at methods that use the current output gap at national economy level and fixed revenue and expenditure items associated with cyclic elasticity. The European Commission's output gap method is one such method.

Firstly, a cycle-independent budget should not contain individual expenditure and revenue items that have no clear connection to the long-term balance. Such cycle-independent changes can temporarily obscure the overview of the public finances produced by the cyclically adjusted deficit, and thus undermine the grounds for using this indicator to control financial policy. Although it is easy to eliminate one-off items from the budget in principle, problems occur when trying to define which items are temporary or large enough.<sup>6</sup> (European Commission, 2006)

Secondly, the budget balance of the public finances can depend on fluctuations in asset and commodity prices that correlate only weakly with economic cycles. As an example, pricing bubbles in the housing market can trigger changes in public finance revenue that are not taken into account in cyclically adjusted deficits (see e.g. Eschenbach and Schuknecht, 2002). In some cases, the effect of separate cycle-independent fluctuations can be adjusted using a separate cyclical adjustment. (Price and Dang, 2011)

Economic crises and their aftermaths are often associated with structural revisions that do not treat every sector and public finance revenue base equally. Adjusting for structural changes in production requires a new approach to SBP calculation, since calculations based on an aggregated output gap assume that economic upswings and downswings are symmetrical and thus neutral towards sources of tax revenue. If structural changes are major, cyclical adjustment on the aggregate level can be replaced with disaggregated methods, whereby the investigation of the output gap is replaced with investigations of individual revenue bases. The disaggregated method can also be supplemented by a review that takes account of individual expenditure items and other cyclic development (Kremer et al., 2006; Morris, 2007).

Moreover, changes in legislation may also trigger asymmetrical effects on revenue. Studies in different countries suggest that discretionary revenue changes are a significant explanatory factor for short-term cyclic elasticity (Wolswijk, 2007; Barrios and Fagnoli, 2010). Ignoring them may distort estimates of the effects of cycles on the public finances. Cyclic elasticity should therefore be measured without discretionary elements.

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<sup>6</sup> In Finland, the yields of pension funds have recently been a particular topic of discussion (Talouspolitiikan arviointineuvosto, 2015).

Finally, the budgetary position may depend on monetary policy and the increase in the interest rate of government debt (Blanchard, 1990). As the current crisis has shown, the reactions of the financial markets to economic crises can have significant impacts on the budgetary position of the public sectors. On the other hand, the interest and exchange rate policy of central banks has had a significant effect on both the funding expenses of the public sector and on economic cycles.

In all, since the method used by the European Commission is based on the aggregated output gap and fixed cyclical elasticity, it creates fairly large limitations in the measurement of the structural budgetary position. Due to economic bubbles, or growth and changes to the taxation structure, tax bases may be only weakly coupled to the development of the output gap during economic cycles. A financial crisis triggers the need to control the economy through changes to taxation or public expenditure, which can obscure the development of various tax bases in relationship to the cycle.

In this paper, I will evaluate the alternative methods (expenditure rule and bottom up assessment) recently presented as solutions to these problems (European Commission, 2013B; Carnot and de Castro, 2015). These methods directly observe perceived policy changes rather than using indirect assessments based on the output gap.

On the revenue side, the monitoring of changes in perceived economic policy is easy in principle: economic policy can be considered neutral unless new decisions are made. The combined effects of new decisions can be interpreted as a change in financial policy. The expenditure side, however, lacks a correspondingly obvious neutral reference. Instead, an increase in expenditure must somehow be aligned with other developments in the national economy. Instead of using the output gap method, changes in financial policy are measured based on the growth rate of aggregated expenditures, with various cyclical items being eliminated in proportion to the potential medium-term growth in GDP<sup>7</sup>. Depending on the method used, the elimination of cyclic expenditure items is usually more straightforward than the output gap method.

## 2.2 SBP as part of financial policy and the EU rules for financial policy

Next, I will review the significance of measuring the SBP in financial policy, with a particular emphasis on the aforementioned uncertainty. I will then present the role of alternative indicators from the perspective of the EU's rules on financial policy.

### Measurement of the SBP as part of financial policy

Structural adjustments to the financial position seek to respond to the key question in financial policy: is an economic shock structural or not. If the nature of shocks can be determined, the execution of financial policy will follow simple rules in principle (Aguar and Gopinath, 2007). For example, when the nature of a negative shock is transient, it is beneficial to compensate for it by increasing public expenditure and debt, because the change in financial position can be offset by a more contractionary financial policy during an upswing. A structural shock, on the other hand, has a long-term negative effect on growth potential and the sustainability of public finances. Therefore, in such a case financial policy should be contractionary.

Behind this simple principle there are difficult, ultimately quantitative questions about what kind of financial policy is appropriate for crisis management and long-term sustainability (Blanchard, 1990). With respect to SBP, particular problems lie in the practical difficulties of dividing economic shocks into structural and cyclic ones. For example, in a small export-driven economy like Finland's, shocks are often a mixture of both, as the economy encounters permanent structural shocks whose effects may nevertheless be temporary as the structures of the economy adapt to the change. It is also worth noting

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<sup>7</sup> The calculation principle is not new. In the early 1990s, Blanchard (1990) was already of the opinion that the problems associated with traditional cyclical adjustments (mainly expressed above) may require the use of alternative indicators for measuring the tuning of financial policy. The idea was to eliminate obviously cyclical items directly from aggregated public expenditure. According to Blanchard, a simple but effective indicator for financial policy could be based on the deficit adjusted by the increase in interest expenses and the estimated change in unemployment expenses compared to the previous year.

that a cyclical policy can even solve a prolonged crisis and, on the other hand, may have long-term effects.<sup>8</sup>

It is important to find the correct indicator to ensure the correct timing and scope of changes in financial policy. If financial policy is based on an indicator that is biased towards indicating that a crisis is structural, the resulting financial policy can easily become procyclical. When the economy encounters a positive shock, an indicator that overemphasises the structural nature of the shock will suggest that the change is permanent, which can easily lead to an excessively lax financial policy. In the case of a negative shock, financial policy based on such an indicator may become too contractionary. Since the structural nature of different shocks cannot be determined with certainty, Thwaites (2006) uses a model whereby financial policy is controlled by an indicator that corresponds to an output gap-based SBP to demonstrate that financial policy should be slow to react to shocks. The reason for this is simple. When the economy has just encountered a shock, it is more likely that the shock is temporary. As time passes and the effect does not wear off, it is more likely that the shock is structural.<sup>9</sup>

On the other hand, an indicator that is too cyclical may also create problems. During an upturn, the indicator may provide too bleak a picture of the growth potential of the economy, in which case there is little room for increasing public consumption or lowering taxes. On the other hand, emphasising cyclicity in economic crises may lead to a financial policy that is too expansionary in view of the actual debt-bearing capacity of the national economy.

The choice of indicator also affects assessment of the effects of financial policy. Studies that have used traditional indicators based on the structural budgetary position to estimate changes in financial policy have often come to the conclusion that the multiplier effect of contractionary measures on the national economy is fairly minimal (Alesina and Perotti, 1995; Alesina and Ardagna, 1998). On the other hand, recent literature has used more direct estimates based on individual decisions to determine changes to financial policy; the conclusions have been that the estimates have been too small. In particular, contractionary measures in financial policy may have stronger negative multiplier impacts on the national economy (see for example IMF, 2010; Guajardo et al., 2011).

### **Parallel indicators of financial policy in the EU rules for financial policy**

The EU rules for financial policy and their interpretations demonstrate an increasing awareness of the uncertainty associated with output gap-based SBP (European Commission, 2013B; Carnot and de Castro, 2015). Although the method plays a fairly large role – especially in the Stability and Growth Pact (SGP) – there are parallel alternative methods: the expenditure rule in the preventive arm and the bottom-up-assessment in the corrective arm. I will now briefly present the role of the different indicators in the rules, based on an article by Henriksson and Leino-Sandberg (2014).<sup>10</sup>

The preventive arm of the SGP (applied when the 3 and 60 per cent deficit and debt criteria of the excessive deficit procedure criteria are not breached) uses the structural budgetary position and the increase in expenditure to assess deviations from the medium-term objective (MTO)<sup>11</sup> or from the path

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<sup>8</sup> A good example of the first case is the liquidity trap: a national economy can be trapped in an equilibrium between deflation and a high unemployment rate, when monetary policy and financial policy do not react sufficiently and in time to deflationary developments in the economy (Evans et al., 2008). E.g. DeLong and Summers (2012) are of the opinion that large negative output gaps have a permanent impact on the production potential of the economy through the long-term effects of unemployment and, for example, neglecting investments in product development and education. For example, IMF (2012) estimates that if the output gap increases by one percent point per year, the effect on potential production could be a decrease of 0.1 percentage points, mainly due to labour market hysteresis.

<sup>9</sup> Thwaites (2006) is also of the opinion that the faster the market loses its faith in financial policy, the faster contractionary measures should be undertaken.

<sup>10</sup> The background consists of the methods identifiable after the recent revisions: the excessive deficit procedure, the SGP preventive arm and the significant deviation procedure therein, the preventive arm of the macroeconomic imbalance procedure and the excessive macroeconomic imbalance procedure. (for more details, see Henriksson and Leino-Sandberg, 2014).

<sup>11</sup> The MTO links the rules to the long-term sustainability assessments of the public economies, since the MTO is evaluated every 3 years as based on a long-term sustainability indicator that estimates the level of debt of public economy and the ageing of the population. In this paper, I will review the cyclic structural adjustment only. For more information on the estimation of the MTO, see European Commission (2013A).



towards it. The Fiscal Compact obliges the member states to set an MTO; as a result, this obligation is included in their national legislation. In the Fiscal Compact, the lower limit of the MTO for countries in the Eurozone was set to a budgetary position of -0.5 percent, except in the case of countries whose debt is less than 60% and which do not have long-term sustainability risks (in which case the lower limit is -1 per cent).<sup>12</sup>

The increase in expenditure is associated with the achievement of the MTO via the expenditure rule. The purpose of the expenditure rule is to ensure that the countries remain committed to the MTO or a path of adjustments leading to it. According to the expenditure rule, countries which have attained the MTO may not increase their expenditure rate beyond the potential medium-term growth rate of the GDP used as the reference. In countries that have not attained the MTO, the expenditure growth rate must remain lower. If the rate of expenditure increase is faster than this, the excess amount must be compensated for through discretionary measures affecting revenue.

In the corrective arm of the SGP, the indicators are used as part of the excessive deficit procedure, when the 3 and 60 per cent deficit and/or debt criteria are breached.<sup>13</sup> In such a case, the Council makes a decision on an excessive deficit and approves recommendations for the member state to amend such a deficit. These recommendations define a path towards a nominal deficit, the required annual improvement of the structural deficit (usually 0.5 per cent of GDP) and the deadline for amending the excessive deficit. In the corrective arm, the parallel status of the various indicators for budgetary position becomes visible when the actualisation of the required adjustments is assessed. In such a case, the decision is based on a careful consideration that not only takes direct account of the sensitivity analysis of the output gap method (a 'top-down' assessment), but also of the adequacy of the measures, which are assessed using a method corresponding to the expenditure rule ('bottom-up' assessment) (European Commission, 2013A, p. 67).

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<sup>12</sup> Detailed numerical values are presented in chapter 5.

<sup>13</sup> According to Article 126(2) of the Treaty on the Functioning of the European Union, the Commission uses various criteria to assess the state of the public finances of Member States. The assessment is made on the basis of whether the ratio of the planned or actual deficit in the public finances exceeds a certain reference value, unless the ratio has declined substantially and continuously and has reached a level that comes close to the reference value, or the excess above the reference value is exceptional and temporary in nature only and the ratio remains close to the reference value, or whether the debt ratio exceeds a certain reference value, unless the ratio is diminishing sufficiently and approaching the reference value at a satisfactory pace.



## 3 Methodology for measuring the budgetary position

In this chapter, I will present the method of measuring SBP based on the European Commission's output gap method (Havik et al., 2014; Mourre et al., 2013) and its discretionary alternatives. The first method presented in this paper is the output gap method. I will first present the output function defined in the method, and will then review its components in more detail. Of the components, I will concentrate on examining unemployment and total factor productivity, since they play a central role in the output gap method and offer the greatest opportunities for a review from an economics point of view. I will also present a method for making structural adjustments. At the end of the chapter, I will present the methodological alternatives: the expenditure rule and the bottom up assessment method.

### 3.1 SBP using the Commission's output gap method

#### 3.1.1 Production function and its division into various factors

The starting point of the Commission's calculation method is the production function calculated for the entire national economy. I will assess the magnitude of the function later using the potential maximum level, i.e. when the economy's resources are fully utilised (Havik et al., 2014). The production function is assumed to have a Cobb-Douglas formulation and can be presented as

$$Y_t = (U_{Lt}L_tE_{Lt})^\alpha(U_{Kt}K_tE_{Kt})^{1-\alpha} = TFP_tK_t^\alpha L_t^{1-\alpha},$$

where  $Y_t$  is total production,  $L_t$  total labour,  $K_t$  physical capital base. The use of each production factor is controlled by their utilisation rate ( $U_{Lt}$ ,  $U_{Kt}$ ) and the efficiency of use ( $E_{Lt}$ ,  $E_{Kt}$ ). The parameter  $\alpha$  measures the share of labour input of all inputs. Labour input is measured as the total number of work hours, and capital is measured as the amount of capital services, divided into buildings and equipment.<sup>14</sup> The Cobb-Douglas production function still allows total factor productivity to be examined separately as the weighted product of efficiency and the utilisation rate.

$$TFP_t = (U_{Lt}E_{Lt})^\alpha(U_{Kt}E_{Kt})^{1-\alpha}.$$

In recent years, the nature of the production function has been examined in several studies concerning Finland. Jalava et al. (2006) state that the Cobb-Douglas production function may be statistically applicable in the long-term, but not completely adequate for describing Finland's production since World War II. Luoma and Luoto (2010) are of the opinion that a more suitable production function would be the CES (Constant Elasticity of Substitution) production function, whereby the proportions of production inputs may vary as their relative prices change.

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<sup>14</sup> A more detailed assessment of the methods used to measure the amount of inputs is not presented here. For a review of the measuring methods, see, for example, Virkola (2013).



A key question when selecting a production function is that of how technological development affecting production factors – capital and labour – changes the quantity of inputs adjusted for technological development, and their nominal proportion in production. Research on Finland indicates that, in the long-term, the proportions of the inputs change: the input proportion of the production factor that becomes cheaper (capital) reduces in proportion to the factor that becomes relatively more expensive, and on the other hand, technological development may support the growth of the amount of capital more than it raises efficiency in the utilisation of labour.

However, there are still fairly good grounds for using the Cobb-Douglas production function in short-term output gap calculations (Havik et al., 2014). First of all, when applied during a crisis, the C-D production function may provide a good estimate of the CES production function, even if the predictions generated by the C-D production function would not work in the long term. According to the Commission, the Cobb-Douglas production function provides a fairly good estimate of the CES production function when the substitution elasticity of production factors is between 0.8 and 1.2. Moreover, within labour input, the substitution elasticity of low-educated and highly educated labour force in relation to capital might be different so that, in practice, the C-D production function can offer a reasonable estimate of total elasticity.

On the other hand, during a crisis it is very difficult to assess technological development supporting various production factors and the change in respective input proportions. The effect of trends that are often weak but that affect the production function in the long term is dominated by the effect of a crisis on the profitability, efficiency and product demand of companies. For example, the reduction in the profitability of companies during a crisis has a direct diminishing effect on the estimate of the nominal proportion of capital in production, which is thus a quantity that is highly sensitive to economic cycles.

All in all, developing the production function method towards an approach that – in conjunction with the measurement of potential production – takes account of the direction of technological development and sector-level changes in the public economy, would constitute an important research topic. However, in this paper I will concentrate on reviewing the aggregate production function suggested by the Commission.

The output gap can be divided further into different components. When the potential magnitude of the components of the production function is known, the percentual deviation from potential can be approximately estimated as the difference between the logarithms of the components.

$$LN(Y_t) - LN(Y_t^{pot}) = LN(TFP_t) - LN(TFP_t^{pot}) + (1 - \alpha)(LN(L_t) - LN(L_t^{pot})).$$

It is worth noting that, in the output gap calculation, the capital base is not adjusted separately in line with the status of the economic cycle. Instead, the efficiency of the use of the capital base is estimated as part of the total factor productivity term. Moreover, the quantity of potential workforce is divided further into several components. This corresponds to the potential workforce adjusted based on the level of structural unemployment,  $NAWRU_t$ . Potential workforce is the product of the number of population of working age  $POP_t^W$ , average level of participation  $PART_t^{pot}$  and working hours per employee  $H_t^{pot}$ .

$$L_t^{pot} = POP_t^W PART_t^{pot} (1 - NAWRU_t) H_t^{pot}.$$

The following review focuses on methods of assessing structural unemployment and total factor productivity. The cyclical adjustment of participation and working hours is based on a statistical HP filter. Thus, the assessment of trends does not include a separate economic theory. The population of working age is measured based on the actual number of people of working age.

### 3.1.2 Structural component of unemployment

In the following sections, I will first review the theoretical basis for deriving the equations required in the calculation of structural unemployment Havik et al. (2014) and will then present an empirical

model based on publications Havik et al. (2014) and Planas and Rossi (2014). In the next chapter, I will empirically examine the suitability of these assumptions to the methods employed in Finland's case.

### Labour market equilibrium

To model unemployment, the Commission uses a general labour market framework whose features are ultimately estimated based on the data and correspond to the predictions of various labour market theories (Havik et al., 2014). The various theories on the creation of a labour market equilibrium include e.g. the neoclassical theory, efficiency-wage-theory, wage negotiation theory and search theory. All of these theories share a wage formation equation that can be written in logarithmic format as follows:

$$w_t - E[p_t] = m_t^w + (1 - \lambda)E[b_t] - \lambda u_t + \mu(E[y_t - l_t] - \omega E[m_t^p]) + a_{wt}. \quad (1)$$

At a given point of time  $t$ , the employee side negotiates its nominal salary  $w_t$  based on the expected inflation at a point in time  $t$ ,  $E[p_t]$ , expected reservation wage,  $E[b_t]$ , expected labour productivity,  $y_t - l_t$ , and unemployment,  $u_t$ . Based on this equation, unemployment defines wage results as a measure of labour market tightness, and the employee side sets its wage demands as a linear combination of the reservation wage and productivity of work. Moreover, the salary can be affected by a price premium variable over time,  $m_t^p$ , a wage premium,  $m_t^w$ , and a labour market shock  $a_{wt}$ . In this subchapter, all variables expressed in lower case letters are log-transformed.

Different theoretical frameworks emphasise different factors behind wage formation. Within the neoclassical and efficiency wage framework, productivity is not directly linked to the productivity term,  $\mu = 0$ , whereas in wage negotiation and search models, productivity has a direct effect,  $\mu > 0$ . In the latter models, workers have negotiating power, whereas in atomistic labour market models wages are defined by the reservation wage. In the neoclassical model, the reservation wage is defined by consumption and free-time substitution elasticity, whereas other theories emphasise the monetary effect of options outside the labour market, such as unemployment benefits or undeclared work. In the neoclassical model, the correct concept for productivity is the marginal revenue of the workforce, whereas in the negotiation models the correct concept is the average rate of return. Havik et al. (2014) examines the significance of the different assumptions in more detail, from the perspective of the estimation of structural unemployment.

Resolving the employment market balance also requires the modelling of demand for work. The equation for demand for work is the first order condition required to achieve optimal demand for work, according to which the monetary marginal revenue of a work input equals the wage:

$$w_t - p_t = y_t - l_t - m_t^p. \quad (2)$$

The right side of the equation defines the supply-based wage that a company is willing to pay for productivity  $y_t - l_t$ . On the other hand, the equilibrium condition also defines the target level of company profitability at a given wage level.

The model is still consistent with various assumptions concerning the reservation wage. In particular, it can be assumed that the reservation wage depends on productivity and the pricing premium  $m_t^p$

$$b_t = b_t^0 + (y_t - l_t) + \omega m_t^p, \quad (3)$$

where  $b_t^0$  is the logarithm of the compensation level of unemployment benefit. It is worth noting, that in the equation  $b_t^0$  can develop freely, so the equation does not limit the development of the reservation wage. Critical factors affecting this first of all include  $\omega$ , which defines how strongly the worker side takes account of monopoly profits resulting from incomplete competition. The reservation wage is affected by e.g. the scope of unemployment benefits and household incomes via the wealth effect.

When the labour market is in equilibrium, unemployment is expressed as  $u_t^*$ . In equilibrium, the labour market does not experience shocks ( $a_{wt} = 0$ ), and the assumptions concerning the different variables correspond to the actual state of affairs, in which case

$$u_t^* = \frac{m_t^w + b_t^0 + (1 - \omega)m_t^p}{\lambda}. \quad (4)$$

In the labour market, equilibrium unemployment increases in proportion to the quotient of the wage premium, reservation wage and productivity<sup>15</sup>, as well as the price premium (if the employee side does not take this fully into account, i.e.  $\omega < 1$ ).

### Deriving the empirical Phillips curve theoretically

Outside balance, the short-term state of the labour market can be assessed using the so-called Phillips curve. This curve describes the inverse proportion of inflation and unemployment. Key factors affecting the curve include assumptions about the creation of expectations.

Until recently, the European Commission used a traditional retrospective assumption on expectations when assessing the Phillips curve. At a given point in time  $t$ , economic operators base their operations on assumptions on prices during the same period. These are based on perceived inflation during the previous period  $E_t[\pi_t] = \pi_{t-1}$ . On the other hand, the development of productivity is assumed to be free of bias  $E_t[\Delta(y_t - l_t)] = \Delta(y_t - l_t)$ . The labour market equation (1) and equilibrium unemployment (4) can be used to derive an equation for the expected real wages as a function of unemployment and expected productivity:

$$w_t - E_t[p_t] = E_t[y_t - l_t] - \lambda(u_t - u_t^*) + a_t^w. \quad (5)$$

This equation can be used to derive NAWRU, i.e. the level of unemployment at which inflation remains constant, by inserting the assumptions on expectations into the equations. This enables the solving of an equation in which the rate of change in nominal wage inflation ( $\Delta^2 NULC_t$ ) is a function of the unemployment gap:

$$\Delta^2 NULC_t = -\lambda(u_t - u_t^*) + a_t^w. \quad (6)$$

Moreover, the traditional Phillips curve used by the Commission may include delayed unemployment gap terms and other delayed growth terms of labour productivity.<sup>16</sup> In an open economy, this model could be affected by the exchange ratio of the prices of foreign goods.

The traditional model is associated with a multitude of problems. Defined in this way, the development of unemployment should always be dependent on the acceleration of inflation, which, in practice, does not seem to be a realistic assumption in every case (Havik et al., 2014). The Commission has suggested an alternative, a so-called Neo-Keynesian Phillips curve for wages. This is derived using a model<sup>17</sup> whereby a randomly chosen proportion of employees may re-negotiate their wage during the year, whereas the rest of the wages (whose agreement term is still ongoing) are expected to develop according to retrospective index adjustments. There is a connection between negotiated salaries and employment: increasing unemployment is associated with lower wage offers. Indexed wages, on the other hand, follow the development of real unit labour costs. Expectations related to the inflation and output gap are unbiased:

$$E_t[\pi_t] = \pi_t \text{ and } E_t[\Delta(y_t - l_t)] = \Delta(y_t - l_t).$$

When it is assumed that unemployment will follow the second order autoregressive process, as in the United States, on an annual level, the relation can be written out as an empirically testable equation as follows:

<sup>15</sup> I.e. the difference between the logarithms.

<sup>16</sup> Their use is justified when the forecasts are rolling averages based on previously perceived inflation and expectations on productivity include uncertainty, in which case expectations are based on previous figures on productivity. These variables are presented in the method assessment section of the next chapter.

<sup>17</sup> For more details, see Gali (2011).

$$RULC_t = \alpha + \gamma RULC_{t-1} + \psi_0(u_t - u_t^*) + \psi_1(u_{t-1} - u_{t-1}^*) + e_t, \quad (7)$$

where  $RULC_t$  is the rate of change or real unit labour costs,  $u_t - u_t^*$  is the cyclical component of unemployment and  $\alpha$  is a term that includes various long-term relations (such as the average rate of the increase in productivity).

The following relations apply to the variables of the equation:  $\psi_0 < 0$  means that real unit labour costs can be expected to decrease when unemployment is at a high level. First of all, the magnitude of the parameter depends on the length of the agreement terms: if the terms are long, wage inflation is only slightly dependent on unemployment. On the other hand, if unemployment is highly path-dependent,  $\psi_0$  is large, which implies that the wage level has already adjusted to unemployment. Due to self-correcting forces in the economy,  $\psi_1$  can be expected to be positive. In equation (7),  $\gamma$  indicates the weight attributed to the index variable in the agreement negotiations (development of the unit labour costs of the previous year) compared to the long-term development of wages, which remains part of the constant term  $\alpha$  within the equation. Strong indexing generates greater autocorrelation within the wage inflation variable.

Finally, it should be stated that the recent literature suggests that the behaviour of inflation does not necessarily correspond to the Neo-Keynesian Phillips curve, even though it includes a delayed inflation term. For example, Stock and Watson (2010) are of the opinion that, in the US, an increase in unemployment does decrease inflation, but this effect wears off when a higher level of unemployment has lasted for 11 quarters. One of the underlying causes of this could be anchored inflation expectations, whose effects during the euro crisis are a topic of discussion, see for example Krugman (2013). Wage inelasticities (for example, pressure not to reduce nominal wages) can affect the relation between inflation and unemployment in such a way that it does not correspond to the Neo-Keynesian Phillips curve. (Daly and Hobijn, 2013). In Finland's case, there is clear evidence of fairly substantial wage inelasticity in the crisis of the early 1990s (Gorodnichenko et al., 2012).

### Estimation method

In order to estimate long-term equilibrium unemployment, the Commission's method solves a two-variable equation system based on Kuttner's (1994) method (Planas ja Rossi, 2014). The method breaks unemployment down into its structural and cyclical components, of which the cyclical component has an accelerating or decelerating effect on inflation, whereas the structural component has a permanent effect on unemployment, and it is inflation-neutral.

In the following review, the function forms and assumptions are the same as the assumptions concerning Finland in the forecast for autumn 2014. The first equation of the model is a regression model with structural time series error terms

$$u_t = \sum_{i=1}^{M_1} \alpha_{1i} z_{1it} + x_t, \quad (8)$$

where  $z_{1t}$  are exogenous variables. The error term  $x_t$  is a sum of the trend component  $p_t$  and cyclic component  $c_t$ , so that

$$x_t = p_t + c_t. \quad (9)$$

The cyclical component is defined as the AR(1) model:

$$c_t = \phi_{c1} c_{t-1} + a_{ct}, \quad (10)$$

where  $a_{ct}$  is a cyclical shock term with a variance of  $V_c$ .

With regards to Finland, a trend shock is modelled in the reviewed Commission's method as a second order random walk defined by the following equations

$$p_t - p_{t-1} = \mu_{t-1} + a_{pt} \quad (11)$$

$$\mu_t - \mu_{t-1} = a_{\mu t} \quad (12)$$

The equations  $a_{pt}$  contain a shock that affects trends directly and has a white noise distribution. Its variance is  $V_p$ . The second shock  $a_{\mu t}$  affects the slope of the trend and is also white noise. Its variance is marked as  $V_\mu$ .

Another equation used in the method is the Neo-Keynesian Phillips curve (equation 7 in the previous subchapter), that can be expressed more concisely as  $u_t - u_t^* = c_t$ :

$$RULC_t^w = \alpha + \gamma RULC_{t-1}^w + \psi_0 c_t + \psi_1 c_{t-1} + e_t,$$

A difference compared to the traditional method of estimating a Phillips curve lies in the assumption that the cyclical component  $c_t$  cannot be perceived. Instead, the problem with a statistical method of calculation is the assessment of unperceivable variables  $p_t^f$  and  $c_t$  using the maximum likelihood method and the so-called Kalman filter. A more detailed description of the method is presented by Planas and Rossi (2004), and Planas and Rossi (2014). These papers contain descriptions of the closed form solution for an estimator and of deriving the confidence intervals for forecast errors.

### 3.1.3 Structural component of total factor productivity

The total factor productivity term is also broken down into a cyclical and structural component. Unlike for unemployment, no precisely described theoretical model can be invoked to justify the breakdown. Instead, it is assumed that the cyclical term depends on the under-utilisation of economic resources, which is measured using the capacity utilisation rate series. Furthermore, by making various assumptions about the duration of the effects of various shocks, it may be possible to identify the cyclical component of the overall factor productivity series. Next, I will present an empirical model based on Havik et al.(2014) and Planas and Rossi (2014).

#### Estimation method

In the following review, the function forms and assumptions are the same as the assumptions concerning Finland in the forecast for autumn 2014.

Like NAWRU, the magnitude of the structural component of total factor productivity is estimated using a model containing two dependent variables. The first dependent variable is the logarithmic transformation of total-factor productivity, which is broken down into a cyclical and structural component like unemployment in equation 9 above:

$$tfp_t = p_t^f + c_t. \quad (13)$$

Since the cyclical component of total factor productivity is dependent on the capacity utilisation rate, which in turn is dependent on the cyclical indicator, the connection between the cyclical component of total factor productivity and the indicator can be expressed as:

$$cu_t = \mu_U + \beta c_t + e_{cut}, \quad (14)$$

where the lowercase letters indicate log-transformed variables.  $e_{U_t}$  is a dynamic shock term that conforms to the AR(1) process  $e_{cut} = \delta e_{cut-1} + a_{cut}$ .

As in the case of unemployment, total factor productivity is driven by an undetected dynamic trend component, which in the case of Finland is expected to follow a dampened trend model

$$\begin{aligned} \Delta p_t &= \mu_{t-1} \\ \mu_t &= \omega(1 - \rho) + \rho \mu_{t-1} + a_{\mu t} \\ c_t &= 2A \cos \left[ \frac{2\pi}{\tau} \right] c_t - A^2 c_{t-2} + a_{ct} \end{aligned} \quad (15)$$

where  $\mu_t$  is an undetected trend component. The shocks  $a_{cut}$ ,  $a_{\mu}$  and  $a_{ct}$  follow a white noise process with variances  $V_{cut}$ ,  $V_{\mu}$  and  $V_c$ . The cycle frequency  $\tau$  and the strength  $A$  of the cycle is defined in the last equation (15) of the system of equations.  $\omega$  is the average growth rate of long-term total factor productivity in the model.

The calculation of total factor productivity is carried out using a Bayesian method of calculation, which means that the final selection of a model is based not only on the distribution of likelihood generated by the data, but also on the preset probabilities of parameter values (prior probability distributions). These a priori beliefs can be based on economic theory or previous empirical research. Prior probability distributions enable the re-weighting of maximum likelihood estimates, leading to a final understanding of the expected values of the parameters (posterior probability distribution).

Unlike the maximum likelihood method, the posterior probability distribution used in the model does not include a closed form solution. Instead, the estimate is based on solving Markov chains using the Monte Carlo method, whereby parameter values are changed in order to simulate a posterior distribution via a so-called Gibbs sampling. For a more detailed description of this method and its use in the assessment of the reliability of forecasts, see Planas and Rossi (2014) and Havik et al. (2014).

### 3.1.4 Output-gap-based SBP using the Commission's method (fixed elasticity)

As stated above, the SBP is determined as the difference between the actual budget position and the cyclical effect in proportion to GDP.

$$RRA_t = \frac{R_t - G_t}{Y_t} - \epsilon * OG_t - OO_t$$

where  $R_t$  is public sector revenue and  $G_t$  is public sector expenditure,  $Y_t$  is the nominal GDP. The cyclic correction is the product of the output gap ( $OG_t$ ) and the (semi)elasticity between the output gap and budgetary balance  $\epsilon$ .<sup>18</sup> In addition, the budgetary balance is adjusted in proportion to GDP by using the effect of certain one-off revenue and expenditure items ( $OO_t$ ).

Based on the traditional method used by the Commission, elasticity is assumed to be constant and divisible into expenditure and revenue elasticity. Let us define elasticity

$$\epsilon = \frac{d\left(\frac{B}{Y}\right)}{\frac{dY}{Y}} = \frac{d\left(\frac{R}{Y}\right)}{\frac{dY}{Y}} - \frac{d\left(\frac{G}{Y}\right)}{\frac{dY}{Y}} = \frac{\left(\frac{dR}{dY} - 1\right)R}{Y} - \frac{\left(\frac{dG}{dY} - 1\right)G}{Y} = \frac{(\eta_R - 1)R}{Y} - \frac{(\eta_G - 1)G}{Y},$$

where  $\eta_G$  describes expenditure elasticity and  $\eta_R$  revenue elasticity in proportion to the output gap. At the moment, the estimated elasticity in Finland's case is 0.57.

On the revenue side, elasticity is further based on the empirically measured elasticity of various revenue items (personal taxes, corporate taxes, social security fees and other fees). These correspond to the historically observed average percentual change in the revenue item in proportion to the change in the output gap. Individual elasticities are aggregated further into total revenue elasticity according to their share of revenue. Subtracting 1 from the elasticity gives the elasticity of total revenue, and multiplying this by revenue as a proportion of GDP yields the total revenue elasticity in proportion to the output gap.

Likewise, on the expenditure side, the Commission uses OECD's estimates on the unemployment-based cyclical elasticity of expenditures. Again, when 1 is subtracted from the elasticity, the result is the cyclical elasticity of the relation between unemployment expenditures and GDP. Multiplied by unemployment expenditure as a proportion of GDP, this yields the desired elasticity.

<sup>18</sup> The semi-elasticity of budgetary balance (hereinafter simply referred to as elasticity in this context) refers to the change in the GDP ratio of the budgetary balance as a reaction to a change in an output gap. In this case, SBP refers to a budgetary position in a situation where the production is at the potential level when  $\epsilon$  is semi-elasticity. On the other hand, the elasticity of the budget balance has typically meant the direct elasticity of the budget balance in proportion to changes in GDP. (Mourre et al., 2013)



The (total) cyclical elasticity of the budget can be rewritten as

$$\epsilon = \epsilon_R - \epsilon_G = \frac{(\eta_R - 1)R}{Y} - \frac{(\eta_G - 1)G}{Y} = \frac{\left(\sum_{i=1}^5 \frac{\eta_i R_i}{R} - 1\right)R}{Y} - \frac{\left(\frac{\eta_{G_u} G_u}{G} - 1\right)G}{Y}.$$

The elasticities required to calculate cyclical elasticity are thus the cyclical elasticities of different revenue classes,  $\eta_i$ , unemployment expense elasticity,  $\eta_{G_u}$ , the weights of different revenue and expenditure items within total revenue and expenses, and the amounts of total expenditures and revenues in relation to nominal GDP.

I will not present the details of the calculation methods of elasticities here; they can be found in e.g. Virkola (2013) and Mourre et al. (2013).

### 3.2 Methodological options: expenditure rule and bottom up assessment

I will next present alternative indicators for financial policy. These comprise the expenditure rule within the preventive arm of the SGP, which is defined in the Commission's vade mecum guideline (European Commission, 2013A). The purpose of the expenditure rule is to ensure that the countries remain committed to the MTO or a path of adjustments leading to it. On the other hand, the excessive deficit procedure in the SGP's preventive arm assesses the outcomes of actions that seek to correct the budgetary position by e.g. means of a bottom up assessment, which very closely resembles the expenditure rule in the preventive arm in methodological terms. The latter indicator is discussed by e.g. the European Commission (2013B) and Carnot and de Castro (2015).

In both the expenditure rule and bottom up assessment the goal is to determine the tuning of financial policy to the greatest extent possible by utilising micro-level (i.e. observed changes in tax bases) materials. The change in financial policy is assessed as the change in the increase of expenditures in relation to the growth potential of the economy, when account is taken of changes made to the revenue bases.

The revenue side is assessed in a completely discretionary manner, but on the expenditure side the assessment is performed in relation to the long-term growth forecasts of potential production. Thus, financial policy is not viewed in complete isolation from potential production (and the output gap). The reason for this is that the expenditure side does not know what the balanced growth rate of expenditures should be. As the economy grows, it is natural for public expenditure to grow as well. However, the approach to growth consists of a longer-term perspective of the growth potential of the economy rather than a short-term output gap.

In the case of the expenditure rule, revenue base changes and various cyclical items are subtracted from public expenditure.

$$E_t = G_t - INT_t - EU_t - (I_t - I_t^{KA}) - UC_t \quad (16)$$

where in year  $t$ ,  $G_t$ , is total public economy expenditure,  $INT_t$  interest expenses,  $EU_t$  the country's share of EU structural fund projects,  $I_t$  public investment expenditure,  $I_t^{KA}$  average public investment expenditure in the ongoing year and 3 previous years and  $UC_t$  cycle-related changes in unemployment expenditure. Unemployment expenditure due to economic cycles is assessed based on an estimate of the magnitude of cyclical unemployment (derived from the magnitude of structural unemployment) and average unemployment expenses per unemployed person.

The change in adjusted aggregated expenditures is calculated further, taking account of the discretionary change in revenue  $N_t^R$  (and certain expenses funded by earmarked revenue) in such a way that the proportional change in expenses is

$$\frac{\Delta E_t}{E_{t-1}} = \frac{E_t - N_t^R - E_{t-1}}{E_{t-1}}.$$

The growth rate of expenses is deflated using the price change in GDP. Using the method of calculating the expense rule, inflation is measured as the average of the Commission's spring and autumn inflation forecasts. Let us express the real change as  $\frac{\Delta e_t}{e_{t-1}}$ .

The estimate of growth potential is based on the potential change in the amount of production by the national economy in the medium-term. When the growth rate of expenditure equals the potential growth rate of production, the economy does not include a tendency to increase or decrease public demand in proportion to GDP in the medium-term. Based on the Commission's suggestion, the potential growth rate is defined as the average based on observations of the growth rate of potential GDP during the last 5 years and forecasts of the growth rate for 4 years into the future.

$$\frac{\Delta_t^{pot} e_t}{e_{t-1}} = \left( \left( \frac{Y_{t+4}^*}{Y_{t-5}^*} \right) - 1 \right)^{\frac{1}{10}}, \quad (17)$$

where  $Y_t^*$  is potential (real) production at a point of time  $t$ .

When the adjusted expenditure aggregate has been calculated, its real growth  $\frac{\Delta e_t}{e_{t-1}}$  can be compared to the growth potential of the national economy  $\frac{\Delta_t^{pot} e_t}{e_{t-1}}$ . A useful result is that the growth of expenditure aggregate must undershoot the reference growth rate by  $x * \frac{1}{E_t/Y_t}$  to have the corresponding proportion of expenditure to GDP fall by  $x$  per cent, where  $E_t/Y_t$  is the nominal GDP proportion of the expenditure variable used.

In a bottom-up estimate, the definition of the adjusted expenditure aggregate is slightly different. The expenditure aggregate is defined by first subtracting the non-discretionary unemployment expenditure ( $U_t^{nd}$ ), interest expenses of public bodies ( $I_t$ ) and one-off expenditure items ( $OO_t$ ) from the total expenditure of public bodies ( $G_t$ ):

$$E_t^{BU} = G_t - U_t^{nd} - I_t - OO_t. \quad (18)$$

The change rate of expenditure is estimated as above

$$\frac{\Delta E_t^{BU}}{E_{t-1}^{BU}} = \frac{E_t^{BU} - N_t^R - E_{t-1}^{BU}}{E_{t-1}^{BU}}.$$

The discretionary fiscal effort ( $DFE_t$ ) resulting from the *nominal* difference between the expenditure variable and reference growth indicates their impact on the change in the proportion of expenses in GDP between the years  $t$  and  $t-1$ . I define DFE in the same way as the European Commission (2013B) and Carnot and de Castro (2015), as the difference between growth rates divided by the GDP ratio of the expense indicator, as follows:

$$\begin{aligned} DFE_t &= -\frac{\frac{\Delta E_t^{BU}}{E_t^{BU}} - \frac{\Delta_t^{pot} E}{E_{t-1}}}{\frac{Y_t}{E_t^{BU}}} = -\frac{E_t^{BU} - N_t^R - E_{t-1}^{BU}}{Y_t} + \frac{\frac{\Delta_t^{pot} E}{E_{t-1}} E_{t-1}^{BU}}{Y_t} \\ &= \frac{N_t^R}{Y_t} - \frac{E_t^{BU} - E_{t-1}^{BU} - \frac{\Delta_t^{pot} E}{E_{t-1}} E_{t-1}^{BU}}{Y_t} = DFE_t^R + DFE_t^E, \end{aligned} \quad (19)$$

where the reference growth of potential production is now defined as nominal  $\frac{\Delta_t^{pot} E}{E_{t-1}} = \left( 1 + \frac{\Delta_t^{pot} e_t}{e_{t-1}} \right) * \frac{P_t}{P_{t-1}} - 1$ . In the last breakdown, the indicator is further divided into the impact of revenue base changes ( $DFE_t^R$ ) and the change in expenditure related to potential ( $DFE_t^E$ ).

Subject to reservations due to the differences in the methods, both the DFE indicator and SBP can measure the same cycle-independent change in the budgetary position. If the DFE indicator is positive by 1 percentage point, the growth rate of expenditure (with an adjusted



expense aggregate and taking the revenue side into account), is estimated to be so slow that the budgetary position is strengthened on a discretionary basis by 1 percentage point.

The theoretical connection between the output-gap-based SBP and the DFE indicator defined by aggregated expenditures used in a bottom up assessment has been reviewed by the European Commission (2013B, box III.2.1) and Carnot and de Castro (2015, Appendix 1).<sup>19</sup> In principle, the indicators are equivalent: During long-term growth equilibrium where the elasticity of revenue and expenditure items are close to the averages estimated using the fixed elasticity method and economic growth remains stable, highly similar results should be yielded by the different methods. However, differences may appear in the case of a large shock. Based on the breakdowns of the two indicators, it becomes apparent that the differences on the revenue side are explained by changes in expenditure elasticity in cycles (such as windfall revenue), deviations of income class proportions from their fixed shares according to the fixed elasticity method, and the changes generated by potential output in the long-term ratio of revenue and GDP (which are only generated in the case of the output gap method). Of the above, changes in cyclical elasticities associated with windfall revenue are by far the largest explanatory factor according to Carnot and de Castro (2015). On the expenditure side, the differences are mainly explained by unemployment expenditure that cannot be directly attributed to cycles, differences in the methods of measuring potential output, and interest expenses.<sup>20</sup> When the DFE indicator is used, changes in potential production in particular wind up on the expenditure side.

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<sup>19</sup> It is not possible within the scope of this paper to present a complete breakdown describing the differences between the DFE and SBP methods. Instead, I have reviewed the key differences, not only by comparing DFE directly to RRA, but also to RRA without interest expenditures. Moreover, I have also reviewed the elasticity of revenue changes at different points in time.

<sup>20</sup> Smaller explanatory factors might include deviations in the fixed expenditure items used in the calculation of SBP, and the effect of trend-based growth of potential productivity on interest expenses and unemployment expenditure, which are only taken into account in the output gap method.



## 4 Assessment of the output gap-based method of calculating the structural balance

In this chapter, I assess the European Commission's output gap method in the case of Finland, with reference to the measurement of the two main components: structural unemployment and potential total factor productivity. On the basis of the assessment, I propose changes in the method of calculating structural unemployment in particular.

A considerable number of assessment criteria are available. The first and most natural is the statistical credibility of the model: the credibility with which a specific model describes a phenomenon, beginning with the structure selected. From the standpoint of statistical credibility, the maximum likelihood (ML) estimates conducted for the model are important. In addition, assessment of credibility also requires analyses over different time periods. Because the output gap-based structural balance is used as a real-time indicator of fiscal policy, its function at the endpoints of the data should be assessed in various cyclical conditions.

Although the model may seem credible, its use may not, in some cases, be justifiable from a theoretical standpoint. Theoretical models (for example, the labour market model) or preconceptions of the features of empirical models can be used as a basis for credibility assessment.<sup>21</sup> Furthermore, credibility can be assessed in relation to data outside the model, for example in the case of data from the labour market and from key sectors in terms of technological development. If the theory or external observations are clearly incompatible with the statistical model used, this probably means that the statistical model has been prepared incorrectly and should be altered.

### 4.1 Structural component of unemployment

#### Data

In the main, I use the data from the European Commission's autumn 2014 forecast as material. This comprises a time series on unemployment ranging from 1963 to 2016. The data between 2014 and 2016 comprises forecasts. The inflation variable used in the Phillips curve is the change in unit labour costs. The unit labour cost is equal to wage inflation less the labour productivity growth rate and the change in consumer prices. The material extends up to 2014, while the data for 2014 is the forecast by the Commission.

The data from spring 2014 also provides a number of other explanatory variables, which I use as auxiliary variables when assessing the Phillips curve. These consist of the change in terms of trade,

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<sup>21</sup> It is difficult for traditional unemployment theories to explain, for example, why growth in unemployment would lead to a rise in pay demands. If, however, the statistical model maintains – without any theoretical justification – that this would happen it is likely that the model has been defined incorrectly and the credibility of the statistical model will suffer. In such a case, the model probably lacks elements that are crucial to its functioning; the model is otherwise defined incorrectly or the results indicate problems in statistical reasoning.

which is estimated on the basis of the change in consumer prices and the GDP price ratio; the lagged change in terms of trade; the rate of change in labour productivity (GDP per number of workers); the acceleration of change in labour productivity; the lagged rate of change in labour productivity and the share of wages and salaries of GDP and its two lags. I use these to assess the effect of other explanatory variables in the spring 2014 data.

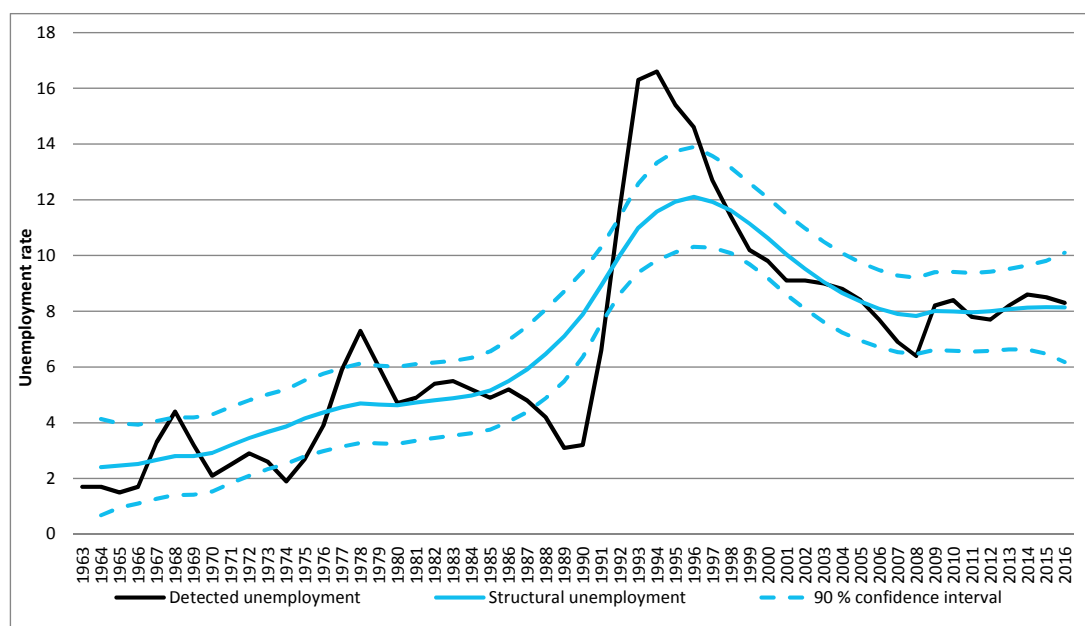
### Statistical credibility

I begin the analysis by repeating the Commission’s assessment of structural unemployment on the basis of the autumn 2014 forecast. Since I use the calculation basis and data provided on the Commission’s website, the method and the results are identical to those used in the Commission’s estimate.<sup>22</sup> It is worth noting, however, that a further adjustment of -0.72 percentage points will be made to the official structural unemployment estimate concerning Finland, which will smooth out the average structural unemployment differences between the traditional Phillips curve previously used and the New Keynesian Phillips curve currently used (Havik et al., 2014).

Figure 1 includes the European Commission’s estimate of the level of structural unemployment and an estimate produced by the model of the related statistical uncertainty (Model 1). In the figure, the evolution of the estimate is dominated by the recession at the beginning of the 1990s and the resultant hump-like rise in structural unemployment. Structural unemployment increased by approx. 7 per cent from its level in the 1980s to the level at the peak of the crisis. With respect to the 2000s, it is noteworthy that, on the basis of the estimate by the Commission, structural unemployment will increase between 2007 and 2016 by a total of approx. 0.5 percentage points. The uncertainty relating to the estimates is fairly high: the 90 per cent confidence interval is, on average, approx. 2 percentage points in any direction.

With respect to the application of the model, I paid particular attention to the parameter constraints used when determining the model.<sup>23</sup> When considering the details of the model’s solution, it is observed that the parameter constraints concern the variance of cyclical variation ( $V_c$ ), which is restricted, bound by an assumption, to a value of 0.5<sup>24</sup>. Likewise, the shock variance ( $V_p$ ) directly affecting the trend is restricted, in accordance with an assumption, to zero. Although the latter assumption

Graph 1 Commission’s estimate of the structural unemployment (model 1)



<sup>22</sup> <https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp>, where the output gap file is available.

<sup>23</sup> The parameter constraints limit the ML estimate to the user’s desired parameter range. (Planas and Rossi, 2014).

<sup>24</sup> The details of the solution are automatically saved in the software folder and the sol.txt file. The restrictions referred to appear in lines 31 and 33.

is a natural variance positivity requirement, there are no clear statistical or theoretical grounds for the first assumption.<sup>25</sup>

The constrained parameter concerns the size of the variance of the cyclical component of unemployment in so far as the New Keynesian Phillips curve does not directly explain it. The smaller the parameter, the more the estimate on the size of cyclical unemployment is based on inflation changes. Hence, the effects of parameter constraint depend on the function of the Phillips curve. If wage inflation clearly reacts to growth in unemployment, the observed connection can be turned around, and unemployment growth can, for its part, be effectively determined based on inflation.

Figure 2 shows that, in the case of Finland, explaining unemployment on the basis of inflation may be problematic. There is no clear connection between the variables, especially in the case of the crisis at the beginning of the 1990s (see Chapter 3.1.2 for possible explanations). During the years of the highest unemployment, strong wage deflation would have been required in order for such a connection to have been observed. This could not, however, be discerned on the basis of the data. The highest unemployment estimates were specifically for these years, based on the Commission's method. Wren-Lewis (2013) shares the same concern relating to the functionality of the inflation variable in structural unemployment estimates during the euro crisis.

Neither does there appear to be a clear explanation for the constraint. When examining the cyclical variance constraint by country, it can be seen that it has been given different values (see Figure 3). It is also noteworthy that in the parametrisation for Finland, the variances ( $V_p$  ja  $V_\mu$ ) in the structural components of unemployment are, in country comparisons, fairly high compared with the cyclical component  $V_c$ , which may support estimates of high structural unemployment.

Resorting to variance constraint may also involve non-stationarity of the inflation series. When the parameter constraint concerning cyclical variance is removed, it can be seen that the ML estimate for structural unemployment is considerably slower-changing, but at the same time its locus no longer seems appropriate with respect to the 2000s. Equilibrium unemployment would have been clearly higher than actual unemployment during almost the entire period. This problematic behaviour can explain why the constraint is used.

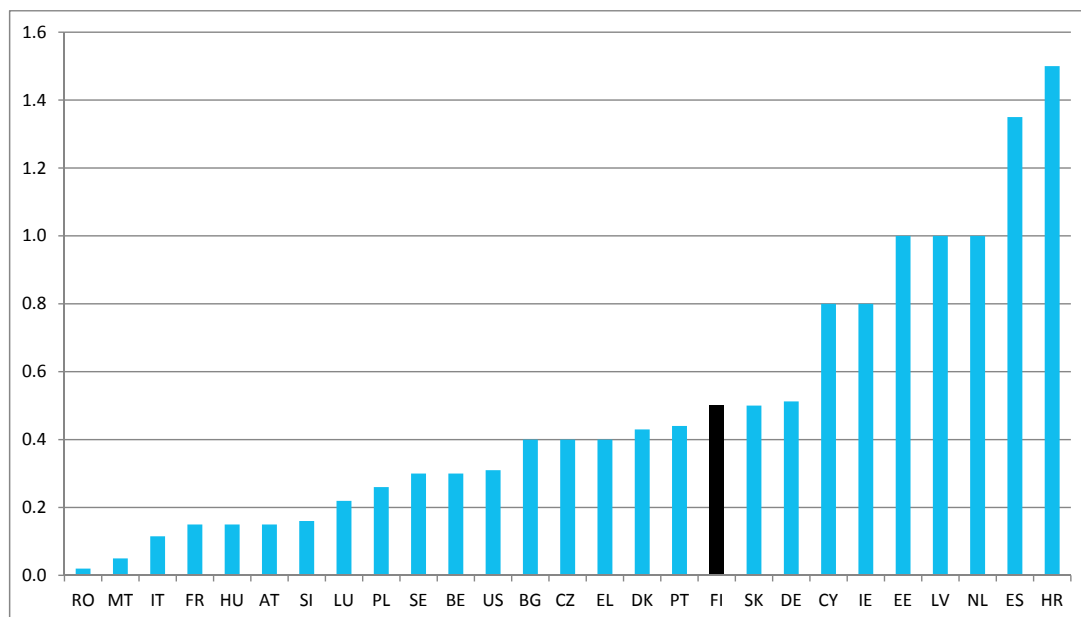
Graph 2 Phillips curve



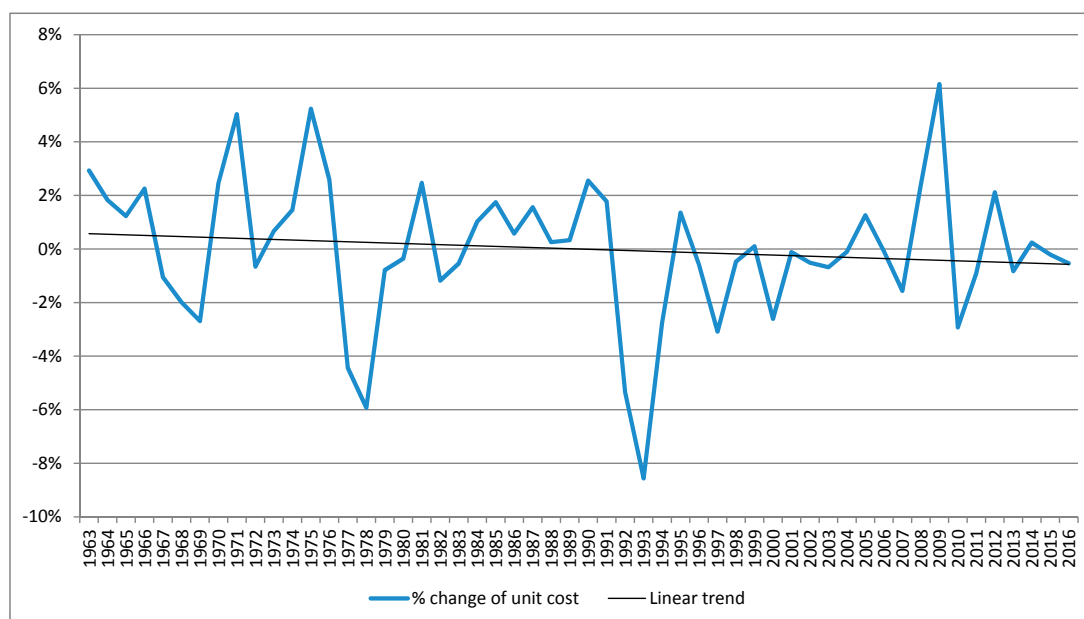
<sup>25</sup> On pages 25 to 26, Planas and Rossi (2014) mention that the GAP Program automatically sets calculation method-related constraints on variances. In the case of an observed constraint, this issue does not, however, involve an essential constraint of such a kind.

The observed behaviour may involve an inflation variable, as one of the criteria for the calculation method is that the New Keynesian Phillips curve's inflation series should be weakly stationary, i.e. its expectation and standard deviation should not change between periods<sup>26</sup>. Figure 4 indicates that there is a falling trend in the series used by the Commission (wage inflation compared with productivity growth and consumer inflation would, on average, have been higher in the 1970s and 1980s than after this period). The trend may explain the estimates of higher structural unemployment at the end of the period concerned<sup>27</sup>. When an inflation variable is not stationary, in the model the level shift occurring

Graph 3 The cyclical variance constraint by country



Graph 4 Trend in the wage inflation series used by the Commission

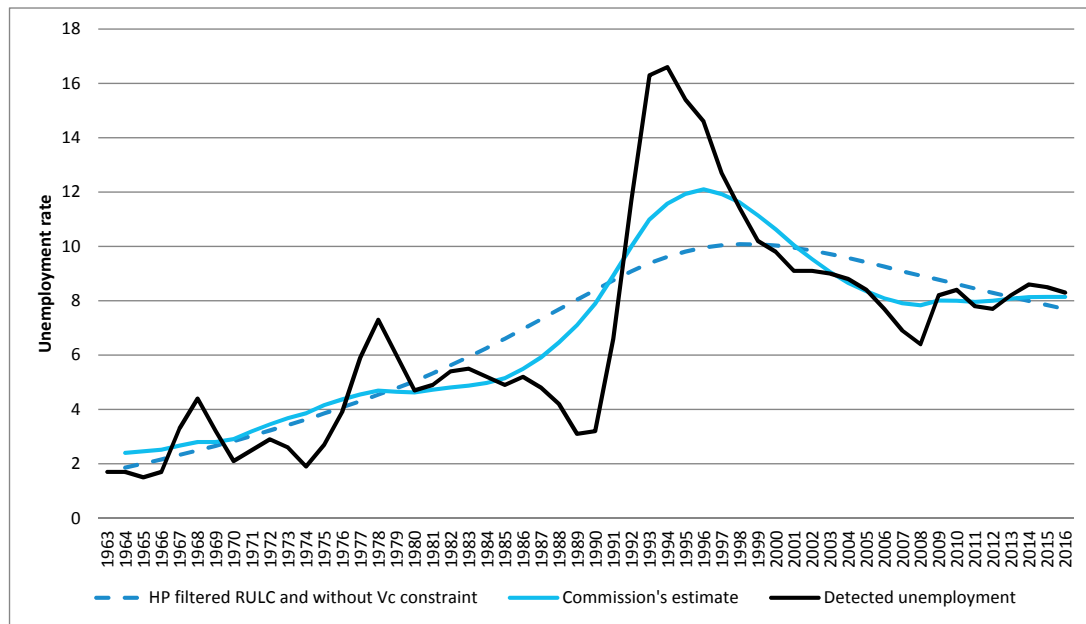


<sup>26</sup> See Planas and Rossi (2014).

<sup>27</sup> This variance, however, would not appear to change over time.

Graph 5 Different estimates of the structural unemployment

(HP filtered RULC and without Vc parameter restriction = model 2, Commission's estimate = model 1)



the relationship between the cyclical component of inflation and unemployment.<sup>28</sup>

I stationarise the inflation variable by removing the time trend with the HP filter ( $\lambda = 100$ )<sup>29</sup> and I then examine the cyclical component. Figure 5 includes an estimate of structural unemployment without a discretionary parameter constraint for cyclical variance (i.e., the constraint is set so high that it no longer binds) when a filtered HP inflation series (Model 2) has been used as an indicator series. The results show that after the removal of the constraint, structural unemployment changes considerably less in a cyclical manner in the recession of the 1990s. The difference between the estimates during the worst recession years is approximately 2.2 percentage points.<sup>30</sup> Equilibrium unemployment develops slowly and grows during periods of high unemployment, whereas in the Commission's estimate (Model 1) equilibrium unemployment begins to fall while unemployment is still high.<sup>31</sup> In alternative estimates, structural unemployment has continued to show a downward trend in the 2000s.

In assessing which model is superior, the European Commission also draws particular attention to a few technical details with respect to which there is no clear difference between the models. Firstly, the dependence between the unemployment gap and the cost variable should be significant, which means that  $\psi_0$  should be statistically significant in equation 7.<sup>32</sup> This condition is fulfilled in both the unconstrained (Model 2) and the constrained model, 1, used by the Commission. In addition, the predicted cyclical component of unemployment should correlate negatively with the component explained by means of the inflation model in such a way that, within the model, the unemployment gap creates pres-

<sup>28</sup> Likewise, statistical testing indicates non-stationarity. In testing, I used a modified Dickey-Fuller test (Stata, *dfgls*), and the results show that, using the lag structure (lags = 9) recommended by the statistical model, the existence of the unit root will not be rejected, even when a confidence interval of 10 per cent is used. It should be noted, however, that there may also be breaks in the time series (for example, the crisis at the beginning of the 1990s), which would explain non-stationarity, in which case the Dickey-Fuller test should not be used. In this case, however, I will leave the analysis of breaks for future research.

<sup>29</sup> Another popular HP filter smoothing parameter value for annual data,  $\lambda = 6.25$ , produces very similar results. The differences between the filters are in the range of tenths of a per cent (see Appendix 1).

<sup>30</sup> Because the uncertainty relating to the estimates is on the same scale in the case of both measurement methods, even if the point estimates deviate there is no actual statistical difference between the methods.

<sup>31</sup> However, the addition of other explanatory variables to the Phillips curve (with the spring 2014 forecast and data from 1965 to 2014) produced an almost identical structural unemployment estimate when using the Commission's parameters. For this reason, the results are not shown separately here.

<sup>32</sup> The equivalent symbol in the printouts from the program used by the Commission is  $\beta$ .

sure to lower price levels. In both models, the correlation is negative (-0.58 in model 2). Moreover, the model's coefficient of determination for changes in inflation should be as high as possible in equation 7. In neither model (Model 1 used by the Commission nor the unconstrained model, 2) does the coefficient of determination rise very high. When inflation is explained based on the component predicted by the model, the coefficient of determination is  $R^2 = 0.2$  in the constrained model, 1, used by the Commission, whereas the coefficient of determination used in the unconstrained model, 2, is  $R^2 = 0.16$ .

Finally, it is worth noting in terms of the selection of the trend model assumption (equations 11 and 12) in the case of the alternative model, 2, that both autoregressive terms of trend  $p_t$  are significant.<sup>33</sup>

### Observations outside the model

On the basis of the above estimate, it would appear that the estimation of unemployment is not without its problems. In particular, the use of the Phillips curve in modelling unemployment together with parameter constraints raises the question of whether or not the estimates are unbiased.

In order to better assess the Commission's method, its results should be considered in relation to the previous literature. For example, on the basis of the IMF's (2012) estimate (a change in the output gap of one percentage point affects structural unemployment by a 0.1 percentage point), it could be calculated that during Finland's crisis of the 1990s the cumulative effect of the output gap on potential production would have been approx. 2.6 percentage points between 1991 and 1997. If the effect was entirely due to the rise in structural unemployment, structural unemployment would have increased by about 3.7 percentage points.<sup>34</sup> The estimate by the Commission regarding the overall effect of the crisis on structural unemployment (Model 1) from the level in the 1980s to the peak of the crisis is higher, approx. 7 percentage points, whereas from the 1980s the freely parameterised model, 2, provides a slightly more moderate estimate of approx. 5 percentage points.

The development of Finland's structural unemployment during the crisis of the 1990s has been assessed by Fregert and Pehkonen (2009), who summarise the results of the previous literature. Their conclusion is consistent with the unconstrained model, 2, The increase in structural unemployment would have been approximately 4 to 6 per cent during the crisis, and would have begun to decrease very slowly during the recovery phase. It is also noteworthy that the methods they use are based on methods in addition to the Phillips curve: on the so-called Okun's law relation, according to which it can be assumed that growth in the output gap increases unemployment, and the movements of the Beveridge curve (the relationship between the unemployment rate and the vacancy rate (vacant jobs/labour force)).

An alternative way of calculating structural unemployment in Model 2 also leads to a different notion of the development of cyclical unemployment during the present crisis. According to the unconstrained model, 2, structural unemployment has decreased slowly during the entire period following the crisis of the 1990s, and the downward trend would also have continued steadily in the 2000s. The Commission's estimates in Model 1, however, would indicate that structural unemployment should have gradually begun to rise since 2007.

During the current crisis, it remains difficult to exploit the above-mentioned alternative methods, whose use would be better suited to ex post estimation. In its report, the Economic Policy Council (2015) discusses various indicators regarding the development of structural unemployment, which can be used to estimate the direction of the change in structural unemployment. These estimates involve a large number of uncertainties, however.

One of the indicators of potential mismatch problems in the labour market, and thus of structural problems, is long-term unemployment. If, for example, the skill composition of the unemployed is such that they become unsuitable for vacant jobs, unemployment spells tend to become longer. The

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<sup>33</sup> The trend's error terms were not statistically autocorrelated (on the basis of the Ljung-Box Q test reported by the program), which would indicate the sufficiency of the selected degree. The problem with the method used – both in the estimate by the Commission and in the alternative – lies in the fact that the error terms in the Phillips curve would appear autocorrelated regardless of different specifications of the Phillips curve.

<sup>34</sup> The size of the hysteresis effect on the structural decrease in labour ( $1 - 0.976^{1/0.7} = -0.037$ ) would then be entirely channelled into structural unemployment.



Economic Policy Council (2015, Figure 1.3.6) deems the proportion of long-term unemployed in the pool of unemployed workers (when persons receiving unemployment pension are included as a result of the 2005 pension reform) to have decreased since 2007<sup>35</sup>.

Another indicator of growth in structural problems in the labour market is regional disparity in unemployment rates. The divergence of unemployment rates in different areas would suggest that supply and demand for labour are spatially mismatched. According to the Economic Policy Council (2015, Figure 1.3.8), regional variation was, however, lower in 2013, for example, than in 2007.

A third indicator is the development of the Beveridge curve. In a recession the number of vacancies decreases and the unemployment rate increases, whereas the opposite occurs during economic expansion. A simultaneous increase in unemployment and vacancies indicates increasing mismatch problems. According to the Economic Policy Council (2015, Figure 1.3.9), a clear simultaneous increase has not, however, been observed, with the exception of the most recent data from 2014. The most recent observations indicate that a turning point has occurred in the development of structural unemployment, of which the unconstrained model does not yet take account.

In all, observations outside the model would also seem to support the use of the unconstrained model, 2.

### Real-time estimates

The ability of the model to forecast actual structural unemployment during different periods in real time at the endpoint of an observation time series can also be regarded as a significant factor in terms of model selection. One method of assessing real-time forecasting ability is to truncate the data to end in different periods.<sup>36</sup> From the standpoint of this assessment, a problem lies in the fact, however, that structural unemployment cannot be unambiguously determined even *ex post*. Hence, it is necessary to begin by choosing an indicator of successful forecasting in real time. In this task, I employ *ex-post* estimates calculated in the previous chapter using the method of the European Commission as a criterion in evaluating success. Specifically, I use the results obtained from the model without extra parameter constraints.

Results suggest that the Commission's method also functions more pro-cyclically in real time. On the other hand, the analysis indicates that the real-time forecasting power of the indicators cannot be improved greatly by means of parameter constraints.

In the analysis, I begin by truncating the data from seven different points in time: 1989, 1993, 1997, 2001, 2003, 2007 and 2009.<sup>37</sup> I then compare the various choices of model with the *ex post* estimate of structural unemployment. Table 1 includes the Commission's real-time assessments of the Commission's parameter constrained model and of the model without constraints. The unit of measurement is the difference between the *ex post* estimate and the real-time estimate of unemployment as percentage units. (t) refers to the estimate of the endpoint of the time series and (t-2) to the estimate for two years preceding the endpoint in relation to the corresponding *ex post* estimate.

A crucial observation is that both models predict the development of structural unemployment rather poorly when success is measured as the difference between a real-time and *ex post* estimate.<sup>38</sup>

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<sup>35</sup> It should be noted that the Ministry of Employment and the Economy estimated an increase in the proportion of long-term unemployed, excluding persons receiving unemployment pension. The Economic Policy Council justifies the removal of persons receiving unemployment pension from the estimates with the assertion that unemployment pension was phased out in the 2005 pension reform, and thus estimates prior to and subsequent to the reform which include persons receiving unemployment pension would not be comparable.

<sup>36</sup> To be precise, a genuine real-time analysis would require the selection – as data – of the time series actually in use during the year under scrutiny. As regards the unemployment series, the data is not revised *ex post*. However, later data or methodological changes may have influenced the inflation series. In addition, the Commission uses estimates for the next two years when measuring the structural deficit. In practice, however, the difference between genuinely real-time estimates and the (quasi) real-time output gap estimates presently calculated was small in the 2000s (Kuusi, 2014).

<sup>37</sup> Because the process of performing the calculations is rather slow, I mainly focus on the key turning points in the economic cycles.

<sup>38</sup> When the outcomes for the two following years are used, the forecasts are already much closer to *ex post* values.



Table 1 Differences between real-time and ex post estimates of structural unemployment

(Maximum likelihood estimate = model 2, Commission's parameter restrictions = model 1). The unit of measurement is the difference between the ex post estimate and the real-time estimate of unemployment as percentage units. (t) refers to the estimate of the endpoint of the time series and (t-2) to the estimate for two years preceding the endpoint in relation to the corresponding ex post estimate.

	Maximum likelihood estimate		Commission's parameter restrictions	
	Str. unemployment (t - ex post)*	Str. unemployment (t-2 - ex post)*	Str. unemployment (t - ex post)*	Str. unemployment (t-2 - ex post)*
<b>1989</b>	-4.2	-2.6	-4.2	-2.6
<b>1993</b>	3.7	-0.3	3.7	0.0
<b>1997</b>	2.6	1.7	4.3	3.9
<b>2000</b>	2.3	1.5	0.8	2.7
<b>2003</b>	1.9	1.2	-1.1	0.0
<b>2007</b>	-2.6	-1.4	-2.7	-1.6
<b>2009</b>	0.7	-1.2	0.6	-0.9

\* Percentage units of unemployment.

In terms of absolute value, average forecast errors have equalled approx. 2.3 percentage points. The average error made by the Commission's model is slightly smaller but, on the other hand, the functioning of the model can be described (also) as more pro-cyclical in real time: structural unemployment peaks in the 1990s in particular, and in 1997 it is approx. 2 percentage points higher than in the case of the unconstrained model. However, when analysed using the unconstrained model, structural unemployment remains elevated for longer than the ex post estimate or the Commission's model would imply.

Finally, in the light of the results, it is reasonable to ask whether the ability of the model to predict structural unemployment in real time could be improved by means of parameter constraints.<sup>39</sup> In principle, the cyclicity of the indicator could be influenced directly by reducing the variance of its structural component. The structural shock variance  $V_p$  directly affecting the trend is already estimated at 0 in equation 11. Thus, in practice, the other shock  $a_{\mu}$  remains the channel of effect influencing the slope of the trend in equation 12, and its variance is marked as  $V_{\mu}$ . In the Commission's autumn 2014 parametrisation  $V_{\mu}$  is given a value of 0.2.

I analysed the functioning of the model using various  $V_{\mu}$  constrained values. Once again, as the criteria of success I employ the error between the real-time estimate and the estimate of the ex post unconstrained model. As a result, it can be observed that the  $V_{\mu}$  variance should be restricted to the value 0.1, so that the method's ability to forecast estimated structural unemployment improves (Model 3). Forecasting power improves, particularly with respect to 1997 (see Table 2). However, if the parameter is further reduced, the model predicts a high level of prolonged structural unemployment at the end of the 1990s, with a high degree of sensitivity. I have not reported these values separately.

Overall, the results show that establishing a model ultimately involves a compromise between flexibility and cyclical sensitivity, since the inflexibility of the model in respect of the economic cycle makes it more sensitive, in the long run, to potentially erroneous trend changes. Nevertheless, it appears that guiding real-time forecasting power by means of parameter constraints can improve the functioning of the model, as shown by Model 3. Although the assessment of this alternative should be developed further, in this report I will focus on assessing the unrestricted model, 2.

<sup>39</sup> It is noteworthy that the Commission's method, presented above, of estimating structural unemployment takes no position on its real-time forecasting power.

Table 2 Parameter restrictions and the model's ability to forecast ex post structural unemployment

The unit of measurement is the difference between the ex post estimate and the real-time estimate of unemployment as percentage units. (t) refers to the estimate of the endpoint of the time series and (t-2) to the estimate for two years preceding the endpoint in relation to the corresponding ex post estimate. (Maximum likelihood estimate = model 2, Commission's par. restrictions = model 1, Restricted  $V_{\mu} = 0.1$  = model 3).

	Maximum likelihood estimate Str. unemployment (t - ex post)*	Restricted $V_{\mu}=0.1$ Str. unemployment (t - ex post)*	Commission's par. restrictions Str. unemployment (t - ex post)*
<b>1989</b>	-4.2	-4.2	-4.2
<b>1993</b>	3.7	2.8	3.7
<b>1997</b>	2.6	2.6	4.3
<b>2000</b>	2.3	2.3	0.8
<b>2003</b>	1.9	1.9	-1.1
<b>2007</b>	-2.6	-2.6	-2.7
<b>2009</b>	0.7	0.6	0.6

\* Percentage units of unemployment.

## 4.2 Structural component of total factor productivity

### Statistical data

In the following analysis, I use the data of the European Commission's autumn 2014 forecast as material. Firstly, this consists of the total factor productivity series which the Commission calculates using real GDP and capital weighted with the input share and the ratio of hours worked. The figures for 2014 to 2016 are based on the Commission's forecasts.

The data also includes a capacity utilisation rate series, which is a collection of business cycle indicators describing economic activity (Havik et al., 2014). The series' components consist of the industrial capacity utilisation rate as well as service sector and construction sector confidence indicators. The indicators are weighted with the shares of total output of the economy attributable to different sectors, and their standard deviations are normalised in such a way that the deviations correspond to the standard deviation of the value added for the sector. Business cycle indicators are published quarterly, and the data for 2014 is based on the average of the first three quarters.

Being based on survey data, the capacity utilisation rate has the advantage of an infrequently occurring and low need for adjustment. The view taken of the size of the utilisation rate can vary at the discretion of the respondents, which can partly weaken the reliability of the indicator. If the attendant bias is independent of time and respondent, this problem can be considered minor. (Virkola, 2013)

When analysing the data used by the Commission, a point worth noting is that the capacity utilisation rate series only extends to 1996. The worst crisis years of the 1990s recession, for example, are therefore missing from the data. When assessing the functioning of the model, a stance should be taken on how a small data pool will affect the results. I also make use of another indicator series: estimates by industrial enterprises regarding their order books in relation to the norm, which I compiled by chaining indicator series BTEOLRSL and BTEOLL:B8S of the Confederation of Finnish Industries (EK). The data has been available since 1976; it thus includes data on the 1990s crisis.

### Statistical credibility

As in the case of structural unemployment, I regard the estimate of the structural component of total factor productivity as a natural basis of the unconstrained maximum likelihood (ML) estimate, which is not affected by preconceptions outside the data (prior distributions) used in the method.

In the case of total factor productivity, analysis is rendered difficult by the fact that – presumably on account of the short data – the solution algorithm does not locate the ML estimate and thus a direct

comparison is not possible. Instead, in the following I begin by comparing the prior distributions of the Commission within a Bayesian calculation framework with the posterior distributions produced by the statistical model using the capacity utilisation rate series. I then estimated the effects of the short utilisation rate series on the results, by means of an alternative indicator (order book) series going further back. In the latter case, it is also possible to estimate the results of the Bayesian method in relation to the ML estimates.

First, I briefly examine the prior distributions used by the Commission. Table 3 includes the first two moments of prior distributions.

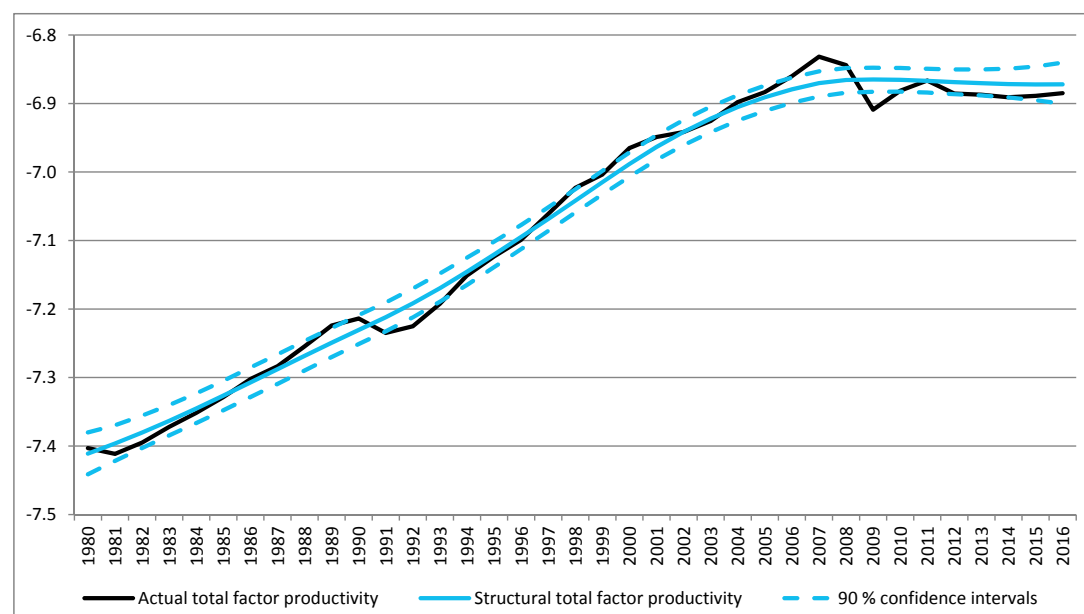
The main assumptions of the Commission are that the average growth in the development of total factor productivity  $\omega$  is 1.5. per cent, with a standard deviation of 1 percentage point. In turn, the persistence of the trend's direction is set at 0.8. The average periodicity (length)  $\tau$  of the cycle assumed in the model is 8 years and strength is measured by the parameter  $A = 0.42$ . The corresponding standard deviations are 4 and 0.17. Periodicity is restricted between the values 2 and 32.  $A$  and  $\tau$  are assumed to be beta distributed, whereas  $\omega$ ,  $\rho$ ,  $m_U$ ,  $\beta$  and  $\delta$  are normally distributed. As in the case of structural unemployment, the variance parameters  $V_\mu$ ,  $V_c$ ,  $V_{cu}$  are country-specific. They receive equally large variances and averages,  $4.67 \times 10^{-6}$ , 0.006 and 0.003, distributed with an inverse gamma distribution (6 degrees of freedom).

Figure 6 shows the natural logarithm of structural unemployment and the estimate of potential total factor productivity for 1980 to 2016, repeated using the Commission's method of analysis (Model 4).

Table 3 The common prior distributions used by the Commission

	<b>Mean</b>	<b>Standard deviation</b>	<b>Boundaries</b>	
			<b>Lower</b>	<b>Upper</b>
$\tau$	8	4	2	32
$A$	0.42	0.17	NA	NA
$\omega$	0.015	0.01	0.00	0.03
$\rho$	0.80	0.24	0.00	0.99
$\beta$	1.40	$0.71 \times V$	0.00	5.00
$\mu_U$	0.00	$0.03 \times V$	-0.10	0.10
$\delta$	0.01	$0.40 \times V$	-0.99	0.99

Graph 6 Structural total factor productivity



A dominant feature in the figure is the strong slowdown in the growth rate in total factor productivity since 2007. For example, compared to the recession of the 1990s, the stagnation in total factor productivity has lasted considerably longer. Total factor productivity reached 1989 levels just a few years after the beginning of the crisis, whereas in the present crisis total factor productivity in 2014 remains far below 2007 levels. The errors related to estimates of potential total factor productivity are fairly large. In the 90 per cent confidence interval, errors can be approx. 2.5 per cent in any direction. When comparing the posterior distributions produced by the model (see Appendix 2) with the prior distributions, it can be observed that they do not appear to deviate substantially from each other. The assumptions concerning prior distributions would not, therefore, seem to have any major effect, at least on estimates of structural total factor productivity.

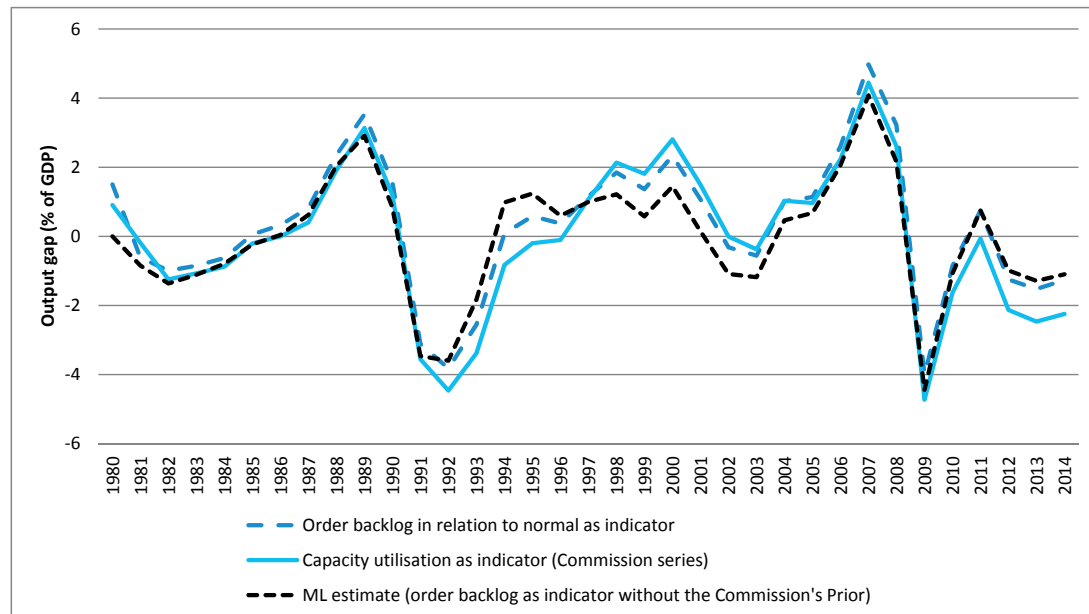
Next, I will examine the alternative indicator series. I begin by using the same prior distributions by the Commission and go on to compare the cyclical component of two different indicator series in order to ascertain whether a longer indicator series could alter the forecast for the structural component of total factor productivity (Model 5). In addition, I calculate the ML estimate for the longer order book series in order to estimate the significance of the prior distribution for the results (Model 6).

On the basis of such an analysis (Figure 7), it would seem that the structural component calculated using different indicator variables is very similar (Model 4 and Model 5). The effect is not, however, quite the same, and the Commission's indicator variables appear slightly more counter-cyclical. On that basis, the total factor productivity gap during upturns has been almost the same, but when crises begin and while they last a gloomier economic climate is forecast, as was the case in 2014. One explanation for this may be the inclusion of the service sector in the Commission's capacity utilisation rate series.

In all, the comparison indicates that the Commission's short time series is not particularly problematic. Although I used longer data and different indicator variables, the results did not differ fundamentally. They also indicate that prior distributions are not particularly dominant when estimating total factor productivity cycles. Order book series-based estimates of total factor productivity potential are very similar when using the ML method (Model 6) and the Bayesian method (Model 5).<sup>40</sup>

Graph 7 Total factor productivity gap, alternative estimates

(Capacity utilization = model 4, Order backlog in relation to normal = model 5, ML estimate = model 6)



<sup>40</sup> With respect to the current crisis and the crisis at the beginning of the 1990s, estimates of cyclical total factor productivity change are almost identical. The greatest differences are found during stronger upswings, when the Bayesian indicator has estimated the effect of the cycle to be slightly greater.

### Observations outside the model

From the perspective of observations outside the model, it is problematic that there is still less information on the effects of economic crises on total factor productivity cycles than on structural unemployment. Total factor productivity is calculated as a residual after removing the effect of other production factors, which naturally leads to difficulties when interpreting its values during a crisis. Total factor productivity includes information not only on technological development but on issues such as changes in contestable markets, production economies of scale and economic restructuring.

During the present crisis, the development of total factor productivity has been the main factor affecting potential output. The reasons for the particularly weak development of Finland's overall productivity during the economic crisis have been sought, in particular, in the sectoral-level shocks to which our economy was subject. It has been argued that the fall in total factor productivity is due to problems in the Nokia-driven ICT cluster and in the paper and mechanical engineering industries.

In the following, I use the total factor productivity growth contributions by industry reported by Statistics Finland<sup>41</sup> to assess the size of the structural shock generated in relation to the productivity of the overall economy.

I first examine total factor productivity growth at the level of the entire economy: between 1997 and 2007 the rate of change in total factor productivity was approximately 2.6 per year and between 2008 and 2013 approximately -1.6 per cent per year. Thus, the growth rate of total factor productivity decreased by approx. 4.1 percentage points per year. During the same period, according to the Commission the structural component of total factor productivity increased, first by approximately 2.1 per cent on average per year and then by 0.2 per cent per year. The change in structural total factor productivity growth was thus approximately -2.3 percentage points per year, which explains about 55 per cent of all changes in the growth rate of total factor productivity between the periods in question.

The growth rate of the structural component is then proportioned to changes in the growth rate of total factor productivity in individual sectors during the same periods, 1997 to 2007 and 2008 to 2013.<sup>42</sup> Statistics Finland estimated that the actual decline in total factor productivity in the entire ITC sector (electronics industry, and telecommunications and data processing services) would have reduced total factor productivity growth in the whole economy between the periods in question by approximately -1.31 percentage points per year. When the contribution to the decline in the total factor productivity growth rate by the paper industry (approx. -0.1 percentage points) and by the mechanical engineering industry (approx. -0.4 percentage points)<sup>43</sup> is added, approximately -0.5 percentage points would remain to be explained. If it is estimated that Finland has suffered from the hysteresis effect generated by the crisis as much as the rest of the eurozone on average (where the decline in potential total factor productivity was approx. -0.5 percentage points, on average, based on the Commission's forecast in the autumn of 2014), a figure not very far from the actual trend is obtained.

Since the calculation takes full account of sectoral-level shocks when calculating potential total factor productivity, it does not take account of the potential cyclical shocks in this regard. A similar result, however, is obtained if growth is estimated in relation to the long-term trends in the countries which, in terms of their technology or production structure, are closest to Finland. When examining the development of structural total factor productivity in Finland, Sweden and the United States during different periods, it can be observed that the total factor productivity growth rates of the respective countries between 1995 and 2014 have been very close to each other. As the crisis unfolds, the strong impact of ICT on pre-crisis growth in the Nordic countries is flattening out to the same level as in the United States.

In sum, the observations outside the model are not incompatible with the structural development of total factor productivity during the present economic crisis.

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<sup>41</sup> See Statistics Finland, productivity survey: <http://tilastokeskus.fi/til/ttut/index.en.html>

<sup>42</sup> It should be noted, however, that the method used by the Commission to calculate total factor productivity does not entirely correspond to the method used by Statistics Finland. This means that the comparison of magnitude estimates should be used indicatively.

<sup>43</sup> Including the manufacture of electrical equipment, manufacture of machinery and equipment n.e.c., manufacture of motor vehicles, etc. and other transport equipment.

### Real-time estimates

In the following, I examine the functioning of the method used in calculating total factor productivity gap in real time. However, the capacity utilisation rate series does not go back far enough to allow me to assess the functioning of the model during the economic crisis at the beginning of the 1990s. Since Figure 7 indicates that the indicator series on new orders functions in a very similar manner, I use it to estimate the size of revisions relating to the Commission's method.

In the following, I examine the forecasting power of Model 5 in the same manner as the analysis of structural unemployment above: I begin by truncating the data at seven different points: 1989, 1993, 1997, 2001, 2003, 2007 and 2009; and then I compare real-time structural total factor productivity to the ex post (2014) estimate, using the same model.

On the basis of the calculations, real-time estimates relating to total factor productivity gap have deviated considerably from the ex post estimates. On the basis of the measurement, both of the major economic crises prior to the structural component of total factor productivity would be overestimated<sup>44</sup>. The results indicate, however, that data observed over even two years considerably improves the model's ability to predict the ex post gap.

Finally, it should be noted that, on the basis of the estimates conducted above, I do not propose the alternative method of measuring total factor productivity. On the other hand, the real-time results suggest that it would be important to continue development work involving the improvement of the model's prior distributions, with a view to increasing the model's real-time forecasting ability. In this respect, improving the Bayesian method will remain a matter for later research.

Table 4 Comparison of real-time total factor productivity gap estimates to the ex post estimates

The unit of measurement is the difference between the ex post estimate and the real-time estimate of total factor productivity gap as percentage units of potential output. (t) refers to the estimate of the endpoint of the time series and (t-2) to the estimate for two years preceding the endpoint in relation to the corresponding ex post estimate.

	TFP gap (t - ex post)*	TFP gap (t-2 - ex post)*
<b>1989</b>	-1.73	-1.20
<b>1993</b>	0.79	0.28
<b>1997</b>	1.68	0.38
<b>2000</b>	0.51	0.38
<b>2003</b>	-0.45	0.58
<b>2007</b>	-3.23	-0.98
<b>2009</b>	-1.49	0.09

\* Percentage units of potential output.

### 4.3 Estimates of the structural balance using the Commission's output gap method

When the gap estimates for different components have been calculated, they can be aggregated as an output gap in the economy. Measuring the structural budget balance used by the Commission is fairly straightforward. The estimated output gap is multiplied by cyclical elasticity ( $\epsilon$ ) and income is subtracted from the headline balance. The most recent estimate for Finland, 0.57, is used as the cyclical elasticity.<sup>45</sup>

<sup>44</sup> With respect to 2007, the difference between real-time estimates calculated using the Commission's indicator series and those using the new orders series is approx. 0.5 percentage points.

<sup>45</sup> However, the Economic Policy Council (2015) estimates that, without the effect of the pension funds, the coefficient may be only 0.19.

Graph 8 Different estimates of the structural budget balance

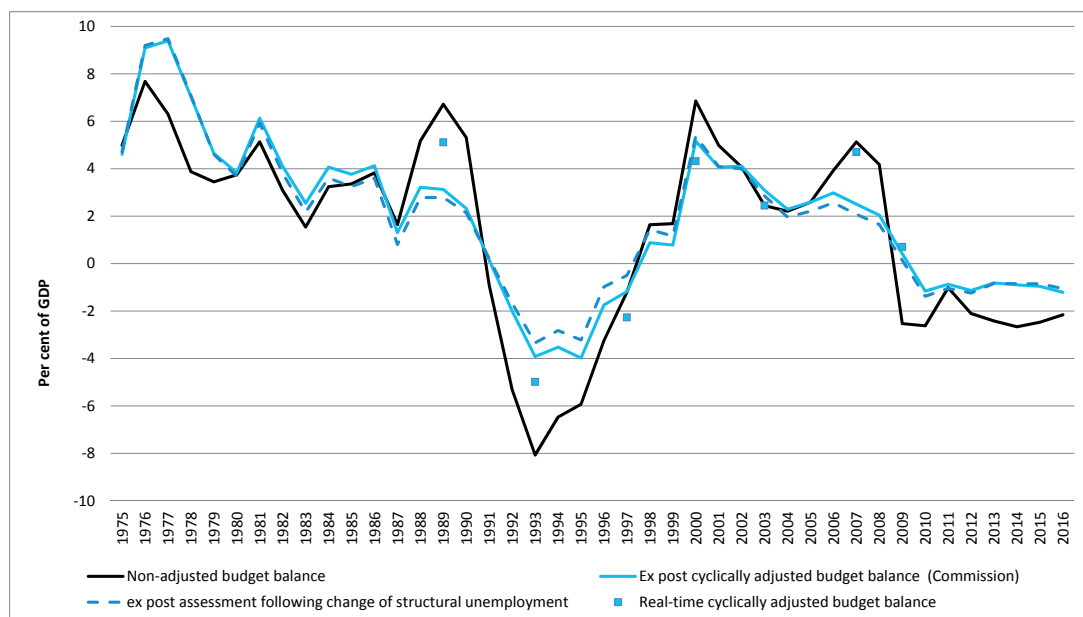


Figure 8 shows alternative structural balance estimates as well as a non-adjusted balance.<sup>46</sup> I have begun by calculating the ex post estimate of the cyclical adjustment on the basis of the Commission's autumn 2014 forecast, in order to estimate the output gap (ex post cyclically adjusted balance (Commission)). Secondly, I have adjusted the output gap in the manner recommended in this report, i.e. I have based structural unemployment on the maximum likelihood estimate by adjusting the output gap estimate of the Commission's forecast using the difference between Model 1 and Model 2 (ex post estimate after changing structural unemployment). Thirdly, I estimated the functioning of the indicator in real time. With respect to year 7, shown above, (1989, 1993, 1997, 2001, 2003, 2007 and 2009), I adjust the output gap estimates I recommended by changing the ex post estimate of total factor productivity (Model 5) and structural unemployment (Model 2) to real-time estimates (real-time cyclically adjusted balance).<sup>47</sup>

First, I examine the ex post estimates of the structural balance. When examining the recession at the beginning of the 1990s, it can be observed that ex post estimates are rather pro-cyclical, particularly when a crisis has emerged. The budget balance weakened by nearly 6 percentage points within a few years when the crisis broke out at the beginning of the 1990s. The proposed change in the method of calculating structural unemployment would have an effect of approximately 1 percentage point for periods of crisis.

In terms of implementing fiscal policy, the effect is not as large in relation to the present crisis. For example, a change in the calculation method of structural unemployment in 2016 would have an effect of approx. 0.02 percentage points on the structural balance. At the same time, however, it should be pointed out that the amount is considerable when expressed in euros: proportioned to the GDP approx. EUR 400 million.<sup>48</sup>

On the other hand, a major issue probably lies in the considerable effect of real time on the indicator's functioning. When estimates of total factor productivity and structural unemployment are based on data which takes no account of the trend for future years, the structural balance proves considerably

<sup>46</sup> Ameco database, early spring 2014.

<sup>47</sup> I make the adjustment by eliminating the difference between the ex post and real-time estimate for both components from the output gap. Here, I make no comment on the cyclical adjustment of other output gap components, such as the participation rate. In the estimates, the GDP and nominal deficit estimates are ex post.

<sup>48</sup> However, the estimate is also affected by the  $\lambda$  parameter of the HP filter. If the parameter value is set at 6.25, the effect for 2016 is approx EUR 200 million.



more pro-cyclical. In real time, the structural balance has deviated materially from the ex post estimate in two of the three expansions in recent decades (1989, 2000, 2007). The structural balance would be overestimated by approx. 1.3 percentage points with respect to three business cycle peaks, on average. In addition, the real-time structural balance underestimated the deficit component due to the economic crisis when the crisis of the early 1990s had already begun. For example, the 1993 ex post estimate of the structural contribution to the total deficit would have been approx. 35 per cent, while the real-time estimate would have been approx. 60 per cent.

It should be noted, however, that the real-time results presented are not without problems. Firstly, the real-time estimate of the present output gap may underestimate the accuracy of the Commission's estimate, as the Commission uses forecasts of the trend for future years to support the estimate. If the forecasts are informative regarding cyclical change, they can improve the model's accuracy. On the other hand, revisions may have been made to the data, which the truncation of ex post data does not account for. Finally, it should be noted that an estimate of the real-time gap takes no account of the effect of changes in other output gap components (such as participation rate).

The previous literature indicates, however, that the differences between realised forecasts and quasi real-time estimates such as those now shown are minor. Using the same method, Kuusi (2014) compared estimated output gaps with the real estimates by the Commission and found that the results obtained using this method did not materially deviate from each other. The average difference in the output gap estimates was approx. 1/2 of a percentage point between 2006 and 2012, equalling an effect of approx. 1/4 of a percentage point in the structural deficit. Virkola (2013), too, examined the Commission's revisions in respect of 2007 and observed that real ex post revisions to the output gap in Finland were on the same scale as the estimates currently shown, i.e. approximately 5 percentage points.





## 5 Discretionary alternatives and an assessment of methodological differences

Based on the previous chapter, it is clear that problems arise when using an output gap-based structural balance as a fiscal policy indicator. If an indicator which is, in principle, independent of economic cycles varies in a pro-cyclical manner in the absence of decisions that are clearly influencing its behaviour, its use could easily lead to pro-cyclical fiscal policy. This is particularly problematic in light of the various reasons put forward for the failure of cyclical adjustment to function correctly. These reasons could relate to issues such as the difficulty of assessing tax base development by means of the output gap or, indeed, of measuring the output gap.

In the following, I will examine alternative methods of using the expenditure benchmark and a bottom-up assessment to assess the output gap-based structural balance. I will begin by presenting the data used and continue by assessing discretionary fiscal efforts through the application of various method-related assumptions. I will then compare the output gap-based structural balance and alternative indicators purely from the perspective of an assessment of changes in fiscal policy: Would these have provided a consistent historical view of fiscal policy changes? I will also examine the reasons for any differences identified. Finally, I will evaluate the methods in question with reference to the requirements set by the EU's fiscal policy regulations, and will discuss the limitations that their use may have imposed, historically, on Finland's fiscal policy.

### 5.1 An assessment of the scale of discretionary measures

#### Data

In order to conduct a historical assessment of alternative indicators, we need information on the revenue-related policy changes implemented in the public finances (including central government, the municipalities and social funds).

With respect to central government finances, the data I have collected for this report includes information on the estimated effects of changes in the tax policy as provided by the Financial Status Reports 1977–2002. Since 2002, the related reports have no longer been available in the same format. I have therefore evaluated changes in tax policy in the light of the Government's budget proposals for 2003–2008. With respect to the years 2009–2014, I have received the necessary information from the Ministry of Finance. The Ministry's data also includes information on various types of deductions concerning the public sector as a whole.<sup>49</sup>

In addition to state taxation, I examine the effects of policy changes made in general government finances. With respect to the years 2009–2014, I have used the evaluations of the Ministry of Finance.

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<sup>49</sup> For the purposes of this report, I continued to count the inflation adjustments made to the income tax scale as part of the effects of changes in the revenue base. This is balanced out in the subsequent analysis of discretionary fiscal efforts, since account is taken of inflation in the applied reference growth in expenditure. I also examined various alternative ways of accounting for inflation, but these did not fundamentally affect the results of this report.

With respect to the preceding years, 1977–2008, because I could find no direct estimates of the effects of changes made in the criteria for charges on revenues, I used the observed changes in charge percentages as the basis for the effects of such decisions.

I evaluated revenue estimates for local government finances on the basis of changes in the weighted average local income tax rate and the real estate tax rate<sup>50</sup>. I calculated the euro-denominated effect of the change by multiplying the change in the tax base by the tax bases for the previous year, which in the case of local income tax means private income and in the case of real estate tax the taxable value of real estate. With respect to social insurance funds, I evaluated the changes in question on the basis of average social insurance contributions (employer’s child benefit, accident, health, national pension, unemployment and TEL contributions and employee’s unemployment and TEL contributions), expressed as percentages of the payroll. I multiplied the change in these by the previous year’s total payroll.

I have combined the changes into a single set of data and classified them into five main groups: personal taxation, corporate taxation, indirect taxation, social insurance contributions and other fees.

Although I will present my evaluations in various contexts throughout this report, I will begin here by comparing them to a number of other evaluations of discretionary policy changes affecting Finland. Perotti (2011) assessed discretionary total changes on the revenue side during the 1990s crisis. Various sources suggest that the estimated cumulative budgetary effect in 1992–1996 was approximately 3.9 per cent of GDP (Table 5).

My own estimates, as a whole, are very similar (approximately 3.8 per cent of GDP), but differ with respect to timing, which suggests the need to investigate the reasons for these differences. With respect to the year 1992, the current assessment is particularly affected by the tightening of energy taxation.. Furthermore, the increase in social insurance contributions amounting to 2 per cent of the payroll had a 0.8 percentage point effect on income growth. With respect to 1993, there is an even greater difference. In that year, the employer’s and employee’s social insurance contributions increased by 3.6 and 1.6 per cent of the payroll, respectively. These decisions increased revenues by almost 2.3 per cent of GDP. Furthermore, the adoption of the real estate tax increased the tax burden considerably. Meanwhile, the sources available today make no mention of a discretionary increase in revenues of a corresponding size after the year 1994.

Despite the differences between my assessments and those of Perotti (2011), both evaluations reinforce the impression that the revenue basis has a major impact on the overall balance of the public finances. However, the results differ from earlier evaluations by the IMF (see Perotti, 2011), according to which the public finances were not improved by increasing revenues but by cutting expenditure. I will return to expenditure assessment later in this chapter.

I will also compare the revenue basis estimates provided by the Ministry of Finance to the Commission’s figures for 2010–2014, which are available in the AMECO database (the UDMGCR vari-

Table 5 The effects of the changes on the revenue basis of the entire public economy in the 1990s

	The estimated budgetary effect (% of GDP)		The estimated cumulative budgetary effect (% of GDP)	
	Perotti	Current estimate	Perotti	Current estimate
1992	0.00 %	1.19 %	0.00 %	1.19 %
1993	0.00 %	2.56 %	0.00 %	3.76 %
1994	2.27 %	0.29 %	2.27 %	4.05 %
1995	-0.09 %	0.18 %	2.18 %	4.23 %
1996	1.75 %	-0.46 %	3.93 %	3.77 %

<sup>50</sup> After the adoption of the real estate tax in 1993; for the years prior to that I evaluated the street maintenance fee.

Table 6 The effects of the changes on the revenue basis of the entire public economy in the 2010s

	The estimated budgetary effect (% of GDP)	
	Commission	Current estimate
2010	0.52 %	-0.46 %
2011	0.27 %	0.59 %
2012	0.27 %	0.32 %
2013	0.96 %	0.95 %
2014	0.39 %	0.40 %

able). Table 6 shows that the estimates for the years 2012–2014 are very similar, whereas the previous estimates for 2010 and 2011 differ somewhat from the data used in this study.

Finally, I would like to point out that evaluating the effects of changes in the revenue basis is not easy. Effect assessments are typically static by nature, i.e. they do not take account of the dynamic multiplier effects that discretionary measures tend to have, as actors in the national economy react by adjusting their operations. When multiplier effects are taken into account, the effects of revenue basis decisions may fundamentally differ from those given in static assessments, since multiplier effects tend to be significant during crises (Finland’s Economic Policy Council, 2015). With respect to the application of the expenditure benchmark and bottom-up evaluation, no clear policy has yet been set on how to take account of multiplier effects.<sup>51</sup>

Furthermore, some uncertainty is involved in the timing of the effects of the decisions. Decisions made at a certain point often affect state revenue or expenditure with a time lag. For example, due to the time lag in the settlement of accounts, changes in tax rates usually affect tax revenue in full only in the second effective year. Decisions are sometimes made to implement changes in future years. Moreover, many decisions are made for a fixed term, after which they no longer affect the balance of the public finances.<sup>52</sup>

In addition to the evaluation of changes in the revenue basis, I have collected other variables needed for the calculation of alternative discretionary measures. Potential output growth estimates for 2011–2014 are based on reference values provided by the Commission to the individual member states<sup>53</sup>. Potential output growth estimates for 2002–2010 are based on the estimates made by the Commission in the autumn of the same year, by applying the production function method. Potential output growth estimates for 1989–2001 are based on the estimates made by the OECD at the end of the same year on average growth for the following two years and the preceding five years. With respect to the 1980s, I have estimated potential output growth on the basis of the average five-year growth forecast made by ETLA (the Research Institute of the Finnish Economy) in the same year.

Graph 9 displays a time series of the reference growth rate for the period 1984–2014. Graph 9 shows that the reference growth rate changed rather moderately during the economic crisis of the 1990s, whereas during the present crisis even the Commission’s long-term growth estimates have been rather gloomy. This is due to the prolongation of the crisis and weak growth expectations for both Finland and the rest of Europe.

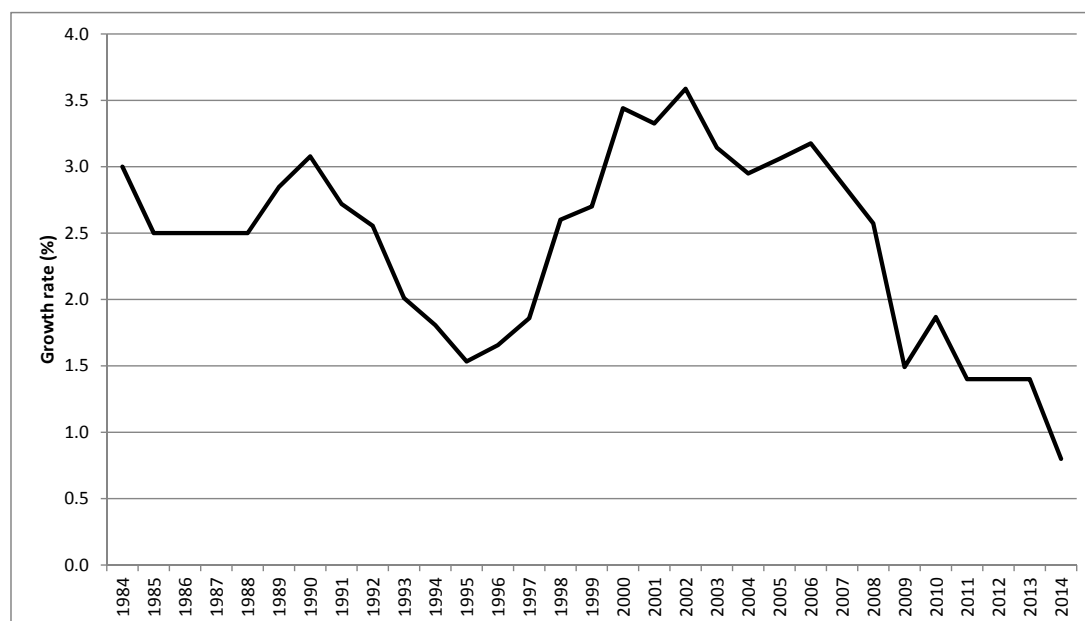
With respect to the expenditure benchmark, I will use the GDP and inflation projections as inflationary series. For the years 2001–2014, these are the European Commission’s forecast averages from the previous year’s spring and autumn. For the years prior to that, I will use the previous year’s average

<sup>51</sup> However, the data also enables the assessment of the dynamic effects of changes, and such an assessment should be used as the basis of an effects analysis in the future.

<sup>52</sup> I have attempted to eliminate such fixed-term decisions from the data.

<sup>53</sup> With respect to 2011–2014, the estimates are based on forecasts made by the European Commission in the autumn of 2011 (1.4% for Finland) and, with respect to 2014, on a forecast made by the Commission in the autumn of 2013 (0.8% for Finland).

Graph 9 Real reference growth rate of the potential GDP



inflation forecasts made by the Ministry of Finance. With respect to bottom-up evaluation, I will use the actual change in the GDP price.

For the other variables, I have followed the principle of trying to find the longest time series possible in order to enable a historical assessment. As expenditure series,  $G_p$ , I have selected a time series, published by the IMF, for general government total expenditure because this covers the longest period from the early 1980s onwards.<sup>54</sup> In addition, I have used the Ministry of Social Affairs and Health's information on unemployment expenditure in the form of the variable  $U_{ind}$ , which I will eliminate from the expenditure aggregate related to the bottom-up evaluation and, with respect to the expenditure benchmark, from the expenditure aggregate related to cyclical unemployment expenditure. As interest expenditure, I will use the time series given for property expenditure<sup>55</sup>. The amount of public investment is based on the figures obtained from the National Accounts.

In order to enable comparability between the results, I will also use the alternative variables which the Commission applies in its assessments. From the AMECO database, I have collected series for general government expenditure (UUTGE), interest expenditure (UYIGE) and investments (UIGGO). However, expenditure aggregates cannot be calculated on the basis of these for the years before 1999.

The data on Finland's shares of EU structural funds is based on the data for 2010–2014 obtained from the audit memorandum<sup>56</sup> prepared by the National Audit Office of Finland regarding compliance with the Stability and Growth Pact. Due to lack of preceding observations, I will set these to zero prior to the year 2010. Likewise, I will not assess the amount of non-recurring items since the related evaluations are not available for the entire period in question. In any case, since they have also been eliminated from the output gap-based structural balance indicator presented by the Commission, they are not essential for comparison purposes.

<sup>54</sup> World economic outlook 2014: General government total expenditure. The corresponding estimate by the European Commission begins as late as 1995 and that of Statistics Finland in 1990.

<sup>55</sup> The amount of property expenditure is derived from the table "General government expenditure by function" by Statistics Finland (S13, G0, D4K) 1990–2012. For 1984–1989, I will estimate the amount of property expenditure on the basis of the series "Government net interest expenses" published by the OECD. The figures for 2013–2014 originate in the AMECO database (interest expenses).

<sup>56</sup> Data for the audit memorandum prepared in 2014 by the National Audit Office of Finland regarding compliance with the Stability and Growth Pact.

### An assessment of the method and volume of discretionary fiscal efforts

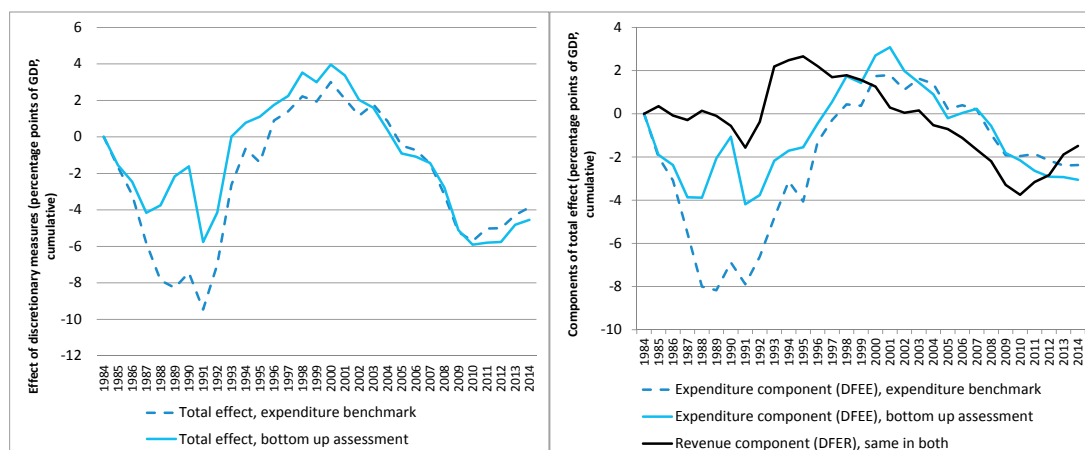
In the following, I will examine discretionary fiscal efforts on the basis of the expenditure aggregate alternatives presented above and the various inflation expectations related to them. In the analysis, I will apply a nominal assessment of discretionary fiscal efforts based on the DFE indicator (equation 19). Although a similar comparison could be achieved by performing a real assessment of the efforts, as in connection with the expenditure benchmark (see Chapter 3.2), here I will focus on a nominal amount, which I will later compare to the change in the nominal structural balance.<sup>57</sup> With respect to the expenditure benchmark, I will leave the real comparison between the change in expenditure aggregate and reference growth to a subchapter dealing with the reference values given in EU fiscal policy regulations. In the next subchapter, I will also examine the change in discretionary fiscal efforts during economic cycles, including in relation to the real reference complying with the expenditure benchmark.

Graph 10 gives assessments of the discretionary fiscal effort based on different assumptions, and the two components of change (see equation 19): the effect of changes in the revenue basis,  $DFE_T^R$ , and the growth in expenditure in relation to the medium-term change in the potential nominal GDP,  $DFE_t^E$ , used as a reference. When applying equation 19 to the expenditure benchmark, I used inflation projections as the inflation variable, as well as the change in the expenditure aggregate based on this (equation 17). With respect to the bottom up method, I applied actual inflation and the expenditure aggregate as defined in equation 18. For the sake of clarity, the graph shows the evaluations in cumulative form. This means that developments occurring during a certain part of the entire time period indicate the average effect of measures on the budget balance.<sup>58</sup>

On the basis of Graph 10, we should make some observations on how well the method functions. Firstly, based on this method, Finland's fiscal policy, as measured in terms of discretionary fiscal effort, was rather different during the two key economic crises of recent decades: the recession of the early

Graph 10 Assessments of the discretionary fiscal effort based on different assumptions, and the revenue and expenditure components

If the indicator is positive by 1 percentage point, the growth rate of expenditure (with an adjusted expense aggregate and taking the revenue side into account), is estimated to be so slow that the budgetary position is strengthened on a discretionary basis by 1 percentage point.



<sup>57</sup> In addition, with respect to the expenditure benchmark, we can see that a real comparison and a nominal comparison produce almost identical results. In appendix 3, I have calculated the change in the budget balance in accordance with the expenditure benchmark. This is derived from a real deviation of the expenditure aggregate from the GDP reference growth figure (excluding the medium-term objective's effect on the reference):  $(\frac{\Delta e_t}{e_{t-1}} - \frac{\Delta^{pot} e_t}{e_{t-1}}) / (\frac{E_t}{Y_t})$ . On the other hand, I have calculated the effect of a corresponding deviation, measured using the DFE indicator (as indicated below) on the budget balance. The results are very similar, and the difference between the effect estimates is of the same order as the inflation percentage.

<sup>58</sup> Average values during the current crisis have been presented by the European Commission (2013B) and Carnot and de Castro (2015).

1990s and the global financial crisis that began in 2007. Towards the end of the 1980s, fiscal policy was looser than prior to the present crisis. On the other hand, when the 1990s crisis began, fiscal policy was tightened fairly quickly and efficiently, whereas a tighter fiscal policy only began in 2011 during the present crisis. On the contrary, fiscal policy was stimulative during the initial stages of the present crisis.

Secondly, based on the observations made, the expenditure aggregates which were calculated differently and applied to both the expenditure benchmark and the bottom-up evaluation, would have functioned similarly in different cyclical situations.<sup>59</sup> The adjustment items for different types of expenditure have a relatively minor effect on the resulting interpretation of fiscal policy developments. On the other hand, the differences between the assessments are almost fully attributable to different inflation variables.<sup>60</sup> Similarity is particularly important because no cyclical adjustment was made for unemployment expenditure in the case of the simpler bottom-up evaluation.

We can see that the inflation variables applied make the assessments somewhat cyclical, although the inflation projections used for the expenditure benchmark reduce the effect of inflation somewhat, particularly with regard to the end of the 1980s. Both indicators allow for strong growth in expenditure during periods of high inflation, while during periods of low inflation the need may arise to make additional cuts in public expenditure. On the other hand, taking account of inflation adjustments in income tax rates as a change in the revenue basis has, to some extent, the opposite effect. Even if the effect of the inflation indicator is no longer as great as during the crisis of the 1990s, it seems, in any case, that from the viewpoint of fiscal policy steering the use of a more stable, longer-term inflation indicator (similarly to the GDP reference growth) would be advisable, alongside the removal of inflation adjustments from decisions on the revenue basis.<sup>61</sup>

Furthermore, the results are fairly dependent on the potential GDP reference growth rate selected. With respect to the crisis of the early 1990s, my evaluation of the extent of balancing measures produces a larger figure than that of Perotti (2011), for example, who, on the basis of a discretionary assessment, concluded that hardly any expenditure cuts were made. In this respect, the assumption that expenditure policy remained unchanged becomes pivotal. In the method applied by the European Commission, growth in expenditure is scaled to the growth rate of potential output, whereas Perotti (2011) evaluates only discretionary changes.

From the viewpoint of fiscal policy steering, the assumption that a neutral fiscal policy keeps expenditure as a proportion of potential constant – if no new revenue-related decisions are made – appears to be a sensible starting point. However, it should also be pointed out that, from this viewpoint, the present reference values are not necessarily the best possible ones. In practice, the reference values set for Finland, for example, for the years 2014–2016 are based on the potential output growth forecasts made in early 2013, while said forecasts have since continuously weakened. On the other hand, long-term potential output growth forecasts are solely based on the Commission's output gap method. From the viewpoint of fiscal policy steering, it may be sensible to switch to growth forecasts that are updated more frequently and that combine various methods.

Finally, it should be noted that the observations presented here are rather close to the earlier assessments of discretionary fiscal effort based on the bottom-up method. Table 7 compares the evaluations of the European Commission (2013B, Table III.2.1) for the years 2004–2013. It appears that the evaluations of this study are 0.17 percentage points more positive on average.<sup>62</sup>

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<sup>59</sup> When we compare the expenditure benchmark calculated using the AMECO variables to that calculated using the long-term data, we can see fairly significant differences arising from the chosen variables. For example, the long-term data suggests that fiscal policy tightened by an average of 0.02 percentage points more per year in 2000–2014.

<sup>60</sup> In connection with the bottom-up evaluation, I will apply actual inflation but for the expenditure benchmark I will apply inflation projections.

<sup>61</sup> It should also be noted that inflation forecast errors have been fairly large recently, which may weaken the applicability, in practice, of the methods in question.

<sup>62</sup> For example, the differences concerning the years 2011–2013 may be attributable to the fact that, in my study, the average effects of changes in the revenue basis were 0.12 percentage points higher than in the Commission's data.



Table 7 Current estimates and the evaluations of the European Commission (2013B, Table III.2.1) of discretionary fiscal effort for the years 2004–2013 based on the bottom-up method. If the indicator is positive by 1 percentage point, the growth rate of expenditure (with an adjusted expense aggregate and taking the revenue side into account), is estimated to be so slow that the budgetary position is strengthened on a discretionary basis by 1 percentage point.

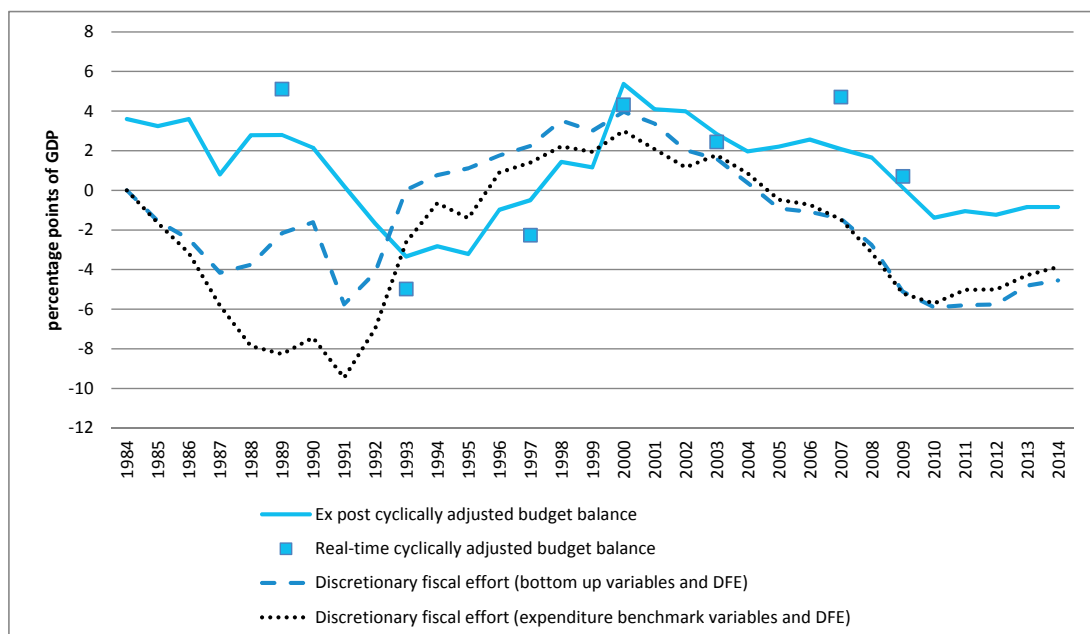
	2004-2007	2008-2010	2011-2013
Commission	-0.90	-1.70	0.20
Current estimate	-0.76	-1.49	0.36

## 5.2 The effect of economic cycles on fiscal policy as measured by structural balance and discretionary fiscal effort

Graph 11 combines information presented in previous chapters on the functioning of the various fiscal policy indicators, and compares these indicators. The graph shows the output gap-based structural balance indicator, based on an ex-post and real-time evaluation.<sup>63</sup> With respect to these, the change in fiscal policy can be evaluated on the basis of the changes in the budgetary position between different years. As the cyclical adjustment of the budgetary position eliminates the cost effect of cyclical automation, the remaining part of the change in the structural balance should, in principle, be discretionary.

The graph also shows discretionary fiscal effort calculated in accordance with the variable assumptions applied in the expenditure benchmark and bottom-up assessment. With respect to these, I will also measure the change in fiscal policy using the cumulative development in the afore-defined

Graph 11 The output gap-based structural balance, and discretionary fiscal effort calculated in accordance with the variable assumptions applied in the expenditure benchmark and bottom-up assessment



<sup>63</sup> The ex-post evaluation is an ex-post evaluation of the structural balance net of structural unemployment, which is presented in more detail in subchapter 4.3. Compared to the ex-post evaluation, the real-time evaluation corresponds to a structural balance that adjusts ex-post data in the manner presented in the same subchapter.



DFE indicator, as in the previous subchapter.<sup>64</sup> When this method is applied, a one percentage point increase in the DFE indicator improves the structural balance by one percentage point. The cumulative change, on the other hand, indicates the change in the budgetary position within a certain time period, similarly to the cumulative change in the structural balance.<sup>65</sup>

Graph 11 shows that the structural balance is more pro-cyclical than the discretionary fiscal effort, particularly in real time. Its interpretations are occasionally problematic. Before the outbreak of each of the two major crises, the structural balance, as measured in terms of the output gap, was exceptionally strong, but deteriorated rapidly at the outbreak of the crisis. For example, in the crisis of the early 1990s, fiscal policy as measured by the output gap-based structural balance would have been fundamentally looser than the policy implemented in the late 1980s.

Alternative measurement methods suggest that no corresponding strengthening in the public finances occurred prior to the crisis of the early 1990s. On the other hand, rising inflation in the late 1980s somewhat increases the cyclicity of alternative methods.<sup>66</sup> After the outbreak of the crisis, fiscal policy was tightened rapidly from 1992 onwards up to the end of the 1990s. By comparing the results to the development of the output gap-based structural balance, we can see that, on the basis of the latter, the tightening in fiscal policy did not begin until after the mid-1990s. Meanwhile, fiscal policy developments from the latter part of the 1990s until the early 2000s are similar, although the alternative methods indicate a more extensive tightening of fiscal policy in the 1990s than that suggested when I use the output gap method.

Prior to the financial crisis that began in 2007, the structural balance measured based on the real-time indicator strengthened more extensively than when measured based on the discretionary fiscal effort and the change in the ex-post structural balance. Thus, a real-time structural balance could have enabled the loosening of fiscal policy: Within the framework of a strong structural balance, there could have been room for weakening the balance. Measured using all indicators, fiscal policy was stimulative at the initial stage of the present crisis, but from 2011 onwards the indicators diverge again as the discretionary fiscal effort indicator suggests a 2–3 percentage point tightening of fiscal policy in 2010–2014, whereas the structural balance indicator shows hardly any signs of improved public finances. At this point, I will no longer differentiate between the real-time and ex-post structural balance.

In order to illustrate the difference between the indicators, in a scatter plot I have also compared the ex-post assessment of a cyclical change to the change in various fiscal policy indicators in 84–89, 89–93, 93–97, 97–00, 00–03, 03–07 and 07–09.<sup>67</sup> When assessing the change in the structural balance, I will apply the output-gap assessment based on the Commission's method which I have proposed, both ex post and in real time. Furthermore, as an indicator of discretionary measures I will apply the change in the DFE indicator produced using the bottom-up assessment method, to which the (ex-post) cyclical adjustment of unemployment is not applied. Thus, in principle this method provides a real-time view of fiscal policy, even though the results may have been affected by ex-post data revisions of the various variables.

Graph 12 shows how, according to the real-time structural balance, a change in the fiscal stance would have been strongly dependent on the economic cycle. Based on the line connecting up the observation points, a one percentage-point growth in the output gap would have weakened the structural balance by approximately 0.65 percentage points. Meanwhile, the bottom-up assessment method does

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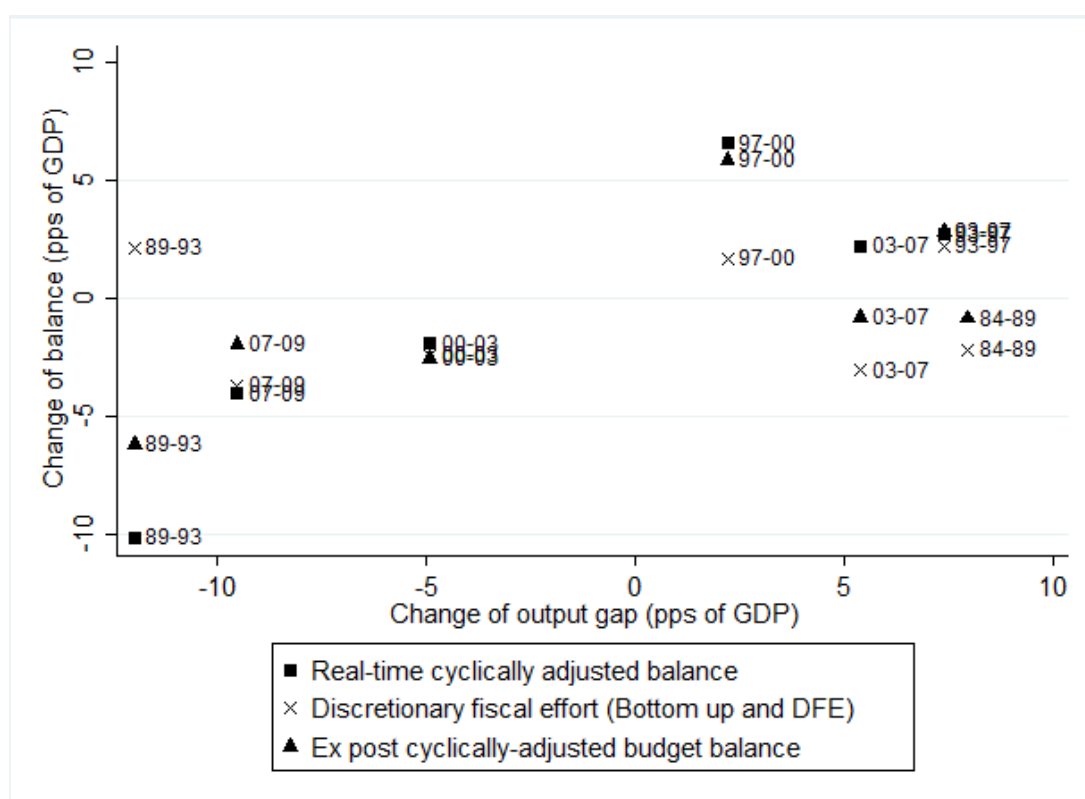
<sup>64</sup> In the comparison with a nominal structural balance, I have applied a nominal assessment of the discretionary fiscal effort. However, it is worth mentioning that a real assessment based on the expenditure benchmark is very close to the nominal assessment (appendix 3). I will discuss the real assessments of the expenditure benchmark at the end of this subchapter.

<sup>65</sup> The European Commission (2013B) and Carnot and de Castro (2015) have reported an average growth rate equal to the cumulative growth rate divided by the length of the time period.

<sup>66</sup> It should also be noted that the expenditure benchmark related to the corrective arm of the Stability and Growth Pact (SGP), the elements of which are calculated in real time without a specific cyclically adjusted unemployment expenditure, functions very similarly to the expenditure benchmark related to the preventive arm of the SGP, particularly when account is taken of the cyclical behaviour of inflation.

<sup>67</sup> With respect to the first time period, 1984–1989, no estimate of the change in the real-time structural balance is available, but the significant surplus observed in 1989 indicates pro-cyclical behaviour during this time period too.

Graph 12 Comparison of the ex-post assessment of a cyclical change to the change in various fiscal policy indicators in a scatter plot



not indicate a clear connection between the cyclical change and indicator developments. This suggests that fiscal policy was, on average, neutral and, following the outbreak of the crisis of the 1990s, even counter-cyclical (see the observation point for the years 89–93, which indicates the largest decline in the output gap).

Similarly to the European Commission (2013B) and Carnot and de Castro (2015), I will also compare the developments in the structural balance net of interest expenses with the bottom-up method. After netting interest expenses, the differences between the indicators are more clearly attributable to methodological factors, such as different cyclical adjustments of revenue and expenditure items and a different method of calculating the potential output growth rate. After netting interest expenses associated with the real-time cyclically-adjusted structural balance, the observed change indicates that the interest expenses explain around 15 per cent of the cyclical changes in the real-time structural balance, while the rest is explained by methodological differences.

Furthermore, I will perform a sensitivity analysis in order to assess the real cyclicality of discretionary fiscal effort in accordance with the expenditure benchmark. I will calculate the effort in relation to the GDP  $(\frac{\Delta e_t}{e_{t-1}} - \frac{\Delta e_t^{pot}}{e_{t-1}}) / (\frac{E_t}{Y_t})$  in the manner explained in chapter 3.2.<sup>68</sup> My alternative viewpoint is ex post. First, I will evaluate the connection between the change in the real discretionary fiscal effort, which complies with the expenditure benchmark based on an ex-post unemployment estimate, and the change in the output gap. Then, I will compare the results with the corresponding connection between the output gap and the ex-post change in the structural balance (with and without interest expenses).<sup>69</sup> An ex-post assessment will enable an annual analysis and I will use a statistical model in which various fiscal policy indicators are explained based on the production gap in 1985–2014.

<sup>68</sup> At this point, I will not vary the reference growth rate for the expenditure benchmark, but keep it unchanged regardless of whether or not the medium-term objective has been achieved.

<sup>69</sup> However, it should be noted that, in this analysis, the estimated changes in the structural balance are nominal, while the estimated changes in discretionary measures are real.

The results are parallel with the earlier assessment: based on a discretionary calculation, fiscal policy appears more pro-cyclical. On average, discretionary fiscal efforts have increased by approximately 0.13 percentage points per percentage point of the output gap. A corresponding assessment of the changes in the structural balance indicates that a one percentage point increase in the output gap weakens the structural balance by 0.18 percentage points. In the event of a structural primary balance, the extent of differences decreases by approximately 20 per cent, which means that the interest expenses explain only part of the differences.<sup>70</sup>

Finally, based on the data on changes in the revenue basis, I will analyse how much of the cyclicity in the structural balance as compared to the discretionary fiscal effort can be explained using the revenue estimates created using the output gap method.<sup>71</sup> In the light of the earlier literature, it appears that during economic cycles, the tax base – due to factors such as asset bubbles – may grow strongly in a manner that can be only weakly linked with developments in the output gap. Using an individual output gap indicator and fixed elasticity to assess these costs may prove impossible, as the changes simultaneously affect the growth and taxation structures.

By means of changes in the revenue basis, we can directly examine the cyclical development of revenue items in different years, instead of the output gap and fixed cyclical elasticity. I will do this by first eliminating the discretionary changes related to the various income types presented above. In principle, the remaining element of income development can be evaluated as a (cyclical) change independent of fiscal policy, while naturally taking account of any errors in the effects of the related decisions. The results of the analysis of various items, presented in more detail in appendix 4, suggest that changes in income in relation to income evaluated using fixed elasticities may explain various percentage points of the differences in the changes in the structural balance. In particular, the analysis of the late 1980s and early 2000s suggests that the income growth experienced during the economic upturn exceeded the estimates produced using the output gap method.

All in all, a comparison of the results produced using the various methods reinforces the impression that the structural balance provides a rather counter-cyclical view of fiscal policy. If, on the basis of any given indicator, fiscal policy functions counter-cyclically, rules based on it can easily lead to a pro-cyclical economic policy. In such a case, the fiscal stance must or can be changed in accordance with the economic cycle. These results are parallel with recent international observations (Carnot and de Castro, 2015). In the light of the results, it also appears that a significant part of the differences between the indicators is attributable to assumptions related to potential output estimates and the cyclical adjustment of unemployment expenditure. Furthermore, it appears that during an economic boom, the differences are affected by the cyclical behaviour of income and, to some extent, the fact that no account is taken of interest expenses in the evaluation of discretionary fiscal efforts.

### 5.3 Indicator differences from the viewpoint of EU regulations

In the following, I will examine how extensively the differences between indicators may have affected fiscal policy enacted via EU fiscal policy regulations at various points in time. In the meantime, however, we should take note that, due to restrictions in historical and other data, I have had to simplify the indicators in some respects. My interpretations should therefore be regarded as approximations that do not necessarily fully correspond to the way in which the current indicators actually function.

My assessment focuses on the preventive and corrective arm of the Stability and Growth Pact (SGP), depending on the arm which would have applied to Finland at any point in time on the basis of

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<sup>70</sup> As the analysis method, I have applied the Stata rreg algorithm which is suitable for small samples. The standard errors in the estimates are approximately 0.1 percentage points in either direction.

<sup>71</sup> The European Commission provides a more detailed breakdown of the causes of differences (2013B), but we will leave a corresponding analysis for future research. With respect to the analysis of the revenue basis, it should be noted that the annually changing elasticities applied in the Commission's breakdown have proven somewhat sensitive to various assumptions, and I have therefore applied a different method (see appendix 4).

the three per-cent deficit limit.<sup>72</sup> The preventive arm of the SGP assesses deviations in light of the medium-term objective (MTO) or the adjustment path taken towards achieving it. This is done by examining the structural balance and expenditure growth as well as any significant deviations in these in comparison to the reference values. With respect to the periods during which the corrective arm of the SGP, i.e. the excessive deficit procedure, would have applied to Finland I will examine the required adjustment of the structural balance using the output gap-based structural deficit and bottom-up assessment.

I will attempt to answer the following two questions in particular: 1. Based on the preventive arm, when would fiscal policy have been regarded as being compliant with the regulations on the basis of the output gap-based structural balance or the expenditure benchmark? 2. Based on the corrective arm, would the assessment of corrective action have been consistent with the output gap-based structural balance and the bottom-up assessment?

I will answer these questions on the basis of the following reference values.<sup>73</sup> For periods when the preventive arm of the SGP would have applied, I will set the medium-term objective (MTO) in accordance with Finland's present MTO, a structural balance of -0.5 per cent of the GDP, which equals the minimum level required by EU regulations. If the country has not achieved its MTO, the adjustment towards the required objective must be at least 0.5 per cent of the GDP on an annual basis, in such a manner, however, that the adjustment effort is higher in good times and lower in bad times.<sup>74</sup> The MTO is considered to have been achieved if the structural balance deviates from the objective by less than 0.25 per cent of GDP. When the MTO has been achieved, it must be continuously adhered to.

The expenditure benchmark is also evaluated with respect to these time periods. In fiscal policy legislation, the reference growth rate of expenditure is long-term growth in GDP, if the MTO has been achieved in a certain year. On the other hand, if the MTO has not been achieved, expenditure growth measured using indicators must be slower so that the deficit decreases by at least 0.5 percentage points per year. A sufficiently slow growth rate in the expenditure variable is obtained by deducting of the reference growth rate  $\frac{1}{2} * \frac{1}{E_t/Y_t}$ , where  $E_t/Y_t$  is the nominal GDP share of the expenditure variable applied.

For times during which Finland would have been covered by the corrective arm of the SGP (evaluated with the three per-cent deficit limit), I will examine the adequacy of measures aimed at adjusting the budgetary position by applying the (output gap-based) structural balance and the bottom-up assessment.<sup>75</sup> When the structural balance development is assessed using the excessive deficit procedure, the country in question must adjust its budgetary position (as a rule, at least 0.5 percentage points of the GDP per year) as from the year following the year in which the country was subjected to said procedure, until the excessive deficit has been adjusted. If the measures as shown by the structural balance indicator are unsuccessful (a significant deviation being at least 0.5 percentage points from the budgetary adjustment path), the DFE indicator is the last-resort criterion for an effectiveness analysis of the changes in the structural balance.

Furthermore, I should comment on the timing of the assessments presented, as well as the definition of certain variables. For example, the assessment of the SGP's preventive arm deviates with respect to the *ex post*, *in-year* and *ex ante* evaluation. Based on the preventive arm – and in the corrective arm – the assessment of the sufficiency of measures, particularly over the last year (*ex post*), is the key issue. From this viewpoint, the results presented in the following should be specifically interpreted as

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<sup>72</sup> I have excluded compliance with the debt rule from this examination, as Finland's debt ratio remained below the debt-related reference values during the period under review.

<sup>73</sup> The reference values applied have been defined by the Ministry of Finance (2015, pp. 71–72).

<sup>74</sup> At present, the adjustment towards the MTO is defined in accordance with the European Commission's guidelines (2015, appendix 2).

<sup>75</sup> Instead, due to lack of historical data, from my analysis I will exclude the so-called top-down efficiency assessment, based on which the effect of the change in the output gap estimate, revenue windfalls or shortfalls and any other factors potentially affecting the structural balance development is adjusted. Such an exclusion can be justified on the basis that my assessment is ultimately grounded in careful consideration based on which account is taken of compliance with the expenditure benchmark and discretionary revenue measures (bottom-up assessment).

an ex post evaluation, despite the fact that such evaluations involve uncertainties.<sup>76</sup>

In my ex post evaluation of the SGP's preventive arm, the significant deviation procedure can only be applied if the deviation from the MTO in the previous year was more than 0.25 per cent of the GDP and an actual (ex post) significant deviation is identified – at least 0.5 per cent of GDP – as compared to the path towards the MTO. The deviation assessment is performed on the basis of both the structural balance and the expenditure benchmark, while taking account of the cyclical state.

Below is a summary of the criteria applied in this report regarding deviations from the rules of the preventive and corrective arms of the SGP:

- Deviation in the preventive arm:
  - The deviation from the MTO in the previous year was more than 0.25 per cent of the GDP **and**
  - the structural deficit does not exceed 3 per cent, i.e. the country is not subject to the corrective arm of the SGP **and**
  - on the path towards the MTO, the budgetary position improves by less than 0.5 percentage points **and**
  - the deviation from the path (ex post) is significant, i.e. at least 0.5 per cent of GDP **and**
  - the deviation is significant from the viewpoint of both the structural balance and the expenditure benchmark while taking account of the cyclical state in accordance with the guidelines of the European Commission (2015, appendix 2).
- Deviation in the corrective arm:
  - The structural deficit exceeds 3 per cent **and**
  - the measures are not effective, i.e. the country is unable to adjust its budgetary position by at least 0.5 percentage points (structural balance adjustment path) **and**
  - the deviation from the path (ex post) is significant, i.e. at least 0.5 percentage points per year **and**
  - the deviation is significant in terms of both the structural balance and the bottom-up assessment.

Graph 13 shows the structural and nominal deficit. Based on this graph, the nominal deficit exceeded the reference value of 3 per cent in 1992–1996<sup>77</sup>. With respect to these years, I will examine the legislation related to the corrective arm and, in particular, the adequacy of measures aimed at adjusting the public finances. With respect to the other years, I will examine the preventive legislation.

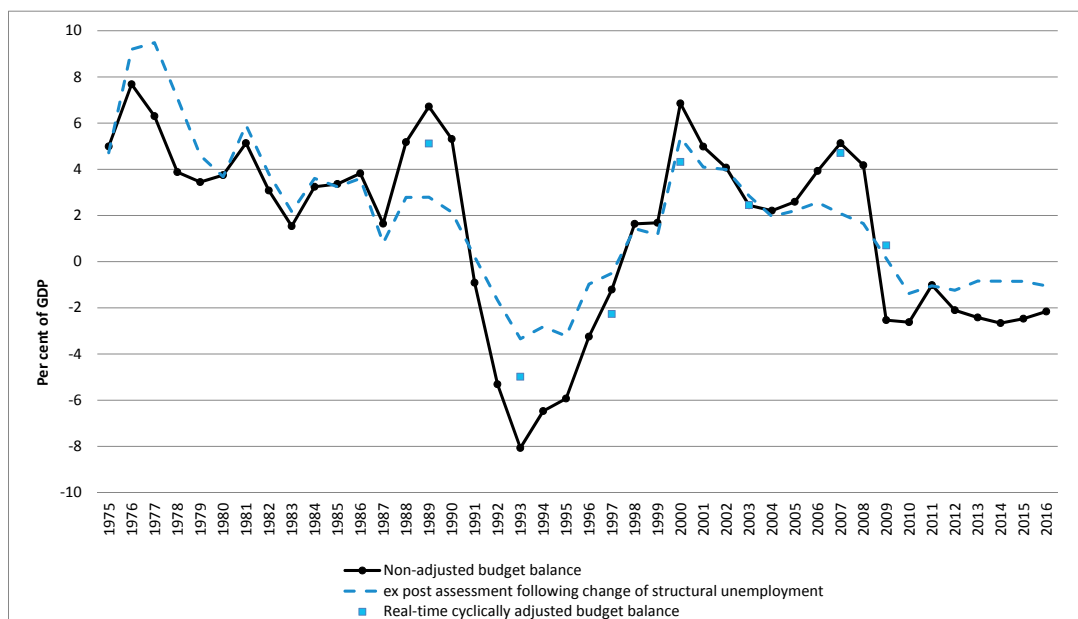
I will begin by examining those years in which the legislation related to the preventive arm might have been implemented. Based on the structural unemployment estimates which I have adjusted, the structural balance would have been below the MTO after the year 2011. However, according to my estimate, no such breach occurred on the basis of the data. Considering the improvement in the structural balance in 2011 and the weak cyclical state in 2011–2014, it is probable that the regulations would not have required larger adjustments in the structural balance.<sup>78</sup> Correspondingly, the expenditure aggregate complying with the expenditure benchmark (Graph 14) exceeded its reference value in 1985–1988, 1991, 2001–2002, 2004–2005 and 2007–2009. For the years 2011–2014, the previous year's structural balance was so weak that I will apply a stricter limit for expenditure growth to the expenditure benchmark.

<sup>76</sup> Almost all variables under review are actual estimates of quantities such as GDP, public spending, inflation and deficits. However, the GDP reference growth applied to the expenditure benchmark and bottom up assessments is based on the autumn forecasts of the year being assessed. Furthermore, the inflation indicator of the expenditure benchmark is determined as the average of the previous year's forecasts. It is also worth noting that the GDP reference growth is assessed within the framework of EU fiscal policy regulations every three years. For the years 2011–2014, I will use the figures provided by the Commission. For the period prior to that, I will apply annually changing reference values.

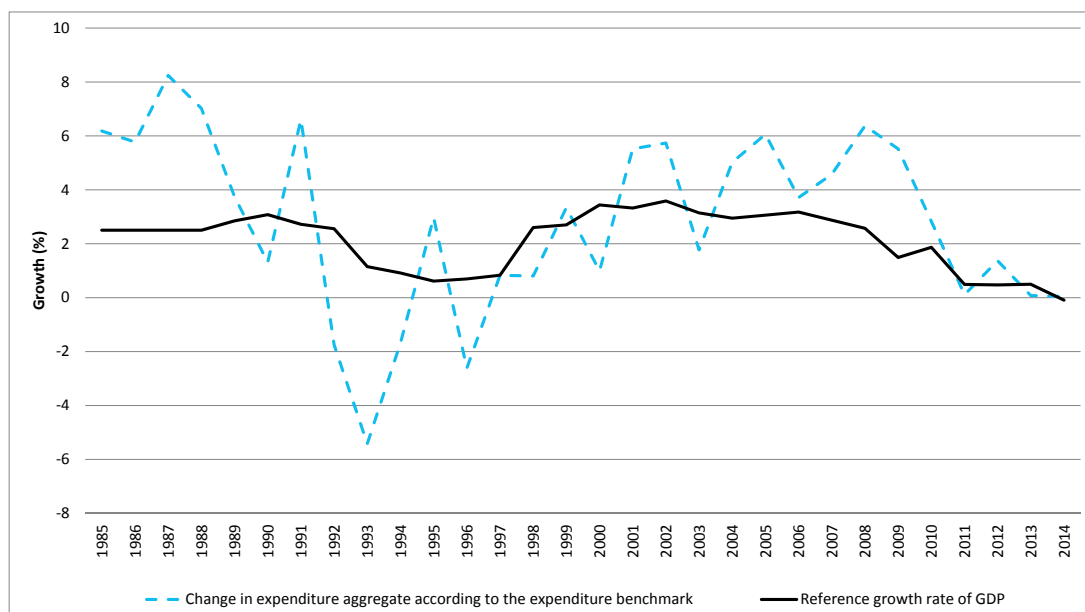
<sup>77</sup> Regarding the years 1992–1995 in particular, the budgetary position was significantly below the 3 per cent reference value.

<sup>78</sup> At the same time, it should be emphasised that the data is from the early spring of 2015 and that the proposed adjustments have been applied to the output gap method. Thus, this report does not provide a fully up-to-date view of fiscal policy indicators, and the results are not fully comparable with official figures.

Graph 13 The output gap-based structural balance and the public balance



Graph 14 The expenditure aggregate complying with the expenditure benchmark and the real reference growth rate of the potential GDP



The results therefore indicate that, for fairly many years, the output gap-based structural balance and the expenditure benchmark provide a different view of fiscal policy developments to that suggested by the reference values. In most years, Finland would have achieved the MTO, but would not have achieved the expenditure growth rate required by the expenditure benchmark, or would have been close to exceeding it. Such years can be identified during economic upturns. The major strengthening in the structural balance that preceded the crisis of the early 1990s and the current crisis could have allowed an expansion in the public finances. During both periods, the structural balance was rather strong as measured on the basis of both ex post and real time output gap estimates. At the same time, the expendi-



ture benchmark might have imposed stricter limits on fiscal policy during the said years.<sup>79</sup> Based on the expenditure benchmark, Finland's real growth in expenditure would have exceeded the medium-term real potential output growth rate in several years in both the early 1980s and the early 2000s.

Since the outbreak of the present crisis, the position has varied regarding regulation requiring a tighter fiscal policy. At the early stages of the crisis, in 2008–2009, Finland would have breached the expenditure benchmark, whereas it would have achieved the MTO as measured by the structural balance indicator. Since 2010, fiscal policy has tightened as measured by the expenditure benchmark. However, based on the output gap-based structural balance, it seems that fiscal policy has not tightened and Finland has been fairly close to breaching the MTO. As regards the differences, however, it is worth noting that the medium-term potential output growth rate in line with the expenditure benchmark has been slower than the reference growth rate applied. If this is taken into account in the expenditure benchmark, the expenditure aggregate development is not far from its reference values.<sup>80</sup>

Finally, I will examine the years 1993–1996, during which the legislation related to the corrective arm of the SGP could have been applied on the basis of the deficit criterion. Graph 15 gives an evaluation of the developments in the structural balance based on the output gap method and the bottom-up assessment, as indicated by the DFE indicator which reflects discretionary fiscal effort. On the basis of these, the adequacy of measures can be estimated (one year after the deficit criterion was breached in 1992). The results indicate that, based on the output gap method, Finland would not have reached the 0.5 percentage point adjustment requirement in the crisis years 1993 and 1995. Due to its fiscal policy in those years, Finland would have been unable to sufficiently adjust its structural deficit, and further measures might have been required.<sup>81</sup> However, following a careful consideration based on the bottom-up indicator, it can be seen that a strong adjustment of the general government balance was implemented in those years.<sup>82</sup>

All in all, it appears that the use of a discretionary bottom-up assessment and expenditure benchmark may facilitate fiscal policy steering in a more counter-cyclical direction, including from the viewpoint of compliance with fiscal policy regulations.

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<sup>79</sup> It is worth noting that, in situations in which a country, on the basis of an ex post evaluation, has achieved the MTO, but has not achieved the expenditure growth rate based on the expenditure benchmark, the Commission's current view is that this does not constitute a breach of the regulations, but the Commission may launch a further assessment of the structural balance in order to identify windfall revenues, for example (European Commission, 2013A). The (ex post) evaluations shown in appendix 4 indicate, for example, that the cyclical revenue development at the end of the 1980s and in the early 2000s would have been faster than suggested by the output gap-based adjustment. This indicates the existence of windfall revenues. No corresponding difference existed prior to the present crisis.

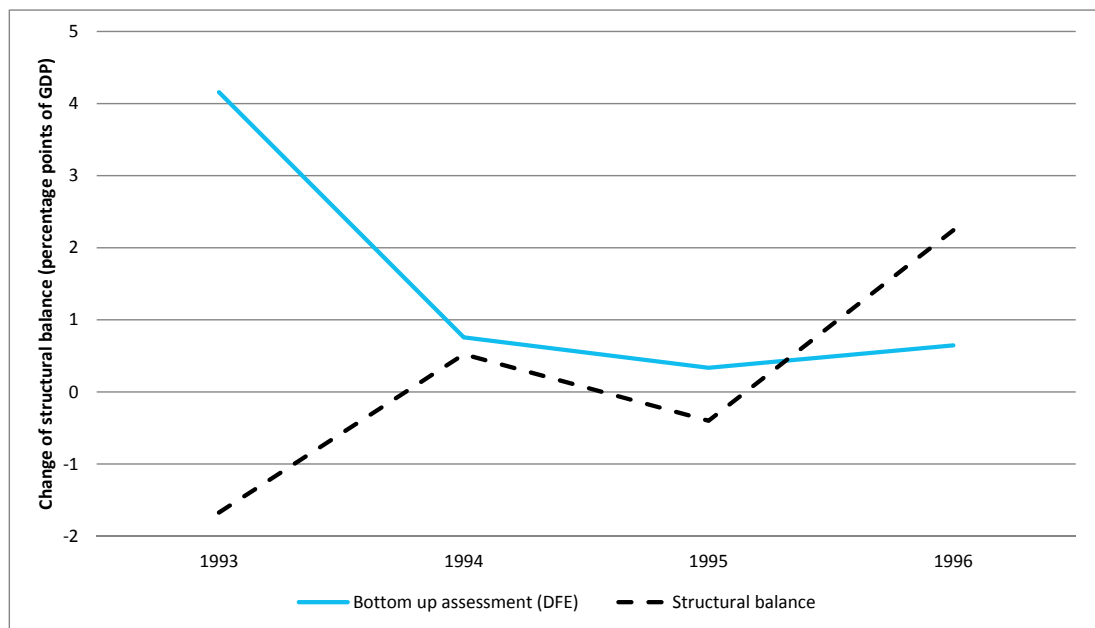
<sup>80</sup> It should be noted that the European Commission (2014) too has estimated that, at present, Finland complies with the expenditure benchmark, but in the current situation more emphasis is placed on the structural balance in the overall assessment of regulatory compliance. I will also examine the results against the estimates provided by the National Audit Office of Finland, available from 2012 onwards (National Audit Office of Finland, 2014). There are some differences between the results due to changes in the research data. In particular, the investment series has changed considerably following the change in the compilation of R&D investment statistics. However, the results point in the same direction. With respect to the years 2013 and 2014, the National Audit Office of Finland also estimates that Finland was in compliance with the expenditure benchmark. For the year 2012, the Office estimates that Finland exceeded the reference growth rate for expenditure, which corresponds to the observations I made in my study.

<sup>81</sup> Kuusi (2014) has examined the structural balance in real time during the crisis of the 1990s and has similarly come to the conclusion that, under the output gap-based method, further restrictions may have been required.

<sup>82</sup> To understand the differences, it should be noted that, with respect to the years 1993 and 1995, the growth in interest expenses accounts for approximately 30 per cent of the differences between the indicators in 1993 and approximately 5 per cent in 1995. The remainder is attributable to the way in which the methods distinguish cyclical changes in unemployment expenditure and revenues, as well as the definition of potential output growth (European Commission, 2013B). Estimates of changing elasticities (appendix 4) indicate that the differences between the methods are explained by factors other than revenue developments (expenditure developments and the different methods of measuring potential output).



Graph 15 Evaluation of the developments in the structural balance based on the output gap method and the bottom-up assessment in 1993–1996





# 6 Conclusions

## 6.1 General conclusions

The structural balance has been given a key role in the EU's new fiscal legislation. In this study, I examine estimates of the structural balance from a historical perspective, using the European Commission's analysis method and comparing it to alternative fiscal policy indicators.

The results of the study corroborate the view presented in earlier literature, according to which a structural balance is difficult to estimate using the output gap approach (cf. Chapter 2). Although the European Commission uses the latest statistical methods to assess the cyclical state of the economy, measuring the output gap in real time proves to be a difficult task in practice. The capacity of the output gap method to filter out cyclical fluctuations and to measure the impact of each cyclical phase on the budgetary position is limited, which may result in an underestimate or overestimate of the budget balance independent of the economic cycle. In particular, during the phase in the 1980s when the economy was overheating and during the deep economic crisis of the early 1990s, steering fiscal policy by means of the structural balance may have resulted in a more pro-cyclical policy than observed at the time.

In addition to the output gap structural balance, I examine the SGP's preventive part's expenditure benchmark. According to that benchmark, in countries that have reached the medium-term target, expenditure can, at a maximum, grow at the same rate as the medium-term reference rate of potential growth in GDP. In countries that have not reached the medium-term target, the growth rate in expenditure must remain below that. If the rate of increase in expenditure is faster, the overrun must be compensated for by discretionary revenue measures. Alongside the structural balance, I examine the effectiveness of corrective budgetary action using what is known as the bottom-up approach.

In both the expenditure benchmark and the bottom-up approach, growth in GDP is assessed by means of the medium-term growth of potential output (which is less cycle-dependent), cycle-dependent items are deducted from expenditure, and the build-up of revenue is measured on the basis of identified discretionary revenue measures and their impact analysis. As background, I collected data on changes in the revenue base from the years 1977–2014.

Judging from the analysis, a financial policy based on the expenditure benchmark and the bottom-up approach might have been more counter-cyclical than one based on the structural balance. A financial policy based on the expenditure benchmark would have been stringent before the crisis of the 1990s in particular, which might have contributed to mitigating the crisis and allowed for a greater fiscal impulse contingency during it. On the other hand, on the basis of a discretionary bottom-up assessment, the financial policy pursued since 1992 would have been sufficiently stringent, whereas a policy based on the structural balance would have created further pressure for tightening.

Also, in the present situation an assessment of the trend in Finnish financial policy, based on the discretionary expenditure benchmark, deviates somewhat from output gap-based assessments. An output gap-based structural balance would threaten to breach the limits of the EU's financial policy rules, but on the basis of the expenditure benchmark tightening in financial policy has been sufficient to compensate for the pressure – resulting from the weakened growth rate in potential output – to limit increases in expenditure. It should nevertheless be borne in mind that the reference value for potential output employed in the expenditure benchmark approach is infrequently updated and does not therefore necessarily correspond to the current actual growth potential of the economy.

All in all, it would seem that parallel indicators are needed, although maintaining them would also mean maintaining the existing complexity of rules and add to the discretionary nature of their interpretation. Assessments of individual changes in policy and of the trend in the long-term growth potential of the national economy should be utilised in the steering of financial policy, even if measuring such changes would involve challenges. On the other hand, there is no reason to ignore established methods of analysing economic under-utilisation, especially by means of inflation, although methodological challenges have been encountered when such methods have been applied in practice. Long-term growth values calculated based on discretionary methods do not offer a reference point for assessing the cyclical position of the national economy which is as clear as, for instance, the inflation-neutral equilibrium unemployment used for measuring the output gap. The best solution therefore lies in analysing the differences between various indicators and using them in combination when steering financial policy.

## 6.2 Methodological considerations

On the basis of my analysis, I recommend changing the manner in which the output gap method for calculating structural unemployment is implemented. The method currently employed by the European Commission involves underlying assumptions about the magnitude of the cyclical and structural components of unemployment, which are problematic in view of their statistical credibility, the earlier literature and the functioning of such models in real time. My findings suggest that such presuppositions result in an underestimation of cyclical unemployment and hence of the output gap. This is particularly true with regard to the recession of the 1990s, but to some extent also in relation to the current crisis. At any rate, clearer reporting of the parametric constraints important to the functioning of the method and a more analytical evaluation of their effects within the Bayesian network would be essential.

One means of improving estimates of structural unemployment would involve the use of more accurate parameters relating to labour market dynamics. It could be argued that, in a country like Finland where nominal rigidities are great, a downward wage mechanism in the labour market has a greater impact on the extensive (unemployment) than on the intensive (working hours) margin. People becoming unemployed during economic crises are forced to take jobs at lower wage rates. On the other hand, more productive employees – often on higher salaries – are able to hold onto their jobs. In actuality, mutually offsetting effects make aggregate wages less resilient in the downward direction. On the other hand, such effects can be differentiated into statistically separate components and, in principle, applied when measuring cyclical unemployment (Kauhanen and Maliranta, 2012).

However, the starting-points for assessing total factor productivity are less clear. One way of developing the assessment of performance within total factor productivity is to examine it from the industry or sector level (cf. e.g. Pohjola, 2011; Kuusi, 2013; Fernald, 2014). In Finland, this is of particular importance since the meltdown in potential output during the present crisis is an outcome of the country's strong specialisation within export markets and of the weak competitive performance of some industries. Hence, the current report recommends that methods be devised allowing the systematic follow-up of potential trends in total factor productivity at industry level and aggregation of the results to give the total factor productivity potential of the economy and the total output gap.

The expenditure benchmark and bottom-up assessment are not immune to measurement problems either. They should also be buttressed by an understanding of the medium-term output potential of the economy. Although the moving average presented in this report for past trends and forecasts over the business cycle is less sensitive to cyclical changes, short-term positions may also be reflected in longer-term assessments. This may also lead to cyclicity in alternative methods of assessing the structural balance. Furthermore, the reference GDP growth employed in the expenditure benchmark and the bottom-up approach are infrequently updated at the moment. The reference rate can represent a position on the growth potential of the economy that is more than three years old.

The present report also recommends substituting the inflation parameter of the expenditure benchmark and the bottom-up approach with a longer-term equilibrium, in order to avoid changes in inflation or its forecasts having the effect of enhancing cyclicity. This would improve the predictability of the

methods employed. In principle, both alternative instruments would allow a strong increase in expenditure under conditions of high inflation, whereas under crisis conditions of low inflation they may produce an additional need for cuts in public spending. This is despite the fact that taking account of the inflation adjustment of the earning and income scales as a change in the revenue base partly serves as a balancing factor. Furthermore, employing inflation forecasts would appear to alleviate the problem of cyclicalities as far as the expenditure benchmark is concerned.

An independent economic analysis of the effects of various changes in policy is needed to back up the expenditure benchmark and the bottom-up approach. In particular, any appraisals of the magnitude of the multiplier effect of financial policy – both during and outside crises – remain fairly contradictory. Hopefully, the material on fiscal decisions compiled to serve as background for the present report will be of assistance in evaluating the multiplier effect in Finland in the future.

Finally, it is problematic, in view of the expenditure benchmark in particular, that the benchmark plays no clear role – independent of the structural balance and its calculation methods – in the EU's fiscal rules. In determining the medium-term growth reference rate of potential output in accordance with the expenditure benchmark, the preventive arm of the SGP still lacks an estimate of the fulfilment of the MTO, as well as output gap-based assessments of cyclical unemployment. One problem lies in the fact that this method as such does not involve monitoring the objective level of fiscal policy, but changes in fiscal policy. A solution could involve tying the expenditure benchmark more closely to the debt level and to forecasts of its future trends based on sustainability calculations. Hughes Hallett and Jensen (2012), for example, propose a given limit for the indebtedness level below a GDP ratio of 60%, where exceeding such a limit would trigger preventive measures. Although the debt ratio is also sensitive to cyclical changes, it is not as prone to fluctuation as the (structural) deficit. On the other hand, we already have experience of cyclical adjustments of debt under the present rules.



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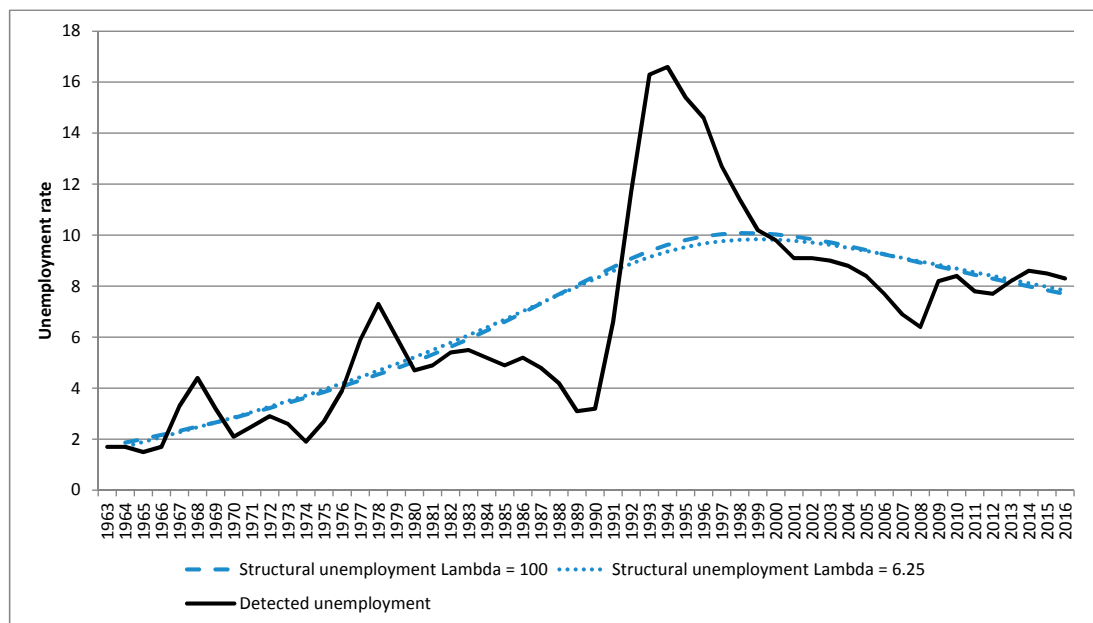
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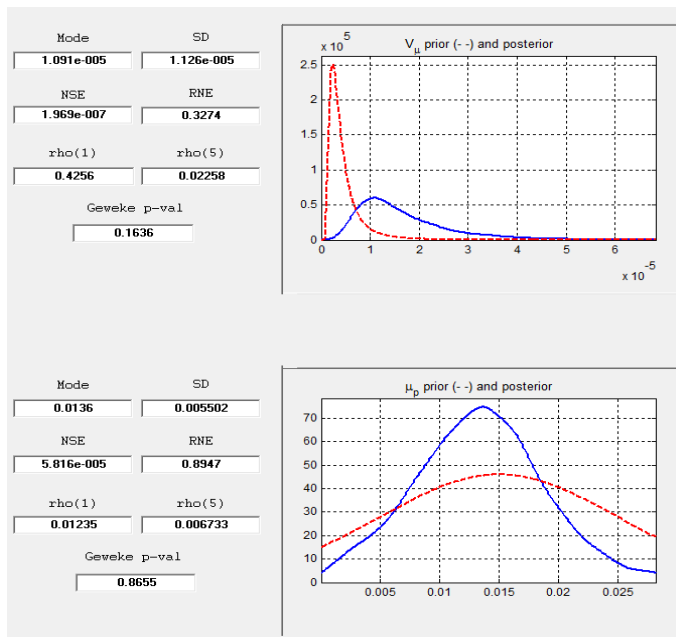
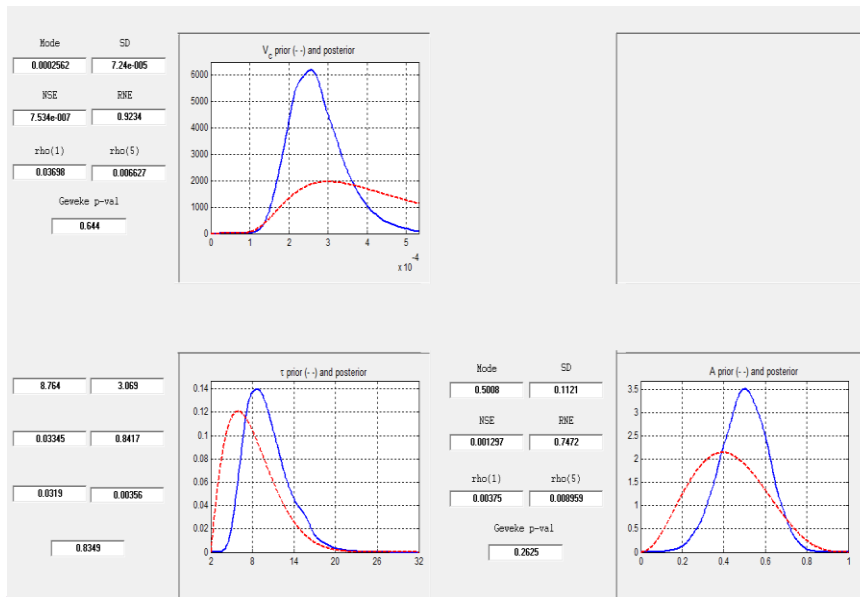
# Appendices

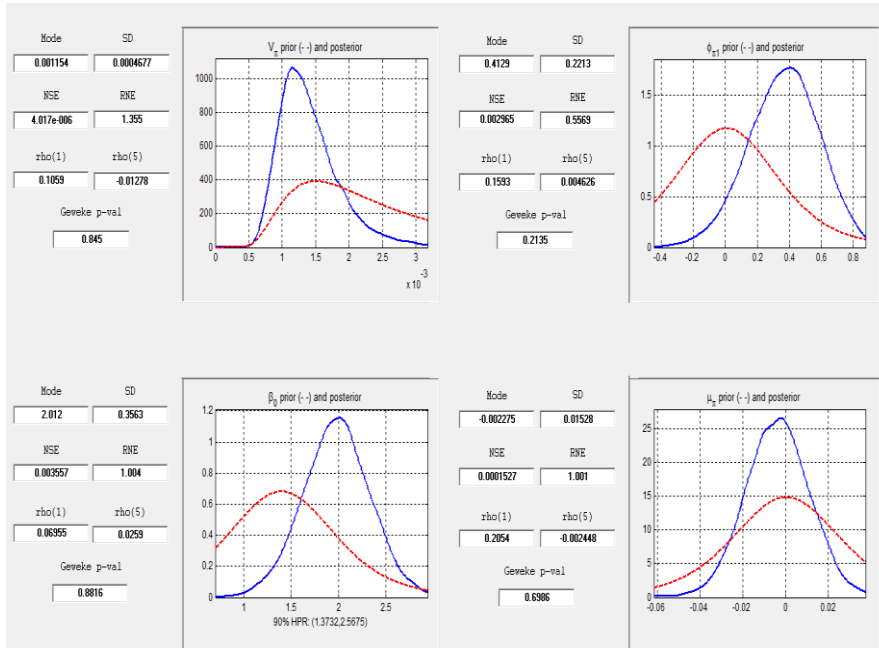
## Appendix 1. Effects of the value of the smoothness parameter of the HP filter on estimates of structural unemployment

Graph 16 Smoothing parameter and the estimates of structural unemployment

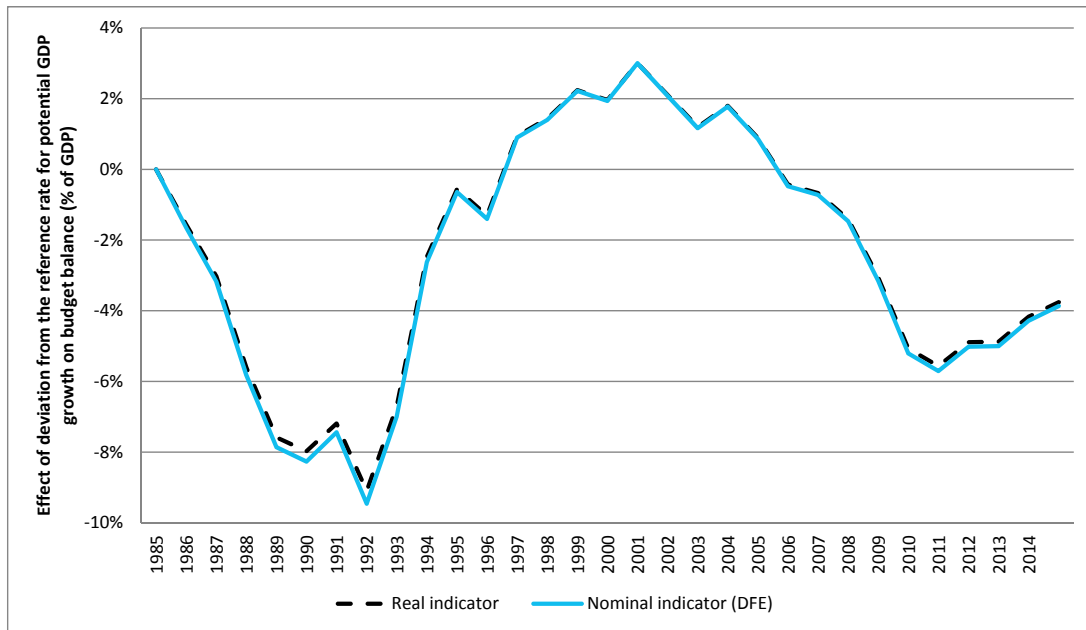


## Appendix 2. Prior and posterior distributions of the parameters of total factor productivity measurement





### Appendix 3. Deviation from the growth rate of medium-term potential GDP: real and nominal assessments (DFE)



## Appendix 4. Varying revenue elasticities

The basic idea of the method is that it is easy in principle to monitor changes in economic policy on the revenue side as observed on the basis of the revenue base: economic policy is essentially neutral if no new decisions are made. On the other hand, there is no corresponding distinct neutral reference point on the expenditure side, but the growth in expenditure must in some way be quantified by reference to other growth in the national economy. In the varying elasticity method, cyclical change in expenditure is still assessed by the output gap method and fixed elasticities.

On the revenue side, the discretionary changes are first removed from the different types of revenue on the basis of the impact values of individual discretionary measures as set forth above. According to the reasoning above, the remainder of the revenue performance is cyclically dependent, at least when there are no significant errors in the assessment of the changes in revenue base. This allows direct observation of the cyclical development of revenue items in different years, instead of the output gap and fixed elasticity. On the basis of such changes, an annually varying elasticity can in principle be calculated for the different revenue items.

In the following, I will correct the income in the different income brackets by adding the effects of changes in revenue base carried out in different years to previously detected income, as was done by Carnot and de Castro (2015). The magnitude of the addition in previous years is estimated in accordance with the estimated relative impact for the actual year of implementation of the change. If, for example, a tax reform were to increase indirect taxation by 0.5% starting from the year of implementation, also the taxes of the previous years must be proportionately increased in order to eliminate the impact of the reform in the tax series.

I will formally examine such correction in the following. Let the total income relating to year  $j$  be  $T_j$  and changes in revenue base  $N_j$ . In order for it to be possible to look at the previous year corrected with discretionary changes in relation to the present  $t$ , the finding on the previous year must be corrected with discretionary measures conducted in the current year. The required correction in accordance with the above is  $\frac{T_t}{T_t - N_t}$ . I will denote this corrected finding by the symbol  $A_{t-j}$ . In more general terms, each corrected finding preceding the point in time  $t$  can be obtained by the same line of inference in accordance with the equation

$$A_j = T_j \prod_{k=j+1}^t \frac{T_k}{T_k - N_k} \quad | \quad \text{kaikille } j < t .$$

When the effects of the discretionary measures have been corrected, there is in principle no need to use fixed cyclical elasticities, but the sensitivity of any revenue item to discretionary changes in (here, nominal) GDP can be directly calculated for each point of time by using the corrected series  $\epsilon_t = \Delta \log(A_j) / \Delta \log(GDP_t)$ . When the elasticity is known, the change brought about by the output gap in the revenue item can be directly estimated by means of the output gap estimate  $\epsilon_t * OG_t$ , and this effect can be further aggregated onto the level of the national economy by using the GDP component of the revenue item.

I will, however, not employ this straightforward approach, even though the Commission has employed it to assess the problems of fixed elasticity. In practice, elasticity estimates  $\epsilon_t$  are always very unstable, particularly because in practical circumstances, elasticity is very dependent on the growth rate of the GDP in the denominator. Particularly if the denominator approaches zero, the elasticities may have very high absolute values and do not provide a rational basis for assessing cyclical effects.<sup>83</sup>

Instead, I settled upon assessing the cyclical component of each revenue item separately and comparing the results directly with the output gap calculated from the nominal GDP. To focus on the effects of varying elasticities, I also standardise the measuring method of the output gap as the HP filter in all

<sup>83</sup> For example, I found that the results of the method are highly dependent on the assumed time lags between changes in income and the GDP performance.

cases<sup>84</sup> To assess the cyclical correction, I multiply the GDP gap by a fixed factor (0.57). On the other hand, in revenue item -specific cyclical correction, the cyclical items are directly summed together to provide a cyclical correction on the revenue side. To improve comparability, however, I have added the cyclical effect of unemployment from the expenditure side to both calculation methods.

### Evaluation of the method

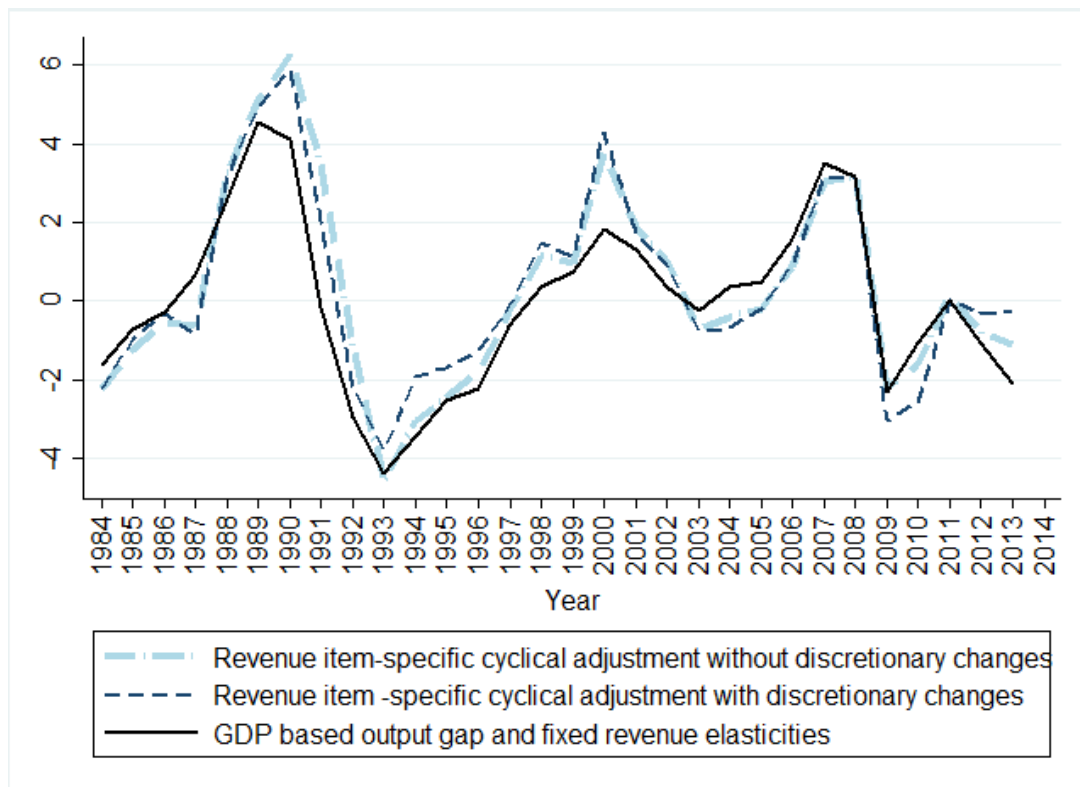
Figure 17 is a comparison of the conventional method (cyclical correction of GDP and fixed elasticity) to revenue item -specific cyclical components without discretionary changes and with them. The results show first of all that discretionary changes only explain a small part of the changes in revenue items, in other words, a large part of the fluctuation in the revenue items has been independent of the discretionary measures.

On the other hand, eliminating the changes in revenue base from the material also has significance for elasticities. In the recession of the 1990s, taking discretionary measures into account results in a stronger estimate of the pro-cyclicality of the fiscal policy. In economic upturns, taking into account the lenience measures in financial policy and the resultant decrease in revenue items strengthens the notion of the impact of economic cycles on revenue items, whereas in an economic downturn, with regard to the austerity measures enacted in the financial policy (increase in revenue), revenue decreased even more as a result of the economic cycle. In the present crisis, taking into account the lenience measures in financial policy will give a lower estimate of the cyclical elasticity of revenue items.

All in all, it seems that the elasticities are in order as far as the present crisis is concerned. Cyclical corrections with the Commission's elasticity utility and with revenue item -specific assessment, without discretionary changes, converge strongly. However, as far as the crisis of the 1990s is concerned, the elasticities were undersized particularly in view of the changes in revenue base made during the crisis.

Graph 17 Fixed and varying elasticities

Cyclical correction (pps of potential GDP), HP-filter.

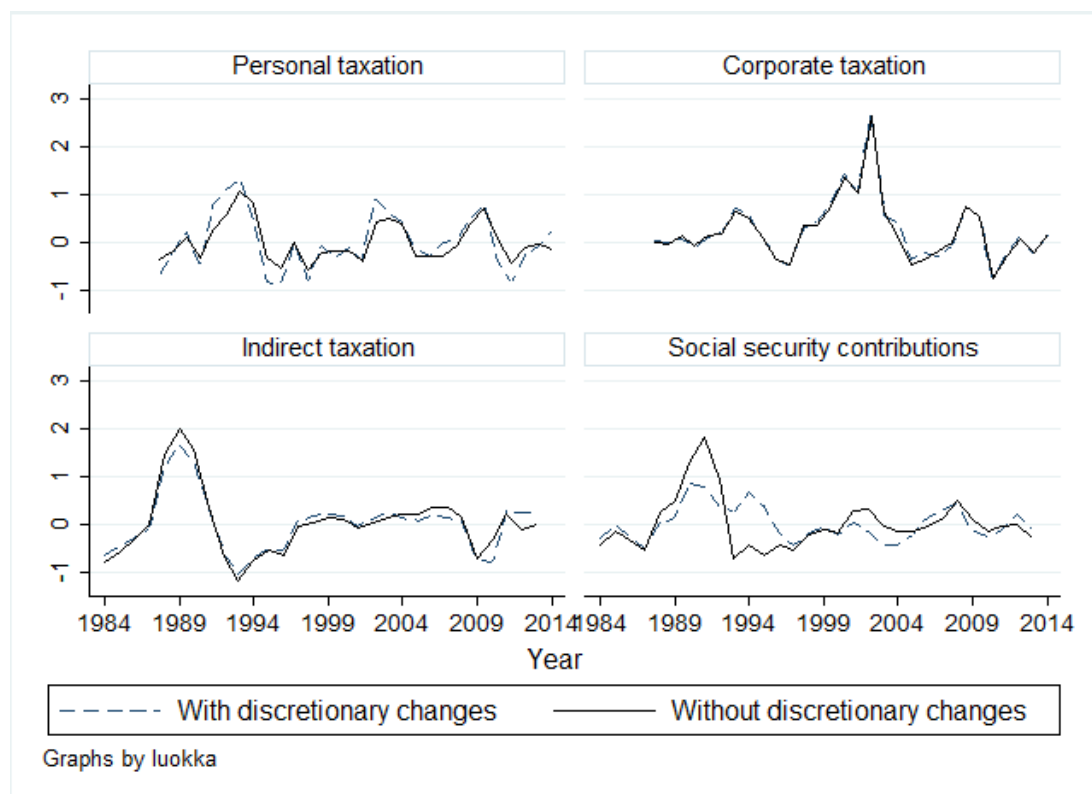


<sup>84</sup> In the year material employed, I select  $\lambda = 100$ . I have also performed corresponding calculations with the value  $\lambda = 6.25$ , but the results are very similar.



In the following, I will analyse the trends as broken down into four main revenue items. I find that changes in the revenue base of social security funds largely explain why the cyclical fluctuation of revenue is stronger in the corrected material in the early 1990s. The results (Figure 18) show that the largest factor contributing to revenue elasticities in the crisis of the 1990s was the easing of social security contributions and the later raising of such contributions. When the effect of the discretionary measures is eliminated, also the build-up of the revenue of the social security funds follows cyclical trends more closely. Significant factors in the recession of the 1990s also include the strong increase in personal and indirect tax revenue before the crisis. Such factors are partly explained by the financial policy conducted at the time.

Graph 18 Cyclical correction as broken down into four main revenue items (pps of potential GDP, HP-filter)



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