Session 1

CYCLICAL ADJUSTMENT

MEASURING CYCLICALLY-ADJUSTED BUDGET BALANCES FOR OECD COUNTRIES

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1. Introduction and summary

1. An important tool in the analysis of fiscal policy is the distinction between structural and cyclical components of the budget balance. This paper describes work undertaken to re-estimate and re-specify the elasticities underlying the Economics Department's calculations of cyclically-adjusted budget balances, which were last updated in 1999.[1] In particular:

- Account is taken of tax reforms introduced since the previous updating exercise, which have modified the sensitivity of tax receipts with respect to the tax base.
- The equations linking the tax bases to the output gap have been revised with a view to improving the statistical properties of the estimates.[2]
- A number of methodological innovations have been introduced to better account for the lags between taxes and activity and to ensure greater cross-country consistency in the estimates of tax base elasticities.
- The methodology underlying cyclical adjustment of expenditures has also been reviewed.
- Finally, the country coverage has been extended.

2. The paper is organised as follows. Section 2 describes the methodology. Section 3 reports the computation of revenue elasticities with respect to tax bases according to current taxation regimes and the elasticities of tax and expenditure bases with respect to the output gap, estimated using panel regression techniques. Section 4 combines the elasticities presented in Section 3 into reduced-form elasticities. The final section evaluates the sensitivity of public finances to the economic cycle. The Appendix provides detailed econometric results.

3. The overall results are broadly consistent with the previous set of estimates.

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1 See OECD Economic Outlook, No. 66, for a description of the previous update of the OECD's cyclical adjustment method. Detailed results were reported by van den Noord (2000).

2 In particular, the stability and the significance of the estimates through time and the possibility of endogenous bias were examined.

- The sensitivity of government net lending to a 1 percentage point change in the output gap remains at around 0.5 per cent of GDP for OECD economies on average. The most noticeable changes are for Denmark, Finland, the Netherlands and Sweden, where the estimated responsiveness has declined, and for Australia, Austria and Japan where it has increased.
- The re-estimation of the levels of the cyclically-adjusted fiscal balances with the revised elasticities has thus had a limited effect for most OECD economies. The main exceptions are Denmark and the Netherlands, where the 2003 cyclically-adjusted balances shift towards deficit by around ½ per cent of GDP, and Japan, where the deficit is about ½ per cent of GDP smaller.
- Fiscal elasticities have been estimated for eight OECD member countries not covered in the previous analysis. In Korea, Hungary, the Slovak Republic and Luxembourg deficits seem to have been almost entirely of a structural nature in 2003. In the Czech Republic, Iceland, Poland and Switzerland, 2003 deficits are estimated to have had a more visible cyclical component. However, it should be noted that greater uncertainty attaches to these estimates due to data limitations and the fact that some of these economies are experiencing important structural changes, in particular Eastern European countries.

2. Conceptual and methodological issues

4. As noted above, the cyclically-adjusted balance is computed to show the underlying fiscal position when cyclical or automatic movements are removed. In terms of revenues, four different types of taxes are distinguished in the cyclical adjustment process: personal income tax; social security contributions; corporate income tax and indirect taxes. The sole item of public spending treated as cyclically sensitive is unemployment-related transfers.[3] The cyclically-adjusted balance (ratio to potential output), b^*, is thus defined as:

$$b^* = [(\sum_{i=1}^{4} T_i^*) - G^* + X] / Y^* \qquad (1)$$

where:

G^* = cyclically-adjusted current primary government expenditures

T_i^* = cyclically-adjusted component of the i-th category of tax

X = non-tax revenues minus capital and net interest spending

Y^* = level of potential output

and the cyclically-adjusted components are calculated from actual tax revenues and expenditures adjusted according to the ratio of potential output to actual output, the

3 The adjustment is made at the level of total primary spending as time-series data on unemployment-related expenditure are not available across countries.

ratio between structural unemployment and actual unemployment and the assumed elasticities:

$$T_i^*/T_i = (Y^*/Y)^{\varepsilon_{t_i, y}} \tag{2}$$

$$G^*/G = (U^*/U)^{\varepsilon_{g, u}} \tag{3}$$

where:

T_i = actual tax revenues for the *i*-th category of tax

G = actual current primary government expenditures (excluding capital and interest spending)

Y = level of actual output

U^* = level of structural unemployment

U = level of actual unemployment

$\varepsilon_{t_i, y}$ = elasticity of the *i*-th tax category with respect to the output gap

$\varepsilon_{g, u}$ = elasticity of current primary government expenditure with respect to the ratio of structural to actual unemployment

From these relationships, the cyclically-adjusted balance can be derived as follows:

$$b^* = [\,(\sum_{i=1}^{4} T_i\,(Y^*/Y)^{\varepsilon_{t_i, y}}) - G\,(U^*/U)^{\varepsilon_{g, u}} + X\,]\,/Y^* \tag{4}$$

5. Conceptually, the elasticities $\varepsilon\, t_{i,}\, y$ can be separated into two components, an elasticity of tax proceeds with respect to the relevant tax base, $\varepsilon\ t_i,\ tb_i$ and an elasticity of the tax base relative to a cyclical indicator, $\varepsilon\, tb_i,\, y$:

$$\varepsilon t_{i,}\, y = \varepsilon t_i,\ tb_i\ \varepsilon tb_i,\ y \tag{5}$$

6. The elasticity of the tax proceeds with respect to the tax base is determined by the structure of the tax system. For proportional taxes, the value will be unity, but where there are several rates the elasticity can exceed unity (progressivity) or fall below it (regressivity). The personal income tax is generally progressive, being characterised by a statutory rate which rises with taxable income, while social security contributions are usually levied at a flat rate up to a ceiling, which makes them moderately regressive.[4] Corporate income tax is normally levied at a single rate. For indirect taxes, two opposite effects weigh on the value of the elasticity. On the one hand, *ad valorem* indirect taxes such as the value added tax may have a progressive element to the extent that higher rates apply to more income-elastic parts of the base. On the other hand, specific taxes, which are determined by real consumption only and do not account for price movements, may be regressive. The elasticity of the tax base with respect to a cyclical indicator can be quite complex,

4 Recent tax policy reforms in a number of new European Union member countries include the adoption of flat tax systems. The only OECD country having opted for such a system to date is the Slovak Republic.

depending on whether the base is income, expenditure or employment, the behaviour of which can vary across cycles. For instance, the mix between wage income and profits may influence the elasticity of the corporate tax base with respect to the output gap.

7. The OECD methodology calculates the business cycle's impact on fiscal balances using indicators capturing the effects of the degree of resource utilisation, *i.e.* deviation between actual and potential output and between actual and structural unemployment. This calculation is subject to measurement errors relating to estimates of potential output and structural unemployment. Moreover, this framework constitutes an approximation as it takes no account of the forces driving the business cycle which varies over time, with implications for revenues and spending. The cyclically-adjusted fiscal position may also be affected by temporary factors, not directly linked to the cycle, including one-off operations, creative accounting, classification errors and asset prices cycles. The relevance of these issues is discussed below in the Box.

3. Specifying and calculating the elasticities

8. This section describes the method used to calculate the elasticities for the four taxes and one spending element described above. The elasticities of various taxes with respect to their base are extracted from tax legislation and related fiscal data, while the sensitivity of the different tax bases with respect to the output gap is estimated econometrically using time-series data.[5] Eight countries have been added to the actual set of 20 countries. They are the Czech Republic, Hungary, Iceland, Korea, Luxembourg, Poland, the Slovak Republic and Switzerland. Mexico and Turkey have not been included for lack of comparable data.

3.1 Elasticities of tax receipts and expenditures with respect to their base

3.1.1 Elasticities of personal income tax and social security contributions based on tax rules and detailed revenue data

9. Using the same approach as in Giorno *et al.* (1995), the elasticity of income tax revenues (social security contributions) with respect to the tax base $\varepsilon t_{i,}\ tb$ is assessed on the basis of statutory tax rates and the income distribution to which they are applied.[6] The previous set of elasticities incorporated 1996 tax law information

[5] Boije (2004) argues that traditional approaches to cyclically-adjust budget balances disregard the simultaneity between fiscal policy and the business cycle. Taking into account this issue can result in larger elasticities of revenues and expenditures. See for instance the studies of Murchison and Robbins (2003) for Canada and Kiss and Vadas (2005) for Hungary.

[6] Given the detailed data requirements, the tax base is approximated by wage income in the manufacturing sector to allow for an international comparison of countries. Specifically, to take account of the progressivity of the income tax system, the base is defined in terms of average wages *per* employee. The exclusion of other income components under personal income taxes implies some loss of information

(continues)

Box
Limitations of the Cyclical Adjustment Process

The difficulties associated with the estimation of potential output and hence output gaps and structural unemployment are well known and have been examined in a number of OECD studies.[1] For instance, it might be particularly problematic to estimate potential output at cyclical turning points, which are often associated with trend breaks in GDP growth (Pedersen and Elmer, 2003) and for economies undergoing important structural changes, such as the four Eastern European countries considered in this paper.

Budgetary positions are potentially sensitive to changes in the composition of aggregate demand. For example, a positive domestic demand shock, driven by private consumption is likely to have a different impact on budget balances than a rise in exports which contain relatively less tax-rich components. These effects could be taken into accounts by adjusting tax revenues for deviations of tax bases from their long-term structure.[2] Consequently, the measurement of the composition effect requires the existence of a benchmark composition of aggregate demand. However, unlike potential output, there is no equivalent structural reference for the equilibrium structure of aggregate demand (European Commission, 2004). As an example, a simple test of whether there is an equilibrium structure of demand has been performed for 24 OECD countries at a fairly aggregate level. Unit root tests indicate non-stationarity for the ratio of domestic demand to GDP in 18 out of 24 OECD countries over the 1970 to 2003 period (Table 1).

In general, cyclical-adjustment methodologies, which adjust potential output for composition effects on demand, pose important conceptual problems related to the measurement of the equilibrium composition of output. This issue argues for retaining the output gap as the benchmark for cyclical adjustment.

The cyclically-adjusted fiscal position may also be affected by temporary factors, not directly linked to the cycle, including one-off operations, creative accounting, classification errors (Koen and van den Noord, 2005) and asset prices cycles (Girouard and Price, 2004). The OECD cyclically-adjusted balances exclude one-off revenues from the sale of third-generation mobile telephone licences. These revenues have been substantial in a number of countries.[3] However, asset-price based taxes are not currently excluded from cyclically-adjusted balances, despite the fact that a non-negligible share of transitory revenue fluctuations can be related to asset price cycles and in particular to capital gains taxes. Uneven data coverage does not permit the

insofar as these components are expected to vary systematically with the output gap. Public wages are assumed to be non-cyclical.

Table 1

Stationarity of Aggregate Domestic Demand, 1970-2003
(augmented Dickey Fuller test)
(percentage of GDP)

United States	–0.38	Greece	–2.08
Japan	–3.75 ***	Iceland	–3.66 ***
Germany	–2.39	Ireland	–0.33
France	–1.91	Korea	–2.66 *
Italy	–2.37	Luxembourg	–1.93
United Kingdom	–2.23	Netherlands	–1.87
Canada	–1.91	New Zealand	–3.18
Australia	–1.90	Norway (mainland)	–1.59
Austria	–2.82 *	Portugal	–3.40 **
Belgium	–1.03	Spain	–4.50 ***
Denmark	–1.10	Sweden	–1.19
Finland	–1.37	Switzerland	–1.77

Note: *, ** and *** indicate the stationarity at the 10, 5 and 1 per cent level respectively.

The lag structures for the ADF equations are chosen using the Schwarz Information Criterion. The critical values are from MacKinnon (1996).

creation of a set of internationally consistent indicators which correct for such taxes.(4) Nevertheless, the experience of the late 1990s, when inaccurate estimates of the structural budget position gave misleading signals to policy-makers, underlines the potential importance of this omission.

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(1) See in particular Cotis *et al.* (2005) and Richardson *et al.* (2000).

(2) For more details on the composition effect for European countries, see Bouthevillain *et al.* (2001) and Braconier and Forsfalt (2004).

(3) Countries and years involved are Australia (2000-01), Austria (2000), Belgium (2001), Denmark (2001), France (2001-02), Germany (2000), Greece (2001), Ireland (2002), Italy (2000), Netherlands (2000), New Zealand (2001), Portugal (2000), Spain (2000) and the United Kingdom (2000).

(4) Moreover, even when data are available, they are often published with a substantial lag, which further complicates the projections of fiscal positions.

applied to the 1992 distribution of income. In this paper, the tax/benefit position of households in 2003 is taken as the reference year for all countries and the income distribution data related to the years 1999 to 2001, depending on data availability.

10. To calculate the elasticity of income tax (social security contributions) with respect to the tax base, the marginal and the average tax rates of a representative household[7] are first calculated for several points in the earnings distribution.[8] The weighted averages of the marginal and average tax rates are then computed. The weights of the various earning levels are derived from estimated earnings distributions. For each country, a log-normal distribution has been fitted according to two parameters, the ratio of the earnings level at the first decile to the median earnings level and the ratio of the ninth decile to the median level.[9] More formally, *per capita* elasticity of income tax (social security contributions) with respect to earnings is expressed as follows:

$$\varepsilon\, tax\, per\, worker, w = \left(\sum_{i=1}^{n} \gamma_i \; MA_i \right) / \left(\sum_{i=1}^{n} \gamma_i \; AV_i \right) \tag{6}$$

with γ_i = weight of earnings-level i in total earnings expressed in currency units earned (the first-moment distribution), MA_i = marginal income tax rate (social security contribution rate) at point i on the earnings distribution and AV_i = average income tax rate or (social security contribution rate) at point i on the earnings distribution. This elasticity is then applied to the cyclical variation in the aggregate wage bill.

11. Table 2 presents the revised elasticities of income tax and social security contributions with respect to earnings, which incorporate both the 2003 tax code information and the updated earnings distribution data. The upward revisions of the income tax elasticities observed in Germany, Ireland, Italy and the United States are driven mostly by tax reform initiatives since 1996 as the effect of the updated earnings distribution data is negligible.[10] For Greece and Portugal, the downward elasticity revisions reflect *ad hoc* adjustments.[11] The elasticity of social security contributions[12] relative to earnings has also risen between 1996 and 2003, especially for Canada, Ireland and the United Kingdom.

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7 A representative household is defined as a full-time, two-earner married couple with two children, with the secondary earner receiving 50 per cent of the wage of the principal earner.

8 The distribution of income retained in this study ranges from half to three times the earnings of an average production worker. The calculations ignore the tax situation of, amongst others, the self-employed. The tax rates are available from the OECD Taxing Wages statistics.

9 The data refer to gross earnings of full-time workers by earnings percentiles in national currency units. The earnings by deciles are available from the OECD Labour Market statistics.

10 The main exceptions are Ireland, the Netherlands and Spain, where the elasticity of tax proceeds is lowered by about ¼ in 2003.

11 The results from the tax code yielded values that were implausibly high. Accordingly, the euro area average elasticity estimate (2.0) was applied in the Greek case while the Bank of Portugal estimate (1.7) was used for Portugal.

12 Social security contributions include those made by both employees and employers.

Table 2

Elasticities of Income Tax and Social Security Contributions Relative to Earnings: Effects of 2003 Tax Codes and Updated Income Distribution Data

Country	Elasticity of income tax relative to earnings	Previous estimates using 1996 tax codes	Elasticity of social security contributions relative to earnings	Previous estimates using 1996 tax codes
United States	1.9	1.3	0.9	0.9
Japan	1.9	1.8	0.9	0.8
Germany	2.3	1.5	0.8	0.8
France	1.7	1.7	1.1	1.0
Italy	2.0	1.5	1.0	0.9
United Kingdom	1.7	1.5	1.3	1.0
Canada	1.6	1.4	0.8	0.5
Australia (1)	1.5	1.6	0.0	0.0
Austria	2.2	2.2	1.0	0.8
Belgium	1.6	1.4	1.1	0.9
Denmark	1.4	1.3	1.0	0.9
Finland	1.5	1.4	1.0	0.9
Greece (2)	2.0	3.1	0.9	0.9
Ireland	2.1	1.5	1.3	1.0
Netherlands	2.4	2.6	0.8	0.6
New Zealand (1)	1.3	1.2	0.0	0.0
Norway (mainland)	1.5	1.5	1.1	0.9
Portugal (2)	1.7	1.9	1.0	1.0
Spain	2.1	1.8	0.8	0.8
Sweden	1.3	1.3	1.0	0.9
OECD average	1.8	1.7	1.0	0.9
Euro area average	2.0	1.9	1.0	0.9

Note: The previous estimates reported here for the output elasticities of social security contributions are slightly different than the one reported in OECD Economic Outlook 66 due to subsequent data revisions, and are taken from van den Noord (2000).
Aggregate country averages are unweighted.

(1) In Australia and New Zealand, there are no social security contributions.
(2) For Greece and Portugal, the euro area average and the Bank of Portugal estimate for the elasticity of income tax were used respectively, as the results obtained in 2003 were not plausible.

Source: OECD Taxing Wages and Labour Market statistics and OECD Economic Outlook 66.

3.1.2 Corporate income tax, indirect tax and spending elasticities

12. For the other tax and spending items identified, the elasticity of tax receipts and expenditures with respect to the base is imposed:

- Corporate income tax receipts, which on average represent 4 per cent of GDP, are assumed to be proportional to the tax base, which implies an elasticity of unity with respect to profits.
- Likewise, indirect taxes, which are the largest single tax category among OECD countries, amounting to 14 per cent of GDP on average, are taken to be proportional to their main tax base, which is consumer expenditure.
- The elasticity of government expenditure reflects cyclical variations in unemployment-related spending. An elasticity of one is assumed between unemployment-related expenditure and unemployment and the elasticity of government spending with respect to unemployment therefore corresponds to the share of unemployment-related spending in total spending.

3.2 Elasticities of tax and expenditure bases with respect to cyclical indicators

13. The second step in calculating the overall elasticities involves the econometric estimation of the sensitivity of the relevant tax/expenditure bases with respect to the output gap. The previous empirical work has been reviewed with the aim of improving overall cross-country coherence and statistical robustness. In particular, panel estimation techniques have been employed to estimate equations linking tax bases and cyclical indicators.

3.2.1 Cyclical sensitivity of the income tax, social security and corporate tax bases

14. The sensitivity of the income tax and social security contributions tax bases with respect to the cycle has been estimated econometrically using equation (7) below, which links directly the cyclical component of the wage bill to the output gap.[13] The cyclical sensitivity of the corporate tax base, (*i.e.* corporate profits) is also a function of the elasticity of the wage bill relative to the output gap but with the opposite sign. More intuitively, the responsiveness of profits is assumed to be proxied by the reciprocal of the wage bill equation which corresponds to the profit share.

15. The equation is specified in first difference form reflecting more robust statistical properties than the level specification previously used.[14] The coefficient

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[13] In the previous specification detailed in van den Noord (2000), the cyclical sensitivity of the income-tax, social security contributions and corporate tax bases was decomposed into two components: the elasticity of wages with respect to the employment gap and the elasticity of employment with respect to the output gap.

[14] The level and first difference forms of the wage bill equation exhibit similar estimated coefficients associated with the output gap variable. Statistical errors of the regression, which are compared with root

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a_1 can be interpreted as the short-run elasticity of the wage bill with respect to the output gap:

$$\Delta \log(W_t L_t / Y^*_t) = a_0 + a_1 \Delta \log(Y_t / Y^*_t) + \mu_t \quad (7)$$

where W = wage rate and L = employment.

3.2.2 Cyclical sensitivity of the indirect tax base

16. The sensitivity of the indirect tax base with respect to the economic cycle was analysed by estimating an equation linking real private consumption to the output gap. In the process, a wide dispersion of estimates across countries and large standard errors associated with the coefficients have been found, due to possible heterogeneity in the consumption pattern among countries and due to potential endogeneity problems. In light of these results, which point to the difficulties of finding consistent cross-country estimates, the elasticity has been set to unity for all OECD economies.

3.2.3 Cyclical sensitivity of unemployment-related expenditure

17. Unemployment-related expenditure is assumed to be strictly proportional to unemployment, the cyclical variations of which has been estimated using equation (8) which links the cyclical component of unemployment to the output gap.[15] Similar to equation (7), the equation is specified in first difference form, the econometric results being more robust than with the level form.[16] The coefficient b_1 represents the short-term elasticity of unemployment with respect to the output gap:

$$\Delta \log(U_t / U^*_t) = b_0 + b_1 \Delta \log(Y_t / Y^*_t) + \mu_t \quad (8)$$

3.3 Estimation strategy and econometric results

18. As a first step, equations (7) and (8) have been estimated separately for each country using Generalised Least Square estimators (GLS), allowing for a correction of first order AR(1) autocorrelation in the residuals. Based mainly on these results and on economic and geographic criteria, subsets of countries were created for each

mean square error (RMSE), mean absolute error (MAE) and mean absolute percentage error (MAPE), are of similar overall magnitude between the two models. Augmented Dickey-Fuller tests suggest, however, that the wage bill variable, when first differenced, is stationary for almost all countries, while it is stationary for less than half of them in level terms.

15 In van den Noord (2000), the cyclical sensitivity of unemployment-related spending was broken down into two components: the elasticity of the labour force with respect to the employment gap and the elasticity of employment with respect to the output gap.

16 The level and the first difference forms exhibit similar estimated coefficients for the output gap variable. Statistical errors of the regression, which are compared with RMSE, MAE and MAPE indicators, show a slight preference for the level form although the magnitude of the differences is small between the two models. Augmented Dickey-Fuller tests suggest, however, that the unemployment gap variable is stationary for all countries in first difference, while it is stationary for two-third of them in level terms.

equation. Next, these sub-groups of countries have been estimated using the seemingly unrelated regression procedure (SURE). This method, which allows for the possibility of non-zero covariance across the error terms in the separate country models, achieved more precise estimates than conventional fixed effects panel estimation.[17] Wald tests have been performed to validate cross-country restrictions. The empirical work has used the *OECD Economic Outlook 76* database[18] over the period 1980 to 2003.[19] Separate sample periods have, however, been used for a number of countries, in particular for the Czech Republic, Hungary, Poland and the Slovak Republic.

3.3.1 Elasticity of the wage bill with respect to the output gap

19. The responsiveness of the wage bill to the output gap averaged ¾ for the OECD as a whole, indicating a less than proportional shift in the wage bill for a given change in the output gap (Table 3). Seven sub-groups of countries have been identified, with group 1 having the lowest common coefficient (0.56) and group 7 the highest (0.91). For Luxembourg, the elasticity of the wage bill has been set to the value of sub-group 1 (Austria, Finland, Iceland and Switzerland) while for New Zealand, the elasticity has been calibrated to that of sub-group 3 (English-speaking countries) and for Greece, to subset 7 (Italy, Portugal and Spain). For the Czech Republic, Hungary, Poland and the Slovak Republic the elasticity has been set to the value of sub-group 5. Tests of the cross-country restrictions in each of the groups of economies for which SURE estimates have been computed showed that, in all cases, the set of restrictions are accepted by the data. The detailed estimation results are reported in the Appendix.

3.3.2 Elasticity of unemployment with respect to the output gap

20. The estimation of the elasticity of unemployment with respect to the output gap yielded an average coefficient of –5 across countries (Table 4). For a 1 percentage point increase in the output gap, the number of unemployed decreases by approximately 5 per cent. The cross-country pattern of individual elasticities is divided between six sub-groups of countries displaying elasticities of –3.3 to –8 respectively.[20] For, Austria, the Czech Republic, Greece, Hungary, Italy and

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17 The estimation strategy is broadly similar to the methodology used by Pain *et al.* (2004).

18 This database incorporates newly revised output gap estimates based on a slightly modified potential output estimation methodology. The OECD approach regarding potential output is discussed in Giorno *et al.* (1995) and in Cotis *et al.* (2005). Data for general government accounts are estimates for some countries, see OECD Economic Outlook Sources and Methods for individual country information on www.oecd.org.

19 The estimation period has been restricted to the beginning of the 1980s to avoid the period of large turbulence that followed the oil price shocks and the complications that can arise from linking together different, and potentially inconsistent, vintages of national account data for many countries.

20 Similar estimates have been reported for OECD countries in Bouthevillain *et al.* (2001), Lee (2000) and Schnabel (2002).

Table 3

Elasticity of the Wage Bill with Respect to the Output Gap

Sub-group 1 = 0.56	Japan and Korea
Sub-group 2 = 0.59	Austria, Finland, Iceland, Luxembourg and Switzerland
Sub-group 3 = 0.66	Australia, Canada, New Zealand, United Kingdom and United States
Sub-group 4 = 0.67	Belgium, France, and Germany
Sub-group 5 = 0.71	Denmark, Ireland, Netherlands, Norway and Sweden
Sub-group 6 = 0.71	Czech Republic, Hungary, Poland and the Slovak Republic
Sub-group 7 = 0.91	Greece, Italy, Portugal and Spain

Note: See detailed estimation results in the Appendix.

Source: Economic Outlook 76 database.

Luxembourg, the elasticity of unemployment has been set to the value of sub-group 1 (mainly other European countries). For Poland and the Slovak Republic, which exhibited higher initial estimated values, the elasticity has been set to that of sub-group 4 and Switzerland is calibrated to the value estimated for sub-group 6. Tests of the cross-country restrictions in each of the groups of economies for which SURE estimates have been computed showed that, in all cases, the set of restrictions are accepted by the data. The detailed estimation results are reported in the Appendix.

4. Overall fiscal elasticities

21. This section draws together the information from the previous section to compute reduced-form elasticities relating tax receipts and unemployment-related spending to cyclical indicators. The previous set of estimated elasticities dating from 1999 are broadly corroborated by the more robust econometric technique used in this paper.

4.1 Elasticities of income tax and social security contributions

22. The reduced-form income tax and social security contributions elasticities relative to the output gap combine the estimates of the sensitivity of tax proceeds to changes in the tax base with the estimates of the sensitivity of the tax base to the cycle. It bears repeating that the elasticities of income tax and social security proceeds, which are extracted from the tax codes on a *per* employee basis, are applied to changes in the aggregate wage bill, on the assumption that changes in

Table 4

Elasticity of Unemployment with Respect to the Output Gap

Sub-group 1 = –3.3	Austria, Belgium, Czech Republic, France, Greece, Hungary, Iceland, Italy, Japan, Luxembourg, Portugal and Spain
Sub-group 2 = –5.0	Germany
Sub-group 3 = –5.3	Australia, Canada, Ireland, New Zealand, United Kingdom and United States
Sub-group 4 = –5.8	Finland, Korea and Norway
Sub-group 5 = –7.9	Poland and the Slovak Republic
Sub-group 5 = –7.9	Denmark, the Netherlands, Sweden and Switzerland

Note: See detailed estimation results in the Appendix.
Source: Economic Outlook 76 database.

per capita wages and in the wage bill have equivalent effects on receipts.[21] More formally, the reduced-form elasticities are defined as follows:

$$\varepsilon_{t,y} = (\partial T/\partial Y)\ Y/T = (\partial((T/L)L)/\ \partial Y)\ Y/T = (\partial((T/L)L)/\ \partial W)\ W/T\ (\partial W/\partial Y)\ Y/W =$$
$$= \varepsilon_{t,w}\,\varepsilon_{wl,y} \qquad (9)$$

where $\varepsilon_{t,y}$ = elasticity of income tax (social security contributions) with respect to the output gap, T = tax proceeds, $\varepsilon_{t,w}$ = elasticity of income tax (social security contributions) with respect to earnings and $\varepsilon_{wl,y}$ = elasticity of the wage bill with respect to the output gap.

23. The revised elasticity of income taxes with respect to the output gap is around 1¼ on average for the OECD as a whole while it is slightly higher for the euro area (Table 5). Differences from the previous estimates are important for several countries, including Austria, France, Italy, Japan, Spain and the United States reflecting mainly a larger cyclical responsiveness of the tax base. In the case of Italy and the United States, a much higher responsiveness of income tax to earnings (stronger progressivity) is also contributing to explaining the upward revisions. The

[21] This assumption may lead to an over-estimation of the elasticities as the progressivity facing individual wage-earners may be higher than the progressivity at the aggregate level (Braconier and Forsfalt, 2004). For example, the expansion of household incomes during economic upturns typically consists of two counteracting effects: Firstly, individuals tend to receive higher wages and, in a given progressive tax system, the average tax rate tends to increase as well. Secondly, aggregate earnings increase as more people become employed. Since these individuals typically are taxed at a lower than average rate, their entry will tend to decrease the average tax rate.

Table 5

Elasticities of Income Tax and Social Security Contributions

Country	Elasticity of income tax relative to earnings	Elasticity of social security contributions relative to earnings	Elasticity of the wage bill relative to the output gap	Elasticity of income tax relative to the output gap	Previous estimates	Elasticity of social security contributions relative to the output gap	Previous estimates
	A	A'	B	C = A x B		C' = A' x B	
United States	1.9	0.9	0.7	1.3	0.6	0.6	0.6
Japan	2.0	0.9	0.6	1.2	0.4	0.5	0.3
Germany	2.3	0.8	0.7	1.6	1.3	0.5	1.0
France	1.7	1.1	0.7	1.2	0.6	0.8	0.5
Italy	2.0	1.0	0.9	1.8	0.8	0.9	0.6
United Kingdom	1.7	1.3	0.7	1.2	1.4	0.9	1.2
Canada	1.6	0.8	0.7	1.1	1.2	0.6	0.9
Australia [1]	1.5	0.0	0.7	1.0	0.6	0.0	0.0
Austria	2.2	1.0	0.6	1.3	0.7	0.6	0.5
Belgium	1.6	1.1	0.7	1.1	1.3	0.8	1.0
Czech Republic	1.7	1.1	0.7	1.2	-	0.8	-
Denmark	1.4	1.0	0.7	1.0	0.7	0.7	0.7
Finland	1.5	1.0	0.6	0.9	1.3	0.6	1.1
Greece [(2)]	2.0	0.9	0.9	1.7	2.2	0.8	1.1
Hungary	2.4	0.9	0.7	1.7	-	0.6	-
Iceland	1.4	1.0	0.6	0.9	-	0.6	-
Ireland	2.1	1.3	0.7	1.4	1.0	0.9	0.8
Korea	2.3	0.9	0.6	1.4	-	0.5	-
Luxembourg	2.5	1.3	0.6	1.5	-	0.8	-
Netherlands	2.4	0.8	0.7	1.7	1.4	0.6	0.8
New Zealand [(1)]	1.3	0.0	0.7	0.9	1.2	0.0	0.0
Norway (mainland)	1.5	1.1	0.7	1.0	0.9	0.8	0.8
Poland	1.4	1.0	0.7	1.0	-	0.7	-
Portugal [(2)]	1.7	1.0	0.9	1.5	0.8	0.9	0.7
Slovak Republic [(3)]	1.0	1.0	0.7	0.7	-	0.7	-
Spain	2.1	0.8	0.9	1.9	1.1	0.7	0.8
Sweden	1.3	1.0	0.7	0.9	1.2	0.7	1.0
Switzerland	1.8	1.2	0.6	1.1	-	0.7	-
OECD average	1.8	1.0	0.7	1.3	1.0	0.7	0.8
Euro area average	2.0	1.0	0.7	1.5	-	0.7	-
New EU members average	1.6	1.0	0.7	1.1	-	0.7	-

Note: The previous estimates reported here are slightly different from the ones featured in OECD Economic Outlook, No. 66, due to subsequent data revisions, and are taken from van den Noord (2000).
Aggregate country zone averages are unweighted.

(1) In Australia and New Zealand there are no social security contributions.
(2) For Greece and Portugal, the euro area average and the Bank of Portugal estimate for the elasticity of income tax were used respectively, as the results obtained in 2003 were not plausible.
(3) In Slovakia, a flat uniform tax rate of 19 per cent on all sources of income and consumption is applied since January 2004. Accordingly, the elasticity of income tax relative to earnings has been set to one.

Source: OECD Economic Outlook 66 and 76 databases, OECD Taxing Wages statistics, OECD Labour Market statistics and Neves and Sarmento (2001).

revised estimates, which are more consistent with economic priors, are also closer to the results found in the literature.[22]

24. The revised elasticity of social security contributions with respect to the output gap is about ¾ on average for both the OECD and the euro area (Table 5). In France and Japan, the responsiveness has been raised compared with the previous set of estimates reflecting mainly a larger cyclical responsiveness of the tax base. Responsiveness has dropped in Germany and Finland since the previous exercise largely due to reduced cyclical sensitivity of the tax base. Overall, the new estimates are closer to expected values.

4.2 Elasticities of corporate income tax

25. The proportionality assumption between the corporate tax proceeds and the tax base (profits) implies that the overall elasticity of corporate income taxes is equal to the elasticity of profits with respect to the output gap. This elasticity is derived from the elasticity of the wage bill with respect to the output gap as mentioned above. More formally, the reduced-form elasticity is defined as follows:

$$\varepsilon_{t,\,y} = (\partial T/\partial Y)\; Y/T = (\partial Z/\partial Y)\; Y/Z = (\partial(Y\!-\!WL))/\partial Y)\; Y/Z =$$

$$= (1 - (1 - (Z/Y))\; ((\partial WL/\partial Y) Y/WL))\; Y/Z = (1 - (1 - PS)\; \varepsilon_{wl,\,y})/PS \qquad (10)$$

where $\varepsilon_{t,\,y}$ = elasticity of corporate income tax with respect to the output gap, PS = profit share in GDP, Z = gross operating surplus and $\varepsilon_{wl,\,y}$ = elasticity of the wage bill with respect to the output gap.

26. OECD countries exhibit an average corporate tax elasticity with respect to output of 1½ (Table 6). With corporate tax generally proportional, the above-unit elasticity is due to the fact that profits are fairly elastic with respect to output.[23] The large upward revisions for Belgium, Finland, Germany and the United Kingdom and the sizeable downward shifts for Japan and the United States reflect more consistent estimates across countries than the previous values. Indeed, the narrower dispersion of the elasticities better reflects the variance of tax rates on capital income across countries (Carey and Rabesona, 2002). Significantly lower standard deviations are attached to these estimates.

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22 See, for instance, Neves and Sarmento (2001), Skaarup (2005), Herd and Bronchi (2001) and Dalsgaard and Kawagoe (2000).

23 These estimate must, however, be interpreted with caution due to the inherent complexity of corporate tax systems. In particular, the non-symmetrical tax treatment of profits and losses (a firm pays taxes if it makes a profit, but it does not receive a refund for tax losses) and the provisions for carrying losses forward into other tax years of most corporate tax systems are likely to cause difficulties in linking the tax base to current corporate income.

4.3 Elasticities of indirect taxes

27. Following a common practice in several countries and given the econometric difficulties in finding consistent estimates across countries, the elasticities are set equal to one. Significant cross-country changes are reported, reflecting the wide dispersion of the previous estimates, which were probably not due to true structural differences across countries (Table 7). In Australia, Austria, Ireland and Japan, the cyclical responsiveness of indirect taxes has risen considerably, while in Denmark and Italy, it has declined.

4.4 Elasticities of current primary government expenditure

28. As stated above, the elasticity of current primary expenditure reflects cyclical variations in unemployment-related spending only.[24] The proportionality assumption between unemployment-related expenditure and the tax base (unemployment) implies that the overall elasticity of current primary expenditure is equivalent to the elasticity of unemployment with respect to the output gap weighted by the share of unemployment-related expenditure in total current primary expenditure. More formally, the elasticity defined relative to the unemployment gap and relative to the output gap is as follows:

$$\varepsilon_{g,\,u} = (\partial G/\partial U)U/G = \mathrm{U}B/G\ (\partial UB/\partial U)U/UB = UB/G \qquad (11)$$

$$\varepsilon_{g,y} = (\partial G/\partial Y)Y/G = UB/G\ (\partial UB/\partial Y)Y/UB = UB/G\ (\partial U/\partial Y)Y/U = \varepsilon_{g,u}\,\varepsilon_{u,y} \qquad (12)$$

where $\varepsilon_{g,u}$ = elasticity of current primary government expenditure relative to the unemployment gap, $\varepsilon_{g,y}$ = elasticity of current primary government expenditure with respect to the output gap, G = current primary expenditure and UB = unemployment benefits.

29. In the previous methodology, three categories of unemployment-related expenditure entered into the calculation. They were subsidised employment, unemployment compensation and early retirement for labour market reasons.[25] Recognising that data coverage and cyclical variation are uneven across time and countries in the cases of subsidized employment and early retirement, the only spending item entering into the current set of calculations is unemployment compensation.[26]

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24 A case could also be made for adjusting debt service payments. The effect of the output gap on debt interest payments is, however, complex and a practical option would be to focus on the primary budget balance.

25 Detailed data can be found in Annex Table H of OECD Employment Outlook.

26 It should be noted that, in some countries, the exclusion of other unemployment related expenditure, in particular, active labour market policies, may contribute to underestimate the cyclical sensitivity of the budget balance.

Table 6

Elasticities of Corporate Tax

Country	Profit share in GDP *(percent)*	Elasticity of the wage bill relative to the output gap	Elasticity of corporate tax relative to the output gap	Previous estimates
	A	B	C = {1–(1–A)B}/A	
United States	36.1	0.7	0.7	1.8
Japan	38.2	0.6	0.6	2.1
Germany	36.1	0.7	0.7	0.8
France	33.7	0.7	0.7	1.8
Italy	44.9	0.9	0.9	1.4
United Kingdom	31.3	0.7	0.7	0.6
Canada	35.3	0.7	0.7	1.0
Australia	40.1	0.7	0.7	1.6
Austria	36.8	0.6	0.6	1.9
Belgium	34.4	0.7	0.7	0.9
Czech Republic	43.7	0.7	0.7	-
Denmark	31.6	0.7	0.7	1.6
Finland	38.4	0.6	0.6	0.7
Greece	55.2	0.9	0.9	0.9
Hungary	40.5	0.7	0.7	-
Iceland	27.1	0.6	0.6	-
Ireland	49.9	0.7	0.7	1.2
Korea	43.3	0.6	0.6	-
Luxembourg	34.9	0.6	0.6	-
Netherlands	36.5	0.7	0.7	1.1
New Zealand	44.8	0.7	0.7	0.9
Norway (mainland)	41.7	0.7	0.7	1.3
Poland	43.6	0.7	0.7	-
Portugal	37.1	0.9	0.9	1.4
Slovak Republic	48.6	0.7	0.7	-
Spain	39.9	0.9	0.9	1.1
Sweden	27.7	0.7	0.7	0.9
Switzerland	33.8	0.6	0.6	-
OECD average	38.8	0.7	0.7	1.3
Euro area average	39.8	0.7	0.7	-
New EU members average	44.1	0.7	0.7	-

Note: The previous estimates reported here are slightly different from the ones printed in OECD Economic Outlook, No. 66, due to subsequent data revisions, and are taken from van den Noord (2000).
Aggregate country zone averages are unweighted.

Source: OECD Annual National Accounts and OECD Economic Outlook 66 and 76 databases.

Table 7

Elasticities of Indirect Taxes

Country	Elasticity of indirect taxes relative to the output gap	Previous estimates
United States	1.0	0.9
Japan	1.0	0.5
Germany	1.0	1.0
France	1.0	0.7
Italy	1.0	1.4
United Kingdom	1.0	1.1
Canada	1.0	0.7
Australia	1.0	0.4
Austria	1.0	0.5
Belgium	1.0	0.9
Czech Republic	1.0	-
Denmark	1.0	1.6
Finland	1.0	0.9
Greece	1.0	0.8
Hungary	1.0	-
Iceland	1.0	-
Ireland	1.0	0.5
Korea	1.0	-
Luxembourg	1.0	-
Netherlands	1.0	0.7
New Zealand	1.0	1.2
Norway (mainland)	1.0	1.6
Poland	1.0	-
Portugal	1.0	0.6
Slovak Republic	1.0	-
Spain	1.0	1.2
Sweden	1.0	0.9
Switzerland	1.0	-
OECD average	1.0	0.9
Euro area average	1.0	0.8
New EU members average	1.0	-

Note: Aggregate country zone averages are unweighted.

Source: OECD Economic Outlook 66 and 76 databases.

30. The current primary expenditure elasticity with respect to the output gap is less than –¼ for OECD countries on average (Table 8). Several countries have elasticity values close to zero reflecting low shares of unemployment compensation spending in total expenditure. On the other hand, Germany and the Netherlands, which, display sizeable shares of unemployment compensation spending exhibit larger expenditure elasticities. The overall elasticities have been revised down since the previous estimates, in particular for Denmark and the Netherlands. The two main contributing factors are the removal from the cyclical adjustment process of two unemployment-related spending items and the reduction in unemployment compensation spending.

5. Sensitivity of public finances to the economic cycle

31. In this section, the responsiveness of fiscal balances to the economic cycle is computed. Sensitivity analysis is then performed to quantify the impact of the tax-base elasticity assumptions underlying the above methodology on the estimated cyclical responsiveness of fiscal balances. The effect on the cyclical budget response of the elasticity of income tax (social security contributions) with respect to its base is also examined using different point estimates, reflecting the evolution of tax codes over time. Subsequently, a simple methodological refinement of the cyclical adjustment process taking into account possible lagged effects is presented. Finally, cyclically-adjusted balances are recalculated with the revised set of elasticities, taking into account the lag structure of tax revenues on activity.

5.1 Overall cyclical responsiveness of the budget

32. The overall cyclical sensitivity of the budget to the economic cycle can be measured by the semi-elasticity of the budget balance (as a percent of GDP) with respect to the output gap.[27] This measure is equal to 0.44 for the OECD as a whole and to 0.48 for the euro area (Table 9 and Figure 1). Sizeable variations exist across countries with Korea and Denmark providing the extremes. While the average OECD semi-elasticity is similar to that calculated in the previous estimation exercise (0.48), significant changes are noticeable across countries. In Denmark, Finland, the Netherlands and Sweden, the lower overall cyclical responsiveness of the budget is mainly explained by the reduced elasticity of current expenditure. In Australia, Austria and Japan, the higher cyclical sensitivity is due, for the most part, to the larger responsiveness of taxes.

33. The sensitivity analysis consists of assessing the effect on the global cyclical budget responsiveness of changes in the tax-base elasticities. For this analysis, two stylised sets of elasticities have been examined and the cyclical budget response

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27 It is defined as the difference between the cyclical sensitivity of the four categories of taxes and the one expenditure item, weighted by their respective shares in GDP.

Table 8

Elasticities of Current Primary Government Expenditure

Country	Elasticity of unemployment with respect to the output gap	Share of unemployment related in total current primary expenditure	Elasticity of current primary expenditure with respect to the output gap	Previous estimates
	A	B	C = A × B	
United States	–5.3	1.8%	–0.09	–0.1
Japan	–3.3	1.5%	–0.05	–0.1
Germany	–5.0	3.5%	–0.18	–0.1
France	–3.3	3.3%	–0.11	–0.2
Italy	–3.3	1.3%	–0.04	–0.1
United Kingdom	–5.3	0.9%	–0.05	–0.2
Canada	–5.3	2.3%	–0.12	–0.2
Australia	–5.3	3.0%	–0.16	–0.2
Austria	–3.3	2.4%	–0.08	0.0
Belgium	–3.3	4.4%	–0.14	–0.3
Czech Republic	–3.3	0.7%	–0.02	-
Denmark	–7.9	2.6%	–0.21	–0.5
Finland	–5.8	3.2%	–0.18	–0.4
Greece	–3.3	1.3%	–0.04	0.0
Hungary	–3.3	1.0%	–0.03	-
Iceland	–3.3	0.5%	–0.02	-
Ireland	–5.3	2.2%	–0.11	–0.3
Korea	–5.8	0.7%	–0.04	-
Luxembourg	–3.3	1.0%	–0.03	-
Netherlands	–7.9	2.9%	–0.23	–0.7
New Zealand	–5.3	2.8%	–0.15	–0.3
Norway (mainland)	–5.8	0.9%	–0.05	–0.1
Poland	–5.8	2.4%	–0.14	-
Portugal	–3.3	1.6%	–0.05	–0.1
Slovak Republic	–5.8	1.0%	–0.06	-
Spain	–3.3	4.6%	–0.15	–0.1
Sweden	–7.9	1.9%	–0.15	–0.3
Switzerland	–7.9	2.4%	–0.19	-
OECD average	–4.9	2.1%	–0.10	–0.2
Euro area average	–4.2	2.6%	–0.11	–0.2
New EU members average	–4.6	1.3%	–0.06	-

Note: The previous estimates reported here are slightly different from the ones appearing in OECD Economic Outlook, No. 66, due to subsequent data revisions, and are taken from van den Noord (2000).
Aggregate country zone averages are unweighted.

Source: OECD Economic Outlook 66 and 76 databases and OECD Employment Outlook 2004.

Table 9

Summary of Elasticities

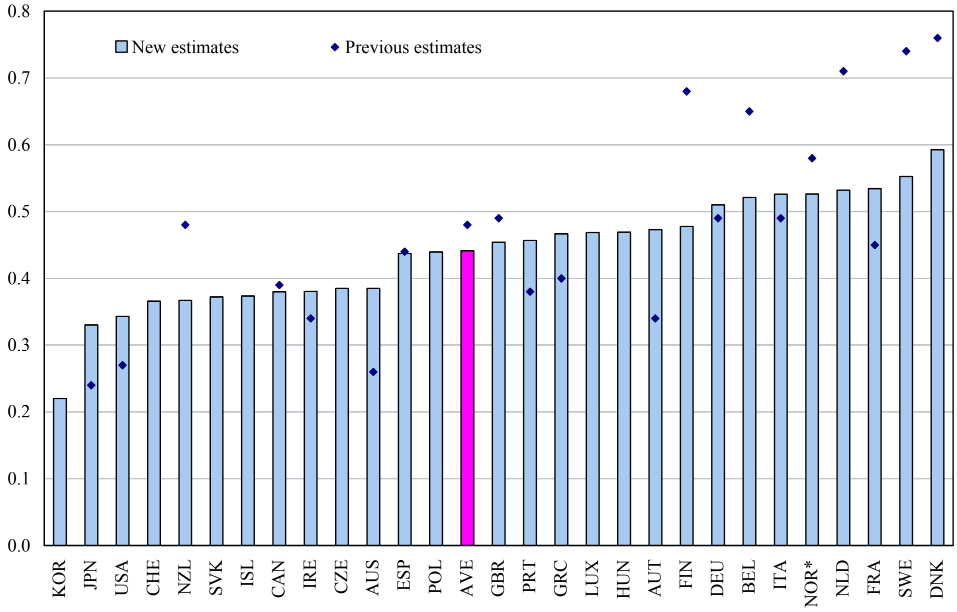
Country	Corporate tax	Personal tax	Indirect tax	Social security contributions	Current expenditure	Total balance
United States	1.53	1.30	1.00	0.64	–0.09	0.34
Japan	1.65	1.17	1.00	0.55	–0.05	0.33
Germany	1.53	1.61	1.00	0.57	–0.18	0.51
France	1.59	1.18	1.00	0.79	–0.11	0.53
Italy	1.12	1.75	1.00	0.86	–0.04	0.53
United Kingdom	1.66	1.18	1.00	0.91	–0.05	0.45
Canada	1.55	1.10	1.00	0.56	–0.12	0.38
Australia	1.45	1.04	1.00	0.00	–0.16	0.39
Austria	1.69	1.31	1.00	0.58	–0.08	0.47
Belgium	1.57	1.09	1.00	0.80	–0.14	0.52
Czech Republic	1.39	1.19	1.00	0.80	–0.02	0.39
Denmark	1.65	0.96	1.00	0.72	–0.21	0.59
Finland	1.64	0.91	1.00	0.62	–0.18	0.48
Greece	1.08	1.80	1.00	0.85	–0.04	0.47
Hungary	1.44	1.70	1.00	0.63	–0.03	0.47
Iceland	2.08	0.86	1.00	0.60	–0.02	0.37
Ireland	1.30	1.44	1.00	0.88	–0.11	0.38
Korea	1.52	1.40	1.00	0.51	–0.04	0.22
Luxembourg	1.75	1.50	1.00	0.76	–0.02	0.47
Netherlands	1.52	1.69	1.00	0.56	–0.23	0.53
New Zealand	1.37	0.92	1.00	0.00	–0.15	0.37
Norway (mainland)	1.42	1.02	1.00	0.80	–0.05	0.53
Poland	1.39	1.00	1.00	0.69	–0.14	0.44
Portugal	1.17	1.53	1.00	0.92	–0.05	0.46
Slovak Republic	1.32	0.70	1.00	0.70	–0.06	0.37
Spain	1.15	1.92	1.00	0.68	–0.15	0.44
Sweden	1.78	0.92	1.00	0.72	–0.15	0.55
Switzerland	1.78	1.10	1.00	0.69	–0.19	0.37
OECD average	1.50	1.26	1.00	0.71	–0.10	0.44
Euro area average	1.43	1.48	1.00	0.74	–0.11	0.48
New EU members average	1.38	1.15	1.00	0.71	–0.06	0.42

Note: The last column is the semi-elasticity which measures the change of the budget balance, expressed as a per cent of GDP, for a 1per cent change in GDP. It is based on 2003 weights.
Aggregate country zone averages are unweighted.

Source: OECD Economic Outlook 76 database and OECD estimates.

Figure 1

Cyclical Sensitivity of Fiscal Balances



* Mainland

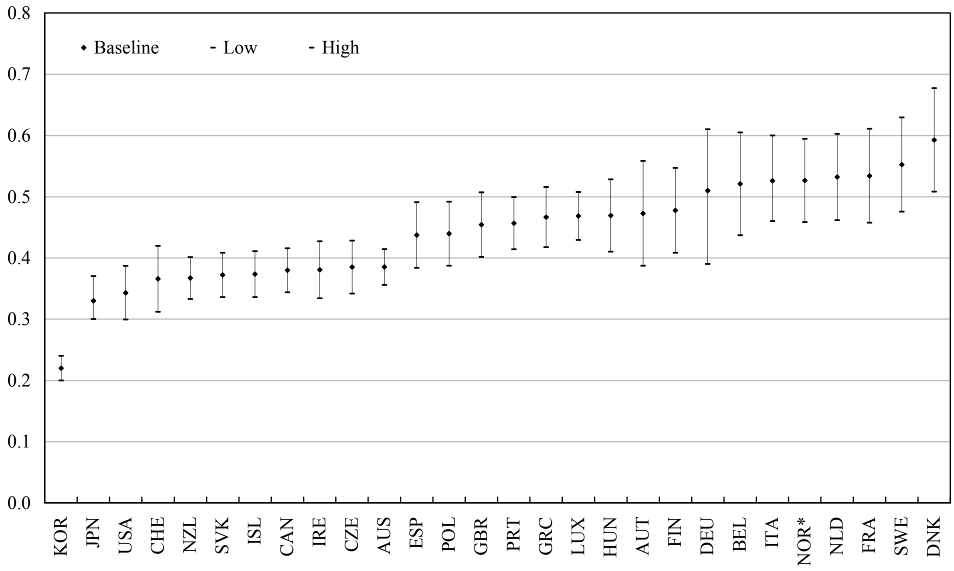
Source: OECD Economic Outlook 76 database and OECD estimates.

recalculated. Specifically, the elasticity of the wage bill and the elasticity of unemployment relative to the output gap have been set to values respectively two standard deviations above and below their mean estimates. As a result, the OECD average semi-elasticity rises to 0.50 or falls to 0.39 compared with a baseline of 0.44, with visible differences in the range estimates across countries (Figure 2).

34. The impact on the overall cyclical budget response of elasticities of income tax and social security contributions relative to their base is examined using three different point estimates, namely those relating to tax codes and income distributions of, respectively, 1996, 2000 and 2003 (Table 10). Semi-elasticities of fiscal balances are computed for each specific year using the associated tax codes and weights while keeping constant the elasticities of tax bases with respect to the output gap. Between 1996 and 2000, the average cyclical sensitivity of fiscal balances decreased slightly, with Luxembourg and Finland recording a larger drop than the average. By contrast, over the 2000 to 2003 period, the average semi-elasticity increased somewhat with the biggest increases found in the Netherlands and the United Kingdom. All in all, the 2003 sensitivity parameter is little change from the 1996 result.

Figure 2

Cyclical Sensitivity of Fiscal Balance: Range Estimates in 2003



* Mainland

Note: Low (high) estimates are derived using values two standard deviations below (above) the mean estimate for the elasticities of wages and unemployment to output.

Source: OECD Economic Outlook 76 database and OECD estimates.

35. The output smoothing capacity of automatic stabilisers varies across countries and depends on both the structure of the tax and benefit systems and the size of government. Among OECD economies, the larger the share of government expenditure in domestic output, the greater is the sensitivity of the fiscal position to fluctuations in economic activity (Figure 3). Denmark, Norway and Sweden, which have a large share of government expenditure, exhibit strong cyclical responsiveness, whereas Korea is at the opposite end of the scale. Country-specific factors such as openness of the economy, the flexibility of labour and product markets as well as the type of shocks can also significantly influence the effectiveness of automatic stabilisers.

5.2 Incorporating a lag structure in the cyclical adjustment process

36. The previous OECD methodology did not take into account the lag structure of major revenue components when calculating cyclically-adjusted balances. However, for several reasons (tax collection, rules for losses carry forwards, slow response of wages and salaries to growth), fiscal revenues react with a delay to variation in

Table 10

Time Varying Semi-elasticities

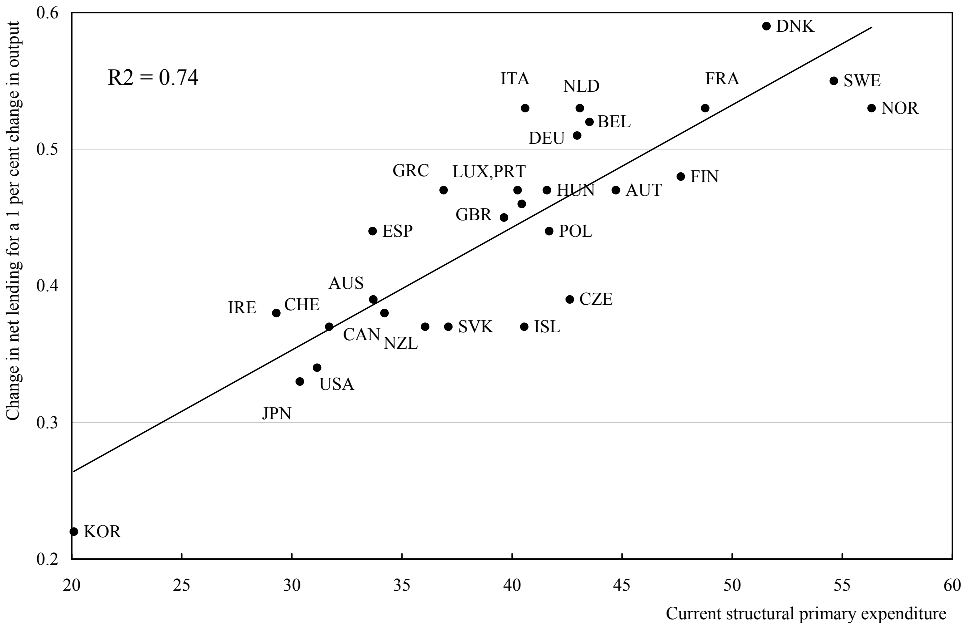
Country	1996	2000	2003
United States	0.32	0.31	0.34
Japan	0.32	0.34	0.33
Germany	0.49	0.47	0.51
France	0.53	0.50	0.53
Italy	0.54	0.49	0.53
United Kingdom	0.43	0.38	0.45
Canada	0.44	0.39	0.38
Australia	0.40	0.39	0.39
Austria	0.52	0.44	0.47
Belgium	0.54	0.50	0.52
Czech Republic	0.38	0.39	0.39
Denmark	0.62	0.57	0.59
Finland	0.55	0.46	0.48
Greece	0.44	0.48	0.47
Hungary	0.46	0.42	0.47
Iceland	0.40	0.37	0.37
Ireland	0.38	0.33	0.38
Korea	0.23	0.22	0.22
Luxembourg	0.55	0.44	0.47
Netherlands	0.52	0.46	0.53
New Zealand	0.37	0.38	0.37
Norway (mainland)	0.52	0.49	0.53
Poland	0.47	0.42	0.44
Portugal	0.44	0.45	0.46
Slovak Republic	n.a.	n.a.	0.37
Spain	0.45	0.44	0.44
Sweden	0.59	0.54	0.55
Switzerland	0.36	0.35	0.37
OECD average	0.45	0.42	0.44
Euro area average	0.50	0.46	0.48
New EU members average	0.44	0.41	0.42

Note: Semi-elasticities of fiscal balances are computed for each specific year using the associated tax codes and weights while keeping constant the elasticities of tax bases with respect to the output gap. Aggregate country zone averages are unweighted.

Source: OECD Taxing Wages statistics.

Figure 3

Cyclical Sensitivity of the Fiscal Position and Government Size
(percent of GDP)



Source: OECD Economic Outlook 76 database and OECD estimates.

economic growth. The approach to the timing issue followed in this paper is based on correlations between lags of tax proceeds and cyclical indicators and incorporates a certain amount of judgment from country desk officers in the OECD's Economics Department.[28] First, Hodrick-Prescott filtered series of personal and corporate income taxes have been calculated for OECD countries. Trend deviations of the two categories of revenues have then been computed and finally, lags were estimated on the basis of correlation between the trend deviation series and the output gap since the 1990s. While the exact lag structure is not known and may vary significantly over time, here a 2-year adjustment period is assumed. Table 11 presents the weights reflecting this correlation pattern. This approach, which is similar to the method employed by the Netherlands Central Planning Bureau is broadly consistent with empirical work available on the subject.[29]

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[28] Given the uneven quality and coverage of data and variable lag structures on tax proceeds, these highly stylized estimates may give rise to inaccurate assessments in individual years and should be modified by a qualitative evaluation.

[29] See for instance, Hansen (2003), CPB Netherlands Bureau for Economic Policy Analysis (2005), HM Treasury (2003), Duchêne and Levy (2003) and Bouthevillain *et al.* (2001).

Table 11

Tax Revenues and the Cycle

Country	Corporate income tax		Personal income tax	
	t	t+1	t	t+1
United States	1.00	0.00	0.50	0.50
Japan	0.75	0.25	0.50	0.50
Germany	0.50	0.50	0.75	0.25
France	0.00	1.00	0.00	1.00
Italy	0.50	0.50	0.50	0.50
United Kingdom	0.50	0.50	0.50	0.50
Canada	1.00	0.00	0.50	0.50
Australia	1.00	0.00	0.50	0.50
Austria	0.25	0.75	0.25	0.75
Belgium	1.00	0.00	1.00	0.00
Czech Republic	1.00	0.00	1.00	0.00
Denmark	0.50	0.50	0.50	0.50
Finland	0.50	0.50	1.00	0.00
Greece	1.00	0.00	1.00	0.00
Hungary	0.50	0.50	0.50	0.50
Iceland	0.25	0.75	0.50	0.50
Ireland	1.00	0.00	0.50	0.50
Korea	1.00	0.00	0.25	0.75
Luxembourg (1)	0.50	0.50	..	..
Netherlands	0.00	1.00	0.00	1.00
New Zealand	1.00	0.00	1.00	0.00
Norway (mainland)	0.50	0.50	0.50	0.50
Poland	0.75	0.25	1.00	0.00
Portugal	0.75	0.25	1.00	0.00
Slovak Republic	0.50	0.50	1.00	0.00
Spain	0.75	0.25	0.25	0.75
Sweden	1.00	0.00	1.00	0.00
Switzerland	0.50	0.50	1.00	0.00

Note: The figures shown in the first column indicates the share of corporate tax revenues collected in year *t*. For example, a lag of 0.75 indicates that 75 per cent of the corporate revenue collected in year t is for the tax liability in the same year, and the remaining 25 per cent is collected in year *t*+1. The weighted average lag structure has been estimated using correlation results between the gap of different categories of tax revenues (using HP filter method) and the output gap over the 1990 to 2003 period.

(1) For Luxembourg, the lag structure corresponds to the sum of corporate and personal income tax as there is no breakdown available in the OECD Outlook 76 database.

Source: OECD Economic Outlook 76 database.

37. The cyclically-adjusted fiscal balance formula has been modified to take into account these lagged responses of taxes to variations of activity. The structural budget balance can be written with a weighted average lag structure for personal income and corporate taxes as follows:

$$b_t^* = \sum_{i=1}^{2} T_i \left(\gamma \, (Y_t^*/Y_t)^{\varepsilon_i^{t,y}} + (1-\gamma)\,(Y_{t-1}^*/Y_{t-1})^{\varepsilon_i^{t,y}}\right) + \\ + \sum_{i=1}^{2} T_i \,(Y_t^*/Y_t)^{\varepsilon_i^{t,y}} - G\,(U_t^*/U_t)^{\varepsilon^{g,u}} + X_t \qquad (13)$$

where γ = the share of tax revenues collected in year t and $(1-\gamma)$ = the share of tax revenues collected in year $t+1$.

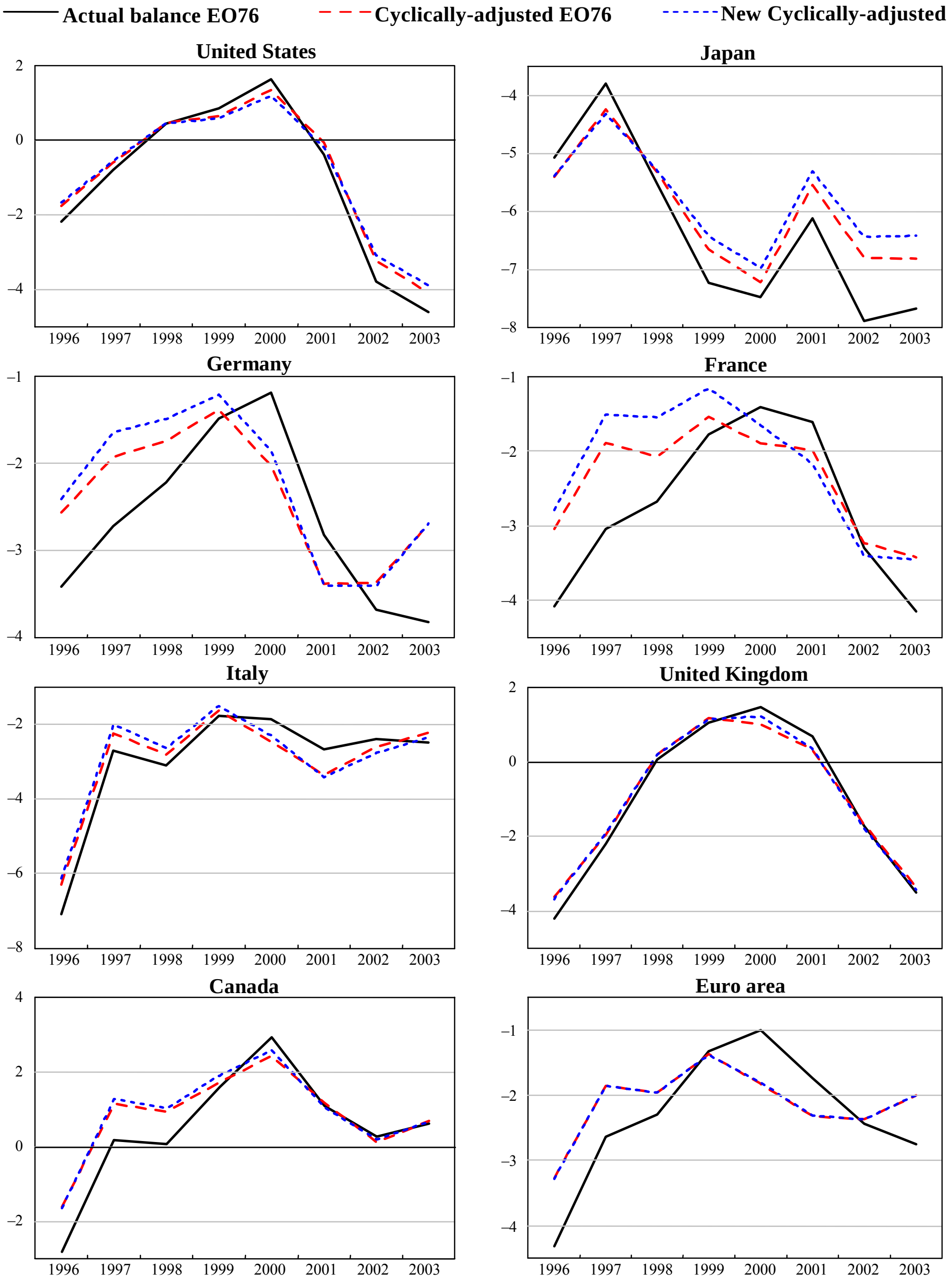
38. Overall, the effect of the revised set of elasticities and the impact of lags did not modify significantly the cyclically-adjusted position of most OECD economies (Figure 4). The largest downward revisions for 2003 are for Japan, where the cyclically-adjusted deficit would be smaller by close to ½ per cent of GDP and for Denmark and the Netherlands, where the 2003 cyclically-adjusted balances shift towards deficit by about ½ per cent of GDP.

39. Cyclically-adjusted balances have also been calculated for eight countries not covered in the previous analysis. In Korea, Hungary, the Slovak Republic and Luxembourg deficits seem to have been almost entirely of a structural nature in 2003, reflecting output at close to potential levels. In the Czech Republic, Iceland, Poland and Switzerland, 2003 deficits are estimated to have had a more visible cyclical component. These results are consistent with recent studies published in these countries.[30] However, it should be noted that greater uncertainty attaches to these estimates due to data limitations and the fact that some of these economies are experiencing important structural changes.

30 Kiss and Vadas (2004), Bezdek *et al.* (2003) and Kotecki and Pachucki (2003) also suggest a relatively small cyclical component over the recent period for Hungary, the Czech Republic and Poland respectively.

Figure 4

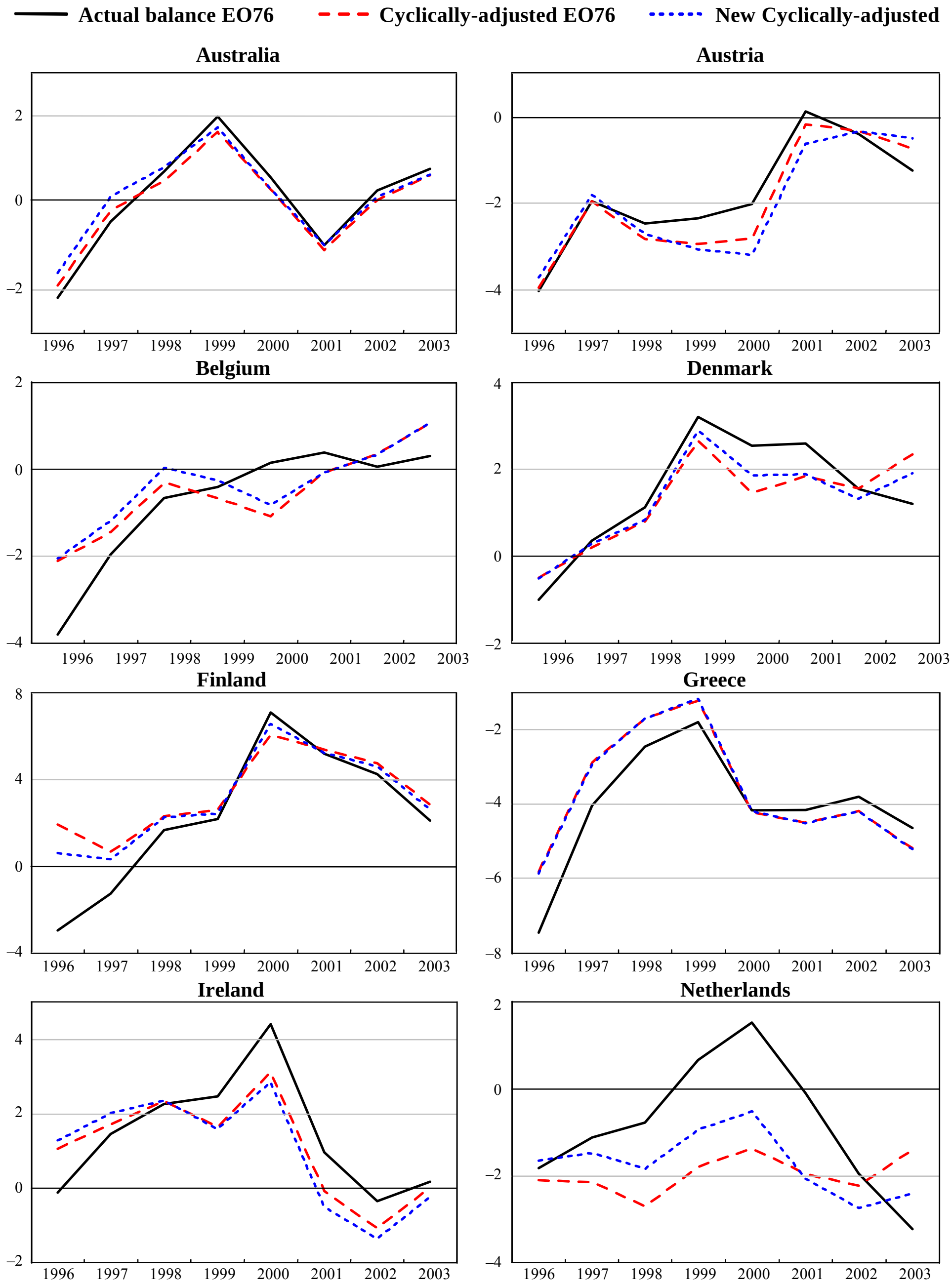
Actual and Cyclically-adjusted Fiscal Balances
(percent of GDP / potential GDP)



Note: Balances exclude one-off revenues from the sale of mobile telephone licences.
Source: OECD Economic Outlook 76 database and OECD estimates.

Figure 4 (continued)

Actual and Cyclically-adjusted Fiscal Balances
(percent of GDP / potential GDP)

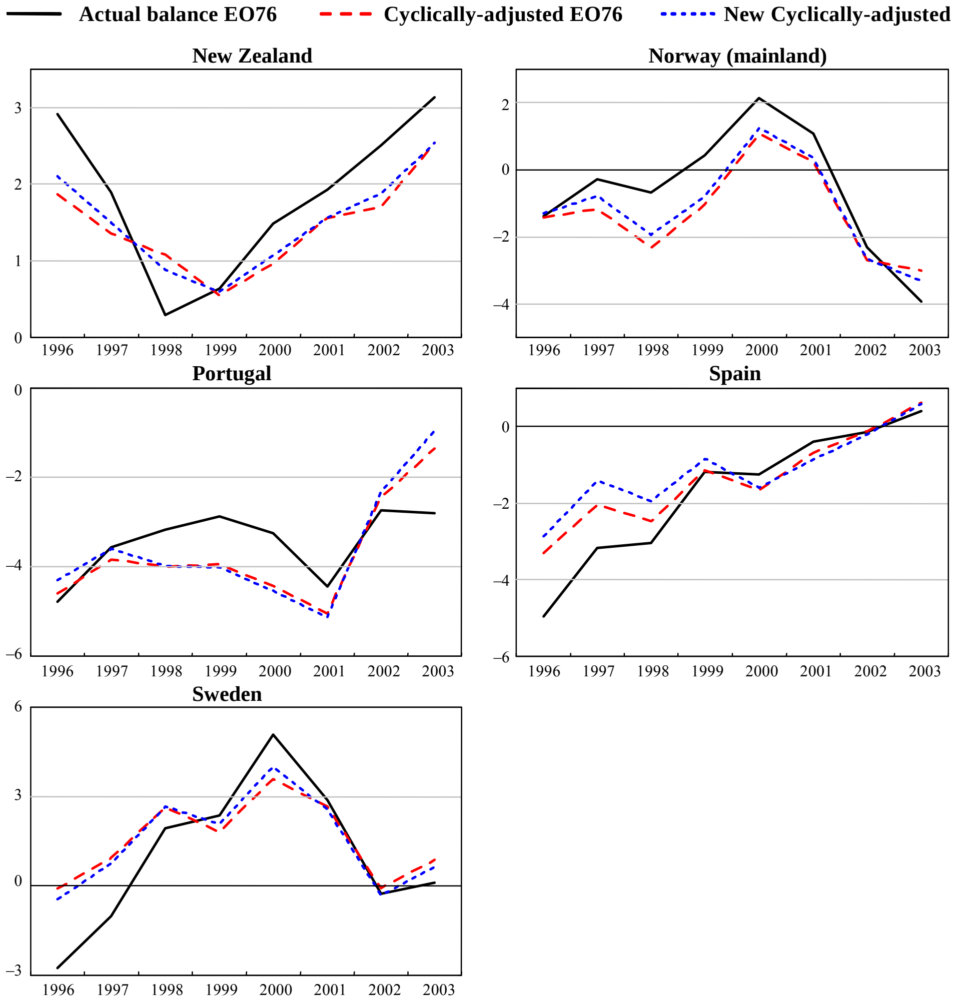


Note: Balances exclude one-off revenues from the sale of mobile telephone licences.
Source: OECD Economic Outlook 76 database and OECD estimates.

Figure 4 (continued)

Actual and Cyclically-adjusted Fiscal Balances

(percent of GDP / potential GDP)

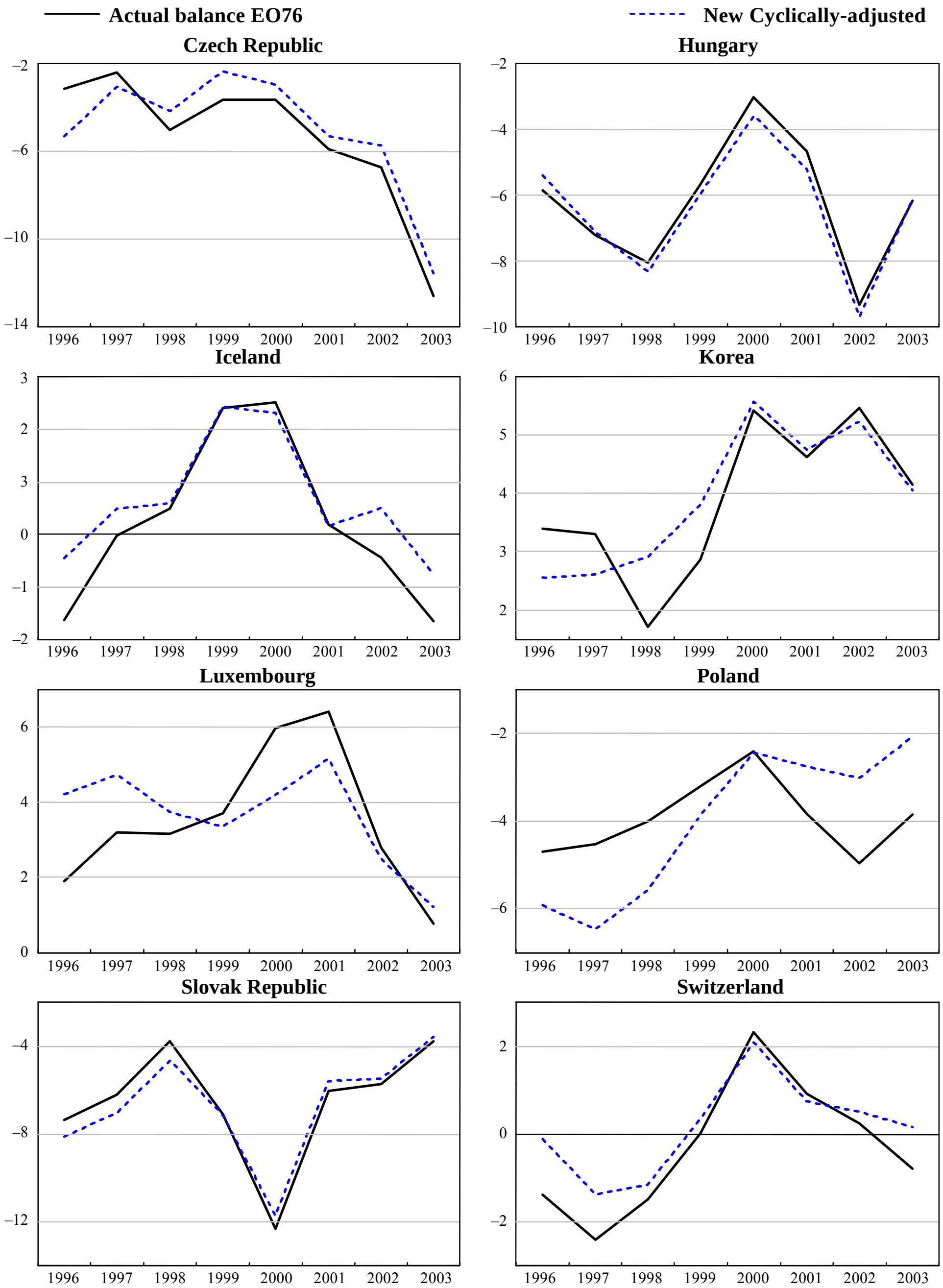


Note: Balances exclude one-off revenues from the sale of mobile telephone licences.
Source: OECD Economic Outlook 76 database and OECD estimates.

Figure 4 (continued)

Actual and Cyclically-adjusted Fiscal Balances

(percent of GDP / potential GDP)



Source: OECD Economic Outlook 76 database and OECD estimates.

APPENDIX: DETAILED ESTIMATION RESULTS

This Appendix provides detailed estimation results and methodological notes for the computation of the elasticities of tax bases with respect to the output gap.

1. Elasticity of the wage bill with respect to the output gap

The tax base for personal income taxes and social security contributions is the wage bill. The following equation allows estimating how this base moves in relation to the output gap:

$$\Delta\log(W_t L_t / Y^*_t) = a_0 + a_1 \,\Delta\log(Y_t / Y^*_t) + \mu$$

where:

W = wage rate

L = employment

Y = output

Y^* = potential output

This equation has been estimated separately for each country using Generalised Least Square estimators (GLS), allowing for a correction of first order AR(1) autocorrelation in the residuals. The results presented in Table 12 are estimated over the 1980 to 2003 period (constant terms are not shown).

Combining these results using statistical, geographic and economic criteria, seven subsets of countries were identified, for which it seemed reasonable to estimate a common coefficient using panel estimation technique:

Sub-group 1 = 0.56	Japan and Korea
Sub-group 2 = 0.59	Austria, Finland, Iceland, Luxembourg and Switzerland
Sub-group 3 = 0.66	Australia, Canada, New Zealand, United Kingdom and United States
Sub-group 4 = 0.67	Belgium, France and Germany
Sub-group 5 = 0.71	Denmark, Ireland, Netherlands, Norway and Sweden
Sub-group 6 = 0.71	Czech Republic, Hungary, Poland and the Slovak Republic
Sub-group 7 = 0.91	Greece, Italy, Portugal and Spain

Table 12

Effect of the Output Gap on the Wage Bill, 1980-2003
(estimation results for individual countries)

Country	a_1	Standard error	t - Statistic	Adjusted R^2	Durbin-Watson Statistic
Hungary[(1)]	–0.26	0.81	–0.32	0.11	1.84
Luxembourg[(1)]	0.34	0.18	1.92	0.13	1.06
Austria	0.42	0.18	2.28	0.34	1.86
Netherlands	0.44	0.25	1.72	0.35	1.39
Ireland	0.52	0.17	3.02	0.27	1.59
Finland	0.53	0.25	2.14	0.42	1.72
Switzerland	0.56	0.14	3.85	0.41	1.98
Denmark	0.57	0.21	2.68	0.27	1.97
Korea	0.58	0.05	11.87	0.95	1.85
France	0.58	0.18	3.19	0.49	1.97
Canada	0.59	0.12	4.94	0.61	1.57
United Kingdom	0.60	0.19	3.21	0.61	1.64
Germany	0.61	0.21	2.97	0.41	1.66
Japan	0.65	0.14	4.48	0.51	2.01
Iceland	0.67	0.35	1.89	0.05	1.91
Poland[(1)]	0.69	0.60	1.15	0.21	0.75
New Zealand[(1)]	0.72	0.22	3.29	0.47	2.30
Australia	0.78	0.25	3.14	0.30	1.93
United States	0.78	0.13	6.06	0.64	2.03
Italy[(1)]	0.81	0.21	3.75	0.83	1.89
Sweden	0.82	0.34	2.40	0.26	1.98
Belgium	0.83	0.21	3.96	0.46	1.68
Spain	0.89	0.33	2.72	0.43	1.70
Slovak Republic[(1)]	0.94	0.59	1.61	0.06	1.59
Norway	0.98	0.18	5.49	0.62	1.73
Greece	1.01	0.38	2.65	0.21	1.96
Portugal	1.20	0.30	4.08	0.67	1.39
Czech Republic[(1)]	1.23	0.44	2.79	0.47	2.48

[(1)] For Eastern European countries, Italy, Luxembourg and New Zealand, shorter sample periods have been used in the estimation.

Sub-groups 1 to 5 and 7 have been estimated using SURE estimation technique with fixed effects (not shown). A variance-covariance matrix of residual errors was generated from an initial set of non-linear least squares parameters estimates for each country in the sub-group, and then the full sub-group systems of parameters were jointly recomputed until convergence was achieved, conditional on the variance-covariance matrix. Within this framework, Wald tests were employed to check cross-country restrictions (results are available on request). Table 13 presents the unrestricted and the restricted equations where the GAP coefficient is common across countries of the sub-group.

For Luxembourg, the elasticity of the wage bill has been set to the value of sub-group 2 while for New Zealand and Greece, the elasticity has been calibrated to that of sub-groups 3 and 7 respectively. For the Czech Republic, Hungary, Poland and the Slovak Republic, the time span covered by the data was too short to allow reliable econometric estimations. Hence, the elasticity has been set to the value of sub-group 5.

2. Elasticity of unemployment with respect to the output gap

The Okun relationship is used for the computation of the semi-elasticity of budget balances relative to the output gap.

$$\Delta\log(U_t / U^*_t) = b_0 + b_1 \Delta\log(Y_t / Y^*_t) + \mu$$

where U = unemployment level and U^* = level of structural unemployment.

Similarly to the previous equation, this equation has been estimated separately for each country using Generalised Least Square estimators (GLS), allowing for a correction of first order AR(1) autocorrelation in the residuals. The results presented in Table 14 are estimated over the 1980 to 2003 period (constant terms are not shown).

Combining these results using statistical, geographical and economic criteria, five sub-groups of countries were identified, for each of which it seemed reasonable to estimate a common coefficient using panel estimation technique. Germany, which has been estimated over a shorter sample period, has not been included in the panel estimation.

Sub-group 1 = –3.3	Austria, Belgium, Czech Republic, France, Greece, Hungary, Iceland, Italy, Japan, Luxembourg, Portugal and Spain
Sub-group 2 = –5.0	Germany
Sub-group 3 = –5.3	Australia, Canada, Ireland, New Zealand, United Kingdom and United States
Sub-group 4 = –5.8	Finland, Korea and Norway
Sub-group 5 = –5.8	Poland and the Slovak Republic
Sub-group 6 = –8.0	Denmark, Netherlands, Sweden and Switzerland

Table 13

Effect of the output gap on the wage bill, 1980-2003
(estimation results for sub-groups of countries)

Sub-group 1

	a_1	t - Statistic
Japan	0.45	4.14
Korea	0.58	10.64

Adjusted R^2 = 0.82
Durbin-Watson = 1.59

Observations: 46

	a_1	t - Statistic
Common coefficient	0.56	11.19

Adjusted R^2 = 0.82
Durbin-Watson = 1.56

Observations: 46

Sub-group 2

	a_1	t - Statistic
Austria	0.60	3.62
Finland	0.82	4.73
Iceland	0.46	1.41
Switzerland	0.49	4.29

Adjusted R^2 = 0.33
Durbin-Watson = 1.79

Observations: 96

	a_1	t - Statistic
Common coefficient	0.59	6.63

Adjusted R^2 = 0.34
Durbin-Watson = 1.74

Observations: 96

Sub-group 3

	a_1	t - Statistic
Australia	0.71	3.16
Canada	0.53	5.66
United Kingdom	0.68	5.31
United States	0.81	7.71

Adjusted R^2 = 0.44
Durbin-Watson = 1.70

Observations: 96

	a_1	t - Statistic
Common coefficient	0.66	9.11

Adjusted R^2 = 0.45
Durbin-Watson = 1.61

Observations: 96

Table 13 (continued)

Effect of the Output Gap on the Wage Bill, 1980-2003
(estimation results for sub-groups of countries)

Sub-group 4

	a_1	t - Statistic		a_1	t - Statistic
Belgium	0.70	4.00	Common coefficient	0.67	5.95
France	0.64	4.40			
Germany	0.71	4.39			
Adjusted R^2 = 0.31			Adjusted R^2 = 0.33		
Durbin-Watson = 1.44			Durbin-Watson = 1.43		
Observations: 72			Observations: 72		

Sub-group 5

	a_1	t - Statistic		a_1	t - Statistic
Denmark	0.64	4.10	Common coefficient	0.71	8.72
Ireland	0.38	2.11			
Netherlands	0.56	3.29			
Norway	0.91	7.82			
Sweden	0.92	3.55			
Adjusted R^2 = 0.40			Adjusted R^2 = 0.39		
Durbin-Watson = 1.59			Durbin-Watson = 1.54		
Observations: 120			Observations: 120		

Sub-group 7

	a_1	t - Statistic		a_1	t - Statistic
Italy	0.52	1.43	Common coefficient	0.91	5.67
Portugal	0.85	4.87			
Spain	1.03	5.31			
Adjusted R^2 = 0.40			Adjusted R^2 = 0.42		
Durbin-Watson = 1.52			Durbin-Watson = 1.44		
Observations: 51			Observations: 51		

Table 14

Effect of the Output Gap on Unemployment, 1980-2003
(estimation results for individual countries)

Country	b_1	Standard error	t - Statistic	Adjusted R^2	Durbin-Watson Statistic
Slovak Republic[1]	–10.16	2.40	–4.24	0.79	1.45
Netherlands	–8.34	1.78	–4.69	0.64	1.73
Switzerland[(1)]	–7.69	3.43	–2.24	0.54	1.78
United Kingdom	–7.16	1.74	–4.12	0.70	1.63
Norway	–6.42	0.91	–7.05	0.61	1.52
Denmark	–6.15	1.26	–4.90	0.60	1.49
Sweden	–6.12	1.57	–3.90	0.55	1.49
Poland[(1)]	–5.75	1.81	–3.18	0.46	2.16
Finland	–5.69	0.79	–7.24	0.73	1.98
Australia	–5.65	1.18	–4.80	0.59	1.95
United States	–5.47	0.78	–7.00	0.71	1.98
Germany[1]	–5.01	1.28	–3.92	0.76	2.50
Korea	–4.79	0.61	–7.81	0.72	1.63
Canada	–4.69	0.69	–6.81	0.73	1.89
France	–4.60	0.64	–7.13	0.59	1.94
Ireland	–4.57	1.09	–4.19	0.35	1.08
Spain	–4.41	1.14	–3.86	0.58	1.84
Belgium	–4.36	1.09	–4.01	0.48	1.67
New Zealand[(1)]	–4.23	1.14	–3.72	0.38	2.09
Hungary[(1)]	–3.94	1.65	–2.40	0.40	2.18
Portugal	–3.87	1.01	–3.85	0.56	1.62
Iceland	–3.84	1.34	–2.87	0.17	2.15
Czech Republic[(1)]	–3.35	1.77	–1.90	0.28	1.39
Japan	–3.04	0.76	–3.99	0.54	2.09
Greece	–2.28	1.10	–2.09	0.14	1.78
Austria	–2.15	1.64	–1.31	0.11	1.82
Luxembourg	–1.85	0.92	–2.02	0.12	1.92
Italy[(1)]	–1.59	0.55	–2.88	0.67	1.82

[(1)] For Eastern European countries, Germany, Italy and New Zealand, shorter sample periods have been used in the estimation.

Sub-groups 1, 3, 4 and 6 have been estimated using SURE estimation procedure with fixed effects (not shown). Table 15 presents unrestricted equations and restricted equations where the GAP coefficient is common across countries of the sub-group. Diagnostic tests are available on request.

For, Austria, the Czech Republic, Greece, Hungary, Italy and Luxembourg, the elasticity of unemployment has been set to the value of sub-group 1 (mainly other European countries). For Poland and the Slovak Republic, which exhibited higher initial estimated values, the elasticity has been set to that of group 4. For Switzerland, the gap coefficient is calibrated to the value estimated for group 6.

Table 15

Effect of the Output Gap on Unemployment, 1980-2003
(estimation results for sub-groups of countries)

Sub-group 1

	b_1	t - Statistic
Belgium	–3.77	–4.46
France	–3.87	–6.29
Iceland	–2.92	–2.21
Japan	–2.53	–3.41
Portugal	–2.65	–4.00
Spain	–3.65	–4.75
Adjusted R^2 = 0.34		
Durbin-Watson = 1.76		
Observations: 144		

	b_1	t - Statistic
Common coefficient	–3.26	–9.32
Adjusted R^2 = 0.36		
Durbin-Watson = 1.71		
Observations: 144		

Table 15 (continued)

Effect of the Output Gap on Unemployment, 1980-2003
(estimation results for sub-groups of countries)

Sub-group 3

	b_1	t - Statistic
Australia	–5.44	–6.38
Canada	–4.99	–10.31
Ireland	–3.49	–3.70
New Zealand	–4.43	–4.33
United Kingdom	–7.20	–6.85
United States	–6.03	–7.67

Adjusted R^2 = 0.60
Durbin-Watson = 1.89

Observations: 138

	b_1	t - Statistic
Common coefficient	–5.26	–14.85

Adjusted R^2 = 0.61
Durbin-Watson = 1.88

Observations: 138

Sub-group 4

	b_1	t - Statistic
Finland	–5.79	–9.22
Korea	–5.58	–9.24
Norway	–6.19	–7.33

Adjusted R^2 = 0.74
Durbin-Watson = 2.09

Observations: 69

	b_1	t - Statistic
Common coefficient	–5.78	–14.72

Adjusted R^2 = 0.75
Durbin-Watson = 2.09

Observations: 69

Sub-group 6

	b_1	t - Statistic
Denmark	–7.44	–7.09
Netherlands	–8.80	–6.88
Sweden	–8.35	–6.23

Adjusted R^2 = 0.58
Durbin-Watson = 1.62

Observations: 69

	b_1	t - Statistic
Common coefficient	–8.04	–9.95

Adjusted R^2 = 0.59
Durbin-Watson = 1.59

Observations: 69

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THE MISSING CYCLE IN THE HP FILTER AND THE MEASUREMENT OF CYCLICALLY-ADJUSTED BUDGET BALANCES

Matthias Mohr[*]

The HP filter suffers from a pro-cyclical bias in end-of-sample trend estimates. This paper argues that this feature is related to the "missing cycle" in the stochastic model of the filter. The paper suggest an extensions of the HP filter by including a stochastic cycle component in the underlying model of the filter. As a consequence, the derived trend and cyclical components are more consistent with the underlying filter model, and the end-point behavior improves significantly because the pro-cyclical bias in end-of-sample trend estimates is virtually removed.

1. Introduction

The decomposition of macroeconomic time series into trend and cyclical components is crucial to many macroeconomic concepts such as potential output, p-star, or the natural interest rate, and derived indicators such as cyclically adjusted budget balances. All these concepts imply that short- and long-term movements can be separated. Typically, the components are theoretical concepts and therefore not observable. Rather, they have to be identified on the basis of a theoretical model or plausible *ad hoc* assumptions.

Several tools for trend extraction have been developed in the literature.[1] Some of them allow building multivariate economic models and adjusting the model parameters to the data such as models with unobserved components (UC), others are are purely mechanical transformations of the original data such as the Baxter-King filter (Baxter and King, 1999) and the Hodrick-Prescott filter (Hodrick and Prescott, 1997). From a theoretical perspective, complex unobserved components models are clearly superior to the simpler methods. From a more practical point of view, the estimation of unobserved component models – which is usually carried out using recursive estimation methods such as the Kalman filter – can be difficult: The results depend on well specified initial conditions for unobserved variables and their variances. The final model chosen is usually the outcome of a relatively elaborate

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The opinions expressed here are those of the author and do not necessarily reflect the views of the European Central Bank. Any errors are the sole responsibility of the author.

[1] Comprehensive overviews over trend-cycle decompositions are given in Dupasquier *et al.* (1997) or in Chagny and Döpke (2002).

procedure of model selection.[2] Furthermore, in some cases the Kalman filter approach may not work with annual data.

While simple trend extraction methods are more convenient to use, the economic interpretation of their results may pose problems. This is mainly because it is not possible to adjust the filter to properties of the time series to be filtered. Such mechanical approaches may also give rise to “spurious cycles” (Harvey and Jäger, 1993; Jäger, 1994; Cogley and Nason, 1995) which reflect more the properties of the filter used rather than those of the time series. An additional problem, which all approaches – including UC models – have in common, concerns the instability of trend estimations at the end of the data sample. The trend values of the last sample periods can change significantly when the sample is extended with the arrival of new data.[3]

This paper follows an approach between the two polar methods of trend extraction – UC models on the one hand and mechanical filters on the other. The well known Hodrick-Prescott filter (HP filter) is extended by an explicit stochastic models for both the trend and the cycle. The resulting “trend-cycle filter” (TC filter) allows for the simultaneous extraction of the trend and the cyclical process.

Compared with the HP filter as well as other common univariate filters, the TC filter has several advantages: first, it has better real time properties than other common univariate filters, as for instance the HP filter. Second, as both, trend and cyclical component, are explicitly modelled, it has a better foundation in the time domain than common univariate filters. Third, it can to some extent be adjusted to the data. Fourth, it can be easily extended to incorporate structural breaks. Finally, it is more convenient to use than unobserved components models.

The paper proceeds as follows. Section 2 discusses general properties of the HP filter. In Section 3, the trend-cycle filter is developed by generalising the underlying trend model of the HP filter and by adding an explicit stochastic model for the cycle. Section 4 discusses the instability of trend/cycle estimations at the end of the sample – the so-called “end-point problem” of filters. Second, it assesses the end-point reliability of the TC filter empirically by applying it to real GDP in selected countries and the euro area. Section 5 concludes.

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2 As Planas and Rossi (2004, p. 130) note in an investigation of the real time reliability of UC Phillips curve models:

“...recursive estimation requires a close monitoring of the parameter values, as sudden jumps can strongly increase the revisions. For instance, we found that the proper handling of the Kalman filter starting conditions is critical to the stability of model parameter estimates over time”.

3 The trend also changes if past data are revised *ex post*. Empirically, the instability due to the revision of past data is less problematic than the instability stemming from new data (Döpke, 2004; Rünstler, 2002).

2. The HP Filter

The HP filter is obtained by minimising the objective function:

$$\sum_{t=1}^{N}(x_t - x_t^T)^2 + \lambda\sum_{t=2}^{N}\left[(x_t^T - x_{t-1}^T) - (x_{t-1}^T - x_{t-2}^T)\right]^2 \tag{1}$$

for x_t. It is convenient to express the objective function in matrix form:

$$(X - X^T)'(X - X^T) + \lambda X^{T'}\nabla^{2'}\nabla^2 X^T \tag{2}$$

where X and X^T are $N\times 1$ vectors of the original data and the trend and ∇^2 denotes the 2nd difference matrix.[4] The solution[5] of this optimisation problem follows from the first order conditions in matrix form:

$$X^T = (I + \lambda\nabla^{2'}\nabla^2)^{-1}X \tag{3}$$

$$X^C = X - X^T$$

2.1 The stochastic model of the HP Filter

For a more general interpretation of the HP filter one may start with the implicit stochastic trend model, a second order random walk. Let us write the model in matrix notation:

$$\begin{aligned} & X - X^T - X^C = 0 \\ & \nabla^2 X^T = \eta,\quad E(\eta_t) = 0 \quad E(\eta_t^2) = \sigma_n^2 \quad \forall t = 1 \ldots N,\quad E(\eta\eta') = \sigma_n^2 I_N \\ & X^C = \zeta,\quad E(\zeta_t) = 0 \quad E(\zeta_t^2) = \sigma_\zeta^2 \quad \forall t = 1 \ldots N,\quad E(\zeta\zeta') = \sigma_\zeta^2 I_N \\ & E(\eta\zeta') = 0_N \end{aligned} \tag{4}$$

The residuals η and ζ are typically referred to as signal and noise. We assume that these processes have a zero-mean and that their variances exist. Furthermore, they are assumed to be mutually uncorrelated. The signal variable η is a white noise error term, whereas ζ may follow an unspecified stationary ARMA-process.

When inspecting the stochastic model of the filter and the definition of the trend in equation (4), several points are worth mentioning. First, the objective function in equation (2) is a weighted sum of the inner products of the residuals $\zeta'\zeta + \lambda\,\eta'\eta$ with the weight parameter λ.

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4 Lag and difference operators in matrix form are explained in Appendix 1.

5 For a more detailed derivation of the solution see for instance Danthine and Girardin, 1989.

Second, the stochastic model of the trend process as a second order random walk is a prior which may or may not be appropriate, depending on the properties of the series being filtered.[6]

Third, the cyclical component generated with an HP is proportional to the fourth difference of the HP filter trend, shifted forwards by two periods (see Reeves *et al.*, 1996, p. 4) – a highly implausible property.

Fourth, the trend and the cycle add up to the original series, meaning that there is no residual component capturing non-cyclical random impacts. According to the time domain representation of the filter in equation (4), the cycle is not explicitly modelled. Rather, it is defined as a residual process so that an additional residual component cannot be identified.

Finally, under the additional assumptions that the cycle process ζ is white noise and that η and ζ are distributed normally, maximising $\zeta'\zeta + \lambda\,\eta'\eta$ gives an optimal filter for the underlying stochastic process[7] if the parameter λ is set equal to the inverse signal-to-noise variance ratio: $\lambda = \sigma_{\zeta}^{2} / \sigma_{\eta}^{2}$. This interpretation is also consistent with an unobserved components model in which the parameter λ would be estimated as the inverse signal-to-noise variance ratio. These additional assumptions are usually not met in practice. In addition, the choice of the value of λ is based on prior assumptions and not on the concept of an optimal filter. Therefore, the HP filter is in general not an optimal filter in practical applications.[8] Furthermore, the cyclical component obtained from filtering is not a white noise process but follows some auto-correlated process, the properties of which depend on λ.

2.2 *The value of λ*

Since the parameter λ is key for the properties of the HP filter, much has been written about the proper value without, however, providing clear indications as to how to choose the appropriate value of λ. Ideally, the choice of λ should be adjusted so that it reflects prior knowledge on the length of the cycle. However, the smoothing parameter does not only affect the cycle but the volatility of trend growth as well – a consequence of the fact that the HP filter does not contain an explicit model of the cycle. Therefore, many practitioners tend to choose high values for λ when filtering annual data because they feel that lower values – as suggested in the

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6 Many macroeconomic time series are assumed to be $I(1)$ which contradicts the local linear trend model underlying the HP filter.

7 Whittle (1983). A filter is optimal if the sum of squared differences between the true and the estimated cyclical component take a minimum.

8 It follows also that the fixed value of λ is unequal to the observed inverse signal-to-noise variance ratio:

$$\frac{(X - X^T)'(X - X^T)}{N-1} \Bigg/ \frac{X^{T\,\prime}\nabla^{2\prime}\nabla^2 X^T}{N-3}$$

econometrics literature – would give rise to implausibly volatile trend growth rates. Thus, the value of λ is often based on a prior assumption of an acceptable trend volatility.

Values of 1600 for quarterly data and of 100 for annual data are commonly used. Ravn and Uhlig (2002) argue on the basis of frequency domain considerations that $\lambda = 1600$ for quarterly data is inconsistent with $\lambda = 100$ but would rather correspond to $\lambda = 6.5$ for annual data. Kaiser and Maravall (1999) propose a value of 8 for annual data, and Pedersen (2001) argues for a value of 1000 for quarterly data and for 3-5 for annual data. In Bouthevillain *et al.* (2001) the filter is applied with $\lambda = 30$ and in Mohr (2001) with $\lambda = 20$ to annual data.

The impact of the value of λ can be best demonstrated in the frequency domain. As the gain functions of the trend and the cyclical component for different λ-values in Figure 1 show, low frequency components are allocated to the trend while high frequency components are allocated to the cycle. Higher values of λ shift the gain function of the trend to the left so that the trend contains less of the higher frequencies, thereby becoming smoother. If $\lambda \to \infty$, the extracted trend approaches a linear trend. With lower values of the smoothing parameter, the trend becomes more volatile as it contains a larger part of the high-frequency spectrum. In the extreme case of $\lambda = 0$, the trend is equal to the original series.[9]

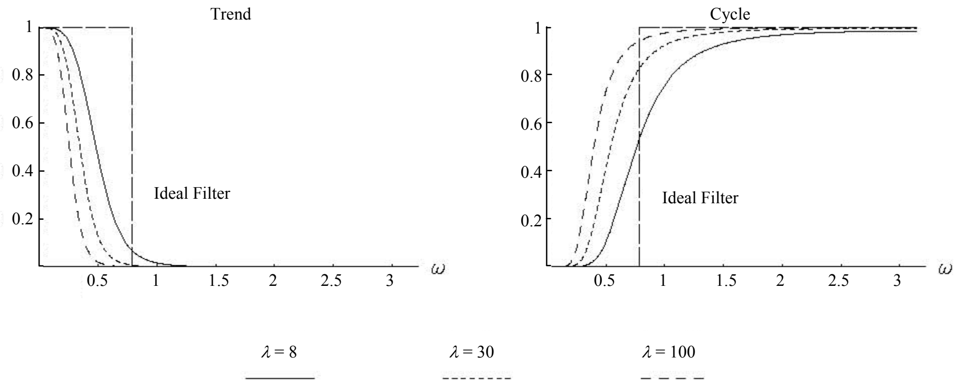
The frequency domain characteristics of the HP filter have well-known implications:

- First, the volatility of the cycle is controlled by the smoothing parameter λ. However, as λ defines the trend-volatility as well, there is no way to model the trend and the cycle independently from each other. Extracting shorter cycles comes automatically at the cost of a more volatile trend.
- Second, the missing model for the cyclical component has important consequences when additional, new data at the end of the sample are processed. There is no other choice than to allocate the information contained in a new data either to the trend or to the cycle, even though it may represent an outlier not generated by the data generating process underlying the HP filter.
- Finally, the HP filter is often used as an approximation to an ideal filter. Suppose, for instance, that the objective is to filter out a cycle of 8 or less periods length implying an ideal filter as shown in Figure 1: all frequencies below the critical frequency of $\frac{2\pi}{8}$ are cut off. By adjusting λ, the HP filter can approximate the desired ideal filter to some extent. However, there is a trade off in the choice of λ: while decreasing λ gives a better approximation to the ideal filter in the low frequency range, it worsens the approximation in the higher range. Therefore, either the trend contains frequencies which ideally should be

9 It is possible to translate the value of λ into a corresponding critical frequency ω_c, determined by $\omega_c / G_{HP}^{-1}(\lambda,.) = 0.5$. In this way, the filter can be characterised by a reference cycle of frequency ω_c.

Figure 1

Gain Function of the Trend and the Cyclical Component of the HP Filter for Different Values for λ



fully captured in the cycle and is therefore overly volatile, or longer waves which – according to the ideal filter – belong to the trend have too much weight in the cycle.

In short, a third component capturing irregular random influences is missing in the HP filter model. This tends to increase the instability of the trend estimate in real time as random influences are partly forced to contribute to the trend variability. This issue will be discussed further in Section 4.1.

3. The TC filter

This section extends the HP filter first by allowing for stochastic trends of arbitrary order and second by adding a stochastic model for the cycle to the filter. The resulting trend-cycle filter provides simultaneous, model-based estimates of the trend and the cyclical component.

3.1 A general stochastic trend model

In the HP filter model, the stochastic trend is restricted to a second order random walk. We generalise the trend model to a stochastic trend of any order. In this way, the order of the stochastic trend can be adjusted to the original series. For instance, many economic time series are $I(1)$ and a first order stochastic trend – possibly with a deterministic drift – would be more appropriate than the second order trend embodied in the HP filter.

The generalised trend model in matrix form can be described as:

$$\nabla^{d-1}(\nabla X^T - U_b) = \eta \tag{5}$$

where U denotes the $(T \times 1)$ vector [0,1,…,1]', b stands for the drift parameter to be determined endogenously, and d denotes the order of the trend. The expression U_b accounts for a deterministic drift if the trend is of first order $(d = 1)$. For a higher order trend $(d > 1)$, the drift term vanishes as $\nabla^{d-1}U_b = 0$.

Replacing the second line in equation (4) by equation (5) leads to the following objective function of the generalised trend filter in matrix form:

$$(X - X^T)'(X - X^T) + \lambda\left[\nabla^{d-1}(\nabla X^T - U_b)\right]'\left[\nabla^{d-1}(\nabla X^T - U_b)\right] \tag{6}$$

In the case of the first order random walk with drift the objective function has to be maximised for both the trend vector X^T and the drift parameter b, yielding:

$$\begin{aligned} X - (I + \lambda\nabla'\nabla)X^T + \nabla' U_b &= 0 \\ b = (U'U)^{-1}\, U'\nabla X^T & \end{aligned} \tag{7}$$

Thus, the drift term is computed as the average change in the trend:

$$b = \frac{x_N^T - x_1^T}{N - 1}$$

Note, however, that the drift term b and the trend X^T are determined simultaneously. Another interpretation of the solution for b in equation (7) is that it represents the parameter of a regression of ∇X^T on the vector U. This allows us to define the residual projection matrix $W = I - U(U'U)^{-1}U'$ of this regression and to merge the solutions for b and X^T to yield:

$$X^T = (I + \lambda\nabla' W\nabla)^{-1} X \qquad \text{d = 1} \tag{8}$$

The solution for $d > 1$ is straightforward, as in this case the trend reduces to a d-th order stochastic trend $\nabla^d X^T = \eta$, and the solution is similar to that of the original HP filter in equation (3):

$$X^T = (I + \lambda\nabla^{d'}\nabla^d)^{-1} X \qquad d \geq 2 \tag{9}$$

The solution in equation (9) can also be applied to a first order random walk with drift if the linear trend is removed from the time series before filtering. The result should not differ too much from the trend as given in equation (8), in which the deterministic and the stochastic trend components are simultaneously determined.

The generalisation of the trend order is well known in the literature. The case of $d = 1$ without simultaneous determination of the deterministic drift is known as "exponential smoothing" and was used by Lucas (1980) in an empirical analysis of the quantity theory of money. The simultaneous determination of the drift was first proposed in Tödter (2002) as the Extended Exponential Smoothing (EES). Furthermore, the Butterworth filter, which is primarily known in the engineering literature, depicts the general case of a stochastic trend of order d (Gomez, 2001).

For macroeconomic time series, stochastic trends of order higher than two do not make much sense. In the following sections, we will therefore concentrate on the EES, the HP filter and on TC filters with first- and second-order stochastic trends.

3.2 *A stochastic model for the cycle*

In this subsection, the stochastic model for the HP filter is extended by an explicit model for the cycle. The cyclical process is now assumed to follow a stationary ARMA-process, which is not left implicit as in the HP filter. Thus, we amend the stochastic model in equation (7) with the equation $AX^{C} = B\zeta$, in which the elements of the matrices A and B are determined by the parameters of an appropriately specified stationary ARMA process.

A convenient approach to model cyclical movements are stochastic cycles as suggested in Harvey (1989) or in Harvey and Jäger (1993). The original stochastic cycle approach in Harvey (1989) was extended towards stochastic cycles of order c in Harvey and Trimbur (2003). A stochastic cycle of order 2 is a stochastic cycle of order 1 with an error process that itself follows a stochastic cycle. Stochastic cycles of higher order are defined respectively. Stochastic cycles of order c give rise to ARMA($2c$, c) processes as shown in Harvey and Trimbur (2003).

The model for the c-th order stochastic cycle can be specified in state-space form as:

$$\begin{bmatrix} x^{C}_{1,t} \\ x^{C*}_{1,t} \end{bmatrix} = \rho \begin{bmatrix} \cos(\mu)\ \sin(\mu) \\ -\sin(\mu)\ \cos(\mu) \end{bmatrix} \begin{bmatrix} x^{C}_{1,t-1} \\ x^{C*}_{1,t-1} \end{bmatrix} + \begin{bmatrix} \zeta_t \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} x^{C}_{1,t} \\ x^{C*}_{1,t} \end{bmatrix} = \rho \begin{bmatrix} \cos(\mu)\ \sin(\mu) \\ -\sin(\mu)\ \cos(\mu) \end{bmatrix} \begin{bmatrix} x^{C}_{1,t-1} \\ x^{C*}_{1,t-1} \end{bmatrix} + \begin{bmatrix} x^{C}_{i-1,t} \\ 0 \end{bmatrix} \tag{10}$$

$$i = 2 \ldots c$$

where $x^{C^*}_{i,t}$ is an auxiliary variable needed to write the model in state space form.

The properties of the cycle are obtained by writing:

$$\begin{bmatrix} x^{C}_{1,t} \\ x^{C*}_{1,t} \end{bmatrix} = \begin{bmatrix} 1-\rho\cos(\mu) & -\rho\sin(\mu) \\ \rho\sin(\mu) & 1-\rho\cos(\mu) \end{bmatrix}^{-1} \begin{bmatrix} x^{C}_{i-1,t} \\ 0 \end{bmatrix}$$

$$i = 2 \ldots c$$

from which one obtains:

$$\begin{gathered} x_{i,t}^{C} = (\alpha(L)/\beta(L))^{-1} x_{i-1,t}^{C} \\ \alpha(L) = 1 - 2\rho\cos(\mu)L + \rho^2 L^2 \\ \beta(L) = 1 - \rho\cos(\mu)L^{\ 2} \\ i = 2 \ldots c \end{gathered} \tag{11}$$

The parameter ρ should be chosen from the open interval]0, 1[. It dampens the cycle, and $\rho < 1$ ensures that the cyclical process is stationary. In practice, ρ will be assigned a value close to 1, for instance $\rho = 0.975$. The parameter μ, which defines the "critical" frequency that dominates the stochastic cycle, is more important. As with the value for ρ, the parameter μ can be determined on the basis of prior knowledge on the length of the cycle.[10]

By iterative substitution, one obtains:

$$(1 - 2\rho\cos(\mu)L + \rho^2 L^2)^c \; x_{c,t}^{C} = (1 - \rho\cos(\mu)L)^c \, \zeta_t \tag{12}$$

for the c-th order stochastic cycle which we will incorporate in the TC filter: $x_t^C = x_{c,t}^C$.

The stochastic cycle model can be easily transformed to its matrix form $AX^C = B\zeta$ where A and B denote $(N - 2c) \times N$ matrices representing the AR and the MA process, respectively:

$$A = \begin{bmatrix} a_{2c} & \cdots & a_1 & 1 & 0 & \cdots & & 0 \\ 0 & a_{2c} & \cdots & a_1 & 1 & 0 & \cdots & 0 \\ \vdots & & & a_{2c} & \cdots & a_1 & 1 & \vdots \\ 0 & \cdots & & & a_{2c} & \cdots & a_1 & 1 \end{bmatrix} \quad B = \begin{bmatrix} & & & \overset{\text{column } c+1}{\downarrow} & & & & & & \\ 0 & \cdots & 0 & b_c & \cdots & b_1 & 1 & 0 & \cdots & 0 \\ \vdots & & \vdots & 0 & b_c & \cdots & b_1 & 1 & 0 \cdots & 0 \\ \vdots & & \vdots & \vdots & & & b_c & \cdots & b_1 \; 1 & \vdots \\ 0 & \cdots & 0 & \cdots & & & & b_c & \cdots \; b_1 & 1 \end{bmatrix}$$

The first c columns of B are set equal to 0, and the a_i's and b_i's are determined by $\alpha(L)^c$ and $\beta(L)^c$ in equation (12).

3.3 *Putting it all together: The TC filter*

Combining the trend and the cycle model in matrix form gives the model of the TC filter:

[10] Alternatively, the parameters ρ and μ can be estimated from the data in an iterative procedure as shown in (?).

$$X - X^T - X^C = \varepsilon, \qquad E(\varepsilon) = 0, \qquad E(\varepsilon'\varepsilon) = \sigma_\varepsilon^2$$
$$\nabla^{d-1}(\nabla X^T - Eb) = \eta, \qquad E(\eta_t) = 0, \qquad E(\eta_t^2) = \sigma_\eta \quad \forall t = 1...N, \qquad \mathrm{E}(\eta\eta') = \sigma_\eta^2 I_N$$
$$AX^C = B\zeta, \quad E(\zeta_t) = 0, \qquad E(\zeta_t^2) = \sigma_\zeta \quad \forall t = 1...N, \qquad \mathrm{E}(\zeta\zeta') = \sigma_\zeta^2 I_N$$
$$E(\zeta\varepsilon') = 0_N, \quad E(\zeta\eta') = 0_N \tag{13}$$

We assume that ζ and η are white noise error terms. Furthermore, we assume $E(\varepsilon) = 0$, that the variance σ_ε exists and that ε is uncorrelated with the other residuals. ε could follow any stationary ARMA process fulfilling these requirements and is not necessarily a white noise process.

As with the HP filter or the EES, the objective function for this problem is constructed as the sum of the inner products of the residuals $\varepsilon'\varepsilon + \eta'\eta + \zeta'\zeta$. Different from the one-component filters, however, there is no smoothing parameter (such as λ in the HP filter or the EES), and it will be explained below why this is so. This gives the following optimisation problem:[11]

$$\begin{aligned} &\underset{X^T, X^C, b}{Min} \left(X - X^C - X^T\right)'\left(X - X^C - X^T\right) + \\ &\left[\nabla^{d-1}(\nabla X^T - U_b)\right]'\left[\nabla^{d-1}(\nabla X^T - U_b)\right] + \\ &X^{C'} A'(BB')^{-1} AX^C \end{aligned} \tag{14}$$

The solutions to this problem for the trend and the cyclical processes are obtained by minimising the objective function for X^T, X^C, and also for b if the trend is assumed to follow a first-order random walk with drift ($d = 1$). For the sake of simplicity, we define the residual projection matrix W of a regression on U as $W = I - U(U'U)^{-1}U'$ and make use of the following notation:

$$\begin{aligned} &M_C \equiv \left[(I + A'(BB')^{-1} A\right]^{-1} \\ &M_T \equiv \begin{cases} (I + \nabla' W \nabla)^{-1}, & if\ d = 1 \\ (I + \nabla^{d'} \nabla d)^{-1}, & if\ d > 1 \end{cases} \end{aligned} \tag{15}$$

We obtain the following system of first order conditions (FOCs):

$$\begin{aligned} X^T &= M_T(X - X^C) \\ X^C &= M_C(X - X^T) \end{aligned} \tag{16}$$

11 The last expression with X^C in equation (14) can be derived as follows: the objective function involves the minimisation of $\zeta'\zeta$. The minimisation can be carried out in two steps: first, minimize $\zeta'\zeta$ for a given X^C under the constraint that the stochastic cycle model $AX^C = B\zeta$ holds. This gives $\zeta = B'\kappa$, with κ as Lagrange multiplier. By replacing ζ in the stochastic cycle model, one obtains $AX^C = BB'\kappa$. From that we derive $\zeta = B'(BB')^{-1} AX^C$ and hence $\zeta\zeta = X^{C'}A'(BB')^{-1} AX^C$.

To explain the intuition behind the system of FOCs, observe that M_T is an one-component trend filter which transforms any series X to a trend series. For instance, assuming $d = 2$, we obtain the HP filter with $\lambda = 1$. Similarily, the matrix M_C transforms any (stationary) series to a cycle series. Indeed, it can be shown (Harvey and Trimbur, 2003) that the matrix M_C defines a band-pass filter with a gain function spreading around the critical frequency μ. If the order of the stochastic cycle c is increased, the cyclical filter approaches a perfect band-pass filter. Thus, the system of FOCs in equation (16), combining the trend and the cyclical band-pass filter, can be interpreted as follows: applying the trend filter to a series from which the cyclical process has been removed (*i.e.*, on $X - X^C$), gives the trend X^T and, similarily, if the band-pass filter is applied to a series from which the trend has been removed (*i.e.*, on $X - X^T$), the cyclical process follows.

From the FOCs we derive the following solutions for the trend and the cyclical process:

$$\begin{aligned} X^T &= (I - M_T M_C)^{-1} M_T (I - M_C) X \Leftrightarrow X^T = M_{TC} X \\ X^C &= (I - M_C M_T)^{-1} M_C (\mathrm{I} - M_T) X \Leftrightarrow X^C = M_{CT} X \end{aligned} \tag{17}$$

Equation (17) defines the $d, c, \frac{2\pi}{\mu}, \rho$ filter with a stochastic trend of order d, a stochastic cycle of order c, a critical cycle length of $\frac{2\pi}{\mu}$ and a dampening parameter of ρ.

As equation (17) shows, the two-components TC filter can be regarded as a combination of the one-component trend and the one-component band-pass filter. For instance, using the trend filter to remove the trend in the first step and applying the band-pass filter on the residual yields:

$$\tilde{X}^C = M_C (I - M_T) X$$

as the cyclical component. However, this stepwise approach would neglect the simultaneity in the computation of the trend and the cycle and is therefore finally corrected by the correction factor $(I - M_C M_T)^{-1}$. In the special case of $M_C M_T = 0$, there is no simultaneity error, so that the stepwise application of the trend and the cyclical filter would not differ from applying the simultaneous TC filter.[12, 13]

As mentioned above, the variance components in the TC filter objective function (14) are not weighted. As the TC filter contains two components which are modelled (the trend and the cycle), two weighting parameters, λ_1 and λ_2, are

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12 Technically, $M_C M_T \rightarrow 0$ means that the intersection of the trend gain with the cycle gain in the frequency domain becomes smaller. This implies that the contribution of the trend to identify the cycle (and vice versa) becomes smaller and that trend and cycle become increasingly independent from each other. *Ceteris paribus*, the intersection of the gain functions decreases when critical cyclical frequency of the cycle μ becomes higher when the order of the stochastic trend, d, or of the stochastic cycle, c, become smaller.

13 Equation (17) gives consistent results if one component is missing. For instance, assume that there is only a trend and no cyclical component, implying $M_C = 0$. It follows that the two-components trend filter collapses to the one-component trend filter: $M_{TC} = M_T$. Respectively, if there is no trend, *i.e.* if $M_{T} = 0$, it follows that $M_{CT} = M_C$.

necessary to define the objective function with weights as $\varepsilon'\varepsilon + \lambda_1 \eta'\eta + \lambda_2 \zeta'\zeta$. Under certain assumptions in addition to those in equation (13), minimising the weighted objective would provide the optimal filter for the process defined in equation (13).[14] However, deriving an optimal filter is not our objective. Instead, we want to extend the HP filter with a cyclical model in order to improve certain properties of the HP filter and in order to account for prior assumptions on the cyclical process in more straightforward manner.

With the HP filter, prior assumptions about the cyclical process are in principle reflected in the choice of the smoothing parameter λ. However, as discussed above, the relationship between the assumed cyclical process and the value of lambda is unclear. The TC filter trend can be interpreted as an HP filter trend in which the smoothing parameter λ is replaced by a more complex expression reflecting prior assumptions on the length of the cycle. Rewriting the trend in equation (17) as:

$$X^T = (I + (I + (A'(BB')^{-1}A)^{-1})\nabla^{d\prime}\nabla^{d})^{-1}X$$

reveals that the trend of the TC filter is similar to the HP filter trend in equation (3) with λ replaced by the matrix expression $I + (A'(BB')^{-1}A)^{-1}$. Since this expression depends on μ, the critical frequency of the cycle, it reflects the prior assumption on the average cycle length.[15] Thus, by amending the HP filter with a model for the cycle, we have replaced the – to a certain extent arbitrary – smoothing parameter λ with a more general model based expression providing a clear-cut relationship between the cycle length and the filter parameter μ.

3.4 *Properties of the TC filter in the time domain*

As equation (17) shows, both the stochastic trend and the stochastic cycle model affect the trend and cycle solutions. This is so because the trend and the cycle are determined simultaneously; prior information on the nature of one component is used to identify the other component.

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14 The additional assumptions are that ε, η and ζ are all normally distributed and that the weights are set equal to the respective inverse signal-to-noise variance ratios:

$$\lambda_1 = \frac{\sigma_\varepsilon^2}{\sigma_\eta^2} \quad \text{and} \quad \lambda_2 = \frac{\sigma_\varepsilon^2}{\sigma_\zeta^2}$$

However, in equation (13) these variance ratios have been implicitly set to 1. This is an important difference to the general Kalman filter approach in (Harvey and Trimbur, 2003), in which signal and noise variances are estimated simultaneously with the trend and cycle. Like the HP filter, the TC filter is in general not an optimal filter.

15 For instance, assuming a relevant cycle length of eight years, μ could be set to $\frac{2\pi}{8} \approx 0.8$ with annual data.

The TC filter reproduces deterministic trends up to order[16] $2d-1$. This can easily be shown by rewriting the trend in equation (17) as:

$$(I + A'(BB')^{-1}A)\nabla^{d\,'}\nabla^{d}X^{T} = A'(BB')^{-1}A(X - X^{T})$$

Preserving a deterministic trend implies $X = X^T$, so that the condition $\nabla^{d'}\nabla^{d}X = 0$ follows: the second difference of the trend should vanish. As the $2d$-th difference of any trend of order $2d-1$ is zero, a trend of order $2d-1$ fulfills the condition. The TC filter resembles in this respect the HP filter, which preserves deterministic trends of at most third order.

Unlike the HP filter, however, the TC filter preserves deterministic, stationary cycles as well, and its trend is *cyclically neutral* as long as the cycle in the data is consistent with the cyclical model of the filter. This means that applying the TC filter on such a process reproduces the input process completely in the cycle and yields a zero trend. In order to prove this we set $X^C = X$ in equation (17) and derive the condition:

$$(I + \nabla^{d\,'}\nabla^{d})A'(BB')^{-1}AX = 0$$

For this condition to hold it is sufficient that $AX = 0$. This is the case if X is generated by $\alpha(L)^k X = 0$, for $1 \leq k \leq n$ and with $\alpha(L)$ defined as in equation (11). The cyclical neutrality of the trend follows immediately from equation (17) together with the assumption that $AX = 0$.

The cyclical neutrality of the trend is an important improvement over an HP filter trend, which is not cyclically neutral: depending on the value of the smoothing parameter λ, the HP filter reproduces harmonic oscillations partly in the trend.[17]

The equations of the trend and the cyclical process are symmetrical: the matrices ∇^d and A can be regarded as containers for arbitrary but distinctive stochastic processes. It is even possible to include exogenous variables in order to identify the trend and the cycle as, for instance, the inflation rate, indicators of capacity utilisation or of consumer sentiments. This is similar to the Multivariate HP filter as proposed by Laxton and Tetlow (1992).[18]

3.5 *Properties of the TC filter in the frequency domain*

In this subsection we analyse the properties of the trend-cycle filter in the

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[16] A deterministic trend of order k is defined as $\sum_{i=0}^{k} a_i t^i$ with t denoting the time index.

[17] This is owing to the fact that the HP filter cannot approximate an ideal filter perfectly, as explained in Section 2. The HP filter would give a zero trend only in the limiting case of $\lambda \to \infty$. The other polar case of $\lambda = 0$ just reproduces the input process. The incorporation of cyclical fluctuations in the HP filter trend reflects the leakage effects of the filter explained above.

[18] For a more recent application of the multivariate HP filter, see Gruen *et al.* (2002) and Boone *et al.* (2000).

frequency domain. We derive the polynomial lag forms and subsequently the frequency domain representations – *i.e.* the Power Transfer Functions (PTFs) – of the trend and the cyclical filter in equation (17).

The matrices A and ∇^d in equation (17) are matrix-form translations of the polynomial lags for the stochastic cycle $\gamma(L)^c = [\alpha(L)/\beta(L)]^c$ – with $\alpha(L)$ and $\beta(L)$ defined as in equation (11) – and the stochastic trend, $(1 - L)^d$. The transposes of these matrices represent the respective *lead*-polynomials $\gamma(L^{-1})^c$ and $(1 - L^{-1})^d$ in matrix form. The polynomial lag forms of the trend and the cyclical filter in (17) can therefore easily be derived by replacing ∇ and A with $1 - L$ and $\gamma(L)$ and their transposes with $1 - L^{-1}$ and $\gamma(L^{-1})$, respectively. After simplifying we have:

$$\begin{aligned} x_t^T &= \left\{1 + \left[1 + \left(\gamma(L)\,\gamma(L^{-1})\right)^{-c}\right]\left[(1-L)\,(1-L^{-1})\right]^d\right\}^{-1} x_t = G_{TC}^T(L,\omega)\,x_t \\ x_t^C &= \left\{1 + \left[1 + \left((1-L)\,(1-L^{-1})\right)^{-d}\right]\left[\gamma(L)\,\gamma(L^{-1})\right]^c\right\}^{-1} x_t = G_{TC}^C(L,\omega)\,x_t \end{aligned} \tag{18}$$

The corresponding gain functions, $\mathrm{G}_{TC}^T(\omega)$ and $\mathrm{G}_{TC}^C(\omega)$, can be obtained by replacing the lag operator L in equation (18) with $U^{-i\omega}$ with ω as the frequency in radians.

As the filters are symmetric, the PTFs are equal to the squared gain functions. The impact of the parameters d, c, μ and ρ on the behaviour of the TC filter can be best explained by visual inspection of the PTFs as shown in Figure 2 for different parameter settings.

The order of the stochastic cycle, c, determines the bandwidth of the frequency spectrum contained in the cyclical process. The spectrum expands around the critical frequency μ when c becomes larger. Increasing the order of the stochastic cycle also shifts the trend spectrum to the lower frequency range. This is a consequence of the simultaneous determination of the trend and the cycle. However, the impact of changes in c on the trend-spectrum is minor.

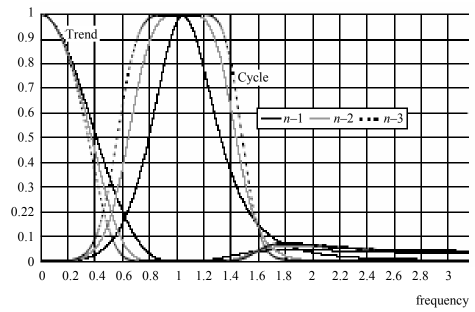
The critical frequency μ determines the center of gravity in the frequency spectrum of the cycle. Changes in μ give also rise to unidirectional shifts in the position of the trend spectrum, implying that μ does not only affect the volatility of the cycle but to some extent the trend volatility as well. Again, this feature follows from the simultaneous determination of the trend and the cycle.

An increase in the order of the stochastic trend d takes higher frequencies in the trend spectrum, implying that the trend becomes more volatile. The impact of changes in d on the cycle-gain are minor. Thus, by setting the order of the stochastic trend, the trend volatility can be manipulated without affecting the cycle too much, whereas the properties of the cycle are mainly determined through μ and c.

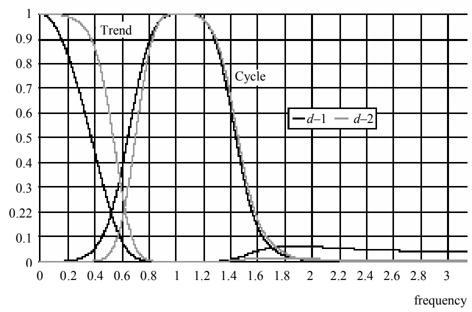
The parameter ρ is necessary to ensure the stationarity of the cycle and should be set close to but less than 1. As Figure 2d shows, the power-transfer functions are quite robust against changes in ρ.

Figure 2

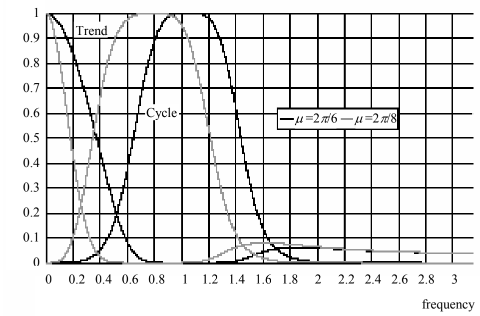
Power-transfer Functions of the Trend and the Cycle of the TC filter for Different Parameter Values



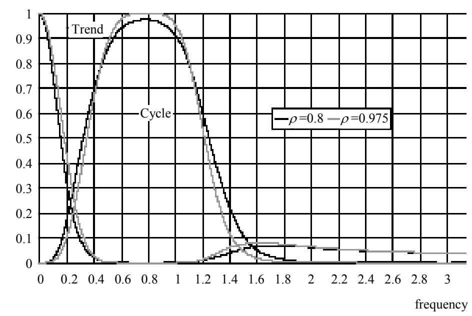
(a) $d = 1,\ \ c = (1,2,3),\ \ \mu = \dfrac{2\pi}{8},\ \ \rho = 0.975$



(b) $d = 1,2\ \ c = 2,\ \ \mu = \dfrac{2\pi}{8},\ \ \rho = 0.975$



(c) $d = 1,\ \ c = 2,\ \ \mu = \left(\dfrac{2\pi}{6}, \dfrac{2\pi}{8}\right),\ \ \rho = 0.975$



(d) $d = 1,\ \ c = 2,\ \ \mu = \dfrac{2\pi}{8},\ \ \rho = (0.8, 0.975)$

4. An application to real GDP in selected countries

Now we apply variants of TC filter to annual real GDP from 1970-2002 in Germany (DE), Spain (ES), France (FR), Italy (IT), the euro area (EURO), and in the US and compare the results to those obtained with the HP filter and the Extended Exponential Smoothing (EES) as suggested by Tödter (2002). The data source is the spring 2004 AMECO database of the European Commission. In order to adjust for the structural jump in the German and the euro area series owing to the German unification, German real GDP was regressed on a constant, a linear trend and a jump dummy which takes a value of 1 from 1991 onwards and of 0 before. The estimated shift parameter value was then added to real GDP before 1991.

We choose a value of 7 for the smoothing parameter for the EES, following Tödter (2002). We fix the λ parameter for the HP filter to 30, as in Bouthevillain *et al.* (2001). We define an 8 years reference cycle for the TC filters, *i.e.* $\mu = \frac{2\pi}{8}$, and set the dampening parameter $\rho = 0.975$.

Figure 3 shows the resulting relative cyclical components for the TC(1,2), the TC(2,2), the HP(30) filter and the EES(7). The cyclical components are very similar to each other in the middle of the sample, with the exception of comparatively large TC(1,2) cycles for Spain and the US. More important, however, are the significant differences we observe at the sample fringes: The procession of end-of-sample information seems to constitute the most distinctive feature.

Furthermore, the patterns of trend growth generated with a TC filter are less smooth than the trend growth pattern derived from the one-component filters (Figure 4). In fact, the HP filter has often been criticised for generating an implausibly cyclical – even pro-cyclical – pattern in trend growth, which is difficult to reconcile with the common assumption that the long run growth path is mainly affected by irregular supply shocks. At the first sight, it seems as if the zig-zag like movements in the TC filter trend growth rates are more in line with this prior assumption than the patterns of the HP filter or the EES trend growth rates.

In the next sections we analyse the properties of trends and cycles computed with the TC filter more thoroughly and compare them with trends and cycles generated with the HP filter and the EES. In the first subsection, the issue of the so-called end-point problem is investigated from a more theoretical perspective. It is argued that the forecasting capability of the stochastic model underlying the filter is the main variable triggering the end-of-sample instability. In the second subsection, we explore the forecasting performance of the filters empirically. We find that the stochastic cycle model improves the forecasting performance of filters considerably. Finally, it is shown that some of the assumptions underlying the TC filter can be tested and that the TC filter can to some extent be adjusted to the data.

4.1 The end-point problem and the predictive capabilities of filters

Many trend-cycle decompositions suffer from the so called end-point problem. The trend in the final period N, x_N^T, is based on information available up to and including period *N*. It can change significantly if new data for period $N + 1$ become available – irrespective of whether the new data point is driven by cyclical or by structural factors. The real-time allocation of the dynamics to structural and cyclical forces is necessarily uncertain as information on the future path of the economy missing. It is only when new data in future periods become available that the trend-cycle decomposition in period N becomes more certain and stabilises.

While the limited amount of real-time information is a general problem for any trend-cycle decomposition that relies on past and future periods, trend extraction tools differ in the significance of the problem. The problem is less significant, the better the model underlying the filter can forecast the original time series. This can be illustrated by taking the example of the HP filter stochastic model.

Figure 3

Cyclical Components of Real GDP
(percent of real GDP)

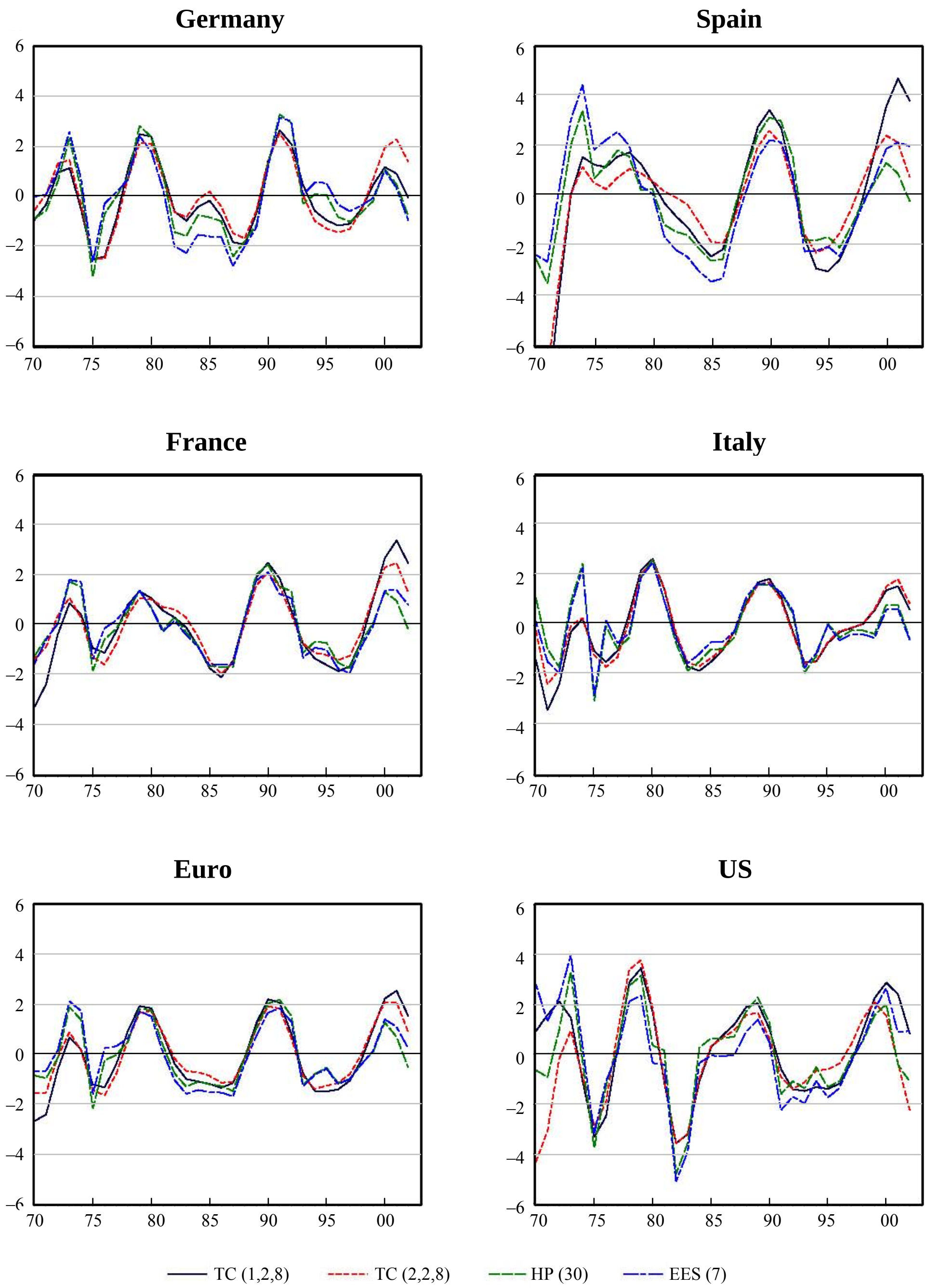
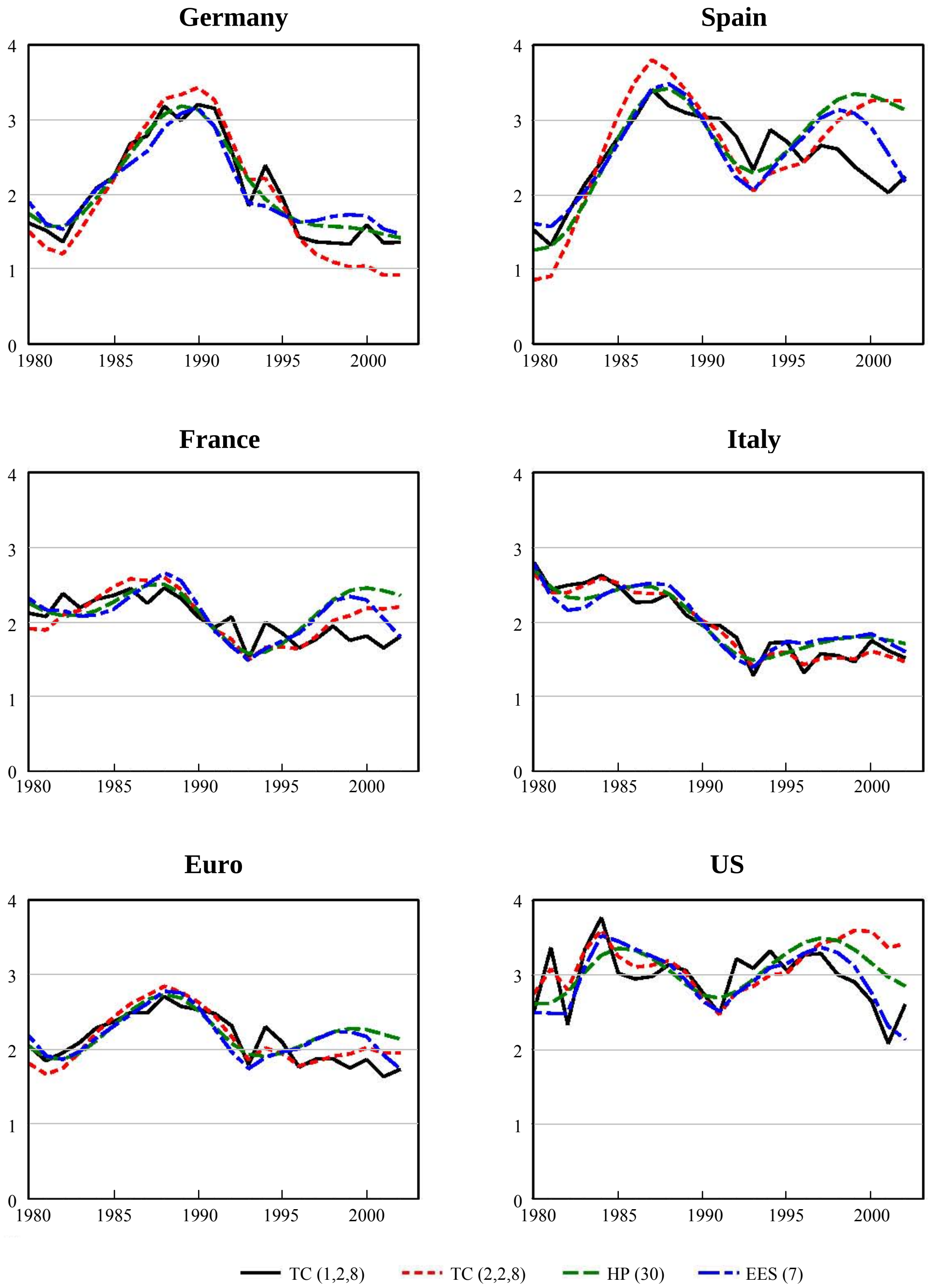


Figure 4

Trend Growth Rates Real GDP
(percent)



The stochastic model of the HP filter can be used to forecast x_{N+1} in period N, once the trend value in N is given. As the trend model is a second order random walk and because the cycle is not modelled, it follows that the optimal forecast for x_{N+1} is equal to:

$$\hat{x}_{N+1} = 2x^T_{N-1} - x^T_{N-2}$$

Now extend the original series by $\hat{x}_{N+1}$ to obtain $[x_1 \ldots x_N, \hat{x}_{N+1}]$ and apply the HP filter to the extended series. As a result, the trend series up to period $N\,[x^T_t \ldots x^T_N]$ is identical to the one obtained from filtering the non-extended series; the HP filter is consistent with its own forecast (Kaiser and Maravall, 1999).

From this we can conclude that there is no end-point problem if new data that arrive in $N + 1$ comply with the implicit forecast of the HP filter. Stating it the other way round: an end-point problem exists only insofar as the stochastic model underlying the filter is a weak representation of the data generating process.

As a standard remedy to the end-point problem, time series are sometimes extended by forecasts,[19] and the filter is applied to the extended series. If the forecast turns out correct *ex post*, there would not be an end-point bias. However, this approach comes with other problems. It is unclear how the filter processes forecast errors, which translate into errors in the trend estimation. Even if the forecast itself is unbiased and the forecast error is a random white noise process, it is unlikely that the implied errors in the computation of the trend share this feature because the filter model differs from that underlying the forecast.

As we have seen, the HP filter is consistent with forecasts derived from its own time series model. Extending the time series on the basis of a different model means that one does not trust the filter model. However, if there are good reasons to assume that there exists a model with a better forecasting performance than the filter model, the former rather than the latter should be applied for the trend-cycle decomposition.

Thus, rendering the filter model more consistent with the data generating process is a more preferable solution to the end-point problem than data extensions on the basis of models inconsistent with the filter. It follows that the end-point problem should be alleviated by improving the forecast performance of the stochastic filter model, *i.e.* its fit to the actual data.

The forecast performance of the filter and the possibilities to adjust it to the data depend mainly on the complexity of the underlying model. The complexity of the stochastic model of the HP filter, for instance, is low: the second order random walk property of the trend is the only prior piece of information that can be exploited

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19 The forecasts are often derived from ARIMA models as for instance in Kaiser and Maravall (1999) and in Denis *et al.* (2002).

for forecasting. Furthermore, the HP filter provides practically no means to adjust it to the data. Hence, its forecast performance cannot be improved.

The TC filter on the other hand provides a somewhat richer stochastic model as it explicitly accounts for the cycle; but does it give better forecasts and what are the empirical implications for the end-of-sample trend-cycle decomposition?

4.2 The forecasting performance of the HP and the TC filter

We investigate now the iterative one-step-ahead forecasts of the TC and HP filters and the EES. Starting with the sample 1970-78, we increase the "last year"s of the sample step by step until 2001, apply the filter on each vintage and compute for each of the filters a series from 1979-2002 of one-step-ahead forecasts $\hat{x}_{s+1|s}$ on the basis of the respective stochastic filter model:

$$\hat{x}_{s+1|s} = \begin{cases} x_s^T + b & \text{for the EES} \\ 2x_s^T - x_{s-1}^T & \text{for the HP filter} \end{cases}$$

where s = 1978...2002. The forecasts generated by the TC filter contains two components: the trend forecast $\hat{x}_{s+1}^T$ generated by the stochastic trend model and cycle forecast $\hat{x}_{s+1}^C$ derived from the stochastic cycle model. Note that only the AR and not the MA part of the stochastic cycle is used to generate the forecast since expected forecast errors are assumed to be equal to zero.

$$\hat{x}_{s+1|s} = \begin{cases} \underbrace{x_s^T + b}_{\hat{x}_{s+1|s}^T} + \underbrace{\sum_{i=1}^{2c} a_i x_{s-i+1}^C}_{\hat{x}_{s+1|s}^C} & \text{for the TC}(1,c)\text{ filter} \\ \overbrace{2x_s^T - x_{s-1}^T} + \overbrace{\sum_{i=1}^{2c} a_i x_{s-i+1}^C} & \text{for the TC}(2,c)\text{ filter} \end{cases}$$

where c =1,2 and s = 1978...2001. The quality of the forecasts can be assessed by testing for $b = 1$ and const = 0 in the regression:

$$\Delta x_t = \text{const} + b\Delta\hat{x}_{t|t-1} + u_t \tag{19}$$

In the case of the TC filter, the additional variance explained by stochastic cycle forecast can be assessed by comparing the explained variance in equation (19) to that in the reduced regression:

$$\Delta x^t = \text{const} + b\Delta\hat{x}_{t|t-1}^T + u^t \tag{20}$$

which contains only the trend forecast of the TC filter model.

Table 1 – we present only the euro area results of this test because they are similar for the other countries – shows the result of the forecast regressions, together with some indicators of forecast quality, the root mean square error (RMSE), the mean absolute percentage error (MAPE), Theil's inequality coefficient and the coefficient of correlation between the one-step ahead predictions and actual values.[20] The bias and the variance proportion measure the part of the MSE due to differences in the mean and the variation between the predicted and the actual series. The covariance proportion captures remaining unsystematic forecasting errors. The bias, variance and covariance proportion add up to one. Ideally, the bias and variance proportions should be small so that most of the bias concentrates on the covariance proportion. All filter models predict real GDP growth in the euro area well and are unbiased. The correlation between predicted and actual GDP growth rates increases considerably with the complexity of the underlying filter model; the TC(1,2) and the TC(2,2)-forecast of real GDP growth explain about 80 per cent of actual growth, the EES-forecast only 38 per cent. Furthermore, the stochastic cycle model improves the fit to the data substantially as compared with the forecasts exclusively based on trends. Growth forecasts on the basis of the TC filter variants yield lower RMSE's, lower mean absolute percentage errors and lower Theil inequality statistics than forecasts using the stochastic models HP filter and the EES.

The decomposition of the MSE reveals that it is almost fully explained by the non-systematic covariance component in the case of the TC filter, whereas considerable contributions to the mean square error (13.8 per cent in the case of the HP filter and almost 38 per cent with the EES) derive from differences in variation between predicted and actual growth rates when predictions are based on the HP filter and the EES models.

To conclude, the endogenous stochastic cycle seems to improve the fit of the stochastic filter model to the actual data.[21] Therefore, we expect the TC filter to yield more reliable real time trend/cycle estimations than the EES or the HP filter.

4.3 The real time reliability of the TC filter

In order to assess the end-point reliability of trend-cycle decompositions, we generate vintages of trend-cycle estimations by cutting the sample artificially in each year s from 1978-2003 and estimating the trend and the cycle for each sample 1970s. In this way we obtain for each years between 1978-2003 one end-point trend/cycle

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[20] Theil's inequality coefficient is defined as:

$$\sqrt{\frac{MSE}{\sum \hat{x}^2 / n + \sum x^2 / n}}$$

It takes values between 0 and 1, with values closer to unity indicating worse predictors. The indicators used here are described – for instance – in Maddala (1977).

[21] It must be kept in mind, though, that an approach with prior parameterisation cannot deliver an optimal fit.

estimation based on the sample 1970s, the so-called "real-time" estimations $\tilde{x}_s^T, \tilde{x}_s^C$ of the trend and the cycle.[22]

The regression of the real-time cyclical components $\tilde{x}_t^C$ on the "final" results x_t^C of the 2002 vintage:

$$\tilde{x}_t^C = \text{const} + b x_t^C + u_t \quad (21)$$

indicates in how far the real time cyclical components are related to the "true" (the final) ones.

In Rünstler (2002), the "reverse" regression of final on real time results is proposed, which is based on the assumption that deviations of real-time from final results are uncorrelated with real-time results. This property of optimal, linear filters is a necessary condition for unbiased, mimimum mean square errors of the filter components,[23] assuming that the underlying stochastic model is correct. Hence, the test in Rünstler (2002) is based on the idea that the filter makes optimal use of real-time information so that subsequent revisions to initial estimates – once additional information comes in – should be orthogonal to the initial estimates. It can therefore be understood as a misspecification test of the stochastic model underlying the filter. However, as argued above, neither the TC filter, nor the HP filter, nor the EES can be regarded as optimal filters for typical economic time series. Here, we are more interested in the question whether errors are systematically pro-or anti-cyclical when compared to "final" trend deviations and not so much in a specification test for the underlying stochastic model. Under the H0 that errors are not systematically related to "final" results, they should be orthogonal to "final" estimates and the test regression should be specified as in equation (21).

Thus, end point reliability implies that $b = 1$ and $\text{const} = 0$ in equation (21) hold so that real-time cyclical components should be broadly in line with "final" cyclical components. Table 2 presents the results of these regressions, together with the *P*-value for the Wald test of the joint H0: $\text{const} = 0 \wedge b = 1$.

For the HP filter, the H0 must be rejected in all cases. While the constant is not significantly different from zero, b is consistently below 1: the HP filter cyclical components in real-time underestimate the "true" cycle considerably. In addition, the correlations of the real-time with "final" cyclical components are are low; the "true" cycle explains at most 38 per cent of the variance[24] of the cyclical component estimated at real time.

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22 More precisely, these are known as quasi-real time vintages, as the *s*-th vintage does not consist of the data available on period *s*, but of data available in *T*. We thus disregard data revisions.

23 See Priestley (1981), p. 775.

24 The highest coefficient of correlation amounts to 0.617 (in the case of for *IT*) so that the explained variance would be $\rho^2 = 0.38$.

Table 1

Regression of Real GDP Growth on One-step-ahead Forecasts for Real GDP Growth for the Euro Area

Filter		Full forecast: Regression[§] const	Full forecast: Regression[§] *b*	Full forecast: Forecast error Indicators		Full forecast: MSE[†] decomposition		Trend forecast: Regression[§§] const	Trend forecast: Regression[§§] *b*	Trend forecast: Forecast error Indicators		Trend forecast: MSE[†] decomposition	
TC(1,1)	Parameter	0.001	0.939	RMSE[†]	0.007	Bias	0.000	0.000	0.990	RMSE[†]	0.010	Bias	0.002
	Stdv.	0.004	0.16	MAPE	0.378	Variance	0.072	0.008	0.382	MAPE	0.687	Variance	0.340
	F–test[‡]	0.928		Theil	0.156	Covar.	0.928	0.982		Theil	0.223	Covar.	0.658
				Corr.	0.781					Corr.	0.484		
TC(1,2)	Parameter	0.002	0.896	RMSE	0.005	Bias	0.000	0.022	–0.083	RMSE	0.013	Bias	0.008
	Stdv.	0.002	0.091	MAPE	0.208	Variance	0.00	0.011	0.497	MAPE	0.900	Variance	0.267
	F–test[‡]	0.530		Theil	0.108	Covar.	0.999	0.107		Theil	0.279	Covar.	0.726
				Corr.	0.902					Corr.	–0.035		
TC(2,1)	Parameter	0.004	0.818	RMSE	0.006	Bias	0.001	0.000	0.980	RMSE	0.006	Bias	0.008
	Stdv.	0.003	0.11	MAPE	0.276	Variance	0.004	0.003	0.137	MAPE	0.418	Variance	0.070
	F–test[‡]	0.273		Theil	0.138	Covar.	0.996	0.908		Theil	0.135	Covar.	0.922
				Corr.	0.846					Corr.	0.837		
TC(2,2)	Parameter	0.003	0.853	RMSE	0.005	Bias	0.001	0.012	0.363	RMSE	0.013	Bias	0.014
	Stdv.	0.002	0.09	MAPE	0.232	Variance	0.011	0.006	0.231	MAPE	0.987	Variance	0.013
	F–test[‡]	0.283		Theil	0.114	Covar.	0.987	0.033[#]		Theil	0.267	Covar.	0.973
				Corr.	0.896					Corr.	0.317		
HP(30)	Parameter							–0.000	0.987	RMSE	0.008	Bias	0.009
	Stdv.							0.004	0.192	MAPE	0.531	Variance	0.138
	F–test[‡]							0.901		Theil	0.168	Covar.	0.853
										Corr.	0.738		
EES(7)	Parameter							–0.005	1.204	RMSE	0.009	Bias	0.003
	Stdv.							0.007	0.331	MAPE	0.649	Variance	0.379
	F–test[‡]							0.800		Theil	0.203	Covar.	0.618
										Corr.	0.613		

§ $\Delta x_t = \text{const} + b\Delta\hat{x}_{t|t-1} + u_t$ §§ $\Delta x^t = \text{const} + b\Delta\hat{x}^T_{t|t-1} + u^t$

† *MSE*: mean square error; *RMSE*: root mean squared error; *MAPE*: mean absolute percentage error.

† *Theil*: Theil inequality measure; *Corr*: Correlation coefficient.

‡ *P*–value of Wald-test of H0: const $= 0 \wedge b = 1$ # H0 rejected at 5 per cent significance level.

The results are slightly better for the EES. Here, the H0 $\text{const} = 0 \wedge b = 1$ cannot be rejected except in the cases of Italy and the US.[25] The slope parameter is closer to 1 than in the case of the HP filter. In two cases (Italy and the US), the real-time EES estimates are strongly biased, as the constant is significantly different from zero. The coefficient of correlation between the real time and final cyclical components varies between 0.60 and 0.84, which is higher than for the HP filter.

The TC(2, 2) filter turns out best in this exercise. The H0 is never rejected at the 5 per cent level.[26] The slope parameter b is close to one, the constant is not significantly different from zero, and the coefficient of correlation varies between 0.57 and 0.91. Decreasing the order of the cycle while maintaining the order of the trend comes at the cost of a considerable decrease in correlation between real-time and final cyclical components. Decreasing the order of the trend gives rise to rejections of the combined H0 in Spain, France, the euro area and the US. Depending on the time series being filtered, the parameters of the TC filter can to some extent be chosen to adapt the filter to the data generating process.

The underestimation of b gives rise to a pro-cyclical error in the estimation of the trend. This can easily be seen if we approximate the cyclical component by $x_t - x_t^T$. The regression equation $x_t - \tilde{x}_t^T = \text{const} + b(x_t - x_t^T) + u_t$ can be transformed into $x_t^T - \tilde{x}_t^T = \text{const} - (1-b)(x_t - x_t^T) + u_t$. Values of b between –1 and 1 and different from zero imply that the trend is underestimated in a recession and overestimated in a boom. If $b = 1$ there is no relationship between the cycle and the error in the trend.

Figures 5 and 6 in Appendix 2 compares the errors in the real-time trend with the final cyclical components for the TC(2,2) and the HP(30) filter and the EES(7). As expected, the errors in the real time trend of the TC filter are largely unrelated to the cyclical component. For the HP filter, however, this relationship is strong. The HP filter real-time trend errors approximate very well the final cyclical component. Likewise, the EES induces a pro-cyclical bias in the real-time trend estimations, although the bias is less pronounced than in the case of the HP filter.

An important feature of real-time assessments of the cycle is the behavior around business cycle turning points. Errors in the real-time detection of the "true" turning points might lead to a misdiagnosis of the current situation. The extent the different approaches to trend-cycle decomposition are prone to errors in the detection of turning points can be assessed by the following indices, which rest on the classification shown in Table 3.

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25 For the euro area and Spain, it would be rejected at the 10 per cent level.

26 It would be rejected at the 10 per cent level in Italy and in the US.

Table 2

Regression of the Real-time Cyclical Component on the final Cyclical Component and Correlation Between the Real-time and theFinal Cyclical Component of Real GDP

Filter	Parameter	DE	ES	FR	IT	EURO	US
TC(1,1)	c	1.379	1.896	0.209	–1.919	4.913	46.935
	std. err.†	5.746	2.281	2.982	1.482	12.826	22.257
	beta	0.898	0.999	0.91	1.015	0.914	0.93
	std. err.†	0.295	0.253	0.168	0.145	0.17	0.272
	Ftest‡	0.937	0.703	0.861	0.359	0.861	0.114
	Correlation	0.683	0.572	0.76	0.849	0.74	0.683
TC(1,2)	c	8.813	5.007	1.582	–1.29	21.831	118.695
	std. err.†	9.776	2.728	2.891	1.975	15.047	25.542
	beta	1.424	1.297	1.209	1.317	1.29	1.596
	std. err.†	0.406	0.171	0.093	0.132	0.146	0.209
	Ftest‡	0.436	0.024#	0.025#	0.074	0.047#	0.000#
	Correlation	0.68	0.807	0.913	0.863	0.849	0.86
TC(2,1)	c	0.01	0.125	0.344	–0.703	0.095	3.923
	std. err.†	4.277	1.368	2.567	1.77	10.978	16.373
	beta	0.587	0.637	0.525	0.608	0.538	0.626
	std. err.†	0.24	0.24	0.169	0.186	0.192	0.131
	Ftest‡	0.005#	0.327	0.008#	0.072	0.008#	0.029#
	Correlation	0.561	0.524	0.531	0.527	0.52	0.615
TC(2,2)	c	1.038	1.463	1.591	0.47	7.37	44.273
	std. err.†	9.299	2.845	4.275	2.443	20.188	21.93
	beta	1.354	1.374	1.077	1.355	1.233	1.372
	std. err.†	0.346	0.331	0.189	0.187	0.229	0.196
	Ftest‡	0.235	0.302	0.717	0.055	0.181	0.061
	Correlation	0.67	0.662	0.75	0.804	0.727	0.874
HP(30)	c	–1.086	1.042	0.715	–0.795	1.738	18.927
	std. err.†	5.981	2.001	3.216	1.89	13.613	21.055
	beta	0.422	0.332	0.43	0.503	0.431	0.485
	std. err.†	0.177	0.174	0.135	0.11	0.13	0.095
	Ftest‡	0.005#	0.003#	0.001#	0.000#	0.001#	0.000#
	Correlation	0.471	0.33	0.511	0.617	0.51	0.589
EES(7)	c	5.208	4.002	0.984	–3.451	13.719	95.813
	std. err.†	6.268	2.501	2.808	1.405	12.906	24.857
	beta	0.695	0.741	0.75	0.766	0.717	0.701
	std. err.†	0.225	0.189	0.127	0.088	0.145	0.162
	Ftest‡	0.303	0.067	0.146	0.002#	0.078	0.001#
	Correlation	0.674	0.598	0.765	0.835	0.722	0.709

Equation: $\tilde{x}_t^C = const + bx_t^C + u_t$

† Newey-West corrected standard errors.

‡ P-value of F-test of H0: const $= 0 \wedge b = 1$.

H0 rejected at 5 per cent significance level.

Table 3

Reliability of Signs of Real-time Cyclical Components

		final output gap		
		+	–	sum
real time	+	N_{++}	N_{+-}	$N_{+.}$
output gap	–	N_{-+}	N_{--}	$N_{-.}$
	sum	$N_{.+}$	$N_{.-}$	$N_{..}$

- The relative share of wrong signs $(N_{[+-]} + N_{[-+]})/N_{[..]}$.
- The information content defined as $I \equiv N_{[++]}/N_{[.+]} + N_{[--]}/N_{[.-]}$. This measure takes values between -1 and 1. Values in the range $0 < I \leq 1$ indicate a positive information content, and $I = 1$ means that the signs of cyclical components in real time and final estimates coincide perfectly. If $-1 \leq I < 0$, there is a systematic bias in the signs of cyclical components in real time.
- The cell counts can be compared with the expected ones under the H0 that cell counts are random: $E(N_{[ij]}) = N_{[i.]}N_{[.j]}/N_{[..]}$, $i, j \in \{+, -\}$. The H0 can be tested, using the test statistic $\Sigma_{i,j\in\{+,-\}}[N_{[ij]} - E(N_{[ij]})]^2 / E(N_{[ij]} \sim x^2(1)$.

Results for these indices for cyclical components of the TC filters with a second order cycle, the HP filter and the EES are shown in Table 4. There is no instance with a negative value for I so that the signs of the real-time cyclical components cannot be regarded biased. The relative share of sign misdiagnoses amounts to roughly 10-25 per cent with the TC filter variants. Signs of cyclical components are likewise often wrongly estimated with the EES except in the case of the US, where the EES gives the highest share (38 per cent) of instances with wrong signs. For the other countries and regions, the HP filter yields the highest shares of wrong signs between 35 and 46 per cent. Correspondingly, the HP filter gives the lowest value for the information content measure I, again with the exception of the US, where the EES performs worse. For all regions except Germany and France, I is generally closer to unity for the TC filter variants. In Germany the EES outperforms both trend variants of the TC filters. In France the EES gives a higher value for I than the TC(1,2) filter. The H0 that the cell counts are random can never be rejected at the 5 per cent level with the HP filter. Only HP filtered real GDP in Germany leads to a rejection of the H0 at the 10 per cent level. According to the χ^2 test, the hypothesis of a random distribution of signs can be rejected at least at the 5 per cent significance level for cyclical components computed with the TC Filter and the EES. All in all, the TC filter generally allows for a more consistent determination of signs of cyclical components in real time than the one-component

Table 4

Sign Tests of Real-time Cyclical Components of Real GDP

Country	Filter	Wrong sign	*I*	Test statistic	*P*-value	Significance†
DE	TC(1,2)	0.23	0.55	7.80	0.005	***
	TC(2,2)	0.19	0.62	10.40	0.001	***
	EES(7)	0.15	0.69	12.76	0.000	***
	HP(30)	0.35	0.36	3.31	0.069	*
ES	TC(1,2)	0.19	0.62	10.40	0.001	***
	TC(2,2)	0.27	0.45	5.42	0.020	**
	EES(7)	0.31	0.39	3.94	0.047	**
	HP(30)	0.46	0.08	0.18	0.671	
FR	TC(1,2)	0.08	0.87	19.07	0.000	***
	TC(2,2)	0.23	0.55	7.72	0.005	***
	EES(7)	0.15	0.69	12.76	0.000	***
	HP(30)	0.35	0.31	2.48	0.116	
IT	TC(1,2)	0.08	0.85	18.62	0.000	***
	TC(2,2)	0.15	0.69	13.77	0.000	***
	EES(7)	0.23	0.50	7.10	0.008	***
	HP(30)	0.46	0.10	0.25	0.619	
EURO	TC(1,2)	0.15	0.70	12.83	0.000	***
	TC(2,2)	0.19	0.62	10.40	0.001	***
	EES(7)	0.27	0.46	5.57	0.018	**
	HP(30)	0.38	0.24	1.47	0.225	
US	TC(1,2)	0.19	0.55	10.64	0.001	***
	TC(2,2)	0.12	0.77	16.25	0.000	***
	EES(7)	0.38	0.33	4.54	0.033	**
	HP(30)	0.27	0.45	5.42	0.020	**

† *,**,***: significant at 10 per cent, 5 per cent and 1 per cent.

filters. The EES performs remarkable well in this test, while results for the HP filter are less satisfying.

The comparatively weak real time properties of the one-component filters – the HP filter and the EES – derive from the “missing cycle” in these filters. Enhancing these filters with stochastic models for the cycle improves the real-time reliability significantly and removes the pro-cyclical bias in end-of-sample estimates. Obviously, it is not possible to identify the trend at real time in a proper way if a model for the cycle is missing.

5. Conclusion

Univariate trend-cycle decompositions suffer from all too simple implicit models of the data generating process, while more elaborated approaches – as for instance unobserved components models – are not always easily applicable. This paper develops an intermediate approach by generalising the HP filter and incorporating a cyclical component in the model representation of the filter in the time domain. The resulting trend-cycle filter has better end-of-sample properties than the HP filter or the related Extended Exponential Smoothing (EES) procedure. In particular, the pro-cyclicality in end-of-sample trend/cycle estimations, characterising the one-component filters which are based on an implicit model for the trend only with cycle left as a residual from trend-extraction. The incorporation of a cycle model turned out crucial for the favourable properties of the TC filter.[27]

While the TC filter is based on a more complex stochastic model than the EES and the HP filter, its application is almost as simple that of the one-component filters. Once the TC filter has been programmed,[28] it is straightforward to choose the appropriate stochastic trend and cycle models and to obtain the trend-cycle decomposition. It is not necessary to experiment with prior variance restrictions and start values for unobserved variables as it is sometimes required in unobserved components model estimations.

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27 The trend-cycle filter form cannot be applied to seasonal time series. However, an expansion towards a trend-cycle-season filter or incorporating additional components such as structural breaks is straightforward, see Mohr (2005).

28 Implementations in EXCEL, EVIEWS 4.x and MatLaB can be obtained from the ECB Working Papers site (http://www.ecb.int/pub/pdf/scpwps/ecbwp499annexes.zip) or from the IDEAS Economics bibliographic database (http://econwpa.wustl.edu:80/eps/em/papers/0508/0508005.zip).

APPENDIX 1
LAG AND DIFFERENCE OPERATORS IN MATRIX FORM

Define the $N \times N$ lag matrix L as:

$$L = \begin{bmatrix} 0 & 0 & \dots & & & 0 \\ 1 & 0 & 0 & \dots & & 0 \\ 0 & 1 & 0 & 0 & \dots & 0 \\ \vdots & & & & & \vdots \\ 0 & \dots & & 1 & & 0 \\ 0 & \dots & & 0 & 1 & 0 \end{bmatrix}$$

The first row of L is zero as in finite samples the d-th lag is not defined for the first d data points. This makes some adaptations to the usual lag- and difference operators necessary. Most of their properties, however, carry over to their matrix representations. Lag and difference matrices have the following properties:

Property 1: The d-th lag in matrix form is defined as $L^d = LL^{d-1}$. It holds that $L^d = L^q L^{d-q}$, for any q, $0 \le q \le d$. For completeness, define $L^0 \equi I$.

Property 2: The lead operator in matrix form is equal to the transpose of L, L'.

Property 3: Denote an $N \times N$ identity-matrix in which the first d rows are filled with zeroes as I_d. Then, $L L' = I_1$ holds. In general, $L^d L^{d'} = I_d$. Furthermore, it holds that $I'_d = I_d$. For any pair (n, m), with $n \ge m$, $I_n I_m = I_n$ holds.

Property 4: The matrix of first differences ∇ can be defined as $\nabla \equiv I_1 (I - L)$. The I_1-matrix renders the first row of ∇ zero, accounting for the fact that the lag of the first data point is not defined. In general we define the d-th difference matrix as $\nabla^d \equiv I_d \nabla \nabla^{d-1}$. Again, this is the same as $\nabla \nabla^{d-1}$ with the first d rows set equal to zero as the d-th lag is not defined for the first d data points. It holds that $\nabla^d = I_d \nabla^q \nabla^{d-q}$, for any q, $0 \le q \le d$. For completeness we define $\nabla^0 \equiv I$.

Property 5:

$$\nabla^{d'} = \begin{cases} L^{d'} \nabla^d & \text{if } d \text{ is even} \\ -L^{d'} \nabla^d & \text{if } d \text{ is odd} \end{cases}$$

Proof:

$$\nabla^{d'} = I^d \underbrace{[I_1(I-L)]' \dots [I_1(I-L)]'}_{d\times} = I^d \underbrace{(I_1 - L)' \dots (I_1 - L)'}_{d\times}$$

$$= I^d \underbrace{(I_1' - L') \dots (I_1' - L')}_{d\times} = I^d \underbrace{[L'(L-I)] \dots [L'(L-I)]}_{d\times}$$

$$= I^d L^{d'} \underbrace{(L-I) \dots (L-I)}_{d\times}$$

$$= \begin{cases} L^{d'} I^{d} \underbrace{(I-L)\ldots(I-L)}_{d\times} = L^{d'} \nabla^{d} & \text{if } d \text{ is odd} \\ -L^{d'} I^{d} \underbrace{(I-L)\ldots(I-L)}_{d\times} = -L^{d'} \nabla^{d} & \text{if } d \text{ is even} \end{cases}$$

APPENDIX 2
ADDITIONAL FIGURES

Figure 5

Cyclical Components and Real-time Cyclical Components of Real GDP
(percent of real GDP)

(a) TC(2,2,8) filter

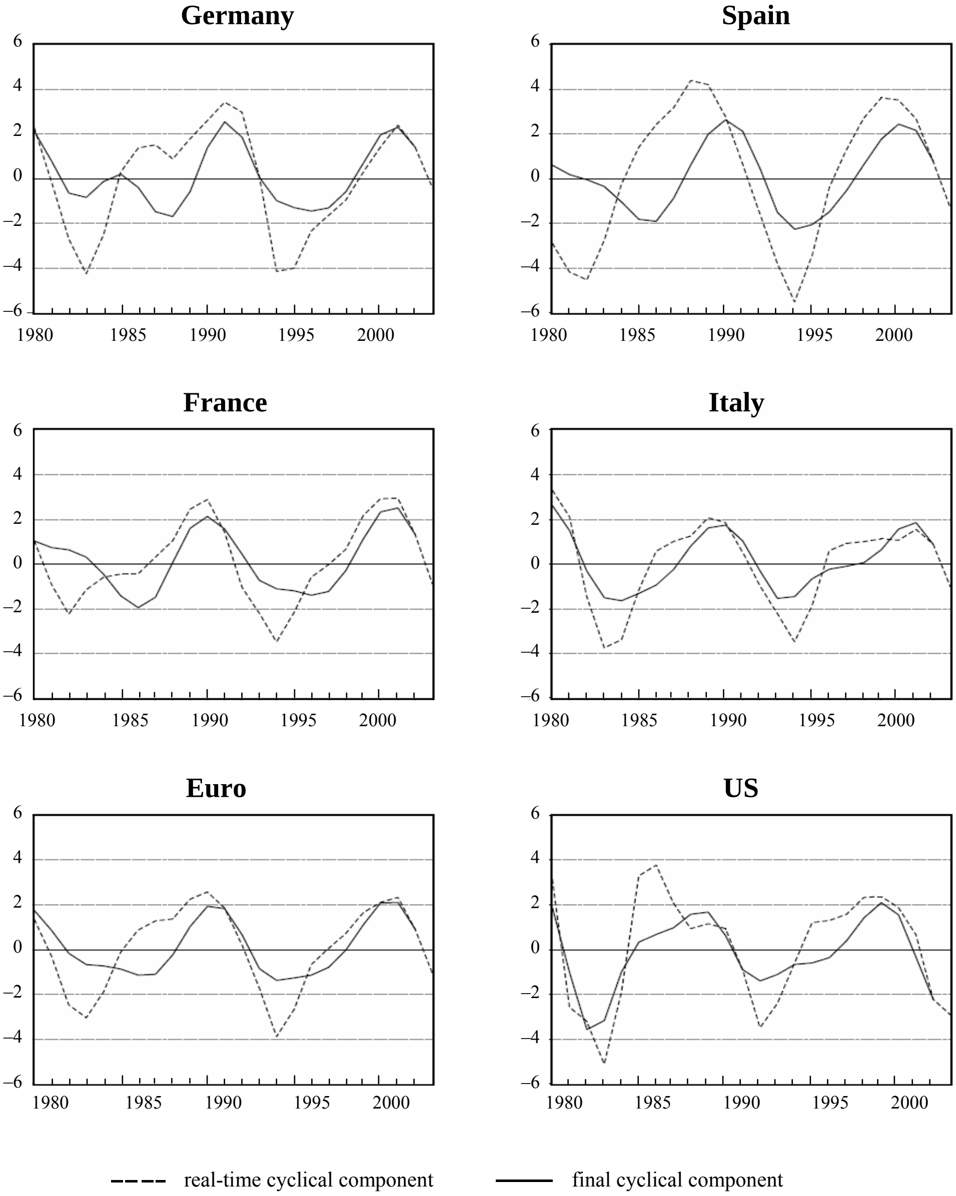


Figure 5 (continued)

Cyclical Components and Real-time Cyclical Components of Real GDP
(percent of real GDP)

(b) HP(30)filter

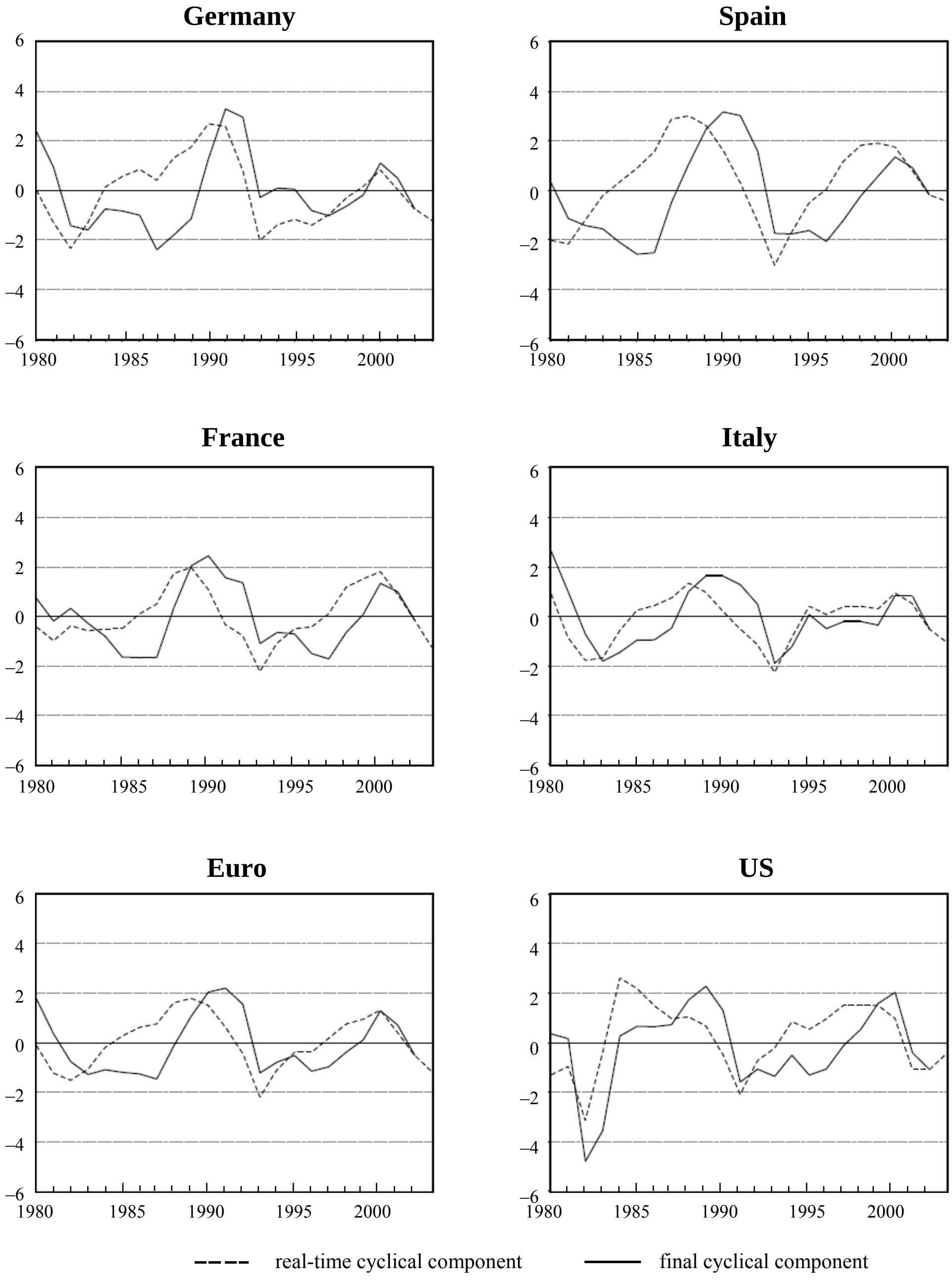


Figure 5 (continued)

Cyclical Components and Real-time Cyclical Components of Real GDP
(percent of real GDP)

(c) EES(7)

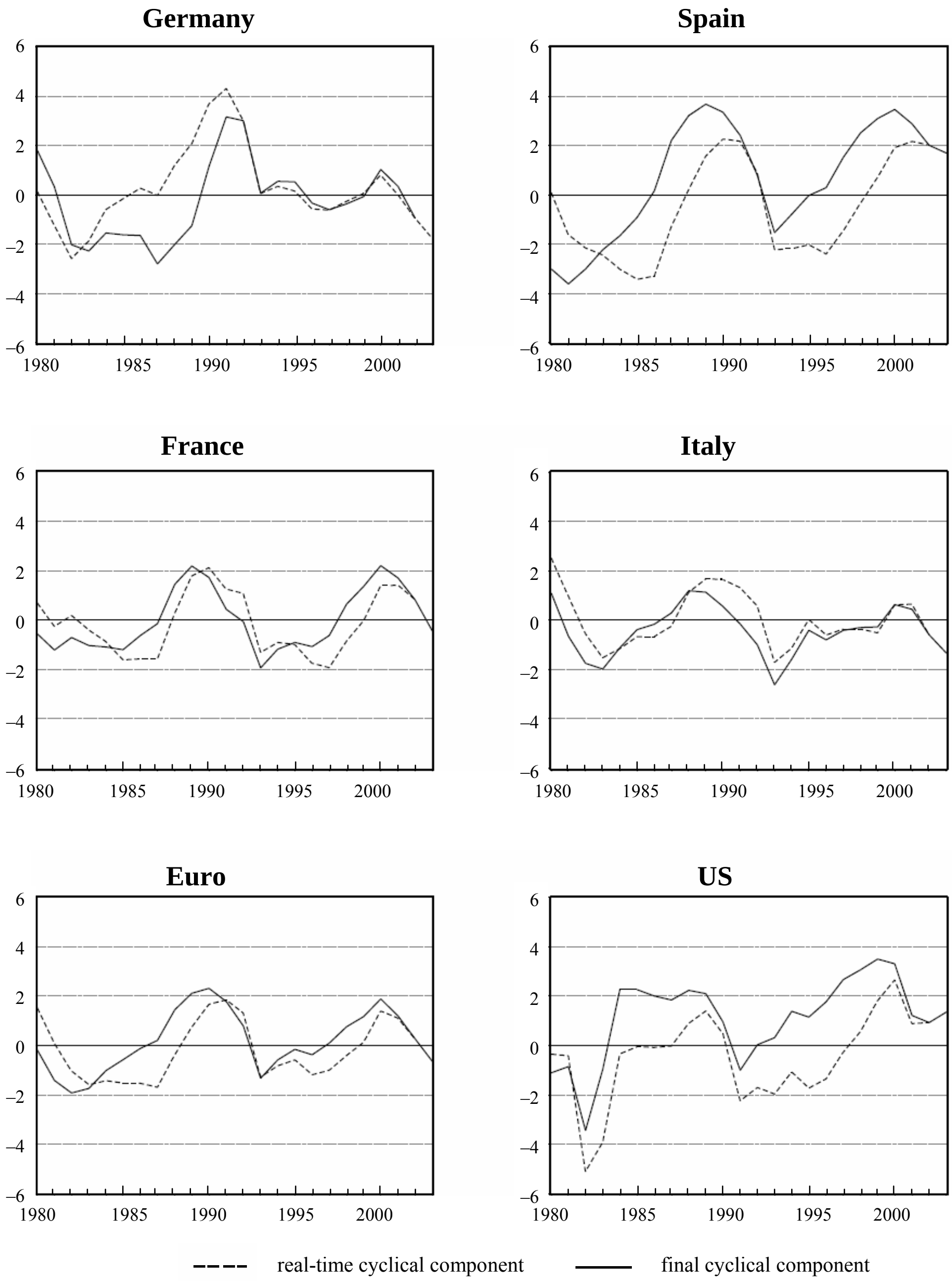


Figure 6

Real-time Minus Final Trend and Final Cyclical Component

(percent of real GDP)

(a) TC(2,2,8) filter

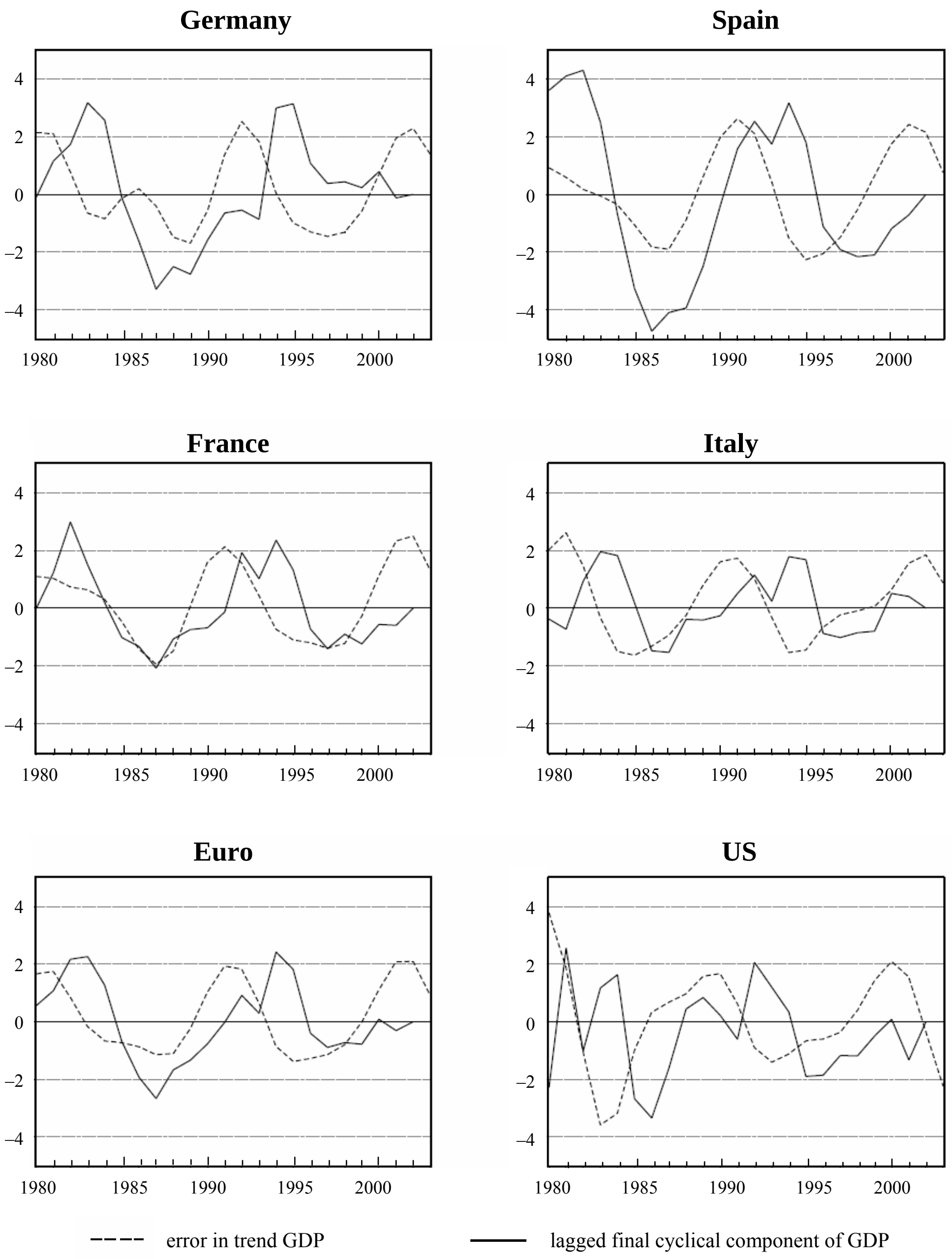


Figure 6 (continued)

Real-time Minus Final Trend and Final Cyclical Component

(percent of real GDP)

(b) HP(30) filter

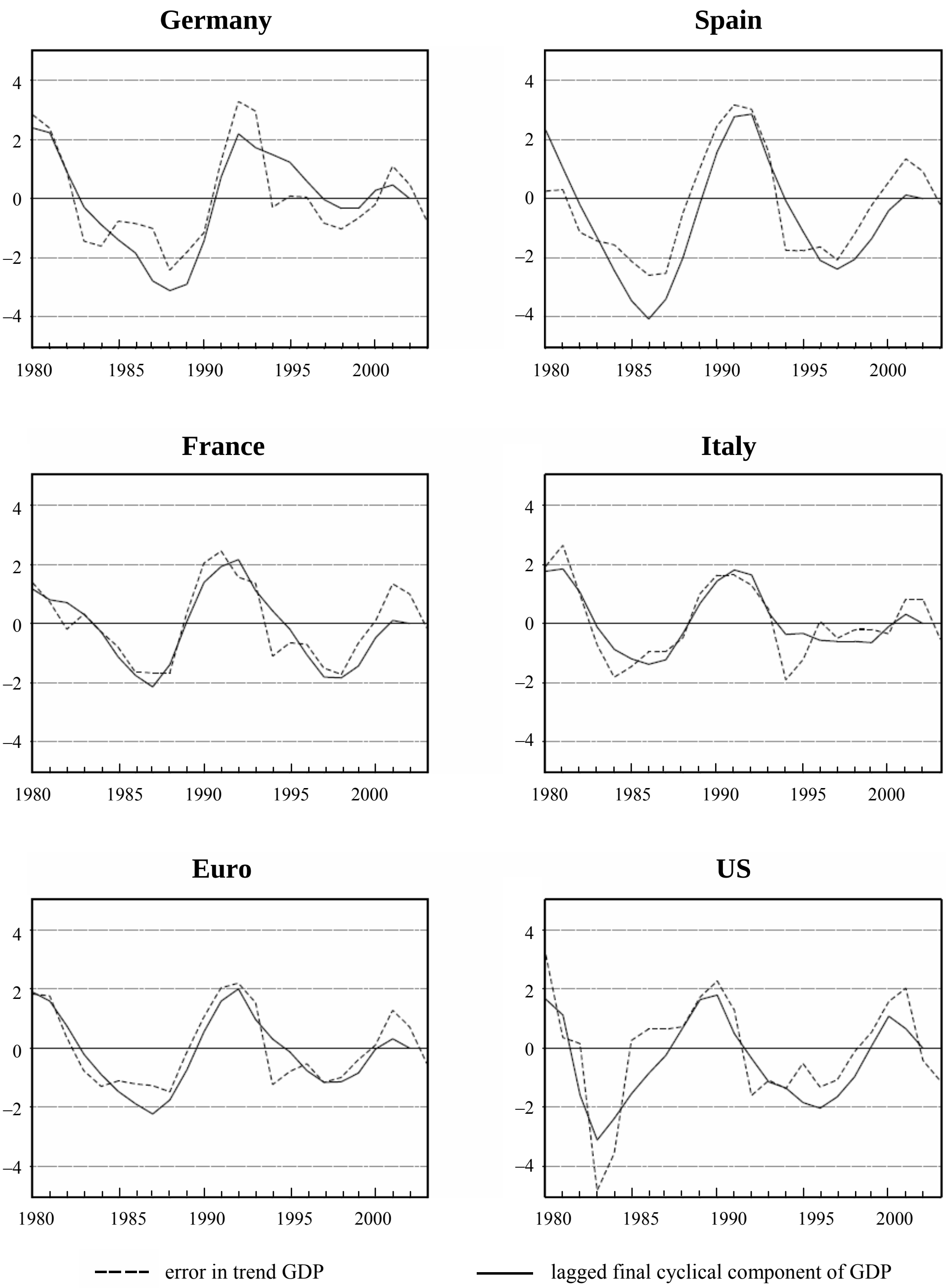
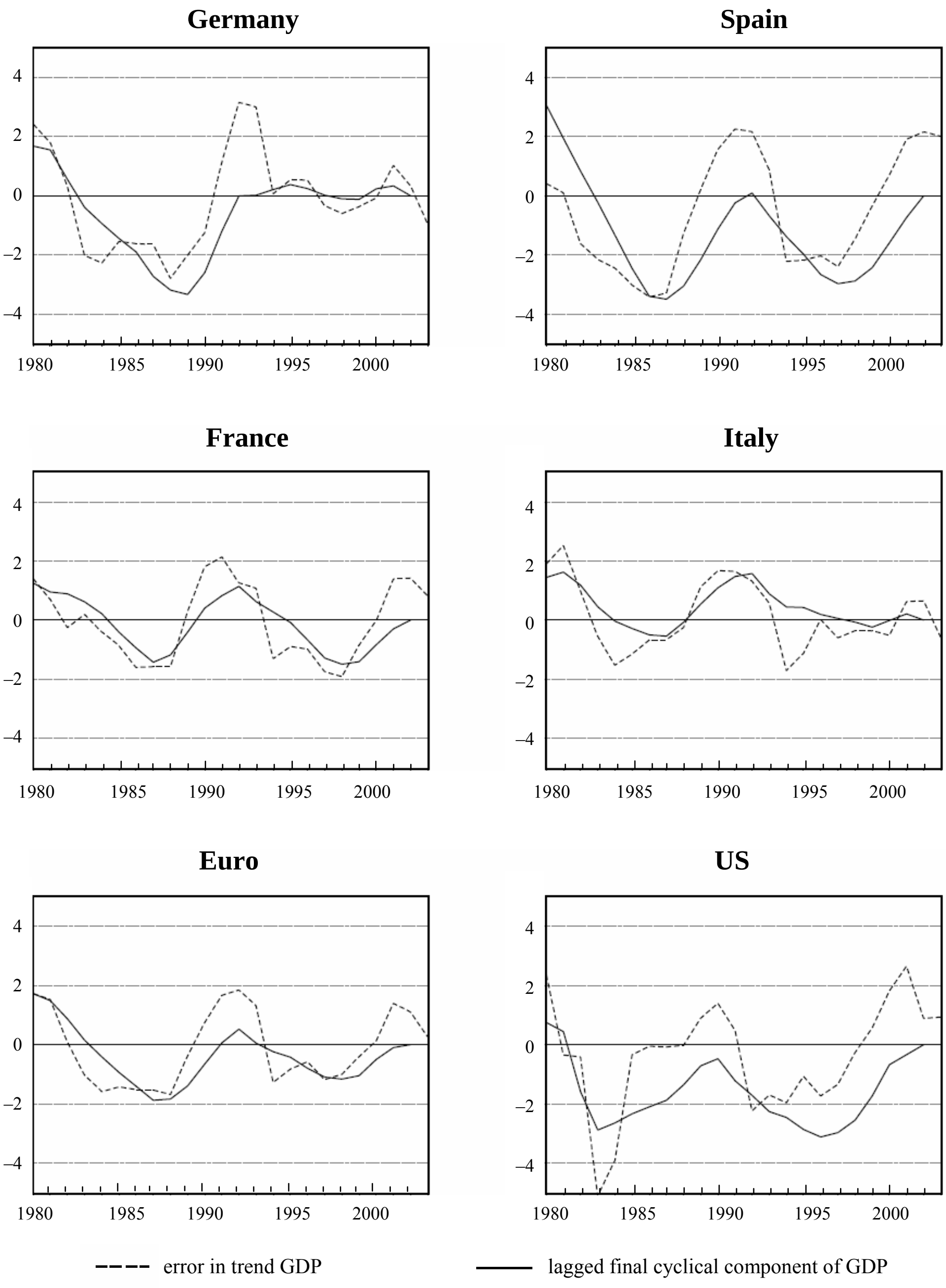


Figure 6 (continued)

Real-time Minus Final Trend and Final Cyclical Component
(percent of real GDP)

(c) EES(7) filter



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FILLING THE GAP
MEASUREMENT OF THE CYCLICAL EFFECT ON BUDGETS

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One of the most vivid discussions in every country is with regard to the assessment of fiscal policy. Since budgets are influenced by business cycles, there is enormous interest in disentangling the underlying fiscal position from the effect of the business cycle. The two main methods used by international institutions to determine this cyclical factor – the aggregated and disaggregated approaches – arguably do not fulfil the necessary requirements for obtaining correct results. In this paper we introduce an alternative disaggregated methodology which is not only able to incorporate theoretical considerations, but is also easily computable, and does not require unavailable data. We also demonstrate that if the deflators of variables are different, then the real cyclical component has to be corrected to obtain the nominal cyclical component. We show that standard cyclical adjustment methods applying constant elasticities are consistent with the broadest definition of discretionary measures, but possibly inconsistent with the underlying deficit. Standard estimations of the cyclical and underlying components can be faulted due to the specific non-linear features of tax systems and unemployment benefit schemes.

1. Introduction

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

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

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

discretionary measures with multi-year impacts, for example designing automatic stabilisers in such a manner that budget responses are more than equiproportionate.

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

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

In this paper we introduce a methodology that overcomes these limitations.[2] Here we do not address the issues of fluctuations of deflators, but our proposed method also reduces the potential distortions related to them.

2. Overview of recent approaches and their shortcomings

The potential output of an economy is a commonly cited and widely used concept by both policymakers and analysts when seeking to evaluate an economy. Although economists generally agree on the intuitive concept of the cyclical component, there is less consensus on how to measure it, given that it is unobservable, and thus cannot be measured statistically.

Of the various econometric techniques to solve this problem, practically all of which have been tested as possible candidates for measuring trends and cyclical positions, two main methods of estimating the CAB have emerged: the aggregated

[2] Gauss code of the two official approaches and our method can be downloaded from http://vadasg.extra.hu

approach, as advocated by the International Monetary Fund (IMF), the Organisation for Economic Cooperation and Development (OECD) and the European Commission (EC), and the unconstrained disaggregated approach, as applied by the European Central Bank (ECB). The aggregated approach assumes that a single number, the output gap, is sufficient to evaluate the cyclical effect on the budget balance. The ECB, recognising that this could be misleading in certain cases, advocates the disaggregated approach. Nevertheless, disaggregation raises two essential issues:

(1) the sum of parts should equal the total value, and

(2) different deflators are used in the case of different variables which are not addressed by ECB-type disaggregation.

2.1 Aggregated approach

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

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

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

Unfortunately, this method has four key drawbacks.

- Firstly, it does not take into account and exploit the consequences of choosing the Cobb-Douglas production form, namely its parameters α and $1-\alpha$ determine not only the labour and capital share in level, but also the relative weight of disaggregated gaps. Specifically, the sum of the labour and capital income gap, weighted by labour and capital shares, should be equal to the aggregated output gap. In addition, labour and capital shares cannot be assumed to be constant even in the case of developed economies, not to mention transition ones.
- Secondly, given that the unemployment rates in transition economies have been influenced by several shocks, the standard relations and state-space estimation therefore yield inappropriate results.

- Thirdly, capital stock and/or TFP are not available in several countries. Moroever, even where they are available, their values are already the result of an estimation process, as they are not observable variables.
- Fourthly, and most importantly, in certain periods the disaggregated approach can be identified as a more appropriate method of cyclical adjustment, because the aggregate output gap and its elements, such as consumption, profit, etc., can vary considerably. The significantly different budgetary implications of these "atypical" circumstances have been taken into account in some *ad hoc* analyses (such as EC, 2000), and a few new methods have been introduced (Bouthevillain *et al.*, 2001; Kiss, 2002; Braconier and Forsfält, 2004).

Given these atypical cases, Boije (2004) argues that the aggregate output gap hides underlying developments. While the same output gap can comprise various components, this output gap has a different effect on the economy and the budget. However, the aggregated approach calculates exactly the same effect based on an identical aggregate output gap.[3] This phenomenon may explain Cronin and McCoy's results (1999). They found that the constant elasticities of budgetary revenue and spending on output are not plausible, although these results may be attributable to the above-mentioned composition effect. Even if elasticities on disaggregated gaps are stable, the degree of elasticity in the aggregate differs if the shares of disaggregated gaps are not constant, which is likely to be true for all countries.

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

2.2 ECB-type disaggregated approach

Since the aggregated approach can be appropriate under an extremely strict assumption, *i.e.* every GDP component is at the same cyclical position, the ECB proposes using a disaggregated method. In practical terms, Bouthevillain *et al.* (2001) estimate numerous gaps, such as private wages, employment, consumption, corporate profit and the unemployment gaps, by using a univariate Hodrick-Prescott

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

(HP) filter. However, although this method helps in identifying the various cyclical positions of relevant economic factors and is extremely easy to adapt, there are some problems that weaken its usefulness.

The most important and relevant objection to univariate HP filtering is that there is no theoretical relationship among variables. Bouthevillain *et al.* (2001) and Mohr (2003) argue that the linear nature of the HP filter ensures theoretical consistency among variables, as the weighted sum of disaggregated HP-filtered gaps equals the aggregate gap. Even though the HP filter is linear, this characteristic cannot be exploited in the field of economic time series, since economic time series should be log-transformed in the HP filter[4] and, as a consequence, aggregation constraint is not satisfied.[5]

Another problem is that using only one univariate method may result in an extreme solution that cannot be revealed since there is no control method. Moreover, Darvas and Vadas (2005) prove that better results can be achieved by using several methods. From the point of view of policymaking, the stability of the output gap estimate is crucial. Methods which provide extensive revision in the estimated output gap cannot be used in policy decision-making because they may frequently render previous decisions inadequate. Using a revision-based weighting scheme, Darvas and Vadas (2005) find that a multiple-method approach provides a more stable output gap estimation than any single method.

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

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4 The general form of the univariate HP filter is:

$$\min\left[\sum (x - x^*)^2 + \lambda \sum (\Delta x - \Delta x^*_{-1})^2\right]$$

Note that economic time series generally grow exponentially, which means that Δx_t also increases over time. As a consequence, the second smoothness term in the HP filter would give higher importance to the end of the sample. Log transformation renders the economic time series to I(1) series, implying that Δx_t becomes constant and thus avoids over-weighting.

5 It is apparent, if:

$$X + Y = Z \qquad \text{and} \qquad HP(X) + HP(Y) = HP(Z)$$

then:

$$x + y > z \qquad \text{when } X, Y > 1$$

thus:

$$HP(x) + HP(y) > HP(z)$$

where small letters denote the logarithm of variables.

2.3 *Effect of different deflators*

Hitherto we have considered variables in real terms; however, both tax bases and tax revenues are in reality in nominal terms. As a result, real and nominal cyclical positions may have different signs. Therefore, prices need to be introduced; that is, nominal variables are used.

To make the situation more transparent, suppose that the real consumption gap determines the real cyclical position of indirect taxes. Nominal consumption is obtained by multiplying real consumption by the consumer price index (CPI), while indirect taxes are multiplied by the GDP deflator. If the CPI is higher than the GDP deflator, then nominal indirect taxes based on nominal consumption are higher than indirect taxes based on real consumption.

For instance, consider the Hungarian economy in the mid-1990s. Owing to the high inflation rate and tight fiscal policy, the consumption gap was negative in real terms, while the CPI was higher than the GDP deflator. As a result, despite the negative consumption gap, the nominal cyclical position of budget revenues was relatively favourable.

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

3. A new method of measuring the cyclical position

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

3.1 *Deriving the cyclical position* [6]

In this part we introduce an easily tractable method, capable of decomposing the output gap. The use of the production function can be favourable, since it is based on various factors that define the aggregate gap. The main drawback of the application of the "full-form" of production function (as in equation (1)) is that it involves several estimated variables, such as capital stock and TFP. Note that since

[6] Gauss code of the two official approaches and our method can be downloaded from http://vadasg.extra.hu

we need only the output gap, these uncertain variables are not necessary. The ratio of actual output to its potential counterpart can be computed by:

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

where *CU* denotes the level of capacity utilisation; here we apply the Cobb-Douglas form with labour-augmenting technical progress.[7]

There are two important deviations from the IMF, OECD and EC approaches. First, we apply a more realistic time-varying capital share, which can be obtained from either estimation[8] or from national accounts. This specification allows us to avoid the assumption of constant labour and capital income shares. It should also be kept in mind that these shares determine how the aggregate output gap should be decomposed into its components. Second, we argue against the HP filtered Solow-residual on both theoretical and practical grounds. If TFP is the explanatory variable of the production function, then estimating equation (1) without it results in an omitted variable problem and misspecification. Using the estimated parameters of this regression and incorporating an HP-filtered residual into the computation of potential GDP cannot, however, be justified. More importantly, in this case the smoothness of potential GDP simply comes from the smoothed disturbance term. Recall that TFP is an unobservable variable. Explaining potential GDP by the deviation of an unobservable variable from its potential level can be cumbersome. Since the CAB plays an important role in policy debate, the usage of the *TFP* variable as the key explanatiory variable could yield albitrary policy argument.[9]

After simplifying and log-transforming equation (2), we obtain:

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

where small letters denote the logarithm of corresponding variables. Although equation (3a) can be used to estimate potential GDP, the level of capacity utilisation is not available for every country, as is the case with capital stock. Basu and Fernald (2001) show that working hours contain information about capacity utilisation, thus:

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

where *wh* denotes the log of working hours. Obviously, where capacity utilisation time series are available, approximation is not necessary and equation (3a) can be used.

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7 Neutral technological progress is not justified by empirical work.

8 For a Kalman filter estimation of the time-varying capital share, see Kiss and Vadas (2004).

9 Nevertheless, if incorporating *TFP* is desired, then this can be done by simply replacing *TFP* with TFP^* in the denominator and extending equation (3a) with an additional $(1-\alpha_t)(\ln TFP_t - \ln TFP_t^*)$ term.

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

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

where variables with superscript stars denote the potential or trend values of the corresponding variables.[10]

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

Obviously, several behavioural equations can be included. However, as (1) the labour-compensation gap determines the direct tax on households, social security contributions and pensions; and (2) the profit gap determines direct tax on corporations, there are only two potential budgetary elements left: unemployment benefit, and indirect taxes on household consumption.

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

Indirect tax on households' expenditure is extremely high, and therefore we incorporate a consumption function, which ensures that the potential value of wages and consumption are connected by theoretical considerations:

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

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

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

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[10] To understand the derivation of this constraint, divide $Y_t^* = W_t^* + \Pi_t^*$ by Y_t and rearrange the right-hand side to obtain:

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

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

St. Amant and van Norden (1997) with an aggregation constraint, we apply a multivariate HP filter. The potential value of the wage and profit shares are constrained by equation (4), and the entire system is influenced by theoretical equations (equations (3a) or (3b) and (5)). To achieve this, we embed the above-mentioned equations into the multivariate HP filter:[11]

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

subject to

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

Only one question has been left open, namely, how to weight (ω_i) the different parts (lines) in the optimisation. In fact, there are two possible weighting schemes which do not involve an arbitrary assumption. First, we leave every variable its own scale, *i.e.* $\omega_i = \omega_j, \forall i, j$. Second, every variable is normalised, which implies equivalent volatility. Instead of normalising every variable, we set ω_i as $\omega_i = 1/\sigma_i^2$, where σ_i^2 denotes the variance of i^{th} variable.[12]

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[11] Based on the empirical literature, we restrict the cointegration vector to [1 –1] in the consumption equation. Note that other cointegration vectors would imply 100 per cent or minus infinity saving rate, which is unacceptable from both a theoretical and an empirical point of view. However, it is technically possible to assume other cointegration vectors and to estimate ρ in line with the other parameters.

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

(continues)

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

3.2 Correcting the effect of different deflators

Although several methods have been proposed[13] for capturing the trend or potential price level, the actual concept of the potential price level is more difficult to interpret. In this paper we do not address the issue of potential price levels. However, another problem was identified that resembles the composition effect of real variables. We capture this composition effect by recording the difference between the CPI and GDP deflators. In order to understand the basic idea behind our method, it should be noted that nominal variables are first deflated; however, the corresponding deflators differ, variable by variable. For instance, corporate profit is usually deflated by the GDP deflator, while private wages and consumption are deflated by the CPI. As the budget deficit is compared to GDP, the GDP deflator is therefore the relevant one for the budget.

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

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

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

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

Now the minimisation problem has the following form:

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

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

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

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

nominal terms. The cyclical component in nominal terms (CC_N) takes the following form:

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

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

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

4. Coverage of the adjusted budget items

After obtaining the gaps in tax bases and unemployment the next step is the identification of the coverage of the cyclically influenced budget items. For instance unemployment benefits are obviously connected to the business cycle. In some countries, other expenditures, such as pensions, are also directly influenced by cyclical fluctuations through different kinds of indexation techniques. At the same, time non-tax revenues and the majority of government expenditures are not directly affected by the cycle, or in other words they exhibit zero elasticities to the cycle.

The majority of government expenditures are also included in legal tax bases; therefore, they increase revenue automatically. The actual effects of discretionary spending can be measured by excluding their direct tax content. In principle, both tax bases and revenues can be corrected by government outlays. In this case the indirect taxes and contributions paid by the government and direct taxes and contributions paid by public employees are assumed to have zero elasticities, similarly to the corresponding expenditure items.[14] These data are available at the national level and the adjustments can be done by country experts. (ECB, 2001, Annex) In our disaggregate methodology private and public tax bases cannot be separated. In order to reduce potential distortions caused by different dynamics of these tax bases we propose alternative solutions. If data on taxes paid by the government are available, distortions can be reduced by assuming that these

[14] In like manner, indirect tax revenues should be adjusted with the portion transferred to the EU, because this expenditure item is assumed to have zero elasticity.

expenditure components can have the same elasticities as private taxes (instead of assuming zero elasticity). This solution would produce the same net coverage of the adjusted budget items as the previous method, but distortions can still not be fully removed. For a full correction estimated cyclical components should be adjusted with effects of public wage shocks by calculating a public wage gap between public and private wage indexes. This public wage gap should be subtracted from or added to the cyclical wage gap estimated with our disaggregate methodology.

Despite this issue of consolidation of budget data, indirect, or second-round effects of fiscal policy are still included in the revenue side, for example higher indirect tax revenue due to higher private consumption. In order to obtain a measure of the effect of fiscal policy on various macroeconomic variables, empirical models would be required in which the interrelationships of fiscal policy and economic behaviour are specified.[15] Cyclical fluctuations affect the budget, which in turn has an influence on the cycle through spending programmes or changes in tax rules. Although taxes and tax bases can be easily consolidated with government expenditures, simultaneity cannot be corrected without empirical models.

5. Issues concerning fiscal elasticities

The more difficult task is the estimation of the responsiveness of the chosen budget items to deviations of actual macroeconomic developments from their trends. It can be demonstrated that there is no uniform solution taking into account that some countries have less complex tax systems some others have more complex ones. In the remaining part of this section as a starting point we show three sources of potential problems, then before suggesting solutions, we develop a simple framework of definitions.

In the simplest case macroeconomic tax bases and legally defined tax bases automatically have the same dynamics; furthermore the system of taxes relies exclusively on tax rates instead of employing a set of nominal elements, ceilings, brackets, etc.

In this case unit elasticities can be assumed not only between the trends of taxes and the trends of the corresponding tax bases but also between actual taxes and actual tax bases. It means that cyclical effects can be removed from the actual deficit by applying unit elasticity. Furthermore, the change of this underlying, cyclically adjusted balance can be simply interpreted as the effect of discretionary measures.

In a more realistic scenario, however, tax systems can employ a number of nominal elements and legally defined tax bases can differ significantly from macroeconomic tax bases reflecting tax-payers' decisions. In this case the assumption of unit elasticities between the trends of taxes and the trends of the

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

corresponding tax bases remains reasonable. On the contrary, elasticities between actual taxes and actual tax bases should be estimated for each year. In the following three sub-sections we show limitations of this estimation.

5.1 Implications of the nominal elements of the tax system

Nominal elements of tax systems can have two consequences on cyclical adjustment. First, nominal brackets and ceilings may create inconsistency between estimated budgetary effects of nominal and real fluctuations for example in case of surprise inflation. In this case the effect of the drop in real wages would be accelerated by employing higher elasticity of personal income tax (PIT). Since the estimated elasticity of PIT is based on nominal elements, this result would be consistent with a drop in nominal wages, but it would be inconsistent with unchanged nominal wages accompanied with a drop in real wages.[16]

The second consequence is more obvious; the responsiveness of the PIT and social security contributions (SSC) should be reestimated for each year because these elasticities depend on the valorisation of nominal elements. As regards the valorisation of nominal elements, the principle of "no policy changes" does not mean that nominal values should be fixed forever. In this extreme case, the bracket creeping effect[17] would qualify as a neutral policy.

In principle the neutrality of the nominal elements can be achieved by keeping the effective tax rates[18] unchanged, *i.e.* nominal values should be valorised by the expected per capita income each year. In this benchmark case, unit elasticity can be assumed even for PIT. This benchmark case is applicable not only for measuring the structural deficit but also for estimating effects of the multi-year discretionary measures.[19] For example, if the operated tax system is a progressive one, PIT could grow faster than income. The operation of this tax system requires a discretionary decision not only in the first year, but in the subsequent years, too. If we want to catch this multi-year impact, we have to use unit elasticities between taxes and tax bases. By calculating elasticities from tax codes in each year, our results capture only the effects of the discretionary actions of the year in question.

In practice the government may keep the tax burden unchanged over the cycle and therefore nominal values increase in line with medium-term trends in income. This built-in progressivity produces temporarily higher revenue in the case of

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16 Progressive tax systems only enlarge the potential distortion stemmed from the divergence in real and nominal developments. In the case of inflation surprise, all kind of cyclical adjustments would suggest a negative cyclical component, completely ignoring the offsetting effects of the fluctuations in the deflator.

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

18 Effective tax rates are equal to actual tax payments as a ratio of the economically defined tax base.

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

expanding income in a self-reversing way. In contrary to the previous approach, maintaining progressivity may qualify as operating automatic stabilizers. In some case governments actually follow pro-cyclical policies through under- and over-valorisation of nominal elements; tax burden is reduced in good times, while it is increased during slowdown. This practice would be captured by the estimated degressivity of PIT or SSC.

It is an important question, however, how to make yearly estimations of elasticities of PIT and SSC. In the case of PIT and SSC the OECD approach has taken into account tax codes; average and marginal rates adjusted with social allowances are systematically calculated for each level of income. The ratio between the weighted averages of adjusted marginal and average rates provides the elasticity of receipts to gross earnings.[20] It represents the responsiveness of PIT and SSC to additional units of income. However, these calculations based on the tax code of a fixed year, and they are not continuously updated. It can be a problem since valorisation practice can be changed over time, therefore it would be more important for us to capture over- or under-valorisation year by year than calculating effects of additional units of income for specific years. Since the benchmark case for neutrality can be the unchanged effective tax rates, therefore over- or under-valorisation can be approximated by the changes of effective tax rates.

5.2 Implications of private decisions on legally defined tax bases and unemployment

Both tax bases and unemployment have legal and economic definitions. While cyclical gaps are estimated according to the economic definitions, budget items are actually determined by legally defined tax bases and unemployment. There are specific cases when tax-payers' decisions affect only legally defined tax bases without effects on economic tax bases. It has two basic forms:

- the tax avoidance and tax evasion affect only legal tax bases. Its size may change over time both because of cyclical reasons and as a reaction to tax measures (e.g. tax amnesties, tax hikes).
- some optional elements of tax codes affect also only legal tax bases. For example the possibility of receiving investment tax credits depends on the decisions of tax-payers. Both fulfilling the criteria and timing of the claims for tax credits require decisions, which can be affected by cyclical developments or fiscal measures.

If these decisions have important effects on the tax revenue, the trend (underlying) revenue should be estimated in an alternative way. It means that usual indirect approach, *i.e.* calculations of elasticities can be replaced by establishing

[20] Weights of the various income categories are calculated on the basis of an estimated income distribution.

direct links between trends of revenues and the estimated trends of the economic tax bases.[21]

5.3 *Implications of asymmetric features of the tax design*

In extreme cases not only the indirect approach of elasticities but even direct links between trends of revenues and trends of the economic tax bases can became unreliable. It is due to the fact that deficit imperfectly reflects fluctuations of macroeconomic variables, because the design of tax/benefit systems sometimes renders the operation of automatic stabilisers asymmetric (see Kiss and Vadas, 2004, p. 16). If these asymmetric features are resulted in an identical magnitude of budget responses with an asymmetric time pattern, the direct links between revenue trends and economic trends are not distorted. For example there can be full self-reversing effects with immediate positive but prolonged negative effects on the budget. If these self-reversing effects are incomplete, however, this kind of asymmetry may distort the direct estimation of trend revenue.

In the case of corporate taxation, effective tax rates depends on the severity of recession, *i.e.* it exhibits non-linear features. At a certain point (where there are no taxable profits at all) the effective tax rate temporarily becomes zero for the loss-making companies. While profit-making companies pay their taxes immediately, losses of the others have a negative impact on the budget only on a deferred basis, as the profit has contrasting economic and legal definitions, and the latter allows for carry forward losses.[22] Against this background the composition of the aggregate profits, *i.e.* share of losses does matter. Self-reversing effects may be incomplete due to legal and practical limits of carry forward losses, e.g. loss-making companies can be dissolved.

Another source of asymmetry is the design of unemployment benefit system. The status of "entitled to unemployment benefits" is different from the economic (ILO) definition of unemployment. If the period of entitlement to unemployment benefits is shorter than the business cycle, decrease in ILO unemployment do not necessarily reduce expenditures (elasticity can be close to zero), while increase in ILO unemployment may increase budget expenditures immediately. Here again the composition of aggregate developments (*i.e.* inflows and outflows) does matter. This composition effect can make difficult to establish reliable links between trend of unemployment benefit and trend of ILO unemployment.

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21 This alternative solution is the direct estimation of the underlying trends of the budget items and receiving the cyclical component as a residual in contrast to the usual indirect approach, namely deducting the estimated cyclical components from actual figures in order to arrive at underlying trends as a residual value.

22 Similar self-reversing effects may occur in the case of the choice of accelerated depreciation rates, which temporarily reduce the legally defined profits.

5.4 *Calculation and interpretation of underlying trends and discretionary measures*

After highlighting the complexity of tax/benefit systems we present a simple scheme of a possible decomposition of actual taxes.

Table 1

Decomposition of Taxes into Underlying and Discretionary Determinants

1. Trends of economic tax bases	4. Fluctuations of real economic tax bases and deflators	Non-discretionary components of taxes (1+4)
2. Effects of permanent changes on tax-payers' behaviour	5. Tax-payers' behaviour affected by temporary measures and business cycle	Mixed components of taxes (affected by both measures and private decisions) (2+5)
3. Effects of permanent fiscal measures	6. Effects of temporary fiscal measures (e.g. incomplete valorisation of nominal elements)	Discretionary components of taxes (3+6)
Trend or underlying components of taxes (1+2+3)	Temporary components of taxes (4+5+6)	

This table shows that trends of taxes can be determined by trends of economic tax bases in absence of permanent fiscal measures. While deficits are shaped by the overall impacts of all measures (Table 2/I), definitions tend to focus on direct impacts of those measures, which were implemented in a given year (Table 2/IV). This narrow definition cannot identify any measures with multi-year effects such as permanent changes in the design of the tax/benefit systems or any indirect effects of measures such as tax optimizing reactions of tax-payers.

Table 2

Alternative Definitions of Discretionary Measures

	All measures (including design of tax/benefit systems)	Measures of a given year only
Total impacts of measures (including reactions of tax-payers)	I. Overall impacts of all measures on the deficit	II. Total impacts of new measures
Direct impacts only	III. Direct impacts of all measures	IV. Direct impacts of new measures

The following example (Table 3) shows that standard cyclical adjustment methods applying constant elasticities are not necessarily able to separate impacts of new measures from multi-year impacts of the tax design. If new measures are not implemented in a given year the change of CAB is equal to those effects of the tax design, which partly offset cyclical influences on the deficit.

Table 3

Standard CAB Methods Can Be Consistent with Broad Definition of Measures

	A. Deficit = B + C + D	B. Cyclical loss calculated with constant elasticity	C. Offsetting effects of tax design (carry forward losses)	D. New Measures	E. CAB = A – B
Year *t* – 1	0	0	0	0	0
Year *t*	–0.4	–1	0.6	0	0.6
change	–0.4	–1	**0.6**	**0**	**0.6**

If we are interested in the underlying component of the budget items, we expect to receive cyclically adjusted figures which are close to the trends of the budget items. In fact, without permanent fiscal measures, cyclically adjusted figures should be equal to the trends of the budget items. The following example (Table 4) shows that standard cyclical adjustment methods applying constant elasticities are not necessarily able to completely remove fluctuations from the deficit.

Table 4

Standard CAB Methods Can Be Inconsistent with Underlying Deficit

	A. Deficit = B+C+D	B. Permanent measures	C. Cyclical loss calculated with constant elasticity	D. Offsetting effects of tax design (carry over losses)	E. CAB = A – C
Year *t* – 1	0	0	0	0	0
Year *t*	–0.4	0	–1	0.6	**0.6**

The closer the tax system to the simple scenario we started with, the smaller the distortion caused by employing constant elasticities. An approximation of the distortion is the volatility of cyclically adjusted budget items, therefore it is important to check results whether we can explain major changes with background information about discretionary measures (Kremer *et al.*, 2006). If we cannot explain changes in these residuals we can replace constant elasticities with continuously updated estimations. This approach can solve specific problems related to valorisation of nominal elements.

If unexplained volatility cannot be removed by employing updated estimations this problem can be a consequence of asymmetries in the tax design and/or difference between legal and economic definitions of tax bases and unemployment. In this case capturing the underlying component of the deficit would require employing unit elasticities directly between the trends of taxes and the trends of the corresponding tax bases. In other words the structural tax revenue should change at the same pace as the trend of the tax base. Changes in the effective tax rates would result in a level shift without affecting this co-movement.

A potential problem here is the identification of the permanent levels of the effective tax rates, which can be approximated with the ratio between the trend levels of taxes and trend levels of tax bases. In fact some temporary factors can make this calculation difficult. Since direct estimation of the underlying trends has some uncertainties, these results should be also controlled by background information about discretionary measures. As we have already mentioned the problem here is that estimations are usually available for only direct impacts of those measures, which were implemented in a given year (Table 2/IV). The effects of some measures can be easily estimated (e.g. changes in statutory tax rates or the entitlement period for unemployment benefits). On the contrary, more difficult to estimate the effects of measures related to the “optional” elements of the tax code, which allow for the possibility of receiving investment tax credits, but which depend on the decisions of taxpayers.

6. Summary

In this paper we have surveyed the two main official cyclical adjustment methods, namely the aggregated approach as adopted by the EC, IMF and OECD, and the unconstrained disaggregated approach championed by the ECB.

The main advantage of the aggregated approach is that it uses the production function and hence incorporates a theoretical background into cyclical adjustment. However, it assumes that any other GDP components that are relevant in terms of budget revenue and expenditure are in the same cyclical position as GDP, which is clearly rarely the case. Moreover, aggregated approaches do not exploit the information content of wage and capital shares, which are used to estimate the production function.

The ECB's disaggregated approach is designed to take into consideration the possibility of the different cyclical positions of real variables. It filters each relevant variable, one by one, using the single variable HP filter. However, this procedure can be criticised for its lack of theoretical considerations. In addition, there are serious implications implied by the application of the univariate HP filter. Since economic variables, due to their exponential nature, are log-transformed, the ECB-type disaggregation cannot fulfil the aggregation criterion.

The above-mentioned drawbacks, namely the lack of disaggregation or theory and the violation of the aggregation constraint, produce considerable bias in the estimation of cyclical components. While the first one involves the possibility of wrong policy implications, the latter, due to its non-linear transformation, causes systematic bias.

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

We also presented that if the deflators of variables are different then the real and nominal cyclical component can differ significantly. This paper has provided a method that corrects this difference.

We showed that the results of standard cyclical adjustment methods applying constant elasticities are consistent with the broad definition of discretionary measures, but possibly inconsistent with the underlying deficit. Standard estimations of the cyclical and underlying components can be faulted due to the specific non-linear features of tax systems and unemployment benefit schemes.

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MEASURING FISCAL PERFORMANCE IN OIL-PRODUCING COUNTRIES

Fabrizio Balassone[*]

Oil-producing countries face unique challenges in the conduct of fiscal policy with respect to both fiscal sustainability and macroeconomic stabilization. Concerning sustainability, complications arise from the fact that a significant part of the current revenue stream comes from exhaustible resources whose overall value is highly uncertain. The volatility of oil price also complicates fiscal management over the medium term. This paper defines and applies a simple "toolkit" for a broad-brush assessment of how oil-producing countries are coping with such challenges. The paper finds that the attainment of sustainable fiscal positions remains an issue in many countries, while a more mixed picture emerges with respect to the contribution of fiscal policy to stabilization.

1. Introduction

Oil-producing countries (OPCs) face unique challenges in the conduct of fiscal policy with respect to both fiscal sustainability and macroeconomic stabilization. Concerning sustainability, complications arise from the fact that a significant part of the current revenue stream comes from exhaustible resources whose overall value is highly uncertain. Assessing a country's oil wealth is difficult because of uncertainty concerning the quantity, quality and cost of extraction of oil reserves, as well as future oil prices. The volatility of oil price also complicates fiscal management over the medium term, since the impact of fluctuations in oil price can be as important – if not more important – than that of standard business cycles.[1]

This paper defines a simple toolkit for a broad-brush assessment of how OPCs are coping with such challenges. With respect to fiscal sustainability, the paper relies on necessary conditions and benchmarks derived from the government present value budget constraint (PVBC). The paper recognizes the limits of the approach – specifically, the impossibility to identify necessary and sufficient conditions for sustainability – and points out the advantages of analytical long term projections of the fiscal accounts in this respect. However, it warns that uncertainty

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[1] Other non-renewable resources pose similar problems, but the scale is different.

over oil wealth negatively affects the stability of long term projections. With respect to macroeconomic stabilization, the paper discusses the relative merits of various deficit/surplus measures as summary indicators of the impact effect of fiscal policy on aggregate demand. The paper argues that focusing on the overall balance alone can provide biased indications concerning the contribution of government budgets to macroeconomic stabilization and suggests to use the non-oil balance (*i.e.* the balance net of oil-related revenues) as a supplementary indicator.

The paper examines fiscal performance in two partly overlapping samples of 18 OPCs each, spanning, respectively, over 1980-2004 and 1992-2004. It finds evidence that the attainment of sustainable fiscal positions remains an issue for most countries in the samples, while a more mixed picture emerges with respect to the contribution of fiscal policy to macroeconomic stabilization.

The paper is organized as follows. Section 2 discusses necessary conditions for sustainability in the presence of oil. Section 3 focuses on summary indicators of the contribution of fiscal policy to macroeconomic stabilization. Section 4 provides the empirical analysis. Section 5 summarizes the main conclusions.

2. Sustainability

Whether a given fiscal policy is or is not sustainable ultimately depends on its effects on macro parameters such as the rate of interest and the rate of growth. "[T]he issue [...] is how interest service will affect the economy" (Musgrave and Musgrave, 1984, p. 689), and "the problem of the debt burden is a problem of an expanding national income. How can a rapidly rising income be achieved?" (Domar, 1944; p. 166).

Given analytical difficulties, however, fiscal sustainability is usually analyzed in a partial equilibrium framework, whereby interest and growth rates are given. In such a framework, debt dynamics is driven "mechanically" by the expected profile of primary balances over the relevant time horizon according to the standard equation:

$$d_t = (1+\gamma)^{-1}\, d_{t-1} - b_t = [(1+\rho)/(1+\gamma)]\, d_{t-1} - p_t \qquad (1a)$$

Where d is the debt to GDP ratio, γ the growth rate of GDP, ρ the interest rate and b and p the overall and primary balance to GDP ratio, respectively (a positive sign indicates a surplus). Equation (1a) can be solved forward to yield

$$d_T = [(1+\rho)/(1+\gamma)]^T\, d_0 - \Sigma_{t=1,T}\, \{p_t\, [(1+\rho)/(1+\gamma)]^{(T-t)}\} \qquad (1b)$$

In this context, sustainability is usually defined by a no-Ponzi game condition, but this turns out to be a rather loose constraint.[2] The no-Ponzi game

[2] Sustainability is different from solvency. The latter would require government debt to be repaid at some point in time, so that the following constraint holds:

$$\lim_{T\to\infty} d_T = 0 \qquad (a)$$

(continued)

condition requires that debt cannot be rolled-over in full in every period to cover both principal and interest[3]

$$\lim_{T\to\infty} d_T [(1+\rho)/(1+\gamma)]^{-T} = 0 \qquad (2)$$

Equation (2) requires that the discounted value of the debt ratio converge to zero, which obtains *also with an ever growing debt ratio* (McCallulm, 1984). In fact, equation (2) is satisfied provided the debt ratio grows no faster than the discount rate – that is, no faster than the difference between the interest rate and the growth rate.[4] Discounting (1b) to time zero, taking the limit for $T\to\infty$ and using (2) gives the present value budget constraint (PVBC)

$$d_0 = \lim_{T\to\infty} \Sigma_{t=1,T} \{p_t [(1+\rho)/(1+\gamma)]^{-t}\} \qquad (3)$$

Equation (3) says that sustainable policies, as defined by the no-Ponzi game condition, require that the present discounted value of the sum of future primary balances (as a share of GDP) must be equal to the current debt ratio (Blanchard *et al.*, 1990; p.12).

Feasibility considerations concerning the primary surplus reduce only in part the latitude allowed under the PVBC. Since the government cannot rise more revenue than the economy generates as income, it has been argued that the primary surplus should be bounded away from unity (Barro, 1989; Kremers, 1989). From (3), we see that this condition would bound the debt ratio as follows:

$$d_j < \lim_{T\to\infty} \Sigma_{t=j+1,T} \; [(1+\rho)/(1+\gamma)]^{-(t-j)} = (1+\gamma)/(\rho-\gamma) \qquad \forall\, j \qquad (4)$$

Nevertheless, this still allows the debt ratio to reach very high levels. Assuming an interest rate of 10 per cent and a growth rate of 6 per cent, the bound of "sustainable" debt ratios would be 2.65 per cent, it would rise to 5.1 per cent for an interest rate of 4 per cent and growth rate of 2 per cent.[5] While the maximum

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or:

$$\lim_{T\to\infty} [(1+\rho)/(1+\gamma)]^{T} d_0 = \lim_{T\to\infty} \Sigma_{t=1,T} \{p_t [(1+\rho)/(1+\gamma)]^{(T-t)}\} \qquad (b)$$

That is, initial debt compounded at a rate equal to the difference between the interest rate and growth rate must be matched by the sum of future primary balances compounded at the same rate. However, government debt need not be repaid. Moreover, there is no reason to believe that a positive, albeit "low," debt ratio should not be sustainable.

3 This condition is also often presented without scaling the variables by GDP. This does not affect the results of the analysis (Chalk and Hemming, 2001).

4 Several econometric tests have been developed to assess compliance of fiscal policy with the PVBC. They ultimately boil down to checking whether on average $(\Delta d/d)<(\rho-\gamma)$ holds true over the period subject to analysis. A general limitation is therefore their backward looking nature: compliance with the PVBC in the past gives no guarantee concerning the future. Balassone and Franco (2001) provide a concise review of the literature. Papers in Banca d'Italia (2001) provide applications of PVBC tests.

5 In a similar vein, much earlier, Domar (1944) argued that sustainability requires that the cost of servicing the debt (as a share of GDP) should not grow indefinitely. He showed that this condition is satisfied by any policy which keeps the overall balance constant as a share of GDP (*i.e.* any $\underline{b}$ such that $b_t = \underline{b}\ \forall t$). From (1) in the main text, it follows that a constant overall balance imposes a bound to the debt ratio:

$$\lim_{T\to\infty} d_T = \underline{d} = -\underline{b}\,(1+\gamma)/\gamma \qquad (a)$$

(continued)

sustainable primary surplus is certainly much lower than 100 per cent of GDP, the choice of any specific value (and of the accompanying bound on the debt ratio) remains to be justified.

All this appears to provide little guidance for the assessment of fiscal sustainability in practice. Relying on convergence to zero of the discounted debt ratio – equation (3) – would provide no reassurance concerning sustainability. Equation (4) does suggest that the debt ratio should be bounded below some "prudent" level, consistent with the maximum fiscal effort that the economy can withstand, but this takes us full-circle to the initial statement that sustainability depends on the macro implications of fiscal policy.[6]

However, the PVBC delivers at least one general prescription for OPCs, *i.e.* that a policy implying a non-oil primary deficit is only sustainable if it also implies an overall surplus during the phase of oil exploitation. If current policies imply a non-oil primary deficit, *i.e.* a deficit in the primary balance net of oil related revenues, they will also imply a primary deficit once oil is exhausted. Therefore, before the exhaustion of oil, overall surpluses will be required for (3) to hold. This can be seen most easily by rewriting (3) as:

$$d_0 - \Sigma_{t=1,T} \{p_t [(1+\rho)/(1+\gamma)]^{-t}\} = \Sigma_{t=T+1,\infty} \{p_t [(1+\rho)/(1+\gamma)]^{-t}\} \qquad (5)$$

where T is the last period of oil revenues.[7] If $p_t < 0$ for $t > T$ – that is, if the primary balance is in deficit once oil is exhausted – the right-hand side of (5) will be negative and, for the equality to hold, the left-hand side of the equation will also have to be negative. The latter implies a positive net asset position at time T,[8] which can only be obtained if overall surpluses prevail over $t \in (1,T)$.[9]

However, (a) still begs the question of which deficit and debt ratios would be the maximum sustainable ones. Under the class of policies defined by (a), the primary balance converges to a finite surplus:

$$\lim_{T\to\infty} p_T = -\underline{b}\,(\gamma-\rho)/\gamma = \underline{d}\,(\rho-\gamma)/(1+\gamma) \qquad (b)$$

As discussed in the main text, p_T must be bounded away from one, in which case (b) reduces to (4).

6 In practice, the assessment of fiscal sustainability has tended to rely on *ad hoc*, "intuitive" notions of what distinguishes a sustainable from an unsustainable policy. For instance, Blanchard *et al.* (1990) suggest to look at the difference between the current primary balance and the primary balance that would stabilize the debt ratio – the "primary gap". They also propose an equivalent indicator – the "tax gap" – computed as the difference between the current tax ratio and the one that would stabilize the debt ratio.

7 While the analysis in the main text assumes that T is exogenous, in reality, the depletion rate of oil resources can be a policy variable. However, for any given T chose by the authorities, equation (5) would still hold.

8 From equation (1b) in the main text, it follows that:

$$d_T = [(1+\rho)/(1+\gamma)]^T \{d_0 - \Sigma_{t=1,T} \{p_t [(1+\rho)/(1+\gamma)]^{-t}\}$$

that is, the net asset position at time T is a multiple of the left-hand side of equation (6) in the main text.

9 Of course policies can be changed and sustainability could be restored after the exhaustion of oil by either decreasing expenditures or rising taxation. However, there are reasons to prefer a front-loaded adjustment. Over time expenditure patterns tend to become entrenched and difficult to reverse. It should also be mentioned that large changes in expenditure and/or revenues can entail macroeconomic costs, including the reallocation of resources to accommodate the changes in demand and relative prices. Finally, if tax collection is subject to increasing marginal costs, cost-minimization calls for tax-smoothing (Barro, 1979).

The question remains of how big the average surplus should be. Recommendations in this respect can only be obtained by supplementing the PVBC with additional normative criteria — e.g., welfare maximization, prudence, or intergenerational equity. One prominent example is the "permanent consumption" approach, whereby the introduction of an explicit welfare maximization objective, allows the selection of an "optimal" policy from the set of those consistent with the PVBC. The optimal policy consists of running a constant non-oil primary deficit equal to the return on the present discounted value of oil-wealth (see, e.g., Barnett and Ossowski, 2003).[10] Assuming that social welfare is a function of the primary non-oil balance as a share of GDP (p'_t), the government maximization problem can be written as:[11]

$$\text{Max}_p \quad \Sigma_{t=1,\infty}\, \beta^{-t}\, U(p'_t) \tag{7}$$

$$\text{s.t.} \qquad \lim_{n\to\infty} \Sigma_{t=1,n} \{(p'_t + z_t)\,[(1+\rho)/(1+\gamma)]^{-t}\} = d_0$$

$$z_t = 0\,\big|_{t>T}$$

where $\beta = (1+\rho)/(1+\gamma)$ and z_t indicates oil revenues as a share of GDP. First order conditions for (7) yield:

$$U'(p'_t) = U'(p'_{t+1})\ \forall t \ \Rightarrow\ p'_t = \underline{p'}\ \ \forall t \tag{8}$$

And solving the PVBC for $\underline{p'}$:

$$\underline{p'} = (\beta-1)\,(d_0 - \Sigma_{t=1,T}\, z_t\, \beta^{-t}) \tag{9}$$

That is, the "optimal" constant non-oil deficit is equal to the return on government net wealth – $(\beta-1) = (\rho-\gamma)/(1+\gamma)$ – defined as the difference between the present value of future oil revenues and the initial debt.[12]

A simple and intuitive benchmark for the assessment of the sustainability of fiscal policy is the "sustainable permanent expenditure level" (SPEL).[13] This is defined as the primary expenditure to GDP ratio which could be sustained indefinitely, without the need to increase the level of taxation in the non-oil sector after oil reserves are depleted, thanks to the return on accumulated financial assets (Figure 1). While similar in spirit to the permanent consumption approach, SPEL allows some "front-loading" of the deficit path, which may be more appealing to developing countries with significant investment needs. The SPEL should not be

[10] In fact, the "permanent consumption" rule is just an application of the familiar smoothing argument.

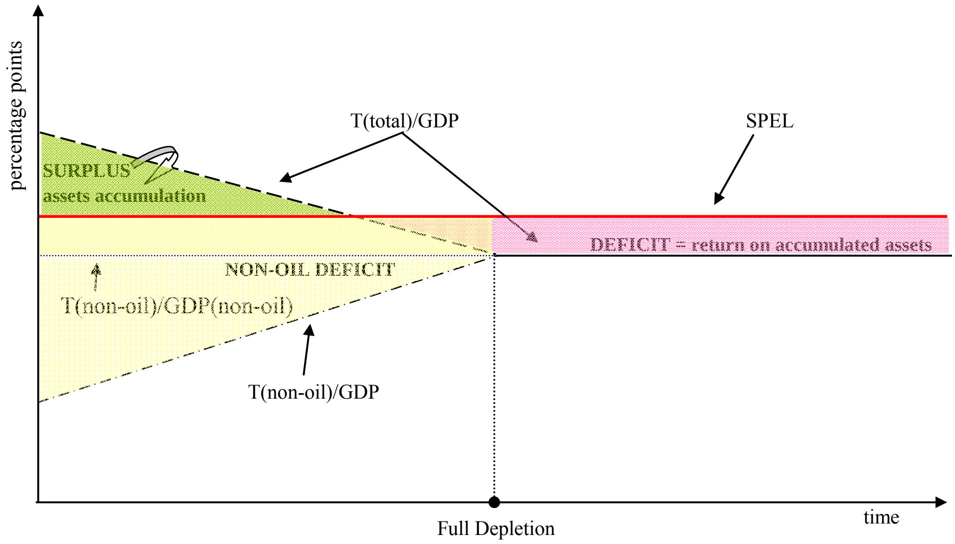
[11] Assuming that welfare depends on the primary non-oil balance allows straightforward comparison with the rest of the analysis in the main text. If non-oil revenues are a constant share of GDP, the formulation used in the text is equivalent to one in which welfare depends on primary spending. Scaling by overall GDP (rather than non-oil GDP) also facilitates comparability and does not affect the qualitative results.

[12] The rule identifies a constant primary non-oil deficit as the optimal policy only if the present value of oil resources is greater than initial debt. Note also that, since the "permanent consumption" rule is consistent with the PVBC, it will be the case that under such rule the primary balance and the overall balance will be in surplus while oil resources are exploited.

[13] See Balassone, Harm and Takizawa (2006) for an application to Russia based on a neoclassical growth model.

Figure 1

Sustainable Permanent Expenditure Level (SPEL)



interpreted as an estimate of the "optimal" expenditure level, rather it should be used as an indicator of whether, *ceteris paribus*, current policies will or will not have to be adjusted once oil is depleted.[14]

The examples above clarify how indications on the appropriate size of the required fiscal surplus can only be based on estimates of oil-wealth. The latter are characterized by a high degree of uncertainty.[15] First, there is uncertainty about oil reserves, their quality and the cost of extracting them. Second, the future path of prices is highly uncertain; ultimately, technological advances could lead to alternative energy sources and make oil obsolete, or simply no longer cost-effective to extract.[16] Oil wealth uncertainty significantly complicates the computation of sustainability indicators and a full discussion of the issues involved is beyond the scope of this paper. However, the following general remarks apply: *ex ante*,

[14] In this respect, there is a clear analogy between the difference between the SPEL and the actual expenditure ratio and the tax gap indicator proposed by Blanchard (1990) and Blanchard *et al.* (1990).

[15] See, for instance, the discussions in Bjerkholt and Niculescu (2004), and Davis *et al.* (2003).

[16] One extreme way to deal with this uncertainty is to assume that there will be no future oil revenue. This is the rationale of the so-called "birds-in-hand" rule, which recommends targeting a non-oil deficit equal to the real return on financial assets accumulated by saving the proceeds of oil exploitation (see, e.g., Bjerkholt, 2002). This is a very conservative approach that can be viewed as an extreme form of precautionary saving. It has the practical advantage to do without estimates of oil wealth. Since 2001, a "bird-in-hand" rule regulates the use of oil revenues in Norway. However, the rule may not be the most appropriate solution for countries with significant needs in terms of basic infrastructures and investment in human capital.

projections will have to be accompanied by thorough sensitivity analysis; *ex post*, projections will have to be periodically reassessed, with special attention paid to the temporary/permanent breakdown in oil price shocks, as only permanent shocks alter oil wealth.

Technical difficulties notwithstanding, the number of studies assessing long-term sustainability in OPCs is increasing.[17] Long term projections can be a powerful instrument to increase the public's sensitivity to sustainability issues. In discussing the efforts made to build support for prudent fiscal policy in Norway, Skancke (2003) notes that the comparison of projections of net cash flow from petroleum and pension expenditure had the greatest impact even though "advocating fiscal restraint is not easy when the general government budget surplus is around 15 per cent of GDP" (p. 316). Long-term projections of both age-related spending and oil revenue have become a regular feature of fiscal policy documents in Norway.

3. Stabilization

This section examines summary indicators of the contribution of fiscal policy to economic activity. The section discusses how such indicators can be used to assess whether the public finances respond appropriately to changes in the macroeconomic environment. The section also briefly addresses issues related to the composition of such response. Specifically it focuses on the distinction between discretionary policy decisions and automatic reactions of the budget to changes in the macroeconomic environment.

Summary indicators can only be about the impact effect of fiscal policy on economic activity. Only simulations of full scale macroeconomic models can shed light on the "final effects" of fiscal policy. "The early OECD indicators, suggested by Hansen at a time when macroeconomists were more confident about their understanding of the macroeconomy, were indeed about final effects. They weighed the different elements of the budget by the appropriate multiplier; that this was too ambitious and too model-dependent was eventually recognized by the OECD". (Blanchard, 1990; p. 8).

Among deficit/surplus measures, the actual overall balance – as a share of GDP – is arguably the most apt to gauge the impact effect of fiscal policy. Blanchard (1990) convincingly makes the point that any improvement on the [inflation adjusted] overall balance as an indicator of the impact effect of fiscal policy would involve estimating marginal propensity to consume, the degree of foresights of consumers (*i.e.* the role of expectations) and future paths of fiscal and macroeconomic variables.

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17 Examples – albeit methodologically diverse – are provided by Liuksila, Garcia, and Bassett (1994) – who analyze Egypt, Indonesia, Mexico, Nigeria, Saudi Arabia, and Venezuela –, Chalk (1998) – who studies Kuwait and Venezuela –, and Wakeman-Linn *et al.* (2004) – who focus on Azerbaijan.

The issue however arises of the appropriate measurement of the overall balance. The distinction between transactions “above the line” and those below it – *i.e.* between non-financial and financial transactions – has a direct bearing on the size of the measured balance and entails some unavoidable degree of arbitrariness. For instance, decisions concerning whether a capital injection into a state owned company represents a capital transfer rather than the acquisition of equity are, to a large extent, based on conventions. But since capital transfers are above the line while acquisitions of equity are below, such decisions will affect the measurement of the impact effect on fiscal policy on economic activity.[18]

In this respect, the special nature of oil-related revenues, suggests the use of the “non-oil balance” as a supplementary indicator in the analysis of fiscal policy in OPCs. Oil resources can be seen as government non financial wealth and oil-revenues can therefore be interpreted as the result of a swap of a non-financial asset (oil) into a financial one (cash).[19] As such, they should not be included among income items in the government budget. They should be considered as financing items to the extent that they are used to finance the excess of government spending over non-oil revenues. This use of oil resources represents a reduction of wealth and should be treated in the same way as sales of financial assets or issuances of bonds, *i.e.* it should be classified “below the line”.[20]

The possibility of changes in oil taxation, introduces further complications and suggests the need to monitor a third indicator, the “balance at constant oil price”. Pursuing further the analogy between oil and financial wealth, changes to oil taxation can be seen as determining changes in government wealth. By decreasing (increasing) tax rates on oil extraction the government is in fact making (receiving) a capital transfer to (from) the private companies who have acquired the right to extract and sell oil. Such “transfers” will have an impact on aggregate demand.[21] By definition, however, the non-oil balance is not affected by changes in oil taxation. The balance at constant oil price, on the contrary, will generally highlight revenue changes due to changes in legislation.

Nevertheless, the balance at constant oil prices provides very imprecise indications and should be used with care. The extent to which the balance at constant

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[18] For instance, this leads to the question of whether the borrowing requirement – which has all transactions in financial assets “above the line” – may be a better measure of the “overall balance” than net borrowing – which is computed by setting all transactions in financial assets “below the line” (see Blejer and Cheasty, 1993, for a general discussion of measures of the fiscal deficit and Balassone and Franco, 1996, for an analysis of the Italian experience with different budgetary indicators).

[19] The identification of oil revenues will depend on the specific arrangements in place in each country. In general, it should include all revenues from extractive industries: dividends coming from the governments' participation in the sector, profit taxes, royalties, and export duties.

[20] See IMF (2001) for a discussion of the treatment of non-financial assets in the context of an integrated statistical framework.

[21] If oil taxes depend on oil price, the share of oil wealth accruing to the private sector will be affected automatically by changes in price. This suggests the possibility to interpret both the “non-oil balance” and the “balance at constant oil price” as indicators of discretionary policy, which is discussed later in the main text.

oil prices is affected by changes in legislation on oil taxation is not invariant to the assumed reference price. In extreme cases, where new legislation only affects revenues if oil price is above a given threshold, the indicator may or may not signal a change in the impact effect of fiscal policy, depending on whether the assumed reference price is above or below that threshold. The "actual" capital transfer between government and the private sector due to the change in legislation will depend on the oil price prevailing at the time when the new legislation becomes effective.

Once a fiscal indicator is chosen, a reference macroeconomic variable is needed to assess the response of public finances to changes in the economic environment; a "natural" candidate would be the output gap. Stabilization policy is usually discussed in the context of standard business cycle theories, where output fluctuates more or less regularly around a well defined trend. In this context, a stabilization oriented policy would be expected to lead to an improvement (deterioration) in the selected summary indicator of the impact effect of fiscal policy whenever cyclical conditions, as measured by the output gap, improve (deteriorate).[22]

However, the output gap may be difficult to estimate in OPCs. These countries are subject to substantial and frequent shocks, for both endogenous and exogenous reasons, making it difficult to identify business cycles. With regard to the former, many OPCs are emerging markets, often embarking on major reforms that can change the structural characteristics and performance of the economy, making it difficult to assess whether buoyant activity reflects temporary or permanent factors. The exogenous factors are equally important, with exports concentration in the oil sector exposing OPCs to sustained shocks in the terms of trade (IMF, 2006).

Searching for references other than the output gap, one possibility is to gauge fiscal policy directly against output growth. After all, it could be argued that it is growth rates that policy makers are concerned about, rather than output gaps. Taking the growth rate of output as a reference would mean checking that the selected summary fiscal indicator improves (deteriorates) whenever growth accelerates (decelerates). However, if the trend-gap model is correct, such a policy may in fact imply fiscal contractions when the output gap is worsening and, symmetrically, fiscal expansion while the gap is improving (Figure 2).

Another possibility is to refer to oil prices, as they exert significant influence on macroeconomic developments in OPCs. The volatility of oil prices leads to corresponding volatility in government revenues and there is a strong macroeconomic case for decoupling public expenditure from oil revenues. Large and unpredictable changes in expenditure have significant costs. "They include the reallocation of resources to accommodate changes in demand and relative prices, real exchange rate volatility and increased risks faced by investors in the non-oil sector" (Barnett and Ossowski, 2003, p. 61).

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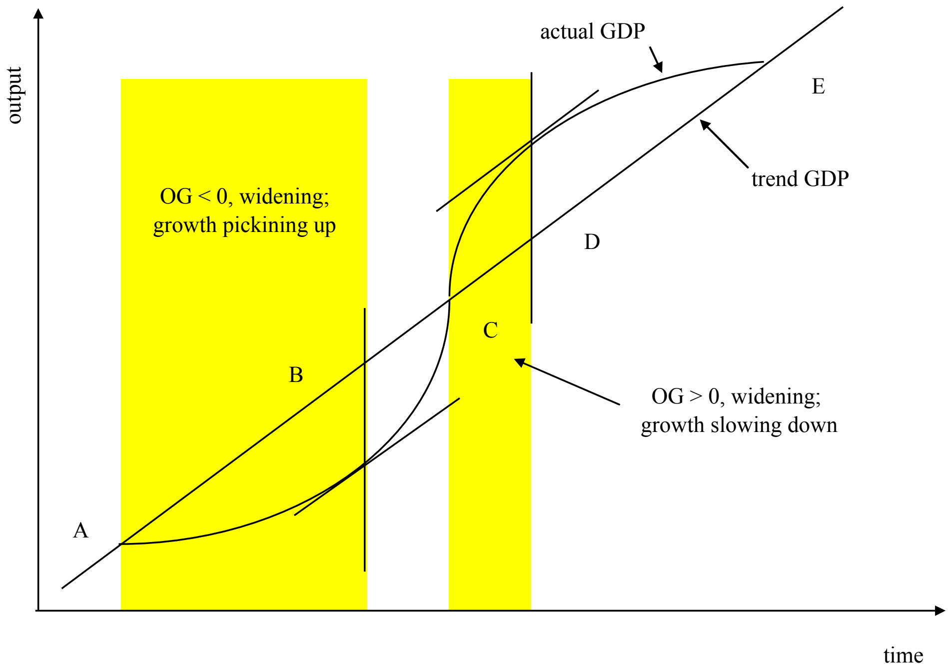
[22] The output gap measures the percentage difference between actual and trend output; a positive gap, therefore, indicates favorable cyclical conditions.

Figure 2

Output Gap and Growth Rate Over the Cycle



AB: output gap worsening; growth rate increasing
BC: output gap improving; growth rate increasing
CD: output gap improving; growth rate declining
DE: output gap worsening; growth rate declining

If oil prices are taken as a reference, then the contribution of fiscal policy to stabilization would be assessed by controlling whether the selected summary fiscal indicator improves (deteriorates) whenever oil price increase (decrease). The overall balance and the non-oil balance can be seen as providing complementary information in this respect. The change in the overall balance indicates whether the budget has provided any "sterilization" of the oil windfall (or cushion against an oil revenue shortfall), while the change in the non-oil balance indicates the extent of the sterilization/cushion provided by the balance.

A crucial issue, is the identification of the temporary and permanent component of oil price changes. Oil prices are subject to shocks with both a temporary and a permanent component. Macroeconomic stabilization would require that expenditure should not be influenced by the temporary price changes. A permanent price-shock, on the contrary, does alter oil wealth and, therefore, calls for a reassessment of sustainable expenditures. However, there is evidence that year-on-year fluctuations in oil price have a large temporary component and, therefore, only a minor impact on oil-wealth.[23]

Whichever way changes in fiscal impact are measured, a relevant question is to what extent they reflect discretionary policy; unfortunately, this question cannot be easily addressed through summary indicators in OPCs. With summary indicators the discretionary component of changes in fiscal impact is typically computed as a residual, after estimating the automatic effect of macroeconomic conditions.[24] While different measures of the discretionary component of changes in budget balances have been proposed, it turns out that they all rely on estimates of the output gap and output semi-elasticity of the budget. In fact, a broad equivalence holds among the "indicator of discretionary change" (Blanchard, 1990), the "fiscal impulse" (Heller, Haas and Mansur, 1986) and the "change in the cyclically-adjusted balance" (see Box). As discussed above, the estimation of trend output (and output gap) raises specific issues in the context of OPCs, which severely limit the applicability of summary indicators of discretionary policy.

An alternative interpretation of the non-oil balance is possible, which would cast it among indicators of discretionary policy. The argument is similar to the one which suggests focusing on the primary cyclically-adjusted balance (CAB) – as opposed to overall CAB – since interest spending is not controlled by the fiscal authorities. If oil revenues react automatically to changes in oil prices and oil prices are not controlled by policy, by excluding oil revenues from the computation of the balance, the analysis focuses on items subject to discretionary action. However, the "adjustment" made by excluding oil revenue is obviously partial (as a minimum, a "non-oil CAB" should be used). Moreover, such an adjustment would only be correct if the structure of oil taxation is not subject to changes, otherwise, reference to the balance at constant oil price would be more appropriate.[25]

4. Evidence

Based on the discussion above, this section turns to the assessment of fiscal performance in a sample of OPCs. Concerning sustainability, the section will examine OPCs' overall balance record to assess whether it is consistent with the necessary condition for sustainability derived from the PVBC; it will also compare

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23 See, for instance, Barnett and Vivanco (2003). *Inter alia*, they point out that future price data imply data about 60 per cent of any given price shock is expected to be reversed within the following year. It should also be considered that the costs of expenditure volatility and the uncertainty surrounding the temporary/permanent breakdown in oil price changes suggests that any expenditure adjustment should be undertaken only gradually, so as to avoid overshooting. Moreover, large and sudden adjustments, "…could strain the government's institutional capacity for planning, executing, and monitoring expenditures, resulting in substantial waste" (Wakeman-Linn *et al.* (2004, p. 21).

24 This approach is not uncontroversial as factors other than discretionary policy and macroeconomic conditions can affect the budget. See IMF, 1998 and 2006, and Hagemann, 1999 for discussions of the issues.

25 As pointed out earlier in the main text, the balance at constant oil price has its own shortcomings.

Box

Indicators of Discretionary Policy

The cyclically-adjusted balance (*cab*) is obtained by removing the cyclical component of the budget – the product of the output gap (ω) by the output semi-elasticity of the budget (ε) – from the overall balance (b):

$$cab_t = b_t - \varepsilon\, \omega_t$$

Correspondingly, the change in *cab* is given by:

$$\Delta cab = \Delta b - \varepsilon\, \Delta\omega \qquad (1)$$

The output gap is defined as the difference between actual and trend output (y and y^*, respectively) as a share of trend output: $\omega_t = (y_t - y^*_t)/\, y^*_t$. The budget semi-elasticity (ε) is defined as: $\varepsilon = \eta_R\ \tau_t - \eta_G\ g_t - b_t$, where revenue and expenditure to GDP ratios ($\tau_t = R/y$ and $g_t = G/y$) are multiplied by their respective elasticities ($\eta_R = (\Delta R/\Delta y)\,(y/R)$ and $\eta_G = (\Delta G/\Delta y)\,(y/G)$).

The indicator of discretionary change (*idc*) is computed by comparing the balance that would have prevailed in the current year if unemployment had been the same as in the previous year ($b^\wedge$), with the balance actually recorded in the previous year. Blanchard (1990) points out that "adjustment for movements in unemployment [should be made] using Okun's Law coefficients for the relation between output and unemployment and a set of elasticities of the different components of the budget with respect to output" (p. 12). Therefore the *idc* is given by:

$$idc_t = b^\wedge_t - b_{t-1} = b_t - \varepsilon\,[(y_t - y^\wedge_t)/y_t] - b_{t-1} = \Delta b - \varepsilon\,[(y_t - y^\wedge_t)/y^\wedge_t] \qquad (2)$$

where $y^\wedge_t$ is the output that would have obtained at time t if unemployment had been the same as at time t–1. Based on Okun's Law, the assumption of constant unemployment rate implies a constant output gap (Okun's coefficient is the ratio of the difference between actual and natural unemployment rates to the percentage difference between actual and trend GDP; see, e.g. Case and Fair, 1999). It follows that $y^\wedge_t$ is the output that would have obtained at time t had output growth (γ) been equal to trend growth (γ^*), that is: $y^\wedge_t = (1+\gamma^*)\ y_{t-1}$. Therefore $[(y_t - y^\wedge_t)/y^\wedge_t] = (\gamma - \gamma^*)/(1+\gamma^*) \cong \Delta\omega$ and:

$$idc_t \cong \Delta b - \varepsilon\,\Delta\omega = \Delta cab_t \qquad (3)$$

The "fiscal impulse" (*fi*) identifies the change in the discretionary component of government balance by comparing the actual balance with an *ad hoc* counterfactual. The counterfactual assumes that the revenue-to-GDP ratio and the expenditure-to-trend GDP ratio (g^*_t) remain constant at the levels recorded in a given benchmark time $t=0$ (Heller, Haas and Mansur, 1986), that is

$$fi_t = \Delta b - \Delta[\tau_0 - g^*_0\,(y^*_t/y_t)] = \Delta b + g^*_0\ \Delta(y^*/y) \qquad (4)$$

Since $y^*/y = (1+\omega)^{-1}$, it follows that:

$$fi_t = \Delta b - g^*_0\, \Delta\omega \qquad (5)$$

An approximate equivalence holds also between the fiscal impulse, on the one hand and the change in cab and the idc, on the other. The average of available estimates of ηR and ηG for European and OECD countries are close to 1 and 0, respectively (see, for instance, Bouthevillain *et al.*, 2001 and Van den Noord, 2000). From the definition of ε, it follows that if $\eta R = 1$ and $\eta G = 0$, then the output semi-elasticity of the budget is equal to the expenditure to GDP ratio, that is $\varepsilon \cong g_{t-1}$. Therefore, from (1), (3) and (5), assuming $g^* 0 \cong g_{t-1}$ we have:

$$idc_t \cong \Delta cab_t \cong fi_t \qquad (6)$$

A special case of the fiscal impulse, also known as "Dutch fiscal impulse" (Chand, 1993), occurs if the benchmark year is $t-1$, in which case:

$$fi_t \cong \Delta b - g^*_{t-1}\, \Delta\omega$$

and the condition for the equivalence result in (6) is:

$$g^*_{t-1} \cong g_{t-1}$$

actual expenditure to GDP ratios to estimates of "sustainable permanent expenditure levels" (SPELs). Concerning stabilization, the section will examine the reactions of both overall and non-oil balances to changes in oil prices and growth rates.

The analysis mainly refers to a data-set covering 18 countries over 1992-2004.[26] For most of the countries included in the sample oil revenues amount to about 20 per cent of GDP and about 60 per cent of overall revenues on average over the period considered (Figure 3). However, there is significant variation in the sample. Average oil revenues are as low as 4 per cent of GDP in Cameroon and Indonesia and 15 per cent of overall revenues in Russia. They reach a maximum of 45 per cent of GDP in Kuwait and 76 per cent of overall revenues in Saudi Arabia. Occasionally, evidence from a deeper sample (1980-2004), covering a different, but partly overlapping, set of countries, will also be discussed.[27] Data on oil revenues are not available for this second sample.

4.1 Sustainability

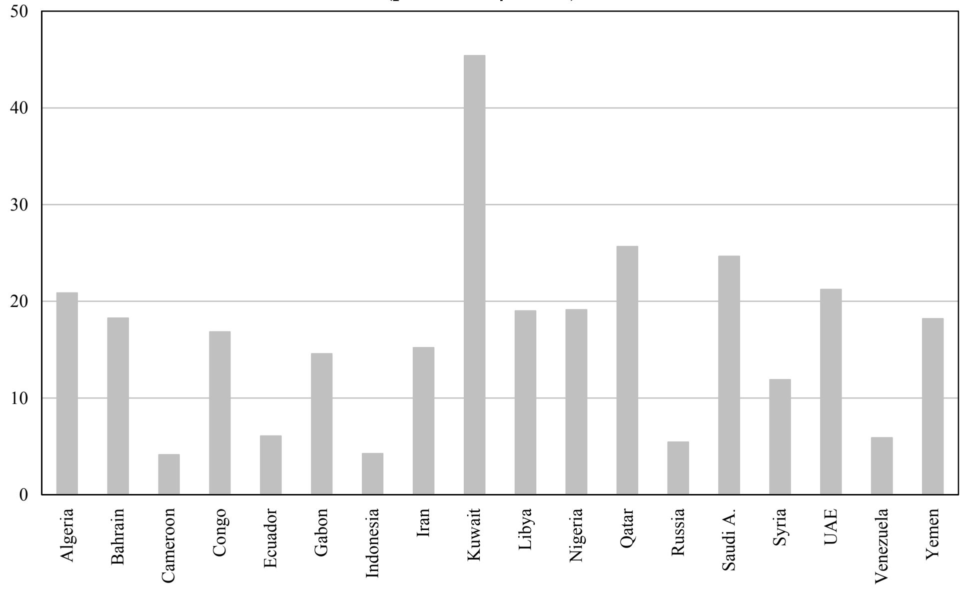
Many oil-producing countries have failed to maintain medium term fiscal positions consistent with long run sustainability. In the shorter of the two samples considered, primary non-oil deficits averaged at 14.2 per cent of GDP, resulting in

[26] Data were provided from IMF Country Desks and the World Economic Outlook database.

[27] Data are from the World Economic Outlook database.

Figure 3

Selected Oil-producing Countries: General Government Oil-revenues
(Averages over 1992-2004)
(percent of GDP)



(percent of Total Revenues)

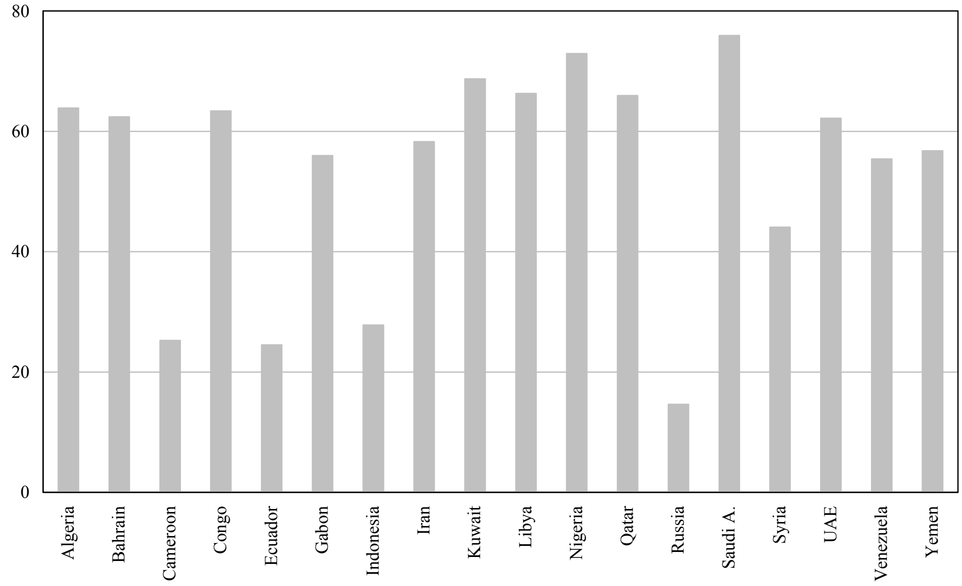
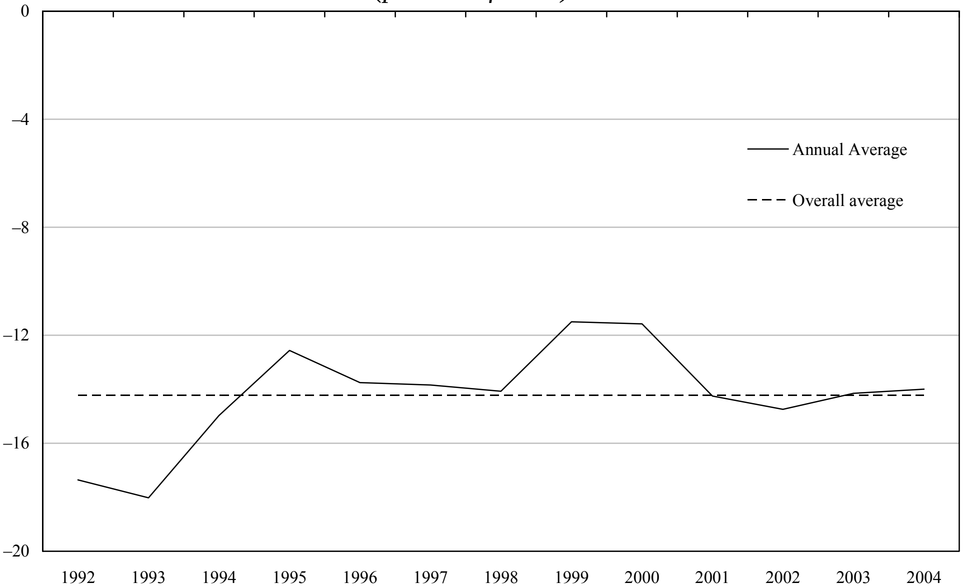


Figure 4

Selected Oil Producing Countries:
General Government Non-oil Primary Balance
(percent of GDP)[1]



[1] Simple average. Countries included: Algeria, Bahrain, Cameroon, Congo, Ecuador, Gabon, Indonesia, Iran, Kuwait, Lybia, Nigeria, Quatar, Russia, Saudi Arabia, Syria, United Arab Emirates, Venezuela, Yemen.

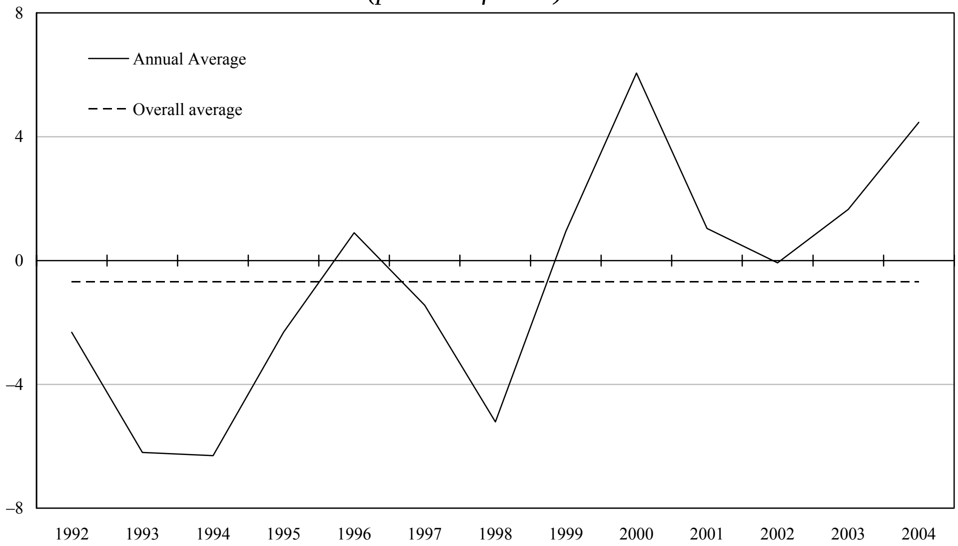
an average overall deficit of 0.7 per cent of GDP (Figure 4 and 5). Only four countries in the sample ran overall average surpluses, ranging between 0.9 per cent of GDP in Algeria and 14.8 per cent in Kuwait (Figure 6 and Table 1).

Evidence over a longer time span confirms widespread difficulties in ensuring long-term sustainability. In the sample covering 1980-2004, primary balances recorded an average surplus of 0.3 per cent of GDP (Figure 7). This implies a significant non-oil primary deficit (the average amount of oil revenues is likely to have exceeded 0.3 per cent of GDP), resulting in an overall average deficit of 2.4 per cent of GDP (Figure 8). Also in this sample, only four countries ran overall surpluses on average, ranging between 0.4 per cent of GDP in Nigeria and 6.0 per cent in Norway (Figure 9 and Table 2).

Weighing this evidence against the expected duration of oil reserves does not alter the picture. The lack of sustained surpluses would be less worrying if it were confined to countries which are relatively far from depletion of their reserves. However, the correlation between overall balance positions and years to depletion of oil reserves is close to zero in the longer sample and even positive (0.52) in the shorter one (Figure 10).

Figure 5

Selected Oil-producing Countries: General Government Overall Balance
(percent of GDP)(1)



(1) See footnote to Figure 4.

Figure 6

Selected Oil-producing Countries: General Government Overall Balance (Average over 1992-2004)
(percent of GDP)

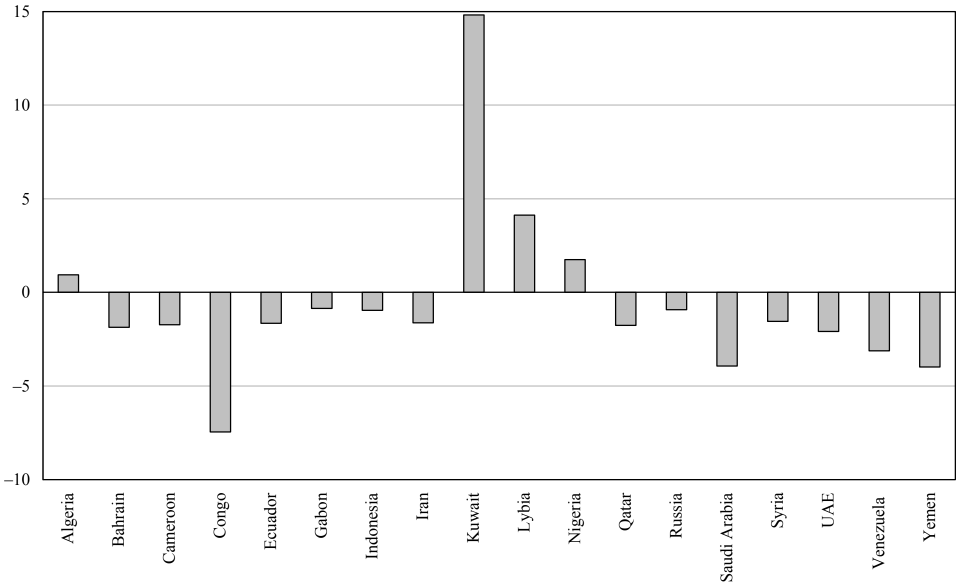
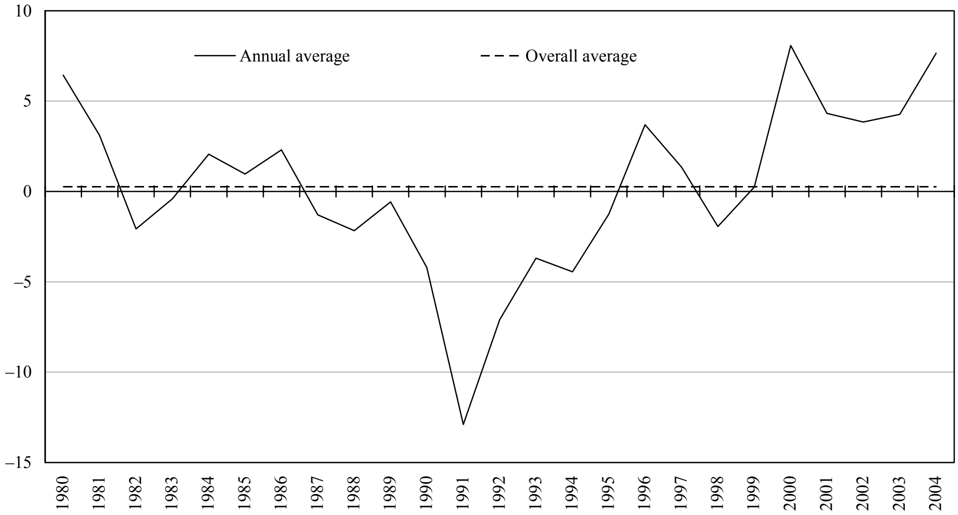


Figure 7

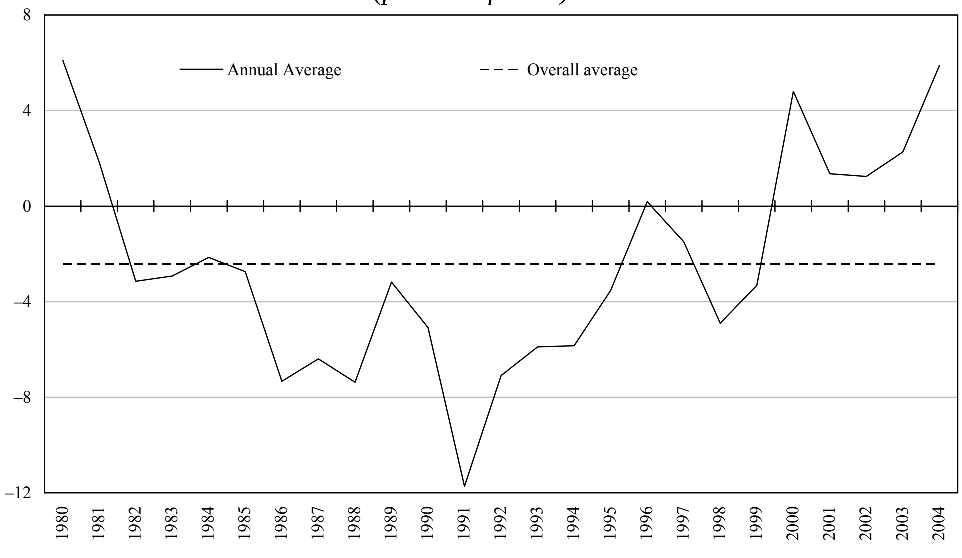
Selected Oil-producing Countries: General Government Primary Balance
(percent of GDP)[1]



[1] Simple average. Countries included: Angola, Azerbaijan, Ecuador, Indonesia, Iran, Kazakhstan, Kuwait, Lybia, Malaysia, Mexico, Nigeria, Norway, Oman, Quatar, Russia, Saudi Arabia, United Arab Emirates, Venezuela.

Figure 8

Selected Oil-producing Countries: General Government Overall Balance
(percent of GDP)[1]



[1] See footnote to Figure 7.

Figure 9

Selected Oil-producing Countries: General Government Overall Balance (Average over 1980-2004)

(percent of GDP)

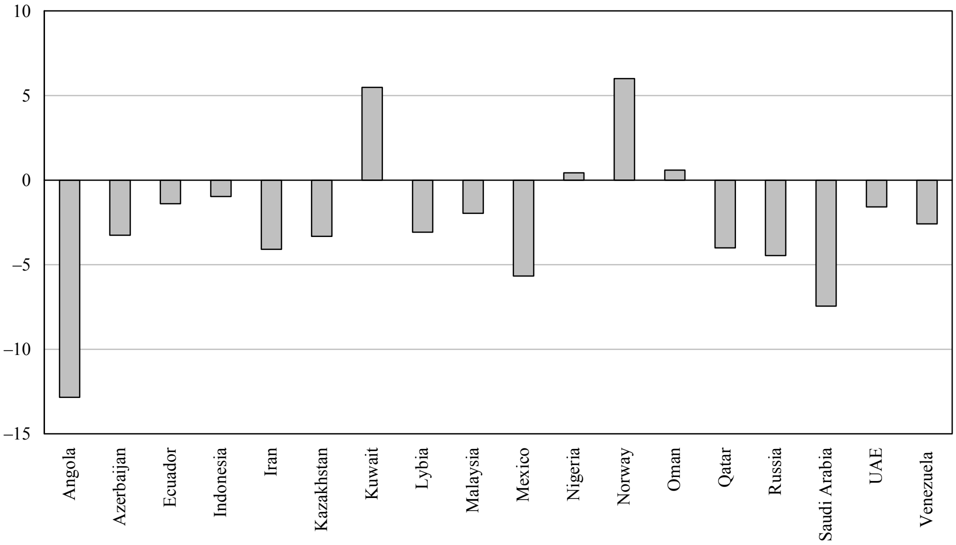
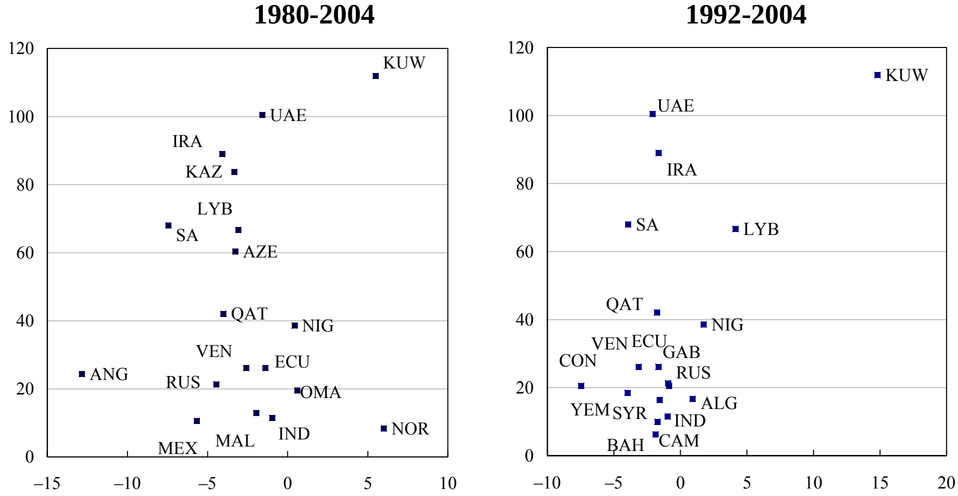


Figure 10

General Government Overall Balance and Years to Depletion of Oil Reserves[1]



[1] Simple averages.

Years to depletion as of 2005, computed on the basis of data on proven reserves and daily production from the 2005 BP Statistical Review of World Energy, available online at http://www.bp.com/statisticalreview

Table 1

Selected Oil Producing Countries:
General Government Primary Non-oil and Overall Balances
(percent of GDP)

Country	Non-oil Primary Balance			Overall Balance		
	1992-99	2000-04	1992-04	1992-99	2000-04	1992-2004
Algeria	–16.9	–17.0	**–16.9**	–2.0	5.6	**0.9**
Bahrain	–18.3	–19.9	**–19.0**	–3.9	1.4	**–1.9**
Cameroon	–1.1	–1.2	**–1.1**	–3.5	1.1	**–1.7**
Congo	–15.0	–13.8	**–14.5**	–11.7	–0.7	**–7.5**
Ecuador	–4.7	–0.6	**–3.1**	–3.0	0.5	**–1.7**
Gabon	–10.5	–6.7	**–9.1**	–4.0	4.2	**–0.9**
Indonesia	–2.6	–2.7	**–2.7**	–0.5	–1.8	**–1.0**
Iran	–17.2	–16.1	**–16.7**	–3.6	1.5	**–1.6**
Kuwait	–29.5	–22.4	**–26.7**	9.1	24.0	**14.8**
Lybia	–11.9	–18.0	**–14.2**	0.1	10.6	**4.1**
Nigeria	–10.4	–19.2	**–13.8**	1.5	2.2	**1.8**
Qatar	–29.8	–15.2	**–24.2**	–7.9	8.1	**–1.8**
Russia	–4.3	–2.1	**–2.9**	–6.6	2.5	**–0.9**
Saudi Arabia	–25.0	–24.2	**–24.7**	–6.9	0.8	**–3.9**
Syria	–11.3	–15.5	**–12.9**	–1.7	–1.3	**–1.5**
United Arab Emirates	–24.9	–20.8	**–23.3**	3.3	–10.7	**–2.1**
Venezuela	–2.9	–8.9	**–4.9**	–3.1	–3.1	**–3.1**
Yemen	–18.1	–22.0	**–19.6**	–7.1	1.0	**–4.0**
Average	–14.5	–13.7	**–14.2**	–2.7	2.6	**–0.7**

With oil price rising rapidly, fiscal positions improved significantly in OPCs over recent years, but even taking 2005 as the benchmark, many countries are still running expenditure above their estimated "sustainable permanent level" (Table 3).

This is all the more cause of concern considering that pressures for spending more of the oil windfall may still have to make their way through the political process in many countries. Moreover, countries where expenditures are higher than SPELs are generally closer to depletion of their reserves than countries where expenditures are lower than SPELs.[28]

[28] Table 3b provides an indication of the robustness of estimates with respect to the assumed oil price.

Table 2

Selected Oil-producing Countries:
General Government Primary and Overall Balances
(percent of GDP)

Country	Primary Balance				Overall Balance			
	1980-89	1990-99	2000-04	1980-04	1980-89	1990-99	2000-04	1980-04
Angola	–8.8	–12.8	–1.0	**–8.8**	–8.8	–21.1	–4.5	**–12.8**
Azerbaijan	n.a.	–4.0	–0.1	**–2.2**	–2.6	–4.8	–0.4	**–3.3**
Ecuador	–2.2	1.7	5.2	**0.8**	–2.2	–1.8	1.1	**–1.4**
Indonesia	0.7	1.7	2.0	**1.4**	–0.9	–0.3	–2.3	**–1.0**
Iran	–7.4	–3.4	1.7	**–4.0**	–7.5	–3.4	1.5	**–4.1**
Kazakhstan	n.a.	–5.3	2.8	**–1.7**	–3.1	–5.9	1.8	**–3.3**
Kuwait	21.8	–16.8	27.3	**7.5**	21.8	–21.0	25.8	**5.5**
Lybia	n.a.	2.9	9.8	**5.2**	–14.3	1.8	9.7	**–3.1**
Malaysia	n.a.	3.4	–2.4	**0.5**	–4.0	0.6	–5.0	**–2.0**
Mexico	3.9	4.6	0.6	**3.5**	–10.1	–2.5	–3.1	**–5.7**
Nigeria	n.a.	1.4	6.0	**4.3**	1.0	0.0	0.6	**0.4**
Norway	5.0	0.6	9.5	**4.1**	6.5	2.7	11.5	**6.0**
Oman	n.a.	–0.2	8.6	**2.7**	0.0	–2.1	7.2	**0.6**
Qatar	n.a.	–4.7	9.3	**0.3**	–5.2	–7.8	6.1	**–4.0**
Russia	n.a.	–6.3	4.9	**–2.5**	–3.1	–9.3	2.5	**–4.5**
Saudi Arabia	–7.6	–5.3	4.7	**–2.4**	–10.4	–8.9	0.8	**–7.4**
United Arab Emirates	–5.7	–3.1	10.7	**–1.4**	–5.9	–3.4	10.7	**–1.6**
Venezuela	–0.8	1.8	1.7	**1.5**	–5.0	–2.4	–2.0	**–2.6**
Average	0.8	–3.0	5.6	**0.3**	–2.7	–4.9	3.1	**–2.4**

Table 3a

Primary Expenditures: SPEL and Actual Level
(percent of GDP)(1)

Country	Actual Level	SPEL	Difference	Years to Depletion
Yemen	39.4	20.5	18.9	19
Bahrain	22.9	9.3	13.6	6
Algeria	31.2	19.7	11.5	17
Syria	31.7	20.6	11.2	16
Nigeria	30.7	21.6	9.1	39
Congo	23.0	18.4	4.6	21
Iran	24.1	21.2	2.9	89
Saudi Arabia	24.7	23.3	1.4	68
Venezuela	17.3	19.0	–1.7	70
Russia	35.3	38.5	–3.2	21
UAE	21.0	24.5	–3.5	100
Libya	33.6	44.4	–10.8	67
Kuwait	29.6	52.9	–23.3	112

(1) For all countries, SPEL are computed assuming gradual convergence to a steady state where real interest rate is 4 per cent, real growth rate is 2 per cent and so is the GDP deflator.

Table 3b

SPEL: Sensitivity Analysis
(percent of GDP)(1)

Country	Expenditures: Actual Level	SPEL (US$60 pb)	difference	SPEL (US$40 pb)	difference	SPEL (US$80 pb)	difference
Yemen	39.4	20.5	18.9	19.4	20.0	21.5	17.9
Bahrain	22.9	9.3	13.6	9.0	13.9	9.6	13.3
Algeria	31.2	19.7	11.5	18.5	12.7	20.9	10.3
Syria	31.7	20.6	11.2	20.0	11.7	21.0	10.7
Nigeria	30.7	21.6	9.1	18.5	12.2	24.6	6.1
Iran	24.1	21.2	2.9	17.6	6.5	24.8	–0.7
Saudi A.	24.7	23.3	1.4	17.8	6.9	28.8	–4.1
Venezuela	17.3	19.0	–1.7	16.8	0.5	21.2	–3.9
UAE	21.0	24.5	–3.5	20.6	0.4	28.4	–7.4
Russia	35.3	38.5	–3.2	37.7	–2.4	39.5	–4.2
Libya	33.6	44.4	–10.8	35.4	–1.8	53.4	–19.8
Kuwait	29.6	52.9	–23.3	42.4	–12.8	63.5	–33.9

(1) For all countries, SPEL are computed assuming gradual convergence to a steady state where real interest rate is 4 per cent, real growth rate is 2 per cent and so is the GDP deflator.

4.2 Stabilization

On average, both primary and overall balances display a tendency – albeit weak – to react in a stabilizing way to changes in oil price. Both indicators tend to improve (deteriorate) when oil prices increase (decrease). During 1980-2004 the correlation with real oil price is 0.32 for primary balances and 0.46 for overall balances (Figures 11 and 12).

The primary non-oil balance does not appear to be significantly influenced by developments in oil prices during 1992-2004 (Figure 13); the correlation coefficient is 0.12. The different behavior of the overall balance and the non-oil balance confirms the importance of using both indicators.

However, the behavior of the average non-oil balance hides significant cross country variation. Three broad groups can be identified (Table 4). In the first group, the smallest, the correlation between oil prices and primary balances is mildly positive (between 0.2 and 0.5); in the second, the largest one, the correlation is low (ranging between –0.2 and +0.2); and in the third, which includes one third of the countries, the correlation is negative (between –0.3 and –0.6). Therefore, while in a minority of countries (the first group), the primary non-oil balance tends to provide a mild stabilizing impulse with respect to changes in oil prices, in about one third of the countries in the sample, the primary non-oil balance appears to impart a pro-cyclical impulse.[29]

Analysis with respect to GDP growth provides a similar picture. Primary and overall balances are also positively correlated with output growth. Over 1980-2004, the correlation is almost 0.5 for both primary and overall balances (Figure 14). Much as was the case with oil prices, average non-oil balances appear not to have any strong systematic relation with GDP growth. The correlation coefficient between real GDP growth and primary non-oil balances over 1992-2004 is negative (–0.19), suggesting, if anything, a pro-cyclical bias (Figure 15). Also in the case of GDP growth, there is significant cross-country variation. Again, three broad groups can be identified (Table 5): in the first group, the correlation between growth rates and primary balances is strong and positive (between 0.4 and 0.8); in the second, the correlation is weak (between –0.2 and +0.2); and in the third the correlation is strong and negative (between –0.3 and –0.8). There is some broad consistency between the grouping of countries in Tables 4 and 5. The rank correlation, while not very high, is positive (0.30). Only one country falls in groups at the opposite ends of the spectrum in the two tables, while six fall in the same group in both tables and the remaining eleven fall in adjacent groups.

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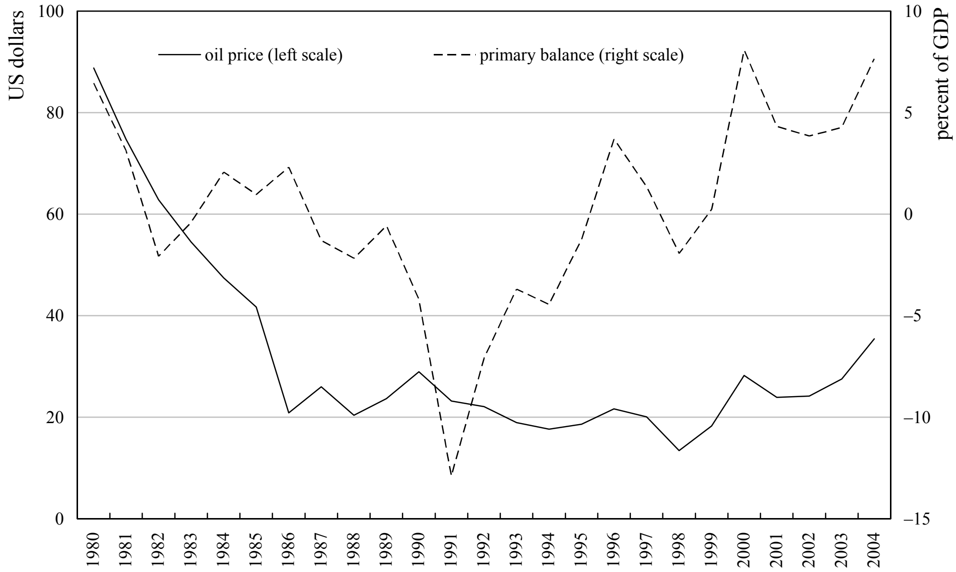
[29] See IMF (2006) for a discussion of the political economy reasons which may cause such behavior.

Figure 11

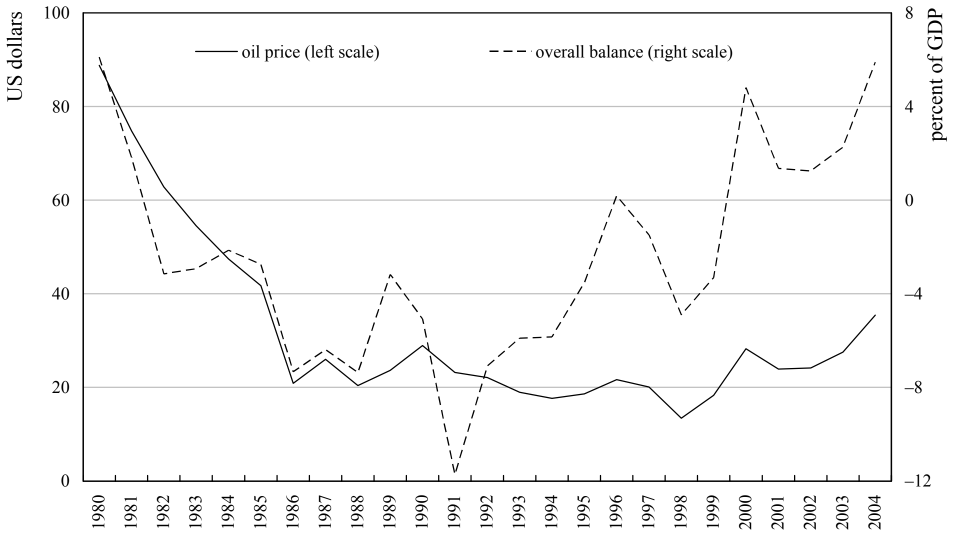
Real Oil Prices and General Government Primary Non-oil Balance[(1)]



(1) Oil price: simple average of three spot prices (Dated Brent, West Texas Intermediate and the Dubai Fateh), US$ per barrel at constant 2000 prices. See footnote to Figure 7 for the list of countries considered.

Figure 12

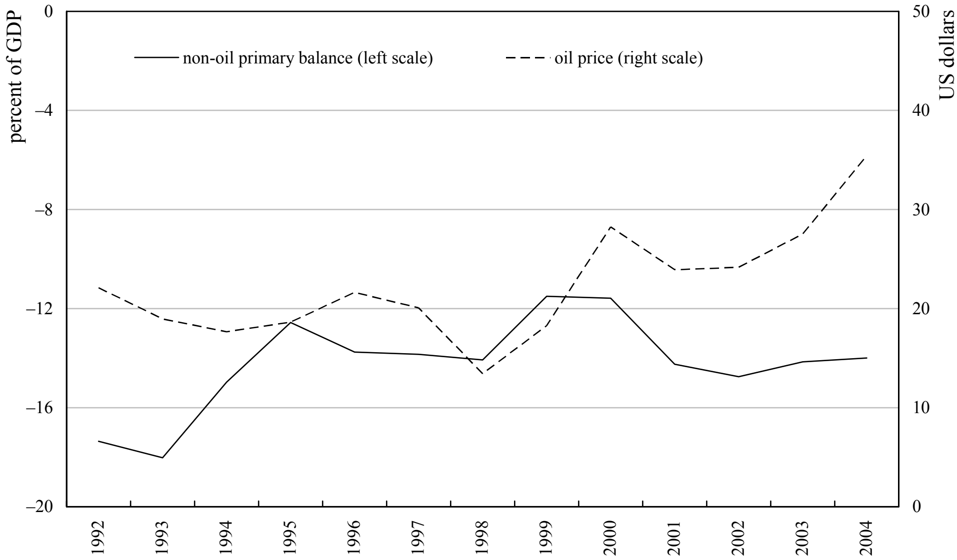
Real Oil Prices and General Government Overall Balance[(1)]



(1) See footnote to Figure 11.

Figure 13

Real Oil Price and General Government Primary Non-oil Balance[1]

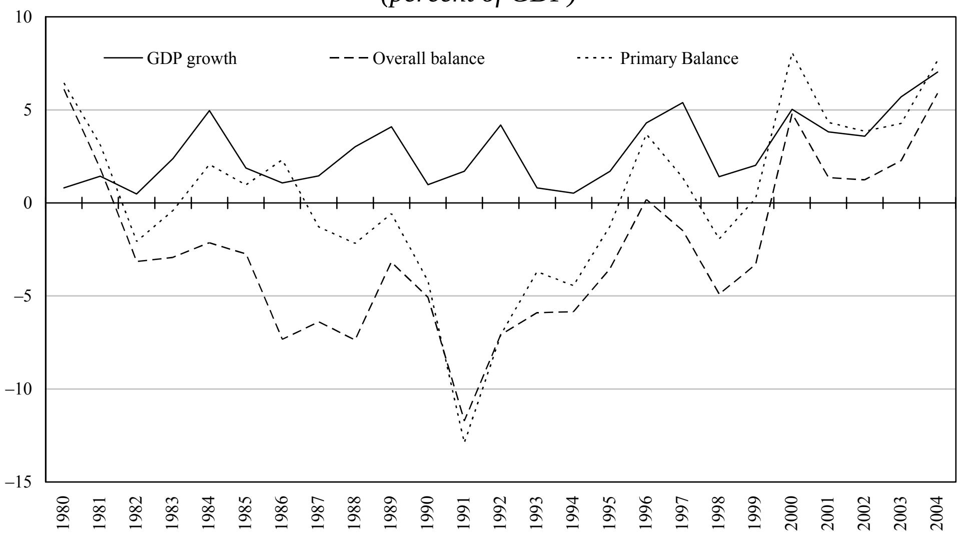


[(1)] See footnotes to Figure 11.

Figure 14

Real GDP Growth and General Government Primary and Overall Balances[1]

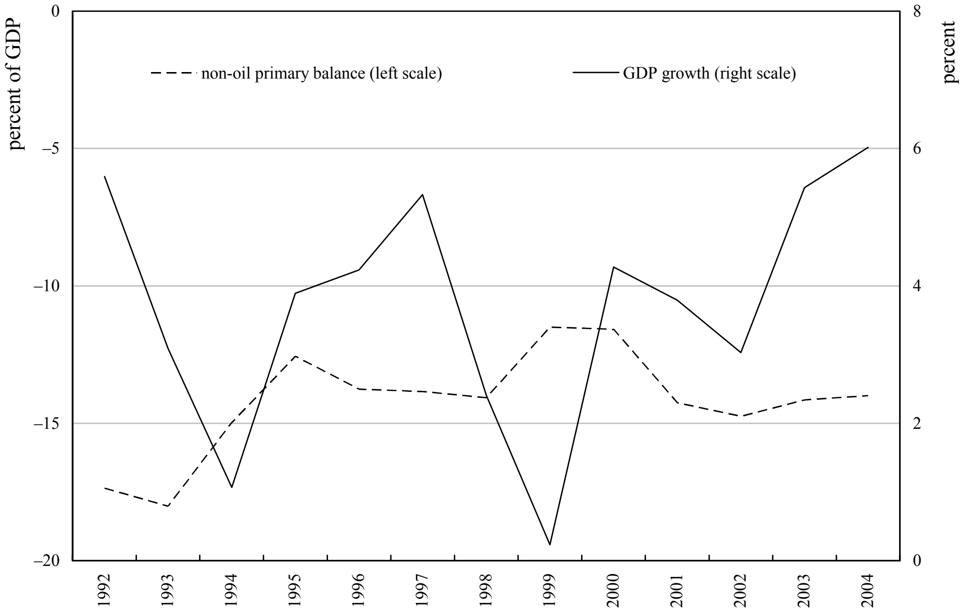
(percent of GDP)



[(1)] See footnote to Figure 7 for the list of countries considered.

Figure 15

Real GDP Growth and General Government Primary Non-oil Balance[(1)]



(1) Simple averages. For the countries considered, see footnote to Figure 4.

5. Summary and conclusions

The assessment of fiscal performance, by no means a straightforward matter in general, faces specific complications in OPCs. The uncertainty concerning the quantity, quality and cost of extraction of oil reserves, as well as future oil prices negatively affects the reliability of estimates of long-term sustainable policies. The volatility of oil price also complicates the assessment of the contribution of fiscal policy to macroeconomic stabilization. The special nature of oil revenues calls for supplementing the overall balance with other indicators of the impact effect of fiscal policy.

This paper defines a simple toolkit for a broad-brush assessment of how OPCs are coping with the challenges they face in the conduct of fiscal policy, with respect to both sustainability and stabilization. The toolkit includes necessary conditions for sustainability derived from the government present value budget constraint; estimates of "permanently sustainable" expenditure ratios; and the joint examination of overall and non-oil balances reactions to changes in oil prices and growth rates. While this is a fairly "compact" toolkit, its application provides valuable insights.

Table 4

General Government Non-oil Primary Balance and Real Oil Price: Correlation Coefficients for Selected Countries (1992-2004)

UAE	0.47
Qatar	0.31
Algeria	0.23
Gabon	0.19
Iran	0.10
Congo, Rep.	0.06
Ecuador	0.02
Kuwait	–0.04
Indonesia	–0.05
Nigeria	–0.07
Cameroon	–0.16
Saudi Arabia	–0.29
Bahrain	–0.35
Lybia	–0.36
Syria	–0.46
Yemen	–0.52
Venezuela	–0.61

Table 5

General Government Non-oil Primary Balance and GDP Growth: Correlation Coefficients for Selected Countries (1992-2004)

Cameroon	0.78
Algeria	0.58
Iran	0.45
UAE	0.42
Yemen	0.36
Indonesia	0.35
Congo, Rep.	0.22
Ecuador	0.19
Qatar	0.17
Syria	0.05
Saudi Arabia	0.01
Venezuela	–0.09
Bahrain	–0.11
Nigeria	–0.18
Gabon	–0.33
Lybia	–0.56
Kuwait	–0.82

The paper finds evidence that the attainment of sustainable fiscal positions remains an issue for many OPCs. In contrast with the necessary condition for sustainability, most OPCs ran average overall deficits both over 1980-2004 and over the shorter and more favorable 1992-2004 period. This applies to countries with still large oil reserves as well as to countries which are much closer to the depletion of their stock of oil wealth. Even in most recent years, with rising oil prices, many countries are running primary expenditure to GDP ratios which exceed the level that would be permanently sustainable.

Concerning stabilization a more mixed picture emerges. Primary balances generally appear to move so as to provide a stabilizing impulse with respect to changes in oil price. However, this does not come from the underlying non-oil primary balance. Indeed, in many countries the non-oil primary balance deteriorates when the oil price improves.

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CYCLICAL INDICATORS OF FISCAL POLICY IN LATIN AMERICAN COUNTRIES (WITH SPECIAL REFERENCE TO CHILE)

Ricardo Martner[*]

1. Introduction

In recent years, numerical fiscal rules have been established in most Latin American countries; at least ten countries have some legislative body constraining explicitly the Government in its fiscal results. Nevertheless, the so-called "leyes de responsabilidad fiscal" are quite different among countries; in Brazil, since 2000, targets of primary surplus are set for three years in the pre-budget law; in Colombia, since 2003, the structural primary balance has to be consistent with medium term debt sustainability; in Peru and Ecuador, primary expenditures have a maximum growth of 3.5 per cent per year; in Argentina, current expenditures cannot surpass GDP growth. In addition, these laws put in place tax funds (Argentina, Peru) or reinforced existing raw material stabilization funds (Ecuador, Mexico, Venezuela).

No mechanisms that ensure a systematical counter-cyclical fiscal policy are considered, except for the case of Chile. For instance, in Argentina the tax stabilization fund has not operated since its creation in 1999, and in Ecuador, Mexico and Venezuela the amounts of reserves in the oil funds are not significant, since most of the incomes are distributed within the year with social or regional purposes.

Yet, in none of these countries the laws are aimed at avoiding pro-cyclical policies, especially in good times. This is crucial, since as we will argue in this document both GDP gap and terms of trade have important fiscal effects. In part, this is due to the lack of consensus regarding the methods of estimation of the cyclical components of the budget. Indeed, in a highly volatile macroeconomic environment, "normal conditions" are quite difficult to define, and so are the gaps that have to be estimated to identify the cyclical position of the economy.

Even if there are a growing number of national studies that compute the magnitude of the cyclical components of fiscal results, still authorities do not make use of these calculations in the budget formulation process. At the national level, there have been very few attempts to include cyclically adjusted indicators in the discussion of the orientation of fiscal policy.[1]

In the first section of this paper, the cyclical part of the fiscal balance is estimated for some selected countries, following the usual methods, determining the output gap, evaluating the cyclical revenues of raw material exporters (when

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[*] ECLAC, United Nations. The author would like to thank Varinia Tromben for her help in providing data and carrying out the econometric estimations.

[1] See, for instance, Martner (2000), where fiscal indicators are calculated for 19 Latin American countries.

Table 1

Fiscal Balance of Central Government
(percent of GDP)

Country	1995	2000	2001	2002	2003	2004	2005
Argentina	–1.9	–2.1	–4.0	–0.6	0.2	2.0	0.4
Bolivia	–1.3	–4.6	–7.0	–8.0	–7.1	–5.4	–3.5
Brazil	–1.7	–3.1	–3.7	–6.4	–2.5	–1.3	–3.5
Chile	3.4	–0.6	–0.5	–1.2	–0.4	2.1	4.7
Colombia	–2.0	–5.4	–5.3	–4.9	–4.7	–4.3	–4.8
Costa Rica	–3.5	–3.0	–2.9	–4.3	–2.9	–2.7	–2.1
Dominican Rep.	0.1	–2.1	–2.4	–2.7	–5.2	–4.0	–0.7
Ecuador	–0.6	0.1	–1.0	–0.7	–0.4	–1.0	–0.5
Mexico	–0.6	–1.3	–0.7	–1.8	–1.1	–1.0	–0.8
Peru	–3.4	–2.8	–2.8	–2.1	–1.8	–1.3	–0.7
Uruguay	–1.9	–3.5	–4.5	–4.9	–4.6	–2.5	–1.6
Venezuela	–4.4	–1.7	–4.4	–4.0	–4.4	–1.9	1.7

Source: ECLAC, United Nations.

relevant), estimating econometrically tax income elasticities, and finally computing the cyclically adjusted balances.

The second section describes the Chilean experience, where for the last five years a structural balance rule is the basis for the budget formulation process. The experience shows that, even in a very volatile environment, due to very frequent external shocks, fiscal rules can improve general welfare. Moreover, an appropriate combination of counter-cyclical monetary and fiscal policies is very powerful in stabilizing GDP fluctuations in emerging countries.

2. Cyclical factors in Latin American countries

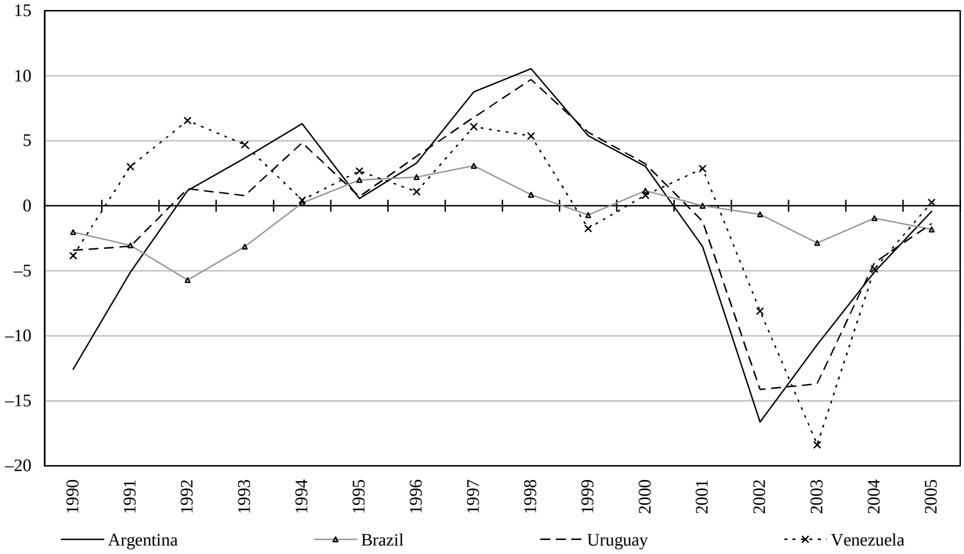
2.1 Fiscal position and the output gap

As it can be seen in Table 1, fiscal position has improved since the large deficits of 2001-02 in almost all Latin American countries. In 2005, although many nations are still in deficit, except for Argentina, Chile and Venezuela, the numbers are much smaller, and debt has diminished substantially in the last four years

Figure 1

Argentina, Brasil and Uruguay: GDP Gap, 1990-2005

(percent of trend GDP)



Source: Author's calculations.

(attaining 44 per cent of GDP in 2005 on average). As usual, this improvement is a combination of discretionary measures and automatic effects, namely the recovery of GDP and of the terms of trade.

In the discretionary side, recent years were characterized by a tight control of public expenditures in all countries, in part as a result of the application of numerical fiscal rules. As discussed in Martner and Tromben (2005), the adjustment particularly affected public investment. In the revenue side, many countries created new taxes that, although in some cases distortionary, permitted significant increases in collection (for instance, taxes on bank transactions in Argentina, Brazil, Colombia and Peru stand for more than one points of GDP, and in Argentina the export tax established in 2003 collects more than two points of GDP).

In the automatic side, for the nine countries included in this study, the evolution of the GDP gap[2] since the early nineties is very similar, alternating a positive phase until 1998-99, and a negative one since then. This cycle has been much more traumatic in Argentina, Uruguay and Venezuela, where negative GDP gap attained values of –15 per cent between 2002 and 2003.

[2] The trend GDP is estimated using HP filter for the period 1980-2010, using CEPAL forecasts for 2006-07 and assuming a 5 per cent rate of growth of GDP until 2010.

Figure 2

Colombia, Ecuador and Peru: GDP Gap, 1990-2005

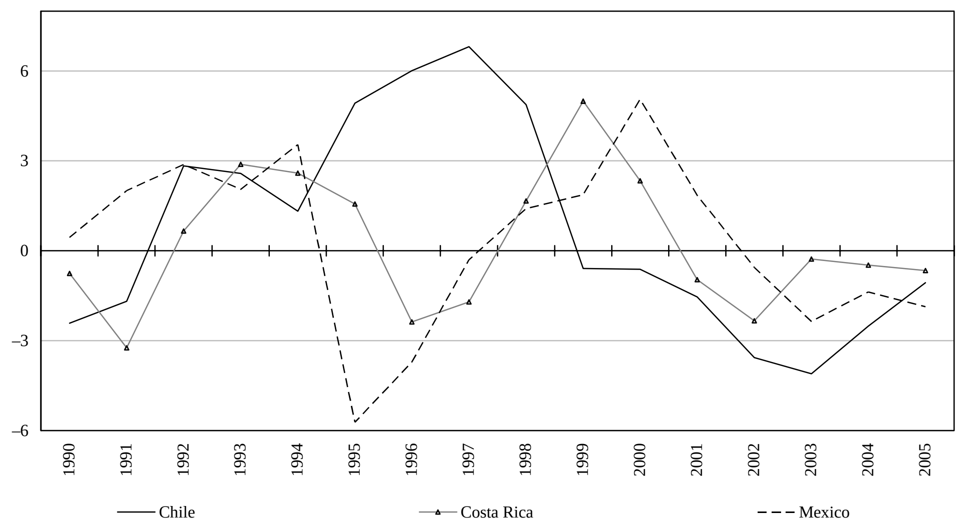
(percent of trend GDP)

Source: Author's calculations.

Figure 3

Chile, Costa Rica and Mexico: GDP Gap, 1990-2005

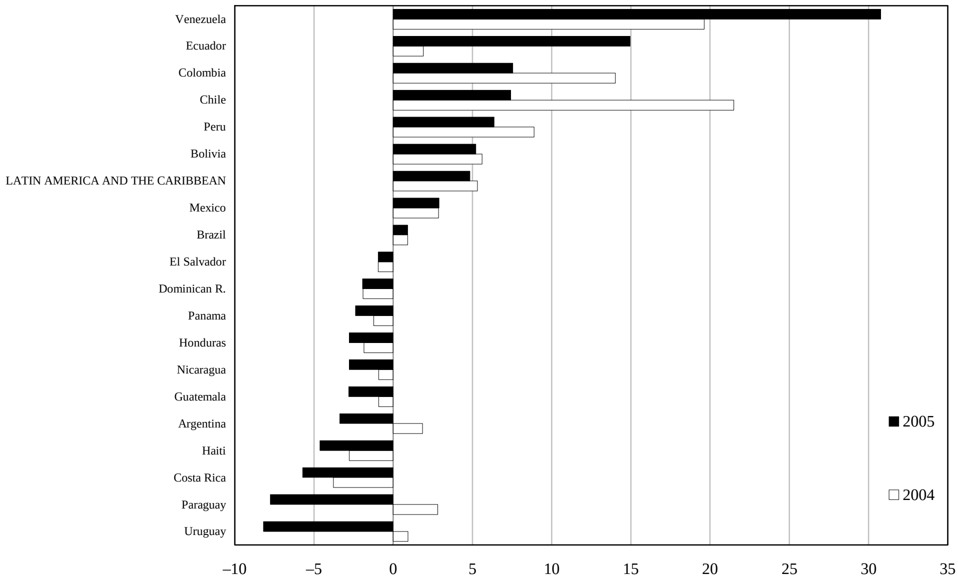
(percent of trend GDP)



Source: Author's calculations.

Figure 4

Terms of Trade in Latin American Countries
(percentage of variation in years 2004 and 2005)



Source: ECLAC, United Nations.

In many countries, assuming a 5 per cent growth of GDP in the next three years, the turning point is 2005. From now on, the output gap and hence the cyclical component of budget, will be nil or positive if the average growth of 5 per cent of the years 2004-05 lengthens in the future.

2.2 *The terms of trade*

As it can be seen in Figure 4, on average the terms of trade expanded around 5 per cent a year in 2004-05. But the panorama is very diverse, since the improvement is only significant in oil exports countries (Venezuela, Ecuador and Colombia) and copper exports countries (Chile, Peru, and other commodities in the case of Bolivia). In other countries, especially those that depend on manufactured exports or "maquila" (Central American countries and the Dominican Republic), the terms of trade diminished the last two years, a result explained by the Chinese and East Asian competition in industrialized markets, and especially in the United States.

The case of Mexico is a combination of the previous trends, with an increase of nominal oil exports and a sharp decline of manufactured exports, resulting in an under average improvement of the terms of trade in 2004-05. In other South American countries, like Argentina, Brazil, Paraguay and Uruguay, there has been a slight improvement of terms of trade, with the expansion of nominal exports in 2005, especially with the rise of prices of soybean and other commodities.

This situation has very different fiscal effects, even though the general improvement of the economy helped in the reduction of public deficits. In Oil producer countries, most of the enterprises are state-owned (Brazil, Colombia, Ecuador, Mexico, Venezuela), with the exception of Argentina. In this country, there is a special tax to exports (up to 10 per cent) since 2003, and hence the exports boom has also benefited public sector income. In Peru almost all copper exports are private, and in Chile half of them.

2.3 Fiscal revenues: an estimation of the cyclical component for selected countries

As it can be seen in Table 2, in many countries the main incomes of central government are tax based. This is the case of Argentina, Colombia, Peru and Uruguay. In Ecuador, Mexico and Venezuela, the revenues of oil exports are quite significant, even exceeding tax revenues in the last country. In Chile, in the last two years copper revenues increased significantly, from 0.9 in 2003 to nearly 4 points of GDP in 2005.

In Table 3 the estimation of total tax income elasticity is shown. The long term value is near unit in Chile, Costa Rica and Peru. In Argentina, Colombia and Mexico the value is much higher than one, probably because in recent years GDP components were very volatile.

With these values, and applying an HP filter to break up cyclical and trend oil incomes in Ecuador, Mexico and Venezuela, a min-max analysis of cyclical factors (Table 4) can be made. It shows that, even if tax burden is low compared to OECD standards, the high volatility of copper and oil prices, and of course the huge fluctuations of GDP, gives rather significant values of the cyclical component of fiscal balance.

The impact of fluctuations in overall balances cannot be underestimated, especially when setting short term fiscal targets of fiscal flows and public debt. The potential gains of adopting counter-cyclical rules are significant, as the case of Chile shows.

3. A successful story: The Chilean case

In May 2000, the new president announced the fiscal rule of a structural surplus of 1 per cent of GDP. This rule was maintained during the whole presidential period, defining the formulation process from 2001 to 2006. In August 2001, the consultant committee of the long term price of copper is established, and

Table 2

Composition of Fiscal Revenues
(percent of GDP)

Country	2000	2001	2002	2003	2004	2005
Argentina	25.0	23.6	23.8	26.7	28.7	
Tax revenues	21.5	20.9	19.9	23.4	26.4	26.7
Other	3.5	2.7	3.9	3.3	2.3	
Brazil						
Tax revenues	32.5	34.0	35.6	34.9	35.9	37.4
Other						
Chile	21.7	21.8	21.1	20.8	22.2	24.5
Tax revenues	17.8	18.2	18.1	17.4	17.2	18.8
Other	3.9	3.6	3.0	3.5	5.0	5.7
of which: copper	0.9	0.5	0.5	0.9	3.0	3.8
Colombia	13.0	14.6	14.9	15.0	15.7	16.1
Tax revenues	11.2	13.2	13.3	13.7	14.4	14.9
Other	1.7	1.4	1.5	1.3	1.2	1.2
Oil (including tax revenues)	1.6	1.8	1.9	1.7	2.0	1.9
Costa Rica	21.3	23.0	22.2	22.7	22.0	22.6
Tax revenues	18.9	19.9	20.1	20.2	20.1	20.5
Other	2.4	3.0	2.1	2.5	1.9	2.1
Ecuador	20.4	18.1	18.4	16.6	15.7	16.7
Tax revenues	10.2	11.2	11.0	9.7	9.6	10.3
Other	10.2	6.9	7.3	6.9	6.1	6.4
of which: oil	8.8	6.0	5.5	5.4	4.7	4.3
Mexico	21.6	21.8	22.2	23.2	23.2	23.8
Tax revenues	12.1	12.9	13.2	12.6	11.5	10.4
Other	9.5	9.0	9.0	10.6	11.7	13.4
of which: oil	7.2	6.7	6.5	7.7	8.3	8.7
Peru	15.2	14.5	14.5	15.1	15.2	16.0
Tax revenues	14.0	14.2	13.8	14.7	14.9	15.4
Other	1.2	0.3	0.8	0.4	0.2	0.7
Uruguay	20.3	20.8	21.2	21.4	21.6	21.6
Tax revenues	16.9	17.4	17.6	18.6	18.5	18.5
Other	3.5	3.3	3.6	2.9	3.1	3.0
Venezuela	20.2	20.8	22.2	23.4	24.6	28.6
Tax revenues	12.9	11.4	10.6	11.3	13.0	15.8
Other	7.3	9.4	11.5	12.1	11.6	12.7
Oil (including tax revenues)	10.0	9.4	10.5	11.6	11.5	13.9

Source: ECLAC, United Nations.

Table 3

Total Tax Elasticity Estimation
(dependent variable: log of total tax revenues)

	Argentina	Chile	Colombia	Costa Rica	Mexico	Peru
Constant	–4.82	–2.82	–21.97	–1.55	–1.93	0.99
	–2.28	*–3.45*	*–3.06*	*–2.40*	*–1.50*	*–1.82*
Log (Total Tax Revenues) (–1)	0.60	0.32	0.27	0.38	0.76	0.61
	4.78	*2.59*	*1.67*	*3.21*	*8.30*	*7.15*
Log (GDP) [short run elasticity]	0.67	0.78	1.95	0.64	0.31	0.41
	2.89	*5.05*	*3.57*	*4.79*	*2.34*	*4.32*
R^2	0.91	0.96	0.76	0.94	0.88	0.91
F	100.9	276	32.1	152.3	62.59	144.1
Number of observations	45	62	46	57	49	49
Solved Static long run equation						
Log GDP [long run elasticity]	1.67	1.15	2.66	1.03	1.30	1.05
	4.55	*23.8*	*7.34*	*15.8*	*3.85*	*7.86*

Notes: Test *t* in italic. Seasonal effects were added in the estimations.
Source: Author's calculations.

the consultant committee of trend GDP a year later.[3] In 2004, the new accounting methodology of the 2001 IMF manual is implemented. In 2005, the cyclical effect of taxes from private copper companies is estimated separately.

The structural balance is estimated with the following simple formula:

$$SB = EB - ET + [ST\ (SY/Y)^{\varepsilon}] - EC + SC$$

where:
SB is structural balance, *EB* is effective (accrual) balance;
ET is effective tax income, including social security revenues;
ST is structural tax income;
SY is trend GDP, *Y* is GDP, ε is income tax elasticity;
EC is effective copper income, and *SC* is structural copper income.

3 Also, the method of estimation is published. See Marcel *et al.* (2001).

Table 4

GDP Gaps and Cyclical Fiscal Balance

Country	Tax Burden	GDP Gap *(percent of trend GDP)*		Cyclical Balance *(percent of GDP)*	
	2005	Minimum	Maximum	Minimum	Maximum
Argentina	26.7	–16.6 (2002)	10.5 (1998)	–6.7 (2002)	4.1 (1998)
Brazil	37.4	–5.7 (1992)	2.3 (1997)	–1.6 (1992)	0.3 (1997)
Chile	18.8	–4.3 (2003)	6.8 (1997)	–2.0 (2002)	3.7 (2005)
Colombia	20.4	–4.2 (2002)	4.9 (1997)	–4.3 (2002)	4.4 (1997)
Costa Rica	21.0	–3.2 (1991)	5.0 (1999)	–0.7 (1991)	0.8 (1999)
Ecuador	14.9	–5.0 (1999)	3.9 (1997)	–2.2 (1999)	1.8 (1996)
Mexico	11.0	–5.7 (1995)	5.1 (2000)	–2.5 (1995)	1.7 (2005)
Peru	15.4	–10.8 (1992)	7.9 (1997)	–1.8 (1992)	1.2 (1997)
Uruguay	23.4	–14.1 (2002)	9.7 (1998)	–3.2 (2002)	2.3 (1998)
Venezuela	12.6	–18.4 (2003)	6.5 (1992)	–3.8 (1994)	6.1 (1997)

Source: Author's calculations.

Following IMF's methodology (see Hagemann, 1999), the application of the fiscal rule involves the following steps:

1. Estimation of the Cobb-Douglas production function inputs. Since 2002, the committee of fifteen experts annually defines the trend growth of labor, the capital stock and the total productivity factor.
2. Estimation of trend GDP, with an estimation of capital stock (adjusted for utilization) and HP filtering of the series of hours worked (adjusted for education) and TPF, using the estimated production function $(Y = A\,K^{\alpha} + L^{1-\alpha})$.
3. Estimation of the long term price of Copper (following the estimation of the consultant Committee of experts).
4. Estimation of cyclical tax incomes with GDP gap (using a value of 1.05 for income elasticity of tax), and estimation of incomes from CODELCO (the public copper company, adjusting physical sales of the firm for the difference between forecasted effective price and the long term price.
5. The structural revenues are then obtained, discounting cyclical factors.

Table 5

Chile: Central Government Overall and Structural Balances
(percent of GDP)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006(e)
Overall balance	2.0	0.4	–2.1	–0.6	–0.5	–1.2	–0.4	2.1	4.7	5.3
Total cyclical component	1.2	–0.2	–1.3	–0.8	–1.4	–1.8	–1.2	1.3	3.7	4.3
Of which:										
Tax revenues	1.0	0.5	–0.4	–0.3	–0.4	–0.7	–0.8	–0.4	–0.3	–0.1
Copper	0.2	–0.7	–0.9	–0.5	–1.0	–1.0	–0.4	1.7	3.9	4.4
Structural balance	0.8	0.6	–0.8	0.1	0.9	0.6	0.8	0.8	1.0	1.0

Source: Dipres (2005) and Dipres (2006).
(e) Official estimations.

6. The level of expenditures consistent with the structural surplus of 1 per cent of GDP can be estimated.

Once these variables are defined, overall expenses are set in the budget process according to the expected growth of structural revenues.[4] Hence, public expenditure growth is defined in terms of trend GDP (and the long term price of copper), regardless effective GDP fluctuations. This in theory ensures a stable multi-annual path to public expenditure, reducing the probability of severe adjustments and bringing in practice some certainty to the execution of public projects and programs.

This rule was first applied in a period of negative output gap (the cyclical component of the budget was negative in the period 2001-03, with a maximum level of 2.0 points of GDP in 2002; see Table 4). In the present period, 2004-06, the rule is applied in the upper size of the business cycle, when pressures to spend tend to increase. The notorious similitude between average structural and effective balance shows that the rule operated symmetrically in both sides of the business and copper cycles in the period 2001-06. A basic requirement is then fulfilled: fiscal policy's neutrality throughout the complete business cycle.

The process can be illustrated with the 2006 formulation of the budget. External Committees defined a long term price of 99 cents of US dollars for the pound of copper, and a trend GDP of 5 per cent. As the forecasted price of copper was fixed in 240 cents in mid 2006, the cyclical revenues are obtained multiplying the difference with expected physical sales during the year. The forecasted growth of

4 This procedure is a direct result of the debate of the 1990s. An influential paper was Marcel (1997), the Budget director in the period 2000-06. See also a previous application of cyclically-adjusted indicators for Chile in Martner (1996).

effective GDP is 5.5 per cent, but the GDP gap, defined in levels, is still negative in 2006 (–0.9 per cent), and so are the cyclical tax incomes.

Note that the cycle of tax revenues is very long; in the whole period 1999-2006 its impact has been negative. This means that in the next years (at least 3 or 4) the GDP gap will mechanically be positive. By contrast, the cycle of copper prices is much shorter, and indeed more significant. Paradoxically, copper revenues are normally low, when compared to tax income, but its impact in the cyclical balance is higher. Along the whole period under analysis, cyclical tax revenues reached a maximum of one point (with a GDP gap of 6 per cent, a tax burden around 18 per cent and a near unit income elasticity), while copper cyclical incomes reached 3.9 points of GDP in 2005, and probably 4.4 points in 2006.

Interestingly, the election period of December 2005 did not alter the rule: there was a widespread consensus in maintaining the concept of structural balance. A candidate suggested a zero structural balance; the others were to maintain the current scheme. The elected president will apply the 1 per cent GDP rule for the four years of her mandate, probably without significant changes in the budget formulation process.

Of course, the uncertainty of this kind of indicator remains high. First, the estimation of structural revenues is problematic. Even if the value of a long term tax elasticity of 1.05 has been corroborated by a recent study (see Dipres, 2004), the old methodology, too aggregated, does not take into account the huge impact in tax collection of the benefits of private copper companies. Indeed, the tax revenues of private copper companies are not correlated with GDP, but rather with the GAP of the copper price. As its amount is growing, the new methodology separates these revenues from the rest.

The other question deals with the estimation of trend GDP. As Figure 5 illustrates, retrospectively the calculations are quite different. For instance, the estimation of trend GDP growth of 2001 for the period 1987-94 is on average one point higher than the 2006 estimation for the same period. As it is well known, the results of filtering methods depend on the starting point (see for instance Ley, 2005). Indeed, the HP estimation is not very different than the official one, since the latter also applies filtering techniques for inputs (Figure 6). But, most important, the existence of the external committee validates the methods used and reinforces the credibility of the process.

The fiscal rule of Chile ensures the free operation of fiscal stabilizers. This is illustrated in Figure 7, where, for the nine Latin American countries included in this study, the changes in the cyclically adjusted primary balance fiscal policy are compared to GDP gap,[5] for the period 1990-2005, showing the pro-cyclical bias of fiscal policy. Almost all the computed episodes are either fiscal loosening with positive gaps, or fiscal tightening with negative gaps. The graph also show the case

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[5] See Martner and Tromben (2004) for the details of the estimation.

Figure 5

Chile: Official Estimation of Trend Growth in Different Periods

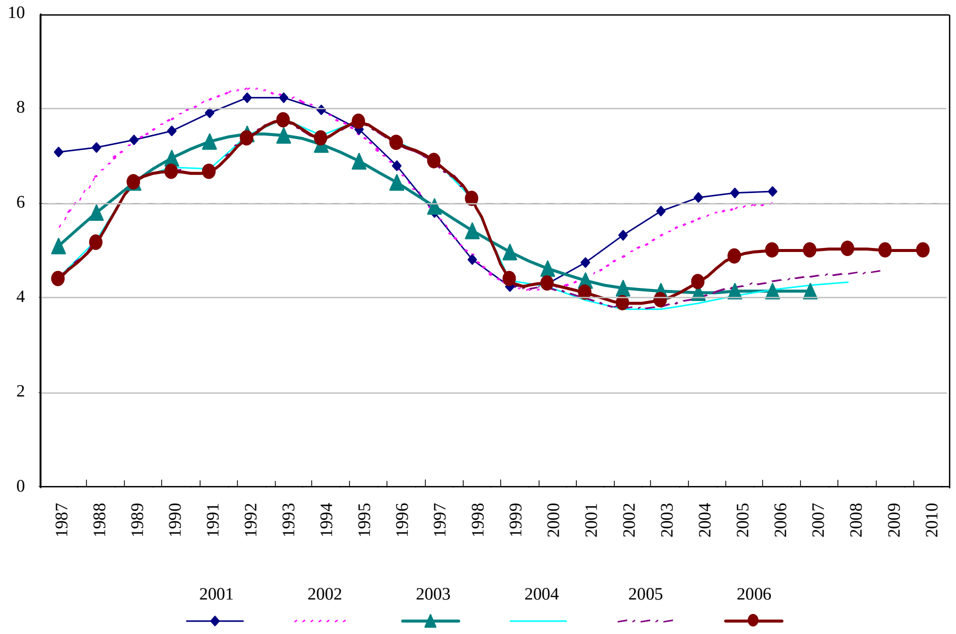


Figure 6

Official and HP Estimation of the Output Gap

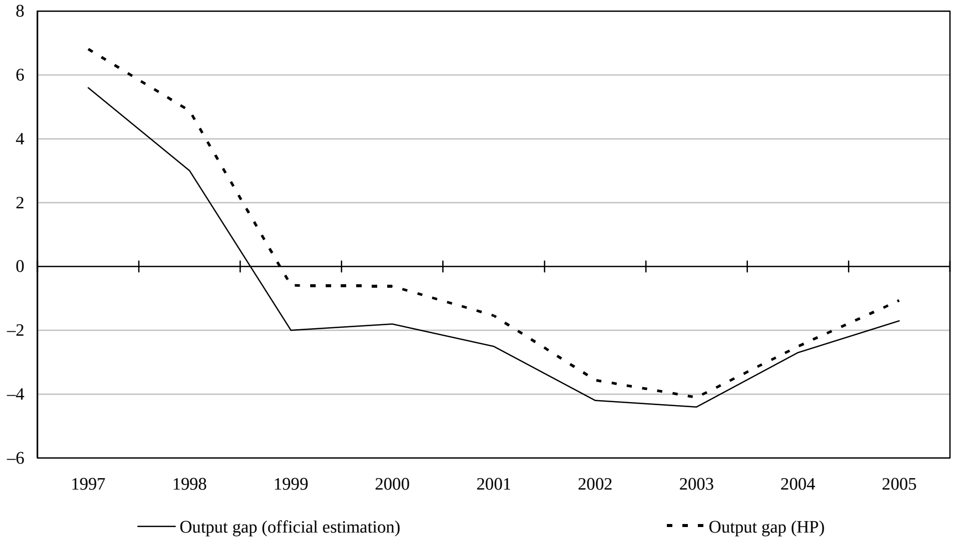
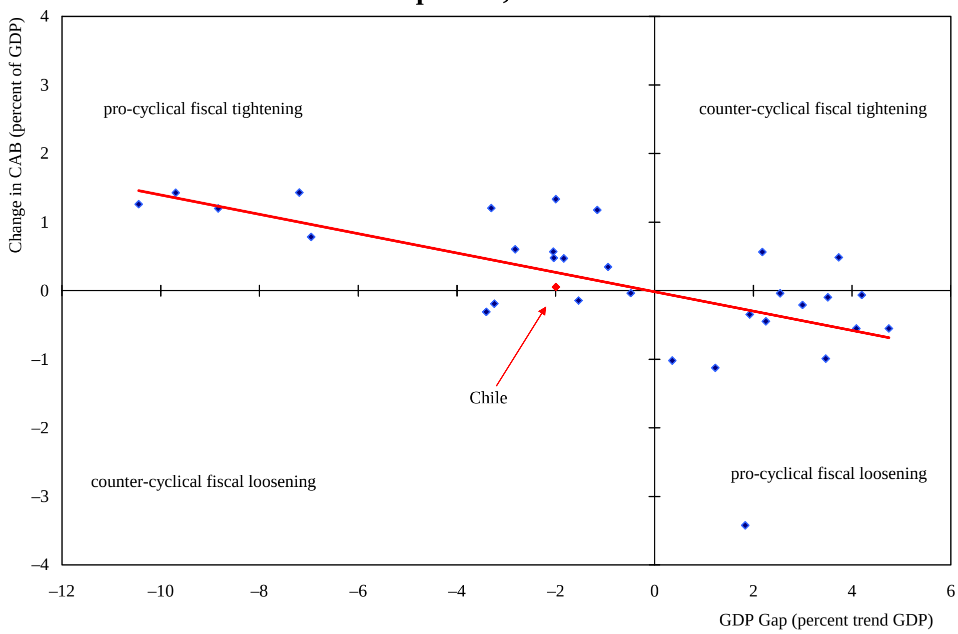


Figure 7

Fiscal Episodes, 1990-2000



Source: Author's calculations.

of Chile for the period 1999-2005, where GDP gap was 2 per cent on average and the cyclically adjusted primary balance did not change.

Hence, the case of Chile is perhaps unique in that sense, as it is strictly defined as a fiscal stabilizer, with no room to discretionary policies. If, as in European Commission (1997), fiscal policy can be defined as:

$$d = d_e - (\alpha + \beta)GAP$$

Where d is the public deficit, d_e is the structural component of public deficit, α the marginal sensitivity to the GDP gap (cyclical deficit), and β the reaction of authorities to the cycle (discretionary deficit). The value of the semi-elasticity α is around 0.2 (there are cyclical fluctuations only in the revenue side, since there are no automatic unemployment expenses), a low value compared to OECD standards, but the impact of copper has to be added. In the case of the rule of Chile $\beta = 0$, simply because the budget is not changed during the year. For the last 15 years, the budget approved in November was generally fully executed, with no revisions within the year.

Indeed, during the years of crisis, there was a discretionary reaction when unemployment surpassed 10 per cent. As an unemployment insurance mechanism was only created in 2003, the Government did react during winter months, traditionally with a lower level of activity, first creating jobs directly and in recent years subsidizing private employment. The budget resources were reallocated, with no aggregate impact on fiscal balance.

As Table 5 shows, the fiscal rule did stabilize the economy. When comparing the two main shocks in the economy in the last thirty years, with an index measure that reflects the combined effect of terms of trade, exports volume and capital inflows, the differences are striking. In 1982-83 monetary and fiscal policies were pro-cyclical, and hence multiplied the impact of external shocks, resulting in an unemployment rate of more than 20 per cent. By contrast, with worse external conditions in 2001-02, the combined effect of counter-cyclical monetary and fiscal policies did manage to stabilize GDP and protect employment, even with a rise in public investment.

Table 6

External Crisis and Fiscal Policy

Variable	1982-1983	2001-2002
Index of external conditions(1)	–4.0	–5.1
GDP growth	–8.2%	2.8%
Unemployment	20.4%	9.0%
Public investment growth	–13.2%	7.8%

Source: Ministerio de Hacienda and Banco Central de Chile.
(1) The index of external conditions is a composite, computed as percent of GDP, including the effects of terms of trade, exports volume and capital inflows.

4. Concluding remarks

The fact that only one country of Latin America do rely on cyclical adjustment methods in conducting their fiscal policy, considering the potential gains of such a measure, is somewhat puzzling. Indeed, the best way to face GDP and terms of trade volatility is to ensure a stable path of public expenditures. Despite all the efforts made, it has not been the case until now. Probably, most of the countries did not succeed to combine properly sustainability and stabilization objectives of fiscal policy.

The calculations made show that the cyclical factors of fiscal results are very significant, attaining six points of GDP in some cases, and certainly more than three in most of the nine countries included in this study. Contrary with the usual statement, where the role of automatic stabilizers in emerging countries is disregarded because of low tax burden, it is noteworthy to emphasize that GDP and terms of trade volatility are sufficient arguments to undertake the task of estimating accurately the cyclical component of budget results.

In that sense the case of Chile is very interesting, since external Committees do fix key projections of trend GDP and the long term of Copper price, the main variables of fiscal revenues forecast. This procedure, in principle, should reduce the optimistic bias of fiscal projections, and at the same time enhance the credibility of the whole budgetary process. It is worth mentioning that the definition of fiscal targets in structural terms is broadly accepted, not only in technical circles, but even in the parliament and in political parties.

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A DISAGGREGATED FRAMEWORK FOR THE ANALYSIS OF STRUCTURAL DEVELOPMENTS IN PUBLIC FINANCES

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1. Introduction and overview

In this paper we analyse the fiscal development in six countries – Belgium, Finland, Germany, Italy, the Netherlands and Portugal – over the period from 1998 to 2005, *i.e.* in the period following the year relevant for the qualification for EMU. We make use of the disaggregated framework for public finance analysis proposed by Kremer *et al.* (2006).[1] The framework allows us to distinguish the factors that affect public finances in broad categories and provides a standardised method to evaluate their impact. In particular, it separates the influence of the economic environment from factors relating to the legal and institutional setting and to policy decisions. The framework provides a clear structure and, thus, helps to increase the transparency and effectiveness of public finance analysis, in particular, in a multi-country setting.

We focus on "structural" developments, defined as changes in the ratio of individual budgetary categories with respect to nominal trend GDP excluding the transitory effects of the economic cycle and the temporary measures taken by governments. The assessment of cyclical effects on each budgetary category is based on the methodology developed within the European System of Central Banks (ESCB). Contrary to most other cyclical adjustment methods that focus on the aggregate output gap, *i.e.* the deviation of output from its potential level, the ESCB

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[1] A slightly different version was previously proposed by Kremer and Wendorff (2004). The disaggregated framework is also useful to assess the consistency and increase the transparency of fiscal forecasts, see Kremer *et al.* (2006) for an example.

approach also corrects budgetary outcomes for the impact of cyclical fluctuations in the composition of aggregate demand and national income.[2]

Cyclical effects and temporary measures are usually the most important transitory factors.[3] Many institutions – the European Commission, the IMF and the OECD among them – now regularly produce indicators of cyclically adjusted budget balances. The issue of discretionary measures with a temporary impact on the budget has come to the fore more recently, largely in the European context. The European Commission (2004) and Koen and van den Noord (2005) have shown that the effects of one-off measures have been substantial and persistent in some European countries in the last years. Recent stability and convergence programmes submitted by the European member states indicate that the resort to one-off measures continues to be substantial.

On the revenue side, a distinction is made between direct and indirect taxes, social contributions and non-tax-related revenue. Changes in the structural revenue ratios of taxes and social contributions are attributed to:

(i) the impact of macroeconomic developments,

(ii) discretionary fiscal policy measures of a permanent nature, and

(iii) residual developments.

The residual captures the effects of irregular, mostly country-specific factors, which need to be explained on a case-by-case basis. On the expenditure side, changes in the structural expenditure ratio are split into the contribution of interest payments, social payments, subsidies, compensation of public employees, intermediate consumption, government investment and an aggregate of other categories. Additional information is provided concerning changes in the number of public employees, health expenditure, old-age pensions, unemployment benefits and social transfers in kind.

The analysis shows that the primary budget balance ratios worsened in structural terms in all six countries with the exeption of Finland, even though the unadjusted budget balances do not display a common trend over the 1998-2005 period. As the analysis reveals, in general both structural macroeconomic developments – via their impact on revenue from taxes and social contributions – as well as policy measures contributed to this deterioration. On the revenue side, fiscal drag, differences between the trend growth of GDP and the respective macroeconomic bases, and legislation changes – in particular cuts in direct taxes – explain in general a significant part of the changes in budgetary ratios. However, in

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2 For an extensive description of the ESCB's cyclical adjustment procedure see Bouthevillain *et al.* (2001). A description of methods based on the output gap, together with recent estimates of budgetary sensitivities, can be found, for example, in Girouard and André (2005). A review of some alternative approaches to the cyclical adjustment of government budgets, as well as a discussion of the role of this indicator in the European context, can be found in Banca d'Italia (1999).

3 The report *Improving the Implementation of the Stability and Growth Pact*, approved by the European Council of 22-23 April 2005, proposes the same correction to identify the adjustment effort of member states of the euro area or ERM II which are not satisfying the medium-term objective.

individual years and, in some instances, also over longer periods, specific factors that are not necessarily linked to the macroeconomic development or recent policy decisions had a significant impact on the structural revenue ratios. The analysis of the structural development of individual budget categories on the expenditure side shows the main driving factors underlying the expenditure stance. In the countries under review, the evolution of social payments were particularly relevant for the fiscal deterioration.

In Section 2 the proposed framework of analysis is briefly described. In Section 3 we present an overview of the common features of the budgetary developments which emerge from the analysis, followed by six paragraphs, each dealing with a specific country.

2. The disaggregated framework

In the disaggregated framework, first the structural levels of revenue and expenditure categories are determined and, second, the changes in those corrected aggregates are attributed to a few relevant factors common to all countries (see also the tables in Section 3).[4]

2.1 Measuring structural balances

The structural levels of the main budgetary categories are derived by subtracting the cyclical component and the impact of temporary measures for the individual categories. To determine *cyclical impacts*, the ESCB method is used.[5] In this approach, revenue and expenditure categories are adjusted individually on the basis of the deviation from trend of the respective macroeconomic bases in real terms. The trend is estimated using a Hodrick-Prescott filter with a smoothing parameter of $\lambda = 30$. The cyclical component of a specific budgetary category is calculated by applying a constant elasticity to the trend deviation. In the standard implementation the following budgetary categories are adjusted (with corresponding macroeconomic bases in brackets): direct taxes on private household income (average compensation of employees and employment in the private sector), direct taxes on corporate income (operating surplus), social contributions paid in the private sector (average compensation of employees and employment in the private sector), indirect taxes (private consumption), unemployment-related expenditure (number of unemployed persons). Average compensation of employees and private consumption are expressed in real terms using the private consumption deflator; for the operating surplus the GDP deflator is used.

4 Cf. Kremer *et al.* (2006) for a detailed description.

5 Cf. Bouthevillain *et al.* (2001).

Concerning *temporary measures*, their effects on budgetary categories have been assessed by each of the authors for his or her own country on the basis of the following precepts. First, effects on public finances are considered as temporary if they affect the budgetary outcomes for a limited number of years (in practice up to three years). The temporary influence can be either strictly one-off or self-reversing; in the latter case measures will be regarded as temporary even if the reverse effects take more than three years to unwind (e.g. a capital transfer in return for the assumption of pension liabilities). Second, only significant effects with a favourable or unfavourable budgetary impact of at least close to 0.1 per cent of GDP are taken into account. In particular, the effects of uncoordinated decisions taken by regional or local authorities that are not significant in themselves are excluded. Third, attention is restricted to government policy actions, excluding events outside the control of governments. In general, the definition of a temporary measure requires a clear benchmark. Usually, this is particularly difficult to obtain for expenditure-side measures, and the major impact of the measures considered occurs on the revenue side.[6]

The structural revenue and expenditure categories are expressed *as percentages of nominal trend GDP* defined as real trend GDP (estimated using the Hodrick-Prescott filter with $\lambda = 30$) multiplied by the actual GDP deflator.

2.2 Identifying the sources of changes in structural balances

The tables in the country chapters of Section 3 display the decomposition of *changes in the structural ratios*, as defined above, of the balance and the main budgetary categories. The tables first summarise the impact of the main adjustments made to construct the structural ratios, showing the role of the changes in the effects of the cycle and temporary measures. By adding the structural ratio of interest payments to GDP to the structural balance ratio the *structural primary balance ratio* is derived. This is the starting point for analysing structural revenue and primary expenditure developments. As additional information, the annual change in interest payments that is attributable to changes in the average interest rate on public debt and to changes in the stock of debt is shown.

In the next part of the tables the changes in the *structural revenue ratios* are analysed. Taxes and social contributions, on the one hand, and non-tax-related revenue, on the other, are examined separately. Taxes are further broken down into:

1) direct taxes payable by corporations,
2) direct taxes payable by households,

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6 Revenues from the sales of UMTS licences and real estate, which are classified as negative “acquisition of non-financial assets” and “investment”, respectively, form the major exceptions. Sales of UMTS licences improved the 2000 budget balance in Germany by 2.5 per cent of GDP, in the Netherlands by 0.6 per cent of GDP and in Italy by 1.2 per cent of GDP. Sales of real estate improved the balance in Italy by 0.9 per cent of GDP in 2002. For detailed information on the temporary measures included in the analysis see Kremer *et al.* (2006).

3) social contributions and
4) indirect taxes.

The changes in the structural revenue ratios of taxes and social contributions are attributed to four factors: *fiscal drag, decoupling of the tax base from GDP*, *legislation changes* and a *residual*. As an additional piece of information, the tables give also an estimate of those parts of revenue which have an equal impact on both the revenue and expenditure side and therefore do not affect the balance, *i.e.* direct taxes and social contributions on the civil servants' wage bill and indirect taxes paid by general government.

2.2.1 Fiscal drag

We use the term *fiscal drag* in a broad sense: it applies not only to progressive income taxes which have elasticities with respect to tax bases larger than one, but to all revenue items which have elasticities different from unity. As such, the fiscal drag associated with a positive income change can even be negative as, for instance, for excise taxes: as they are volume-based, price increases may leave tax revenues unaffected or lead to revenue decreases while the corresponding nominal tax base would rise. Consequently, the ratio of excise taxes to the nominal trend base would decrease. The contribution of *fiscal drag* in a revenue category to the change of the structural revenue ratio is generally computed as[7] (where ε denotes the elasticity of the revenue category R with respect to its macroeconomic tax base, g the nominal trend growth rate of the base and Y the nominal trend GDP):

$$\frac{(\varepsilon - 1) g_t R_{t-1}}{Y_t}$$

2.2.2 Decoupling of the tax base from GDP

In the absence of legislation changes, the ratio of a revenue category to nominal (trend) GDP might change even when the elasticity with respect to the macroeconomic base amounts to unity. This can happen when the (trend) growth rate of the tax base deviates from the (trend) growth rate of nominal GDP. This deviation is denoted as *decoupling of the tax base from GDP*. The contribution of the decoupling to the change of the structural revenue ratio (for each revenue category) is generally computed as (where, in addition to the notation above, γ denotes the growth rate of nominal trend GDP):

$$\frac{(g_t - \gamma_t) R_{t-1}}{Y_t}$$

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7 This and the following formula are simplifications; see Kremer *et al.* (2006) for details. Similar to nominal trend GDP, the nominal trend of a macroeconomic base used for the calculation of fiscal drag and decoupling is calculated by multiplying its real trend with the respective deflator.

2.2.3 Legislation changes

Usually, a significant part of the change in the structural revenue ratios is due to changes in tax and social contributions laws. Expressed as a percentage of nominal trend GDP, the estimated direct impact of such changes is given in the row *legislation changes*. When interpreting the presented results, it has to be kept in mind that the estimation of the fiscal effects of legislation changes is sometimes subject to considerable uncertainty.

2.2.4 Residual

Changes in the structural ratio of taxes and social contributions to GDP not explained by the three factors above are attributed to the *residual*. The residual component is an important element of the disaggregated framework and may contribute in various ways to the analysis of public finances. It may help to understand better the past developments, indicating the quantitative importance of particular unsystematic events. It may show favourable or unfavourable tendencies in specific budgetary categories, requiring further analysis. It may also reveal a need to reassess the impact of legislation changes or biases in revenue elasticities. In many cases, a specific reason for a residual can be given. However, a full explanation of past residuals is not always possible *ex post* because tax revenues are affected by various factors. By contrast, *ex ante* explanation of residuals in a forecasting exercise should be part of the "story" underlying the forecast.

The final part of the tables is devoted to the analysis of annual *changes in the structural expenditure ratios*. It also provides background data on changes in the number of public employees and in health expenditure. The breakdown into components allows the main factors affecting the structural expenditure ratio to be identified and quantified and their effect on the evolution of the fiscal balance to be quantified.

3. Analysing budgetary developments in individual countries

The results presented in this section cover the period from 1998 to 2005 for six countries: Belgium, Finland, Germany, Italy, the Netherlands and Portugal. The first subsection summarises some features of the public finance developments in the various countries. In the following sections a detailed analysis for each country is provided.[8]

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[8] This section is based on the national accounts data and projections available in the summer of 2006.
In contrast to the ESA 95 figures, revenue include, with a positive sign, taxes paid by the non-government sector to the EU budget and, with a negative sign, transfers from the EU budget to government, while expenditure include, with a positive sign, subsidies and other transfers paid by the EU budget to the non-government sector, and with a negative sign, transfers from government to the EU budget. Net payments from government to the EU budget are included in expenditure, if positive, and in revenue, if negative, so that net lending/net borrowing is not affected, cf. also Kremer *et al.* (2006), p. 62.

3.1 General remarks

Over the 1998-2005 period, the unadjusted and structural budget balances of the six countries do not show a common trend. In three countries (Belgium, Finland and the Netherlands) the structural balance ratio improved while in the other three countries it worsened (Germany, Italy and Portugal). This picture changes, however, for the structural primary budget balances, since the favourable refinancing conditions reduced interest payments as a percentage of trend GDP in all countries, despite diverging debt developments. In most countries the structural primary balance ratio clearly worsened (see the following table).

The exception regarding the development of the structural primary balance ratio is Finland. Here, a significant reduction of the fiscal burden was more than compensated for on the expenditure side. The fall in the structural primary expenditure ratio was supported by the strong trend GDP growth. In Germany, too, both the structural revenue and primary expenditure ratios declined. Expenditure-side improvement in the later years of the period was, however, not strong enough to offset the overall increase, in particular, in the social payments ratio and several adverse revenue-side developments. In the other four countries, the structural primary expenditure ratios rose over the reporting period. Here, increases, in particular, in the structural ratios of old-age and healthcare-related expenditure to GDP played a role. While the Netherlands took significant compensatory measures at the end of the period, the structural primary expenditure ratios of Belgium, Italy and Portugal increased or were roughly constant in most years. In Belgium and Italy legislation changes let overall to a decrease of the tax burden. In the Netherlands there was also noticeable consolidation on the revenue side in the later years. In Portugal the structural revenue ratio increased over the whole period. It has to be noted, however, that this was, *inter alia*, related to public sector developments that are also reflected on the expenditure side.

The development of structural revenue was generally significantly influenced by legislation changes. More specifically, in all countries the direct tax burden was reduced and in most cases this was partly compensated by an increase in indirect taxes (for Italy, this pattern was caused by the 1998 tax reform which introduced a new regional tax on productive activities (IRAP) which was classified under indirect taxes). However, other factors also played a role in revenue developments. For example, in some countries a low trend growth in wage income relative to GDP had a negative influence on the structural ratios of direct taxes payable by households and social contributions to GDP. Furthermore, in individual years and, in some instances, also over longer periods, specific factors that are not necessarily linked to the macroeconomic development or recent policy decisions had a significant impact on the structural revenue ratios. For example, the high volatility of profit-related taxes is generally reflected only partly in the macroeconomic base (operating surplus which *inter alia* does not reflect write-offs on corporate balance sheets). In some cases also indirect taxes developed differently from what would have been expected on the basis of the development of the macroeconomic base and legislation changes. Here, changes in the efficiency of tax collection or in the average VAT rate relating

Table 1

Structural Fiscal Components – Summary of Country Results*

(percent of trend GDP)

Belgium	1997	1998	1999	2000	2001	2002	2003	2004	2005	98-05(3)
Balance	**–1.4**	**–0.2**	**–0.7**	**–0.5**	**–0.4**	**–0.6**	**–1.1**	**–0.6**	**0.1**	**1.5**
Interest payments	7.7	7.3	6.9	6.7	6.5	5.8	5.3	4.8	4.3	–3.3
Primary balance	**6.3**	**7.1**	**6.2**	**6.2**	**6.1**	**5.2**	**4.1**	**4.2**	**4.4**	**–1.9**
Total revenue	**50.0**	**50.4**	**50.1**	**50.2**	**50.2**	**50.2**	**49.6**	**49.8**	**50.2**	**0.2**
Taxes and social contributions overall	47.0	47.4	47.1	47.1	46.7	46.9	46.4	46.7	47.0	–0.0
Non-tax-related revenue(1)	3.0	3.1	3.0	3.1	3.4	3.3	3.2	3.1	3.3	0.3
Total primary expenditure	**43.7**	**43.3**	**43.9**	**43.9**	**44.1**	**45.0**	**45.4**	**45.6**	**45.8**	**2.1**
Social payments	22.8	22.5	22.6	22.6	22.9	23.3	23.7	23.8	23.6	0.9
Subsidies	1.5	1.6	1.6	1.5	1.6	1.5	1.6	1.6	1.9	0.3
Compensation of employees	11.8	11.6	11.8	11.8	11.8	12.2	12.2	12.0	12.1	0.3
Intermediate consumption	3.2	3.2	3.3	3.3	3.3	3.7	3.7	3.6	3.6	0.4
Government investment	1.7	1.7	2.0	2.0	1.8	1.7	1.7	1.8	1.8	0.1
Other(2)	2.7	2.7	2.6	2.7	2.6	2.7	2.6	2.7	2.8	0.1
Finland	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Balance	**–1.2**	**0.7**	**0.6**	**6.2**	**4.2**	**4.2**	**2.4**	**2.2**	**2.6**	**3.8**
Interest payments	4.2	3.6	3.0	2.9	2.7	2.1	1.7	1.5	1.5	–2.7
Primary balance	**3.0**	**4.2**	**3.6**	**9.0**	**6.9**	**6.3**	**4.2**	**3.7**	**4.0**	**1.0**
Total revenue	**55.6**	**54.5**	**53.4**	**56.3**	**53.3**	**53.5**	**52.2**	**52.4**	**52.3**	**–3.2**
Taxes and social contributions overall	46.8	46.1	45.8	47.7	44.7	44.9	43.6	43.4	43.6	–3.2
Non-tax-related revenue(1)	8.8	8.3	7.6	8.6	8.6	8.5	8.5	9.0	8.7	–0.1
Total primary expenditure	**52.6**	**50.2**	**49.8**	**47.2**	**46.4**	**47.1**	**48.0**	**48.7**	**48.3**	**–4.3**
Social payments	22.6	21.5	21.1	19.8	19.4	19.6	20.0	20.2	19.9	–2.8
Subsidies	2.4	2.2	2.1	2.1	2.0	1.9	1.9	1.9	1.8	–0.6
Compensation of employees	14.5	14.0	13.7	13.4	13.1	13.3	13.5	13.6	13.6	–0.9
Intermediate consumption	8.8	8.4	8.4	8.2	8.1	8.5	8.7	9.1	9.2	0.4
Government investment	3.1	2.9	2.8	2.6	2.6	2.7	2.9	2.9	2.8	–0.3
Other(2)	1.1	1.2	1.6	1.1	1.2	1.1	1.0	1.0	1.0	–0.2
Germany	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Balance	**–2.0**	**–1.8**	**–1.4**	**–1.6**	**–3.4**	**–3.9**	**–3.7**	**–3.3**	**–2.9**	**–0.9**
Interest payments	3.4	3.3	3.1	3.2	3.1	2.9	3.0	2.8	2.8	–0.5
Primary balance	**1.3**	**1.5**	**1.7**	**1.6**	**–0.3**	**–0.9**	**–0.7**	**–0.5**	**–0.1**	**–1.5**
Total revenue	**46.3**	**46.4**	**46.9**	**47.3**	**45.4**	**44.5**	**44.2**	**43.1**	**43.4**	**–2.9**
Taxes and social contributions overall	42.2	42.4	43.0	43.5	41.5	40.7	40.5	39.6	39.8	–2.5
Non-tax-related revenue(1)	4.1	4.0	3.9	3.8	3.9	3.8	3.7	3.4	3.6	–0.5
Total primary expenditure	**44.9**	**44.8**	**45.2**	**45.7**	**45.6**	**45.4**	**44.9**	**43.6**	**43.5**	**–1.4**
Social payments	26.6	26.5	26.6	27.1	27.4	27.5	27.4	26.7	27.0	0.4
Subsidies	2.1	2.1	2.1	2.0	1.9	1.8	1.7	1.6	1.5	–0.6
Compensation of employees	8.4	8.3	8.2	8.2	8.0	7.9	7.7	7.6	7.4	–1.0
Intermediate consumption	4.0	4.0	4.1	4.1	4.1	4.2	4.1	4.0	4.2	0.2
Government investment	1.8	1.8	1.9	1.8	1.8	1.7	1.5	1.4	1.3	–0.5
Other(2)	2.0	2.2	2.3	2.6	2.6	2.4	2.5	2.3	2.2	0.2
Italy	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Balance	**–3.4**	**–3.9**	**–2.3**	**–2.6**	**–4.5**	**–5.1**	**–5.6**	**–4.9**	**–4.3**	**–0.9**
Interest payments	9.2	8.1	6.6	6.5	6.4	5.7	5.2	4.8	4.6	–4.6
Primary balance	**5.8**	**4.2**	**4.4**	**3.9**	**2.0**	**0.7**	**–0.4**	**–0.1**	**0.3**	**–5.5**
Total revenue	**47.0**	**45.6**	**45.9**	**45.8**	**45.1**	**44.0**	**43.0**	**43.1**	**43.5**	**–3.5**
Taxes and social contributions overall	43.3	42.1	42.2	42.4	41.5	40.6	39.9	39.9	40.4	–2.8
Non-tax-related revenue(1)	3.7	3.6	3.8	3.4	3.5	3.4	3.1	3.2	3.1	–0.7
Total primary expenditure	**41.2**	**41.4**	**41.6**	**41.8**	**43.1**	**43.3**	**43.4**	**43.2**	**43.2**	**2.0**
Social payments	19.4	19.2	19.2	19.4	19.5	19.8	19.9	20.1	20.1	0.7
Subsidies	1.7	1.7	1.6	1.6	1.7	1.6	1.5	1.4	1.3	–0.4
Compensation of employees	11.4	10.5	10.5	10.6	10.7	10.7	10.8	10.8	10.8	–0.6
Intermediate consumption	4.8	4.8	5.0	5.1	5.2	5.2	5.3	5.4	5.4	0.6
Government investment	2.1	2.3	2.4	2.5	2.6	2.6	2.7	2.7	2.5	0.4
Other(2)	1.8	2.8	2.9	2.7	3.3	3.4	3.2	2.9	3.0	1.2
The Netherlands	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Balance	**–0.2**	**–0.8**	**0.3**	**0.5**	**–2.0**	**–3.7**	**–3.4**	**–1.5**	**0.8**	**1.0**
Interest payments	4.9	4.7	4.4	3.8	3.2	2.8	2.6	2.6	2.4	–2.5
Primary balance	**4.7**	**3.9**	**4.6**	**4.3**	**1.3**	**–0.9**	**–0.8**	**1.1**	**3.2**	**–1.5**
Total revenue	**46.4**	**45.7**	**47.1**	**46.9**	**45.0**	**43.3**	**43.4**	**44.6**	**45.7**	**–0.7**
Taxes and social contributions overall	40.2	39.7	41.2	40.9	38.3	37.0	37.2	38.5	39.1	–1.1
Non-tax-related revenue(1)	6.2	6.0	5.9	6.0	6.8	6.3	6.1	6.1	6.6	0.3
Total primary expenditure	**41.7**	**41.8**	**42.4**	**42.6**	**43.7**	**44.2**	**44.2**	**43.5**	**42.5**	**0.8**
Social payments	20.0	19.8	19.6	19.5	19.5	19.7	19.8	19.7	19.3	–0.7
Subsidies	1.9	1.8	1.9	1.8	1.8	1.8	1.7	1.7	1.7	–0.3
Compensation of employees	9.7	9.8	9.9	9.9	9.8	9.8	9.9	9.9	9.7	–0.1
Intermediate consumption	5.9	6.0	6.3	6.2	7.1	7.1	7.1	7.0	6.8	0.9
Government investment	2.8	2.8	2.9	3.1	3.3	3.5	3.3	3.1	2.9	0.2
Other(2)	1.4	1.7	1.8	2.1	2.3	2.2	2.3	2.2	2.1	0.7
Portugal	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Balance	**–2.9**	**–2.9**	**–3.4**	**–4.6**	**–5.4**	**–4.8**	**–4.8**	**–4.7**	**–5.2**	**–2.3**
Interest payments	3.9	3.3	3.1	3.1	3.1	2.9	2.7	2.7	2.7	–1.2
Primary balance	**1.0**	**0.4**	**–0.4**	**–1.5**	**–2.4**	**–1.9**	**–2.0**	**–2.0**	**–2.5**	**–3.5**
Total revenue	**40.5**	**40.5**	**41.1**	**40.4**	**40.3**	**41.0**	**41.2**	**41.9**	**41.8**	**1.3**
Taxes and social contributions overall	33.8	33.9	34.5	34.8	34.8	34.8	34.7	35.5	36.5	2.7
Non-tax-related revenue(1)	6.7	6.5	6.7	5.6	5.6	6.2	6.5	6.4	5.4	–1.3
Total primary expenditure	**39.5**	**40.1**	**41.5**	**41.9**	**42.7**	**43.0**	**43.3**	**43.9**	**44.3**	**4.8**
Social payments	12.5	12.8	13.3	13.9	14.4	14.9	16.7	17.1	17.9	5.4
Subsidies	1.9	2.1	2.3	1.8	2.1	2.1	2.4	2.1	2.2	0.3
Compensation of employees	12.9	13.3	13.8	14.6	14.7	15.0	14.1	14.1	14.3	1.3
Intermediate consumption	3.9	3.8	4.2	4.4	4.5	4.3	3.8	4.0	4.0	0.1
Government investment	4.2	3.9	4.1	3.9	4.0	3.6	3.1	3.1	2.8	–1.4
Other(2)	4.0	4.2	3.8	3.3	3.1	3.1	3.2	3.5	3.2	–0.9

* The fiscal balance is given according to the EDP definition, interest includes settlements under swaps and FRAs (The Netherlands: ESA 95 definition).

(1) Other current transfers receivable, sales and total capital revenue.

(2) Other current transfers payable, other net acquisitions of non-financial assets and capital transfers.

(3) Change in the ratios between 1997 and 2005.

to changes in the composition of private consumption might have had an impact. On the expenditure side, the development was relatively heterogenous and reference is made to the country sections for further information.

3.2 Belgium

From 1997 to 2005 general government improved its budget balance by some 2 per cent of GDP. This was to a very minor extent due to a better cyclical environment, which explains only 0.1 percentage point of the change, and, to a larger extent, to a favourable contribution from temporary measures, that had marginally worsened the 1997 balances but improved them by about 0.5 per cent of GDP in 2005. The *structural budget balance*, *i.e.* the budget balance corrected for cyclical influences and temporary measures, improved from a deficit of 1.4 per cent of trend GDP in 1997 to a balanced budget in 2005 (after having approached the zero mark in 1998).

This improvement was due to the substantial fall in *interest* charges – attributable to both the trend reduction in the debt ratio and the decrease in the implicit interest rate on public debt – that was, however, largely offset by the strong decline of close to 2 per cent of trend GDP in the structural *primary surplus*. This was due entirely to expenditure developments as the structural revenue ratio increased slightly.

The structural *revenue* ratio increased by 0.2 percentage point in the 1998-2005 period. The limited increase in *non-tax-related* revenue as a percentage of trend GDP was partially offset by a marginal decrease in the structural tax pressure. The latter was caused by the net impact of legislation changes and the unfavourable decoupling effect, *i.e.* the trend decline in the macroeconomic bases for the most important taxes with respect to GDP. Those two elements were, however, largely compensated by favourable residuals, *i.e.* the change in the structural tax ratio that cannot be traced back to the factors explicitly identified in the legislation changes, decoupling and fiscal drag.

Legislation changes reduced the structural government revenue ratio by around 1.1 percentage point in the 1998-2005 period. As both the previous and the present government specifically aimed at reducing the tax pressure on labour in order to increase employment, direct taxes on households and social contributions saw significant tax cuts (around 1 per cent of trend GDP in both cases). Direct taxes on households were negatively affected by the stepwise removal of the complementary crisis contribution and the gradual reform of the personal income tax system (the impact of which will continue to grow until 2007). Cuts in social contributions mainly pertained to employers' contributions and to a lesser extent to employees' contributions. These tax cuts were, however, partly offset by several increases in indirect taxes (mainly on tobacco, mineral oils and financial products), which pushed up the revenue ratio by around 0.7 percentage point between 1997 and 2005.

Table 2

Belgium – Changes in Structural Fiscal Components*

(percent of trend GDP)

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Unadjusted balance(1)	**1.3**	**0.3**	**0.6**	**0.6**	**–0.6**	**0.1**	**–0.1**	**0.1**	**2.1**
Cyclical component	0.1	0.7	0.5	–0.1	–0.3	–0.3	–0.2	–0.3	0.1
Temporary measures	0.0	0.1	–0.1	0.6	–0.2	1.0	–0.5	–0.3	0.6
Balance	**1.2**	**-0.5**	**0.2**	**0.1**	**-0.2**	**-0.6**	**0.6**	**0.6**	**1.5**
Interest payments	–0.4	–0.4	–0.1	–0.2	–0.7	–0.5	–0.5	–0.4	–3.3
due to changes in average interest rate	*–0.1*	*–0.2*	*0.1*	*0.0*	*–0.5*	*–0.2*	*–0.3*	*–0.3*	*–1.6*
due to changes in debt level	*–0.3*	*–0.2*	*–0.2*	*–0.2*	*–0.2*	*–0.2*	*–0.2*	*–0.1*	*–1.8*
Primary balance	**0.8**	**–0.9**	**0.1**	**–0.1**	**–0.9**	**–1.1**	**0.1**	**0.2**	**–1.9**
Total revenue	**0.4**	**–0.3**	**0.1**	**0.0**	**0.1**	**–0.6**	**0.2**	**0.4**	**0.2**
Direct taxes payable by corporations	**0.5**	**–0.2**	**–0.1**	**0.2**	**–0.2**	**–0.3**	**0.3**	**0.3**	**0.7**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	–0.1	–0.3
Decoupling of base from GDP	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2
Legislation changes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual	0.6	–0.1	0.0	0.2	–0.1	–0.3	0.3	0.3	0.8
Direct taxes payable by households	**–0.1**	**–0.4**	**0.3**	**0.0**	**0.0**	**–0.2**	**–0.1**	**0.0**	**–0.6**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Decoupling of base from GDP	–0.2	0.0	0.0	0.0	0.0	–0.1	–0.1	0.0	–0.3
Legislation changes	0.1	0.0	0.0	–0.1	–0.3	–0.2	–0.2	–0.1	–0.9
Residual	0.0	–0.5	0.2	0.0	0.3	0.1	0.2	0.1	0.4
Memo item: included in expenditure(2)	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.1*
Social contributions	**0.0**	**–0.1**	**–0.2**	**0.0**	**0.3**	**0.0**	**–0.1**	**–0.2**	**–0.3**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	–0.2	0.0	0.0	0.0	–0.1	–0.1	–0.1	0.0	–0.4
Legislation changes	0.1	–0.1	–0.5	–0.1	0.0	–0.1	–0.2	–0.1	–1.0
Residual	0.1	–0.1	0.2	0.1	0.4	0.2	0.2	0.0	1.1
Memo item: included in expenditure(2)	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Indirect taxes	**–0.1**	**0.4**	**–0.1**	**–0.5**	**0.0**	**0.0**	**0.3**	**0.2**	**0.2**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	–0.1
Decoupling of base from GDP	–0.1	–0.1	0.1	0.0	–0.1	0.0	0.0	0.0	–0.1
Legislation changes	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.2	0.7
Residual	0.0	0.5	–0.2	–0.6	0.1	0.0	0.0	0.0	–0.3

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Taxes and social contributions overall	**0.3**	**–0.3**	**0.0**	**–0.3**	**0.2**	**–0.5**	**0.3**	**0.3**	**0.0**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	–0.1
Decoupling of base from GDP	–0.5	0.0	0.2	0.1	–0.1	–0.2	–0.2	0.0	–0.7
Legislation changes	0.2	0.0	–0.5	–0.1	–0.4	–0.2	0.0	–0.1	–1.1
Residual(3)	0.6	–0.2	0.2	–0.3	0.7	0.0	0.6	0.3	2.0
Memo item: included in expenditure(2)	*–0.1*	*0.1*	*0.0*	*0.1*	*0.1*	*0.0*	*0.0*	*0.0*	*0.2*
Non-tax-related revenue(4)	**0.1**	**–0.1**	**0.2**	**0.3**	**–0.1**	**–0.1**	**–0.1**	**0.1**	**0.3**
of which EU(5)									
Total primary expenditure	**–0.4**	**0.6**	**0.1**	**0.1**	**1.0**	**0.4**	**0.1**	**0.2**	**2.1**
(of which: due to automatic indexation)(10)	**–0.1**	**0.1**	**–0.1**	**0.1**	**0.2**	**–0.1**	**–0.2**	**0.0**	**0.0**
Social payments	–0.2	0.0	0.0	0.3	0.4	0.4	0.1	–0.2	0.9
of which old-age pensions	*–0.1*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*
of which unemployment benefits	*0.0*	*0.0*	*–0.1*	*0.0*	*0.1*	*0.0*	*0.0*	*–0.1*	*–0.1*
of which social transfers in kind	*0.0*	*0.2*	*0.2*	*0.2*	*0.0*	*0.3*	*0.3*	*–0.1*	*1.2*
Subsidies	0.0	0.1	–0.1	0.0	–0.1	0.1	0.0	0.3	0.3
of which EU(6)	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Compensation of employees	–0.1	0.2	0.0	0.1	0.4	0.0	–0.2	0.0	0.3
Intermediate consumption	0.0	0.0	0.0	0.0	0.4	–0.1	0.0	0.0	0.4
Government investment	–0.1	0.3	0.0	–0.2	–0.1	0.0	0.1	0.0	0.1
Other(7)	0.0	–0.1	0.1	–0.1	0.0	0.0	0.1	0.1	0.1
of which EU(8)	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Memorandum items									
Health care(9)	0.0	0.1	0.1	0.2	–0.1	0.3	0.3	–0.1	0.9
Trend growth of real GDP	2.3	2.3	2.2	2.1	2.0	2.0	1.9	2.0	
Change in GDP deflator	1.8	0.7	1.7	1.8	1.8	1.7	2.3	2.2	
Change in public employees	1.6	2.4	0.5	0.4	2.0	1.7	1.1	–0.1	

* The fiscal balance is given according to the EDP definition, interest includes settlements under swaps and FRAs.

(1) Change in unadjusted balance, cyclical component and temporary measures as percentage of nominal GDP. Due to the different denominator, the change in the ratio of the structural balance to trend nominal GDP may deviate slightly from the change in the ratio to nominal GDP of the unadjusted balance less cyclical component less temporary measures.

(2) Payments attributable to the general government sector (estimated).

(3) May also include the change in the structural ratio of direct taxes not payable by corporations/households.

(4) Other current transfers receivable, sales and total capital revenue.

(5) Net receipts from EC budget if country is a net recipient from EC budget. Empty if country is net payer to EC budget.

(6) Expenditure paid by EC budget that is spent under category "Subsidies".

(7) Other current transfers payable, other net acquisitions of non-financial assets and capital transfers.

(8) If country is a net payer to EC budget: net payments to EC budget less expenditure paid by EC budget that is not spent under category "Other". If country is a net recipient from EC budget: expenditure paid by EC budget that is spent under category "Other".

(9) Social benefits, social transfers in kind and other current transfers that can be allocated into the function of the provision of public health care services.

(10) For price effects: see Kremer *et al.* (2006).

Note: Due to rounding there might be deviations between aggregate numbers and the sum of individual numbers.

The trend decoupling of tax bases from GDP also weighed on revenue developments in that period. Detailed calculations show that this was due primarily to a marked divergence between real private-sector tax bases, especially real private-sector labour income, and GDP. The contribution of both public-sector components of tax bases considered in the ESCB cyclical adjustment methodology (public-sector wages and indirect taxes paid by government entities) and pure price effects9 is relatively small and actually slightly reduces the overall decoupling. For instance, real private-sector labour income, the most important tax base for government revenue, posted an annual trend increase of less than 1.5 per cent between 1997 and 2005 while trend activity grew by some 2.1 per cent a year in the same period.

The *fiscal drag* was relatively neutral throughout the period under consideration as the positive drag in direct taxes on households (due to the progressive nature of the personal income tax system) was roughly offset by the negative effect of the econometrically estimated elasticities for both indirect taxes and corporate taxes being smaller than one.

Finally, *residuals* were, on average, positive in the 1998-2005 period and increased the revenue ratio by around 2 percentage points. Residuals increase direct taxes on corporations and households and social contributions and reduce indirect taxes. Relative to the size of the revenue item the largest residuals can be found in direct taxes on corporations which is not unexpected in view of the generally poor fit of the elasticity (either econometrically estimated or derived from the tax rule) used for this category. Large positive residuals for social contributions could be related to an overestimation of the impact of the frequent legislation changes. Finally, the large negative residual for indirect taxes is mainly derived from the substantial 2001 VAT revenue shortfall, which is partly related to a hike in tax reimbursements (for exports and investments) but still not yet fully explained.

Corrected for cyclical influences and temporary measures, the *primary expenditure* ratio grew by more than 2 percentage points. This is mainly due to the strong increase in social transfers in kind (primarily *healthcare* spending for which a real growth norm of 4.5 per cent – *i.e.* far above the trend activity growth – currently applies) and, to a much lesser extent, to *intermediate consumption, compensation of employees* and *subsidies*.

3.3 Finland

There are no temporary measures over the reporting period in Finland; hence structural and cyclically adjusted values are equal.

When analysing changes in structural revenue and expenditure ratios, it should be kept in mind that the early years of the period were very special in the

[9] Price developments lead to a decoupling of government revenue from trend GDP growth if the evolution of the tax base deflators deviates from that of the GDP deflator.

Finnish economy. The economy was still recovering from the huge recession of the early 1990s. While the private sector was rebounding from the previous slump and already growing fast, consolidation needs and spending controls dominated public sector developments. Additionally, the global ICT boom had a huge impact on the economy in 1998-2001.

The general government balance increased by 3.9 percentage points to 2.6 per cent between 1997 and 2005. Overall, cyclical influences were only of minor importance; also, the structural fiscal *balance* saw a 3.8 percentage points improvement, from a deficit of –1.2 per cent of nominal trend GDP in 1997 to a surplus of 2.6 per cent in 2005. The structural improvement was driven mainly by the steady decrease in *interest* payments in relation to nominal trend GDP, amounting to –2.7 percentage points between 1997 and 2005. Two-thirds of the cumulated decrease in the ratio was due to the decrease in the average implicit interest rate. The implicit interest rate on general government debt decreased from 7.9 per cent in 1997 to 3.5 per cent in 2005. The rest of the decrease in the ratio was due to the very moderate increase in the amount of debt.

The structural *primary surplus* ratio increased by 1.0 percentage point, from 3.0 per cent of nominal trend GDP in 1997 to 4.0 per cent in 2005. This improvement was attributable entirely to the considerable decrease in the structural primary expenditure ratio; the –3.2 percentage points decrease in the structural revenue ratio was more than compensated for by the –4.3 percentage points decrease in the structural primary expenditure ratio between 1997 and 2005.

The structural total *revenue* ratio decreased by –3.2 percentage points between 1997 and 2005. The decrease was due to three factors: the tax cuts, the fact that tax bases increased on average slower than nominal trend GDP and the impact of special events. By contrast, fiscal drag clearly contributed to the increase in the revenue ratio and compensated for the decrease in the structural total revenue ratio.

The contribution of *tax cuts* amounted to –3.5 percentage points between 1997 and 2005. Various cuts in household and corporate income taxes and social contribution rates in the years 2000 to 2005 played a decisive role.

The contribution of *fiscal drag* amounted to 1.5 percentage points between 1997 and 2005, reflecting the highly progressive taxation of wages. Since profit-related and consumption-related taxation and social security contributions are strictly proportional, fiscal drag does not exist under these revenue categories.

The contribution of the *decoupling* of tax bases from GDP amounted to –0.4 percentage points between 1997 and 2005. Though limited, the contribution is still visible in all revenue categories except direct taxes paid by corporations. The negative annual contributions concentrated on the early years of the period – especially 1998 – and were particularly high under wage-related revenue categories. They primarily reflected two factors. Firstly, average growth in public sector wages remained below nominal trend GDP growth between 1997 and 2001, while growth in operating surplus and private sector wages exceeded nominal trend GDP growth slightly. Therefore, if public sector wages are excluded, the contribution of the

Table 3

Finland – Changes in Structural Fiscal Components*

(percent of trend GDP)

Increasing +, decreasing –	1998	1999	2000	2001	2002	2003	2004	2005	98-05
Unadjusted balance(1)	**2.9**	**0.0**	**5.3**	**–2.0**	**–0.9**	**–1.6**	**–0.2**	**0.3**	**3.9**
Cyclical component	1.1	0.0	–0.1	–0.1	–1.0	0.2	0.1	–0.2	0.0
Temporary measures	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Balance	**1.8**	**–0.1**	**5.6**	**–2.0**	**0.0**	**–1.8**	**–0.3**	**0.4**	**3.8**
Interest payments	–0.6	–0.5	–0.2	–0.2	–0.6	–0.4	–0.2	–0.1	–2.7
due to changes in average interest rate	*–0.3*	*–0.3*	*0.0*	*–0.1*	*–0.5*	*–0.4*	*–0.2*	*0.0*	*–1.9*
due to changes in debt level	*–0.3*	*–0.2*	*–0.1*	*–0.1*	*–0.1*	*0.0*	*0.1*	*–0.1*	*–0.8*
Primary balance	**1.2**	**–0.6**	**5.4**	**–2.1**	**–0.5**	**–2.2**	**–0.5**	**0.3**	**1.0**
Total revenue	**–1.1**	**–1.1**	**2.9**	**–3.0**	**0.2**	**–1.3**	**0.3**	**–0.1**	**–3.2**
Direct taxes payable by corporations	**0.8**	**0.1**	**1.5**	**–1.6**	**0.0**	**–0.7**	**0.1**	**–0.1**	**0.1**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legislation changes	0.0	0.0	0.2	0.0	0.0	0.0	0.0	–0.4	–0.2
Residual	0.8	0.0	1.3	–1.6	0.0	–0.7	0.1	0.3	0.3
Direct taxes payable by households	**–0.6**	**–0.3**	**1.3**	**–0.7**	**0.1**	**–0.5**	**–0.2**	**0.0**	**–1.0**
Fiscal drag	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	1.5
Decoupling of base from GDP	–0.4	–0.1	0.0	–0.2	0.1	0.1	0.1	0.1	–0.3
Legislation changes	0.0	–0.3	0.0	–0.7	–0.4	–0.4	–0.5	–0.2	–2.5
Residual	–0.3	–0.1	1.1	0.0	0.2	–0.4	0.0	–0.2	0.3
Memo item: included in expenditure(2)	*–0.2*	*–0.1*	*–0.2*	*–0.2*	*–0.1*	*0.1*	*0.1*	*0.0*	*–0.7*
Social contributions	**–0.5**	**–0.1**	**–0.6**	**–0.1**	**–0.1**	**–0.2**	**0.0**	**0.1**	**–1.4**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	–0.4	–0.1	0.0	–0.2	0.1	0.1	0.1	0.1	–0.3
Legislation changes	0.1	0.2	–0.4	–0.4	–0.5	–0.1	0.0	0.3	–0.8
Residual	–0.1	–0.1	–0.3	0.5	0.3	–0.2	–0.1	–0.3	–0.4
Memo item: included in expenditure(2)	*–0.2*	*–0.1*	*–0.2*	*–0.2*	*–0.1*	*0.1*	*0.0*	*0.0*	*–0.7*
Indirect taxes	**–0.4**	**0.0**	**–0.2**	**–0.6**	**0.2**	**0.2**	**–0.1**	**0.2**	**–0.8**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	–0.3	0.0	0.2	–0.1	0.1	0.0	0.1	0.2	0.2
Legislation changes	0.1	0.1	0.0	0.0	0.0	0.0	–0.1	–0.1	0.0
Residual	–0.1	–0.1	–0.4	–0.5	0.0	0.2	0.0	0.1	–0.9

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Taxes and social contributions overall	**–0.7**	**–0.4**	**1.9**	**–3.0**	**0.2**	**–1.3**	**–0.2**	**0.2**	**–3.2**
Fiscal drag	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	1.5
Decoupling of base from GDP	–1.1	–0.1	0.2	–0.5	0.3	0.3	0.2	0.4	–0.4
Legislation changes	0.1	–0.1	–0.2	–1.1	–0.8	–0.5	–0.6	–0.3	–3.5
Residual(3)	0.2	–0.3	1.8	–1.6	0.6	–1.2	0.0	–0.2	–0.7
Memo item: included in expenditure(2)	*–0.5*	*–0.2*	*–0.4*	*–0.4*	*–0.1*	*0.2*	*0.1*	*–0.1*	*–1.4*
Non-tax-related revenue(4)	**–0.4**	**–0.7**	**1.0**	**0.0**	**–0.1**	**0.0**	**0.5**	**–0.3**	**–0.1**
of which EU(5)									*0.0*
Total primary expenditure	**–2.3**	**–0.5**	**–2.5**	**–0.9**	**0.7**	**0.9**	**0.7**	**–0.4**	**–4.3**
Social payments	–1.1	–0.4	–1.3	–0.5	0.3	0.4	0.2	–0.3	–2.8
of which old-age pensions	*–0.4*	*–0.2*	*–0.4*	*–0.2*	*0.3*	*0.2*	*0.1*	*–0.1*	*–0.8*
of which unemployment benefits	*–0.4*	*–0.1*	*–0.4*	*–0.3*	*0.0*	*0.0*	*0.0*	*–0.1*	*–1.3*
of which social transfers in kind	*0.2*	*0.0*	*0.0*	*0.1*	*0.1*	*0.2*	*0.1*	*0.0*	*0.7*
Subsidies	–0.2	–0.1	0.0	–0.1	–0.1	0.0	0.0	–0.1	–0.6
of which EU(6)	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*–0.1*	*–0.1*
Compensation of employees	–0.6	–0.3	–0.3	–0.2	0.1	0.3	0.1	0.0	–0.9
Intermediate consumption	–0.4	0.0	–0.2	–0.1	0.4	0.3	0.4	0.1	0.4
Government investment	–0.2	–0.1	–0.2	0.0	0.1	0.1	0.1	–0.2	–0.3
Other(7)	0.1	0.4	–0.5	0.0	–0.1	–0.1	0.0	0.0	–0.2
of which EU(8)	*0.1*	*0.0*	*–0.1*	*0.0*	*0.0*	*0.2*	*–0.1*	*0.1*	*0.1*
Memorandum items									
Health care(9)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trend growth of real GDP	3.8	3.9	3.7	3.4	3.1	2.9	2.7	2.6	
Change in GDP deflator	3.4	0.9	2.6	3.0	1.3	–0.4	0.6	1.5	
Change in public employees	–0.3	0.5	1.1	1.4	2.2	0.9	0.7	0.7	

* The fiscal balance is given according to the EDP definition, interest includes settlements under swaps and FRAs.

(1) Change in unadjusted balance, cyclical component and temporary measures as percentage of nominal GDP. Due to the different denominator, the change in the ratio of the structural balance to trend nominal GDP may deviate slightly from the change in the ratio to nominal GDP of the unadjusted balance less cyclical component less temporary measures.

(2) Payments attributable to the general government sector (estimated).

(3) May also include the change in the structural ratio of direct taxes not payable by corporations/households.

(4) Other current transfers receivable, sales and total capital revenue.

(5) Net receipts from EC budget if country is a net recipient from EC budget. Empty if country is net payer to EC budget.

(6) Expenditure paid by EC budget that is spent under category "Subsidies".

(7) Other current transfers payable, other net acquisitions of non-financial assets and capital transfers.

(8) If country is a net payer to EC budget: net payments to EC budget less expenditure paid by EC budget that is not spent under category "Other". If country is a net recipient from EC budget: expenditure paid by EC budget that is spent under category "Other".

(9) Social benefits, social transfers in kind and other current transfers that can be allocated into the function of the provision of public health care services.

Note: Due to rounding there might be deviations between aggregate numbers and the sum of individual numbers.

decoupling in wage-related revenue categories is slightly positive. Secondly, the large negative overall contribution in 1998 mainly reflects the unequal composition of nominal GDP growth in the earlier years of the 1990s resulting from the strong growth of (low tax yielding) nominal operating surplus and the comparatively weaker growth of (high tax yielding) nominal compensation of employees (both private and public). This development was partially compensated for by reverse developments in subsequent years.

The *residual* contributed –0.7 percentage point to the decrease in the structural total revenue ratio. Annual residuals under direct taxes payable by corporations and households add up to close to zero between 1997 and 2005. This is plausible because over a longer period of time the impacts of unsystematic developments should cancel out each other. By contrast, the residuals under social contributions and indirect taxes add up to –0.4 per cent and –0.9 per cent of nominal trend GDP respectively. The reasons for these large cumulative residuals are unclear and require further analysis.

The annual contributions of residuals to the changes in the structural total revenue ratio were fairly limited apart from an anomalous impact in the years 2000 to 2003. This is attributable to the exceptionally large 1998-2000 revenue gains from taxes on stock option income and capital gains during the ICT boom phase and the following stock price bubble. Consequently, corporations and households paid more direct taxes in the year 2000 than explainable by the increase in their respective tax bases. However, it should be kept in mind that large changes in residuals under the profit-related taxes also reflect the fact that operating surplus is a bad proxy for the tax base and the complex system of, for example, the deduction of the previous losses from current and future profits makes the annual change in operating surplus an even worse proxy for the annual change in profit-related tax revenue.

Owing to the lagged collection of taxes on stock option income, capital gains and unforeseen corporate profits of 1998-2000, the exceptional revenue from direct taxes payable by corporations and households gradually faded away in 2001-03. In addition, a one-off extraordinary booking, shifting EUR 500 million (0.35 per cent of nominal trend GDP) worth of revenue from 2001 to 2002, increases the negative residual of direct taxes payable by corporations in 2001 and decreases that in 2002.

The structural *primary expenditure* ratio decreased by –4.3 percentage points between 1997 and 2005. The decrease occurred almost entirely in 1998-2001 and resulted from the combination of a limited increase in structural primary expenditure and a rapid increase in nominal trend GDP. Later, as a result of accelerating structural primary expenditure growth and decelerating trend GDP growth, the structural primary expenditure ratio clearly increased. However, the considerable decrease in interest payments constrained the increase in the structural total expenditure ratio.

The average annual increase in nominal trend GDP amounted to 6.3 per cent in 1998-2001. In 1998, 2000 and 2001, when the decrease in the total expenditure ratio was especially rapid, nominal trend GDP grew at an average rate of nearly 7 per cent. At the same time, the structural primary expenditure growth was subdued; in 1998-2000 it increased on average by only 2.5 per cent annually in nominal terms and in real terms it remained unchanged. In 2001 structural primary expenditure growth almost doubled, but it was still outweighed by the rapid increase in nominal trend GDP, and the structural primary expenditure ratio kept declining. The picture changed completely in 2002-2004 when structural primary expenditure growth accelerated further to an annual average of 5.1 per cent whereas nominal trend GDP growth halved to an annual average of 3.4 per cent.

Structural primary spending growth was mainly nurtured by growth in *social payments*, *compensation of employees*, *intermediate consumption* and *government investment* accelerating from 2001 onwards, after a period with only moderate increases or decreases. For example, unemployment-related expenditure decreased year after year in 1998-2001 as a result of the shrinking number of unemployed. However, it clearly increased in 2002-2004 as more money was allocated to active labour market measures and unemployment benefits were raised. On the other hand, the growth of social transfers in kind[10] was clearly higher than that of nominal trend GDP throughout the period. Finally, the ratio of subsidies decreased steadily year after year reflecting the fact that, apart from the level shift in 2000, their annual growth was on average close to zero.

3.4 Germany

Between 1997 and 2005, the general government budget balance ratio deteriorated by 0.7 percentage point. Taking into account the positive cyclical impact of 0.3 percentage point and the zero impact of temporary measures, the structural *balance* ratio fell by 0.9 percentage point, reaching –2.9 per cent in 2005. Owing to the significant drop in the average interest on government debt, the *interest* expenditure ratio declined by 0.5 percentage point despite a distinct rise in the debt ratio. The structural *primary balance* as a percentage of trend GDP decreased by 1.5 percentage points to –0.1 per cent. Overall, the unfavourable development of public finances was due mainly to weak revenue-side developments, while primary expenditure, in particular in 2003 and 2004, contributed noticeably to consolidation.

The structural *revenue* ratio fell by 2.9 percentage points to 43.4 per cent in 2005 in the 1998-2005 period. Given progressive taxation, the observation period saw a *fiscal drag* of 0.8 percentage point overall. It was much weaker than in earlier years in the light of low nominal growth rates. The positive influence of fiscal drag was more than offset by the fact that, adjusted for cyclical influences, compensation of employees – the macroeconomic base of wage taxes and social contributions – grew much more weakly than nominal GDP in the years 1998-2005. Consequently,

[10] To some extent, social transfers in kind resemble healthcare expenditure. Here, healthcare expenditure consists of social benefits, social transfers in kind and other current transfers that can be allocated to the function of the provision of public healthcare services.

wage taxes and social contributions grew more slowly than GDP in structural terms, so that the structural revenue ratio declined. Overall, the impact of the *decoupling* of macro bases from GDP amounted to –1.5 percentage points.

Tax measures and *legislation* changes concerning social security funds had, on balance, no influence on the revenue ratio. On the one hand, there was a distinct reduction in the direct tax burden; here the various steps of the income tax reform, which took effect in 2001, 2004 and 2005, played a particular role. That contrasted, however, with a perceptible rise in indirect taxes. This was, in particular, the result of the sharp hike in energy taxation in order to contribute to the financing of the pension insurance in the context of the "ecological tax reform".

Social contributions and indirect taxes developed considerably less favourably than one would expect given the changes in macroeconomic bases, the usual sensitivities and the changes in legislation, exerting a significantly negative influence on government revenue. Overall, this effect, which is captured in the *residual*, led to a decrease in the structural revenue ratio of 1.8 percentage points between 1997 and 2005. For turnover tax, this is likely to be due in part to tax evasion and usage of tax loopholes. Moreover, the composition of private consumption seems to have been shifted to a structure yielding less tax revenue. The negative residual for excise taxes is mostly concentrated in 2004 and 2005 when strong demand reactions to high energy prices and the increase in the rate of tobacco tax led to falling demand for mineral oil products and taxed cigarettes, which is only partly reflected in the underlying macroeconomic base (real private consumption). As regards social contributions, the negative residual may partly be attributable to the fact that a considerable number of insured persons left the statutory health insurance scheme to join private health insurance plans, making use of the clause which allows employees to opt out of the statutory health insurance scheme once they earn a certain gross salary. Since the drop-outs are mostly younger, higher-earning persons with relatively low expenditure risk, the structural financial situation of the statutory health insurance schemes deteriorated markedly. For direct taxes the overall residual is slightly positive. Here, a moderately positive value for wage taxes, which probably arose because the negative impact of the tax reductions was somewhat smaller than estimated, is offset by a negative residual in "profit-related taxes" (corporation tax, non-assessed tax on earnings, local business tax, interest withholding tax and assessed income tax).[11] For profit-related taxes there were also relatively strong swings between 1997 and 2005. This is due to the fact that the employed macroeconomic base, entrepreneurial and investment income, is linked only relatively loosely to the development of the true tax base over the period (e.g. deduction of depreciations is not taken into account). Moreover, lag structures linking revenue to the base are unstable over time.

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[11] According to the ESA categorisation, the local business tax is an indirect tax. However, the tax base is closely linked to entrepreneurial and investment income. The negative residual for indirect taxes and its fluctuations are partly attributable to the residual for the local business tax.

The ratio of *non-tax-related* revenue to adjusted GDP went down by 0.5 percentage point during the reporting period. About 0.3 percentage point of this fall can be attributed to changes in government revenue from sales. Since these are attributable to a significant degree to the (statistical) outsourcing of fee budgets (for example in the area of sewage and refuse disposal), they are likely to be reflected in a decline in expenditure of a similar size. In addition, the decrease in Bundesbank profits in the years 2003-2005 is a sizable contributing factor.

The *primary expenditure* ratio, adjusted for cyclical influences and temporary measures, went down by 1.4 percentage points to 43.5 per cent between 1997 and 2005, with 2004 being the decisive year. Nominal primary expenditure grew at an annual average of around 1.6 per cent. Though this is very moderate by historical standards, the growth in nominal trend GDP, which basically defines the scope for a deficit-neutral increase in expenditure, was not much higher at an average of about 2 per cent. In 2004, however, the structural primary expenditure ratio fell distinctly, reflecting the restrictive spending stance.

The fall in the adjusted primary expenditure ratio is due to several, and in some cases opposing, developments. In particular, the distinct reduction in staff in the public sector (representing nearly 10 per cent cumulatively) and a wage increase in the public sector which failed to match private sector pay hikes led to no more than moderate growth in *compensation of employees*. Furthermore, a distinct decline in *government investment* over time also has become apparent, reflecting recently mounting strains on municipal budgets. Together with the decline in *subsidies* and the moderate increase in intermediate consumption, these factors contributed a total of about 2 percentage points to consolidation between 1997 and 2005. Since these expenditure categories can be influenced, for the most part, in a discretionary manner and mostly without major legislation changes by the subsectors of government, the decrease reflects the restrictive expenditure policy over the period.

The aforementioned positive influence on deficits was offset to a significant extent by the increase in *social payments* (0.4 percentage point) and *capital transfers* (0.3 percentage point; included under “Other” in the table). A crucial factor was the strong rise in expenditure on old-age provision (0.6 percentage point) owing to an increase in old-age pensions as a consequence of a noticeable rise in the number of retirees and pensioners and the fact that the pension burden for former civil servants of the former Postal Services (Post Office, Telekom and Postbank) was largely assumed by the Federal Government. The increase in capital transfers is attributable mainly to the grant to private home buyers/builders (*Eigenheimzulage*), which rose until 2003 owing to the additional generations of recipients entering the system.[12] In contrast to the other years, in 2004 all expenditure categories contributed to consolidation. In particular, social payments fell distinctly. First, expenditure on retirement pensions grew only moderately because the rise in the number of pension payments and the increase of individual pensions was moderate. Second,

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12 For new cases the grant was reduced in 2004 and fully abolished in 2006. These measures will be reflected in a significant expenditure reduction in the following years.

Table 4

Germany – Changes in Structural Fiscal Components*

(percent of trend GDP)

Increasing +, decreasing –	1998	1999	2000	2001	2002	2003	2004	2005	98-05
Unadjusted balance(1)	**0.5**	**0.7**	**2.8**	**–4.1**	**–0.9**	**–0.3**	**0.3**	**0.3**	**–0.7**
Cyclical component	0.3	0.3	0.6	0.1	–0.4	–0.5	0.0	0.0	0.3
Temporary measures	0.0	0.0	2.4	–2.5	0.1	0.0	0.0	0.0	0.0
Balance	**0.2**	**0.4**	**–0.2**	**–1.8**	**–0.5**	**0.2**	**0.3**	**0.4**	**–0.9**
Interest payments	0.0	–0.2	0.1	–0.1	–0.2	0.0	–0.1	0.0	–0.5
due to changes in average interest rate	*–0.1*	*–0.3*	*0.0*	*0.0*	*–0.1*	*–0.1*	*–0.2*	*–0.1*	*–0.9*
due to changes in debt level	*0.1*	*0.1*	*0.0*	*–0.1*	*0.0*	*0.1*	*0.1*	*0.1*	*0.4*
Primary balance	**0.2**	**0.2**	**–0.1**	**–1.9**	**–0.7**	**0.2**	**0.2**	**0.4**	**–1.5**
Total revenue	**0.1**	**0.6**	**0.4**	**–2.0**	**–0.9**	**–0.3**	**–1.1**	**0.3**	**–2.9**
Direct taxes payable by corporations	**0.1**	**0.2**	**0.2**	**–1.1**	**0.0**	**0.2**	**0.2**	**0.1**	**–0.2**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Legislation changes	0.0	0.1	0.0	–0.5	0.2	0.0	0.1	0.2	0.1
Residual	0.0	0.1	0.2	–0.6	–0.2	0.1	0.1	–0.1	–0.4
Direct taxes payable by households	**0.2**	**0.2**	**0.4**	**–0.3**	**–0.3**	**–0.3**	**–0.6**	**–0.1**	**–0.9**
Fiscal drag	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	1.0
Decoupling of base from GDP	–0.1	–0.1	0.0	–0.1	–0.1	0.0	–0.1	0.0	–0.4
Legislation changes	–0.2	0.0	–0.2	–0.6	0.1	0.0	–0.6	–0.4	–2.0
Residual	0.4	0.2	0.4	0.2	–0.5	–0.3	0.0	0.3	0.5
Memo item: included in expenditure(2)	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Social contributions	**–0.2**	**–0.3**	**–0.2**	**–0.3**	**–0.2**	**–0.1**	**–0.3**	**0.0**	**–1.6**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	–0.3	–0.3	0.1	–0.1	–0.2	–0.1	–0.2	–0.1	–1.1
Legislation changes	0.2	0.1	–0.2	–0.1	0.1	0.2	0.0	0.0	0.1
Residual	–0.1	–0.1	0.0	0.0	–0.1	–0.2	–0.1	0.1	–0.6
Memo item: included in expenditure(2)	*–0.1*	*0.0*	*–0.1*	*–0.1*	*0.0*	*0.0*	*–0.1*	*0.0*	*–0.4*
Indirect taxes	**0.2**	**0.5**	**0.1**	**–0.3**	**–0.2**	**0.0**	**–0.2**	**0.1**	**0.2**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	–0.3
Decoupling of base from GDP	–0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	–0.1
Legislation changes	0.5	0.4	0.2	0.1	0.3	0.2	0.0	0.1	1.9
Residual	–0.3	0.1	–0.1	–0.4	–0.4	–0.1	–0.1	0.0	–1.3

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Taxes and social contributions overall	**0.1**	**0.6**	**0.5**	**–2.0**	**–0.7**	**–0.2**	**–0.9**	**0.1**	**–2.5**
Fiscal drag	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8
Decoupling of base from GDP	–0.4	–0.3	0.2	–0.2	–0.3	–0.1	–0.2	–0.1	–1.5
Legislation changes	0.5	0.6	–0.2	–1.1	0.7	0.4	–0.6	–0.2	0.1
Residual(3)	0.1	0.3	0.4	–0.9	–1.2	–0.6	–0.2	0.3	–1.8
Memo item: included in expenditure(2)	*–0.1*	*0.0*	*–0.1*	*–0.1*	*0.0*	*–0.1*	*–0.2*	*0.0*	*–0.5*
Non-tax-related revenue(4)	**–0.1**	**–0.1**	**–0.1**	**0.1**	**–0.1**	**–0.1**	**–0.2**	**0.2**	**–0.5**
of which EU(5)									
Total primary expenditure	**–0.1**	**0.4**	**0.5**	**–0.1**	**–0.2**	**–0.5**	**–1.3**	**–0.1**	**–1.4**
Social payments	–0.1	0.1	0.5	0.2	0.2	–0.1	–0.7	0.3	0.4
of which old-age pensions	*0.2*	*0.2*	*0.2*	*0.0*	*0.0*	*0.0*	*–0.2*	*0.2*	*0.6*
of which unemployment benefits	*–0.1*	*–0.1*	*0.1*	*0.0*	*0.0*	*–0.2*	*–0.2*	*0.0*	*–0.4*
of which social transfers in kind	*0.0*	*0.0*	*0.2*	*0.1*	*0.0*	*0.0*	*–0.3*	*0.1*	*0.1*
Subsidies	0.0	0.0	–0.1	–0.1	–0.1	–0.1	–0.1	–0.1	–0.6
of which EU(6)	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Compensation of employees	–0.2	–0.1	0.0	–0.2	–0.1	–0.2	–0.2	–0.2	–1.0
Intermediate consumption	0.0	0.2	–0.1	0.0	0.1	–0.1	–0.1	0.2	0.2
Government investment	0.0	0.1	–0.1	0.0	–0.1	–0.2	–0.1	–0.1	–0.5
Other(7)	0.2	0.1	0.2	0.1	–0.1	0.1	–0.2	–0.1	0.2
of which EU(8)	*0.0*	*–0.1*	*0.1*	*–0.2*	*0.0*	*0.1*	*–0.1*	*0.1*	*–0.1*
Memorandum items									
Health care(9)	0.0	0.0	0.1	0.1	0.0	0.0	–0.3	0.1	–0.1
Trend growth of real GDP	1.7	1.6	1.5	1.3	1.2	1.1	1.1	1.1	
Change in GDP deflator	0.6	0.3	–0.7	1.2	1.5	1.0	0.8	0.5	
Change in public employees	–1.8	–1.5	–1.0	–2.1	–0.9	–0.8	–1.2	–0.9	

* The fiscal balance is given according to the EDP definition, interest includes settlements under swaps and FRAs.

(1) Change in unadjusted balance, cyclical component and temporary measures as percentage of nominal GDP. Due to the different denominator, the change in the ratio of the structural balance to trend nominal GDP may deviate slightly from the change in the ratio to nominal GDP of the unadjusted balance less cyclical component less temporary measures.

(2) Payments attributable to the general government sector (estimated).

(3) May also include the change in the structural ratio of direct taxes not payable by corporations/households.

(4) Other current transfers receivable, sales and total capital revenue.

(5) Net receipts from EC budget if country is a net recipient from EC budget. Empty if country is net payer to EC budget.

(6) Expenditure paid by EC budget that is spent under category "Subsidies".

(7) Other current transfers payable, other net acquisitions of non-financial assets and capital transfers.

(8) If country is a net payer to EC budget: net payments to EC budget less expenditure paid by EC budget that is not spent under category "Other". If country is a net recipient from EC budget: expenditure paid by EC budget that is spent under category "Other".

(9) Social benefits, social transfers in kind and other current transfers that can be allocated into the function of the provision of public health care services.

Note: Due to rounding there might be deviations between aggregate numbers and the sum of individual numbers.

discretionary spending cuts in healthcare in 2004 (see memorandum item in the table) contributed considerably to consolidation in this year.

3.5 Italy

Between 1997 and 2005 the general government *balance* ratio in Italy worsened by 1.4 percentage points of GDP (see table below). The information conveyed by the unadjusted balance is partly modified if we exclude the effects of the improvement in cyclical conditions registered over the period and those, significantly larger, of the decline in the recourse to temporary measures. The structural deficit ratio increases by only 0.9 percentage points, from 3.4 per cent of trend GDP in 1997 to 4.3 per cent. The increase was limited by the large drop in *interest* payments (4.6 per cent of trend GDP), which largely reflected the reduction in average rates.

The high structural *primary surplus* achieved in 1997, which allowed Italy to participate in the European Monetary Union, almost vanished, worsening by 5.8 percentage points to 0.3 per cent of trend GDP. The fall in the structural primary balance was concentrated in 1998 and in the years 2001-03; over the entire period, almost two-thirds of the worsening can be attributed to weak revenue developments and one third to expenditure increases.

The structural *revenue* ratio fell by 3.5 percentage points in the years 1998-2005, to 43.5 per cent. The decline in the overall taxes and social security contributions ratio (2.8 percentage points) essentially reflected legislation changes (–3.5 percentage points), partly offset by the positive effects of the fiscal drag (0.8 percentage points) and of decoupling tax bases from GDP (0.2 percentage points). The decline in non-tax-related revenue (0.7 percentage points) was largely due to the fall in interest receivable (0.3) and in sales (0.2 percentage points).

Direct taxes on corporations and on households and social security contributions declined, by 1.7, 0.8 and 2.3 percentage points respectively, while indirect taxes rose by 2.0 percentage points. With the exception of direct taxes on households, which remained virtually unaffected, these developments largely reflect the 1998 tax reform which introduced a new regional tax on productive activities (IRAP). While in official estimates released when the reform was introduced, IRAP was expected to have a neutral effect on total revenue; in the legislation effects shown in Table 2 we include a negative impact close to –0.5 per cent of trend GDP. In our assessment, the reform implied reductions in social security contributions (–2.1 percentage points of trend GDP) and direct taxes on corporations (–1.1 percentage points), only partly offset by the increase in indirect taxes (2.7 percentage points) where the new tax was classified. Excluding the impact of the IRAP reform, over the period 1998-2005 social security contributions remained approximately stable while the other three components registered broadly similar reductions (ranging between 0.6 and 0.8 percentage points of trend GDP).

Concerning *legislation*, the permanent changes implemented over the period 1998-2005 are estimated to have reduced revenue in 2005 by approximately 3.5 per cent of trend GDP. The largest effect of legislation concerned direct taxes on households (–2.1 per cent of trend GDP), which more than offset the impact of fiscal drag (0.9 per cent of trend GDP) and direct taxes on corporations (–2.0 per cent of trend GDP). Tax reductions were sizable in 1998, reflecting the possibly unintended effect of the IRAP reform, in 1999-2001, as the favourable cyclical conditions and economic prospects in 1999 and in 2000 led the Government to use what was called the "growth dividend", and in 2003-04, as the marked slowdown in 2001-02 prompted actions aimed at helping the recovery. It should be emphasized that our assessment of the effects of legislation has to be considered as only broadly indicative. Indeed, the effects of a number of measures could not be assessed, lacking adequate information. Moreover, in many cases we could not perform an independent assessment but had to rely on government estimates.

Concerning the *residual* component, results for individual years can be partly explained by specific factors. The negative overall value in 1998 (0.3 per cent of GDP) partly reflects the reform of the taxation on financial assets, whose complexity has made it difficult to evaluate the impact on revenue. The reform was partly responsible for the fall in revenue from the withholding tax on interest revenue, from 1.8 per cent of GDP in 1997 to 0.9 per cent in 1998, largely reflected in the residual for the direct taxes on households. The latter is partly offset by the positive residual for direct taxes on corporations, which suggests that the indirect (positive) effects of the IRAP reform on these taxes may have been larger than the official estimates (included here). The positive residuals in 2000 are connected with the large amount of revenue from capital gains collected in that year (0.7 per cent of trend GDP); in the following year these extraordinary revenues largely vanished, resulting in a negative residual. The period 2001-03 was also affected, to an extent difficult to gauge precisely, by tax incentives for investment (Tremonti law). The negative residual in the direct taxes paid by corporation in 2002 seem to suggest that our estimates (0.2 per cent of GDP in 2002 and 0.1 per cent in the previous and subsequent years) may underestimate the actual loss of receipts related to the incentives. The recourse in the years 2001-05 to temporary withholding taxes on extraordinary operations (essentially, revaluation of assets and sales of companies) at reduced rates also affected ordinary revenue, albeit to an extent which is difficult to measure. These extraordinary taxes, included in the temporary measures, cumulatively generated revenue amounting to 2 percentage points of trend GDP.

The effects of *decoupling* tax bases from GDP were particularly sizable and negative in 1998. In the following years they were initially positive and afterwards showed small fluctuations around zero. Over the period 1998-2005 this factor had a positive impact on the dynamics of the revenue ratio, equal to 0.2 percentage points.

The structural *primary expenditure* ratio rose by 2.0 percentage points between 1997 and 2005; more than half of the increase occurred in 2001. Positive contributions came mostly from social transfers in kind (0.8 percentage points), a part of health care included in social payments, intermediate consumption

Table 5

Italy – Changes in Structural Fiscal Components*

(percent of trend GDP)

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Unadjusted balance(1)	**–0.1**	**1.1**	**0.9**	**–2.2**	**0.2**	**–0.6**	**0.1**	**–0.7**	**–1.4**
Cyclical component	0.6	0.4	0.0	0.2	–0.2	–0.2	–0.3	–0.2	0.3
Temporary measures	–0.2	–1.0	1.1	–0.6	1.1	0.2	–0.4	–1.0	–0.8
Balance	**–0.5**	**1.6**	**–0.3**	**–2.0**	**–0.6**	**–0.5**	**0.7**	**0.5**	**–0.9**
Interest payments	–1.1	–1.5	–0.1	0.0	–0.7	–0.6	–0.4	–0.2	–4.6
due to changes in average interest rate	*–1.2*	*–1.2*	*0.0*	*0.1*	*–0.7*	*–0.3*	*–0.3*	*–0.3*	*–3.9*
due to changes in debt level	*0.1*	*–0.3*	*–0.1*	*–0.1*	*0.0*	*–0.3*	*0.0*	*0.1*	*–0.7*
Primary balance	**–1.6**	**0.1**	**–0.4**	**–2.0**	**–1.3**	**–1.1**	**0.3**	**0.3**	**–5.5**
Total revenue	**–1.4**	**0.3**	**–0.1**	**–0.7**	**–1.1**	**–1.0**	**0.2**	**0.3**	**–3.5**
Direct taxes payable by corporations	**–0.8**	**0.1**	**–0.3**	**0.1**	**–0.6**	**–0.3**	**–0.2**	**0.3**	**–1.7**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Legislation changes	–1.1	0.1	–0.2	–0.2	–0.2	–0.2	–0.3	0.1	–2.0
Residual	0.3	–0.1	–0.1	0.3	–0.4	–0.1	0.0	0.2	0.1
Direct taxes payable by households	**–0.9**	**0.5**	**0.3**	**–0.4**	**–0.1**	**–0.1**	**0.0**	**0.0**	**–0.8**
Fiscal drag	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	1.2
Decoupling of base from GDP	–0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0
Legislation changes	0.0	–0.2	–0.6	–0.4	–0.1	–0.4	–0.1	–0.3	–2.1
Residual	–0.8	0.5	0.7	–0.2	–0.2	0.1	–0.1	0.1	0.1
Memo item: included in expenditure(2)	*–0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Social contributions	**–2.6**	**–0.1**	**0.2**	**–0.2**	**0.1**	**0.1**	**0.2**	**0.1**	**–2.3**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	–0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0
Legislation changes	–2.1	–0.2	–0.2	–0.1	0.0	0.0	0.1	0.0	–2.4
Residual	–0.3	0.0	0.2	–0.1	0.0	0.1	0.1	0.0	0.1
Memo item: included in expenditure(2)	*–0.5*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*–0.4*
Indirect taxes	**3.0**	**–0.3**	**0.1**	**–0.4**	**–0.2**	**–0.4**	**0.1**	**0.1**	**2.0**
Fiscal drag	–0.1	0.0	0.0	–0.1	–0.1	–0.1	–0.1	0.0	–0.4
Decoupling of base from GDP	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Legislation changes	2.7	–0.3	0.0	–0.1	0.1	0.1	0.1	0.3	2.9
Residual	0.4	–0.1	0.1	–0.2	–0.2	–0.4	0.1	–0.2	–0.5

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Taxes and social contributions overall	**–1.2**	**0.1**	**0.2**	**–0.8**	**–0.9**	**–0.7**	**0.0**	**0.5**	**–2.8**
Fiscal drag	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8
Decoupling of base from GDP	–0.4	0.2	0.3	0.1	0.0	0.0	0.0	0.1	0.2
Legislation changes	–0.5	–0.6	–1.0	–0.7	–0.2	–0.5	–0.2	0.2	–3.5
Residual(3)	–0.3	0.4	0.9	–0.3	–0.8	–0.3	0.2	0.1	–0.2
Memo item: included in expenditure(2)	*0.2*	*0.0*	*–0.1*	*0.0*	*0.0*	*0.0*	*0.2*	*–0.1*	*0.3*
Non-tax-related revenue(4)	**–0.2**	**0.2**	**–0.4**	**0.1**	**–0.1**	**–0.4**	**0.1**	**–0.2**	**–0.7**
of which EU(5)									
Total primary expenditure	**0.2**	**0.2**	**0.3**	**1.2**	**0.2**	**0.0**	**–0.2**	**0.0**	**2.0**
Social payments	–0.1	0.0	0.1	0.2	0.3	0.1	0.2	0.0	0.7
of which old-age pensions	*0.3*	*–0.1*	*0.0*	*0.1*	*0.1*	*0.0*	*0.0*	*–0.1*	*0.3*
of which unemployment benefits	*–0.1*	*0.0*	*–0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*–0.1*
of which social transfers in kind	*0.0*	*0.1*	*0.3*	*0.2*	*0.0*	*0.0*	*0.1*	*0.0*	*0.8*
Subsidies	0.0	–0.1	0.0	0.0	–0.1	–0.1	–0.1	–0.1	–0.4
of which EU(6)	*–0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*–0.1*
Compensation of employees	–0.9	0.0	0.1	0.1	0.0	0.1	–0.1	0.1	–0.6
Intermediate consumption	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.6
Government investment	0.2	0.1	0.1	0.1	0.0	0.0	0.1	–0.2	0.4
Other(7)	1.0	0.1	–0.2	0.6	0.1	–0.1	–0.4	0.2	1.2
of which EU(8)	*0.3*	*–0.1*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.3*
Memorandum items									
Health care(9)	0.0	0.2	0.4	0.2	0.0	–0.1	0.3	0.1	1.2
Trend growth of real GDP	1.6	1.6	1.6	1.4	1.3	1.1	1.1	1.1	1.3(10)
Change in GDP deflator	2.6	1.3	2.0	3.0	3.4	3.1	2.9	2.1	2.5(10)
Change in public employees	–0.7	0.1	1.2	1.3	0.7	0.7	–0.1	–0.2	0.4

* The fiscal balance is given according to the EDP definition, interest includes settlements under swaps and FRAs.

(1) Change in unadjusted balance, cyclical component and temporary measures as percentage of nominal GDP. Due to the different denominator, the change in the ratio of the structural balance to trend nominal GDP may deviate slightly from the change in the ratio to nominal GDP of the unadjusted balance less cyclical component less temporary measures.

(2) Payments attributable to the general government sector (estimated).

(3) May also include the change in the structural ratio of direct taxes not payable by corporations/households.

(4) Other current transfers receivable, sales and total capital revenue.

(5) Net receipts from EC budget if country is a net recipient from EC budget. Empty if country is net payer to EC budget.

(6) Expenditure paid by EC budget that is spent under category "Subsidies".

(7) Other current transfers payable, other net acquisitions of non-financial assets and capital transfers.

(8) If country is a net payer to EC budget: net payments to EC budget less expenditure paid by EC budget that is not spent under category "Other". If country is a net recipient from EC budget: expenditure paid by EC budget that is spent under category "Other".

(9) Social benefits, social transfers in kind and other current transfers that can be allocated into the function of the provision of public health care services.

(10) Period average.

Note: Due to rounding there might be deviations between aggregate numbers and the sum of individual numbers.

(0.6 points) and investment (0.4 points). The limited increase in expenditure on public pensions (0.3 points) reflected the effects of legislation aiming at curbing disbursements. Net of the effects of the IRAP reform, also compensation of employees and the expenditure included in the category "other" increased (by respectively, 0.1 and 0.5 percentage points). Overall, health care rose by 1.2 percentage points.

The IRAP reform led to a reduction in social security contribution rates for public employees which was matched by the recording of payments for the new tax: the reform explains 0.7 percentage points of GDP of the reduction in *compensation of employees* and of the increase in the category "other" registered in 1998. The increase in the cost of public employees, net of the impact of the reform, reflects the rise in their number over the period 1998-2005 (2.9 percentage points). Between 1992 and 2005 public employment in Italy has remained broadly stable. In a first sub-period (1993-1998), broadly corresponding to the years of the Italian budgetary consolidation aimed at ensuring Italy's participation in the Monetary Union from the outset, the number of public employees declined by 3.5 per cent. The reduction was more than offset by the increase registered in the following five years (3.9 per cent). In 2004-05 public employment cumulatively declined by 0.3 per cent.

Among the large components of expenditure, only subsidies declined in the period 1998-2005, by 0.3 percentage points of trend GDP.

3.6 The Netherlands

Between 1997 and 2005 the general government balance improved by 0.8 percentage point. Over the whole period, the cycle contributed mildly negatively to the change in the balance. In addition to the sale of UMTS-licences in 2000 (yielding 0.6 per cent of GDP), there was minor recourse to temporary measures in 2004, amounting to 0.2 per cent of GDP. Adjusted for these effects, the structural *balance* ratio improved by 1.0 percentage points to +0.8 per cent. These overall figures mark significantly different developments before and after 2001. Up to 2000, the structural general government balance improved, caused by falling *interest* payments. This, in turn, was caused by both lower average interest rates and a falling debt ratio. The structural primary surplus worsened slightly. The increase in the structural revenue ratio fell short of the increase in the structural primary expenditure ratio. 2001 marked a turnaround for the Dutch economy, and consequently, for public finances. Economic growth slumped and remained below its potential afterwards. This had a major impact on public finances, which was gradually unveiled only later. *Interest* payments continued to decline, albeit at a more moderate pace as the debt ratio started to increase again. Refinancing conditions remained favourable, though. The structural *primary balance* decreased markedly in 2001 and 2002, when both revenue decreased and expenditure increased. In 2003, consolidation measures started to take effect. The downward trend in the revenue ratio was reversed, while the expenditure ratio began to decrease. As a result, the structural primary balance started to improve again.

The structural *revenue* ratio declined by 3.0 percentage points between 1997 and 2002. Afterwards it increased by 2.4 percentage points. *Fiscal drag* contributed negatively in all years. This was mainly caused by social contributions, which are levied only over the two lowest tax brackets. This has a degressive effect which was particularly sizeable because of high nominal wage increases. For the other revenue categories, fiscal drag was only minor. As employment growth was strong and wages increased considerably in the years 1998-2003, the positive contribution of the *decoupling* of the base from GDP was substantial for direct taxes payable by households and especially social contributions. Decoupling contributed negatively to indirect tax receipts, reflecting relatively sluggish private consumption growth.

With a new cabinet taking office in 1998, *legislation changes* contributed relatively little to the observed revenue changes up to 2000. On balance, the tax burden was relieved somewhat. The tax reform of 2001 had a major negative impact on revenues. On balance, it is estimated to have lowered tax revenues by 1.8 per cent of GDP in 2001. The reform implied a shift from direct to indirect tax revenues. Income tax rates were lowered, the income tax base was broadened by eliminating various tax deductions, and social contribution rates were decreased. At the same time, the VAT rate was increased from 17.5 to 19 per cent, and energy taxes were increased. After 2002, the tax and social contribution burden was increased again in an effort to redress public finance problems. In particular, social contributions and energy taxes were raised.

The overall *residual* component is explained mainly by direct taxes on corporations, with particularly substantial residual contribution in the years 2002 and 2003. The likely cause is the complicated relation between profits and corporate taxation. When calculating the cyclically adjusted corporate tax revenues, an elasticity with respect to gross operating surplus of 1 is assumed. This is a far cry from the compensation schemes available for corporations, enabling them to carry back and forward losses for many years when determining taxable profits. Furthermore, it seems likely that the downturn on the stock markets and the related substantial write-offs on corporate balance sheets impaired corporate tax revenues – effects which are not fully captured in the tax base and elasticities used here. Another factor in the residual development of corporate taxes is natural gas revenue, which partly accrues to the government in the form of corporate tax on Gasunie's profits. In 2001, this factor accounted for an increase in corporate taxes of 0.1 per cent of GDP under the influence of rising (oil and) gas prices, but in 2003 it fell again by the same amount. A special factor in 2005 was the advanced payment of taxes following an increase in the statutory interest rate on overpaid taxes. This effect is estimated at ¼ per cent of GDP and self-reverses in 2006, when the overpaid taxes are reimbursed.

For other revenue categories, some sizeable residuals appeared in individual years. For direct taxes payable by households, additional variations in tax receipts come from the deduction of mortgage interest payments and pension premiums. Mortgage interest payments were increasing annually by 0.05 per cent of GDP on average in the years 1998-2005. Pension premiums were lowered in the years

Table 6

The Netherlands – Changes in Structural Fiscal Components*
(percent of trend GDP)

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Unadjusted balance(1)	**0.3**	**1.4**	**1.5**	**–2.4**	**–1.7**	**–1.2**	**1.1**	**1.8**	**0.8**
Cyclical component	0.9	0.3	0.6	1.0	–0.2	–1.4	–1.2	–0.3	–0.3
Temporary measures	0.0	0.0	0.6	–0.9	0.3	0.0	0.2	–0.2	0.0
Balance	**–0.6**	**1.0**	**0.3**	**–2.5**	**–1.7**	**0.3**	**2.0**	**2.3**	**1.0**
Interest payments	–0.3	–0.3	–0.6	–0.5	–0.4	–0.2	–0.1	–0.2	–2.5
due to changes in average interest rate	*0.0*	*–0.1*	*–0.2*	*–0.2*	*–0.3*	*–0.2*	*–0.1*	*–0.2*	*–1.4*
due to changes in debt level	*–0.2*	*–0.2*	*–0.4*	*–0.3*	*–0.1*	*0.0*	*0.1*	*0.0*	*–1.1*
Primary balance	**–0.8**	**0.8**	**–0.3**	**–3.0**	**–2.2**	**0.1**	**1.9**	**2.1**	**–1.5**
Total revenue	**–0.7**	**1.4**	**–0.2**	**–1.9**	**–1.7**	**0.0**	**1.3**	**1.1**	**–0.7**
Direct taxes payable by corporations	**0.0**	**0.0**	**0.0**	**–0.1**	**–0.6**	**–0.5**	**0.2**	**0.3**	**–0.7**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	–0.2
Legislation changes	0.0	0.0	0.0	0.0	0.0	0.0	0.2	–0.1	0.1
Residual	0.0	0.0	0.0	–0.1	–0.6	–0.5	0.0	0.4	–0.6
Direct taxes payable by households	**–0.3**	**0.1**	**0.0**	**–0.5**	**0.5**	**0.0**	**–0.1**	**0.8**	**0.3**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Decoupling of base from GDP	0.1	0.1	0.1	0.1	0.0	0.0	0.0	–0.1	0.3
Legislation changes	–0.2	–0.1	–0.2	–0.6	0.3	–0.2	0.0	0.6	–0.5
Residual	–0.2	0.0	0.1	0.0	0.1	0.1	–0.1	0.3	0.3
Memo item: included in expenditure(2)	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*
Social contributions	**–0.2**	**0.8**	**–0.1**	**–2.4**	**–0.7**	**0.7**	**0.8**	**–0.7**	**–1.8**
Fiscal drag	–0.2	–0.2	–0.3	–0.3	–0.2	–0.2	–0.1	–0.1	–1.5
Decoupling of base from GDP	0.3	0.3	0.1	0.2	0.1	0.0	–0.1	–0.2	0.7
Legislation changes	–0.1	0.2	0.0	–1.8	–0.1	0.8	0.3	0.0	–0.8
Residual	–0.2	0.6	0.1	–0.4	–0.4	0.1	0.6	–0.5	–0.2
Memo item: included in expenditure(2)	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*–0.1*	*–0.1*
Indirect taxes	**0.0**	**0.5**	**–0.1**	**0.4**	**–0.4**	**0.1**	**0.4**	**0.2**	**1.1**
Fiscal drag	0.0	0.0	–0.1	–0.1	–0.1	0.0	0.0	0.0	–0.4
Decoupling of base from GDP	0.0	0.0	–0.1	–0.1	–0.1	–0.1	0.0	–0.1	–0.4
Legislation changes	0.0	0.1	0.0	0.6	–0.2	0.3	0.2	0.2	1.1
Residual	0.0	0.4	0.0	0.0	0.0	–0.1	0.3	0.1	0.8

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Taxes and social contributions overall	**–0.5**	**1.5**	**–0.4**	**–2.6**	**–1.3**	**0.2**	**1.3**	**0.6**	**–1.1**
Fiscal drag	–0.2	–0.2	–0.3	–0.4	–0.2	–0.2	–0.1	–0.1	–1.6
Decoupling of base from GDP	0.4	0.4	0.1	0.1	–0.1	–0.1	–0.1	–0.3	0.4
Legislation changes	–0.3	0.2	–0.2	–1.8	–0.1	0.8	0.6	0.7	–0.1
Residual(3)	–0.3	1.1	0.1	–0.5	–0.9	–0.4	0.9	0.4	0.3
Memo item: included in expenditure(2)	*0.1*	*0.1*	*0.0*	*0.0*	*0.1*	*0.0*	*–0.1*	*–0.2*	*0.1*
Non-tax-related revenue(4)	**–0.3**	**–0.1**	**0.2**	**0.7**	**–0.4**	**–0.2**	**0.0**	**0.4**	**0.3**
of which EU(5)									
Total primary expenditure	**0.1**	**0.7**	**0.1**	**1.2**	**0.5**	**–0.1**	**–0.6**	**–1.0**	**0.8**
Social payments	–0.2	–0.2	–0.1	0.0	0.2	0.1	–0.1	–0.4	–0.7
of which old-age pensions	*0.0*	*0.0*	*–0.1*	*–0.1*	*0.0*	*0.0*	*0.0*	*–0.1*	*–0.2*
of which unemployment benefits	*0.0*	*–0.1*	*–0.1*	*0.0*	*–0.1*	*–0.1*	*–0.1*	*–0.1*	*–0.4*
of which social transfers in kind	*–0.1*	*0.0*	*–0.1*	*–0.5*	*0.0*	*0.0*	*0.0*	*0.0*	*–0.6*
Subsidies	–0.2	0.1	–0.1	0.0	0.0	–0.1	0.0	0.0	–0.3
of which EU(6)	*–0.1*	*0.0*	*0.0*	*–0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*–0.2*
Compensation of employees	0.0	0.2	–0.1	–0.1	0.1	0.1	0.0	–0.2	–0.1
Intermediate consumption	0.1	0.3	0.0	0.8	0.1	0.0	–0.1	–0.2	0.9
Government investment	0.1	0.1	0.1	0.3	0.2	–0.2	–0.3	–0.1	0.2
Other(7)	0.3	0.2	0.3	0.2	–0.1	0.1	–0.1	–0.1	0.7
of which EU(8)	*0.2*	*–0.1*	*0.0*	*–0.1*	*–0.2*	*0.0*	*0.1*	*0.2*	*0.2*
Memorandum items									
Health care(9)	0.0	0.1	0.1	0.2	0.5	0.3	0.1	0.0	1.2
Trend growth of real GDP	3.0	2.8	2.5	2.1	1.8	1.6	1.6	1.7	
Change in GDP deflator	1.7	1.5	3.9	5.2	3.8	2.5	0.9	1.6	
Change in public employees	3.1	0.9	0.8	1.8	2.1	0.4	–0.7	–1.3	

* The fiscal balance is given according to the EDP definition, interest includes settlements under swaps and FRAs.

(1) Change in unadjusted balance, cyclical component and temporary measures as percentage of nominal GDP. Due to the different denominator, the change in the ratio of the structural balance to trend nominal GDP may deviate slightly from the change in the ratio to nominal GDP of the unadjusted balance less cyclical component less temporary measures.

(2) Payments attributable to the general government sector (estimated).

(3) May also include the change in the structural ratio of direct taxes not payable by corporations/households.

(4) Other current transfers receivable, sales and total capital revenue.

(5) Net receipts from EC budget if country is a net recipient from EC budget. Empty if country is net payer to EC budget.

(6) Expenditure paid by EC budget that is spent under category “Subsidies”.

(7) Other current transfers payable, other net acquisitions of non-financial assets and capital transfers.

(8) If country is a net payer to EC budget: net payments to EC budget less expenditure paid by EC budget that is not spent under category “Other”. If country is a net recipient from EC budget: expenditure paid by EC budget that is spent under category “Other”.

(9) Social benefits, social transfers in kind and other current transfers that can be allocated into the function of the provision of public health care services.

Note: Due to rounding there might be deviations between aggregate numbers and the sum of individual numbers.

1999-2001, as the stock market boomed. As from 2002, premiums were increased again. For social contributions, the high residuals in some years may reflect inaccurate estimations of the elasticities and, especially in the years 2001-02, of the effect of legislation changes. Further analysis would be required to explain the origin of these residuals. The *residuals* for indirect taxes may point to composition effects in private consumption. The boom in private consumption up to and including 2000 and the bust afterwards were mainly concentrated in durable consumption (home furnishing, white and brown goods, computer equipment). These goods are all subject to the regular VAT of 17.5/19 per cent. Daily requirements like food, on the other hand, are subject to the lower tariff of 6 per cent. This composition effect in private consumption is not captured by the framework, and may partly explain the observed pattern of residuals.

Primary expenditure increased up to 2002. Afterwards, a downward trend started. *Social payments* decreased up to 2001, supported by decreasing unemployment and rising participation rates. This was partly offset by increasing *compensation of employees* both due to rising public sector employment and public sector wages. Starting in 2000, healthcare expenditure growth accelerated, reflecting increasing wages and employment, and an effort to reduce waiting lists. In 2003, consolidation measures turned the upward trend of primary expenditure around. Public wages and social benefit increases were contained from this year onwards, and measures were taken to curb healthcare expenditure.

3.7 Portugal

Between 1997 and 2005, the general government balance as a percentage of GDP deteriorated by 3.3 percentage points.[13] Adjusted for the effects of the economic cycle and for temporary measures, which both contributed to this result, the structural *balance* as a percentage of trend GDP still declined by 2.3 percentage points, reaching –5.2 per cent in 2005. This outcome resulted from a sizeable increase in the expenditure ratio (3.6 percentage points), which more than compensated for the rise in the revenue ratio (1.3 percentage points). As interest expenditure as a percentage of trend GDP decreased by 1.2 percentage points, mainly owing to the decline in the average interest rate on public debt, the hike in the primary expenditure ratio was very significant (4.8 percentage points). As a consequence, there was considerable deterioration in the structural primary balance ratio (3.5 percentage points), predominantly concentrated in the years 1997 to 2001.

The rise in the structural revenue ratio in the 1998-2005 period resulted from strong increases in tax receipts and social contributions that more than outweighed the decline in non-tax related revenue. However, if the effects of tax receipts and social contributions also recorded on the expenditure side are netted out, the rise appears less pronounced. Indeed, the evolution of social contributions in this period

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13 This section is based on the national accounts data available at the end of October 2006.

stems predominantly from an increase in the social contributions of civil servants, which are recorded on the expenditure side under the item compensation of employees, and in imputed social contributions that are included in social payments and compensation of employees. Adjusted for these two items, which are treated as a residual in the current application of the methodology for Portugal, the overall tax and social contributions ratios only increased by 1.4 percentage points between 1997 and 2005.

In this period, fiscal drag represented 0.5 percentage point and stemmed from the positive effect of progressive taxation in direct taxes paid by households. It is worth mentioning that, although the elasticity of indirect taxes to its macroeconomic base used in the calculation of the cyclical component is slightly above 1, due to shifts in private consumption toward a bigger share of goods and services taxed at the standard VAT rate in periods of strong growth (and the opposite during recessions), a zero fiscal drag was assumed. Indeed, the changes in the consumption pattern are essentially of a cyclical nature, not contributing to the improvement/deterioration of the structural indirect tax receipts ratio.

The effects of the decoupling of the tax bases from GDP were not particularly significant in the Portuguese case, with the exception of direct taxes paid by corporations. However, the decomposition of corporate income tax receipts is not straightforward given the difficulties associated with the choice of a proper macroeconomic base, the lagged effects resulting from the deduction of losses and the uncertainty of the estimates of the effects of changes in tax legislation. Indeed, the practical implementation of this framework to the Portuguese data showed that the estimated elasticity (6 with respect to real private GDP) is too high. As a provisional solution, the corporate income tax receipts elasticity used in the presented calculations is lowered to 4 but a deeper analysis of the question will be carried out later. Based on these assumptions, the effect of the decoupling of the tax base from GDP in corporate income tax receipts amounts to 0.8 percentage point in the period under analysis, although it is partly offset by a residual with an opposite sign.

On taxes and social contributions overall, the effects of changes in legislation were not very significant between 1998 and 2005, and represented as a whole an increase of only 0.1 percentage point. Nevertheless, the analysis by category of tax shows that the rises in indirect taxation, essentially VAT and tax on oil products, more than compensated the declines in direct taxation paid by both households and corporations.

Finally, the residual component appears to have had a positive effect on the change in the structural tax revenue ratio over the period 1998-2005 as a whole. However, if the part of social contributions that is also included in expenditure is subtracted, the residual becomes almost zero. Regarding direct taxes payable by households, the negative residual in most of the years considered in the analysis can be explained by errors in the measurement of tax legislation changes and, in some years, by net reimbursements differing from what would be expected from the legislative changes and their reflection in the update of the withholding tables. In the

Table 7

Portugal – Changes in Structural Fiscal Components*

(percent of trend GDP)

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Unadjusted balance[1)]	**0.0**	**0.0**	**–0.2**	**–1.4**	**1.4**	**–0.1**	**–0.3**	**–2.9**	**–3.3**
Cyclical component	0.3	0.5	0.6	–0.2	–0.4	–1.0	–0.1	–0.2	–0.6
Temporary measures	–0.4	0.0	0.3	–0.3	1.3	1.0	–0.2	–2.1	–0.4
Balance	**0.0**	**–0.6**	**–1.2**	**–0.8**	**0.6**	**0.1**	**0.1**	**–0.5**	**–2.3**
Interest payments	–0.7	–0.2	0.0	0.0	–0.2	–0.2	–0.1	0.0	–1.2
due to changes in average interest rate	*–0.4*	*–0.1*	*0.0*	*–0.1*	*–0.3*	*–0.3*	*–0.1*	*–0.1*	*–1.4*
due to changes in debt level	*–0.2*	*–0.1*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*
Primary balance	**–0.6**	**–0.8**	**–1.1**	**–0.8**	**0.4**	**–0.1**	**0.0**	**–0.5**	**–3.5**
Total revenue	**0.0**	**0.7**	**–0.7**	**–0.1**	**0.7**	**0.2**	**0.7**	**–0.1**	**1.3**
Direct taxes payable by corporations	**–0.2**	**0.3**	**0.0**	**–0.4**	**–0.1**	**–0.6**	**0.6**	**0.1**	**–0.2**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.8
Legislation changes	–0.2	0.0	0.2	–0.2	0.0	–0.1	0.1	–0.4	–0.7
Residual	–0.2	0.1	–0.3	–0.2	–0.1	–0.5	0.4	0.5	–0.3
Direct taxes payable by households	**–0.2**	**0.0**	**0.3**	**0.0**	**–0.3**	**0.1**	**–0.1**	**0.1**	**–0.1**
Fiscal drag	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.5
Decoupling of base from GDP	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Legislation changes	0.0	0.0	0.0	–0.3	–0.1	0.1	0.0	–0.1	–0.4
Residual	–0.3	–0.1	0.2	0.3	–0.3	–0.1	–0.2	0.1	–0.4
Memo item: included in expenditure[(2)]	*0.1*	*0.1*	*0.1*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.4*
Social contributions	**0.1**	**0.1**	**0.5**	**0.2**	**0.2**	**0.3**	**0.4**	**0.1**	**1.8**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	0.0	0.0	–0.1	–0.1	–0.1	0.0	0.0	0.0	–0.2
Legislation changes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual	0.2	0.1	0.5	0.3	0.2	0.3	0.4	0.0	2.0
Memo item: included in expenditure[(2)]	*0.1*	*0.0*	*0.3*	*0.0*	*0.2*	*0.3*	*0.3*	*0.0*	*1.3*
Indirect taxes	**0.4**	**0.1**	**–0.5**	**0.1**	**0.3**	**0.1**	**–0.1**	**0.7**	**1.2**
Fiscal drag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Decoupling of base from GDP	–0.2	–0.1	0.1	0.0	–0.1	0.0	0.1	0.0	–0.2
Legislation changes	0.0	0.0	–0.6	0.3	0.6	0.5	0.1	0.3	1.2
Residual	0.6	0.2	0.0	–0.2	–0.3	–0.4	–0.2	0.4	0.1

Increasing +, decreasing –	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**98-05**
Taxes and social contributions overall	**0.1**	**0.5**	**0.4**	**–0.1**	**0.1**	**–0.1**	**0.8**	**0.9**	**2.7**
Fiscal drag	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.5
Decoupling of base from GDP	0.0	0.1	0.3	0.0	–0.1	0.1	0.1	0.1	0.5
Legislation changes	–0.2	0.0	–0.4	–0.2	0.5	0.5	0.2	–0.3	0.1
Residual(3)	0.2	0.4	0.4	0.1	–0.4	–0.7	0.4	1.0	1.5
Memo item: included in expenditure(2)	*0.2*	*0.1*	*0.5*	*0.0*	*0.3*	*0.3*	*0.3*	*0.1*	*1.8*
Non-tax-related revenue(4)	**–0.2**	**0.1**	**–1.1**	**0.0**	**0.6**	**0.3**	**–0.1**	**–1.0**	**–1.3**
of which EU(5)	*0.0*	*–0.1*	*–0.9*	*–0.4*	*0.5*	*0.7*	*–0.1*	*–0.7*	*–1.0*
Total primary expenditure	**0.6**	**1.4**	**0.4**	**0.8**	**0.3**	**0.3**	**0.7**	**0.4**	**4.8**
Social payments	0.4	0.4	0.7	0.4	0.5	1.8	0.4	0.8	5.4
of which old-age pensions	*0.1*	*0.2*	*0.4*	*0.3*	*0.3*	*0.5*	*0.5*	*0.5*	*2.6*
of which unemployment benefits	*0.0*	*0.1*	*0.1*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.3*
of which social transfers in kind	*0.0*	*0.1*	*0.0*	*0.1*	*0.1*	*1.1*	*0.0*	*0.4*	*1.8*
Subsidies	0.2	0.2	–0.5	0.3	0.0	0.3	–0.3	0.1	0.3
of which EU(6)	*0.2*	*0.0*	*–0.4*	*0.2*	*0.1*	*–0.1*	*0.0*	*0.0*	*0.1*
Compensation of employees	0.3	0.6	0.7	0.1	0.3	–0.9	0.1	0.1	1.3
Intermediate consumption	–0.1	0.3	0.3	0.0	–0.2	–0.5	0.2	0.0	0.1
Government investment	–0.3	0.3	–0.3	0.1	–0.4	–0.5	0.0	–0.3	–1.4
Other(7)	0.2	–0.4	–0.5	–0.2	0.0	0.1	0.3	–0.4	–0.9
of which EU(8)	*0.0*	*–0.2*	*–0.5*	*–0.4*	*0.4*	*0.6*	*–0.2*	*–0.2*	*–0.5*
Memorandum items									
Health care(9)	-	-	-	-	-	-	-	-	
Trend growth of real GDP	3.0	2.8	2.5	2.1	1.6	1.3	1.1	1.1	
Change in GDP deflator	3.8	3.3	3.0	3.7	3.9	3.1	2.5	2.4	
Change in public employees	3.4	4.9	2.2	2.5	2.0	–5.9	0.8	1.2	

* The fiscal balance is given according to the EDP definition, interest includes settlements under swaps and FRAs.

(1) Change in unadjusted balance, cyclical component and temporary measures as percentage of nominal GDP. Due to the different denominator, the change in the ratio of the structural balance to trend nominal GDP may deviate slightly from the change in the ratio to nominal GDP of the unadjusted balance less cyclical component less temporary measures.

(2) Payments attributable to the general government sector (estimated).

(3) May also include the change in the structural ratio of direct taxes not payable by corporations/households.

(4) Other current transfers receivable, sales and total capital revenue.

(5) Net receipts from EC budget if country is a net recipient from EC budget. Empty if country is net payer to EC budget.

(6) Expenditure paid by EC budget that is spent under category "Subsidies".

(7) Other current transfers payable, other net acquisitions of non-financial assets and capital transfers.

(8) If country is a net payer to EC budget: net payments to EC budget less expenditure paid by EC budget that is not spent under category "Other". If country is a net recipient from EC budget: expenditure paid by EC budget that is spent under category "Other".

(9) Social benefits, social transfers in kind and other current transfers that can be allocated into the function of the provision of public health care services.

Note: Due to rounding there might be deviations between aggregate numbers and the sum of individual numbers.

case of social contributions, the overall positive contribution of its residual to consolidation might be partly explained by efficiency gains in tax collection. Lastly, it should be mentioned that the positive residual of indirect taxes between 1997 and 1999 basically relied on the structural increase of the average implicit VAT rate. This can be explained by a more significant shift in the composition of private consumption towards more goods and services taxed at the standard rate and less at the reduced rates than assumed implicitly in the calculation of the cyclical component, the modernisation of the distribution circuits and some efficiency gains in tax collection. In 2001, with the beginning of the cyclical downturn, this behaviour is partially reversed, more than offsetting the previous favourable evolution, which may partly indicate an underestimation of the cyclical component elasticity. A final remark should be added concerning the very significant residual of overall taxes and social contributions in 2005 (1.0 percentage point). Indeed, from the end of 2004, there was a considerable effort to improve the procedures in tax collection by the tax administration, leading to a substantial rise in tax and social contribution receipts in 2005.

The ratio of *non-tax-related* revenue to trend GDP declined by 1.3 percentage points between 1997 and 2005, which can be explained to a large extent by the decrease in net receipts from the EU budget.

The increase in the *primary expenditure* ratio by 4.8 percentage points stems predominantly from the evolution of the *social payments* and *compensation of employees* ratios, which rose by 5.4 and 1.3 percentage points respectively, outweighing the decline in the *public investment* ratio (–1.4 percentage points). The behaviour of social payments is largely related to the increase in pension expenditure, both in the private sector and the civil servants pension system. It resulted from an expansion in the number of pensioners, related to the ageing of population in the case of the private sector and a rise in the average pension since the systems have not reached maturity yet. Part of the rise in compensation of employees is due to the above-mentioned increase in social contributions to the civil servants pension system. Furthermore, it is a consequence of the rise in the number of civil servants, the effect of automatic promotions and extraordinary revisions in some specific carriers over the 1998-2001 period. From mid-2002 to 2005 the fiscal authorities implemented some measures to limit the growth in the civil servants wage bill. They consisted, essentially, of controlling the number of civil servants, eliminating extraordinary revisions in carriers, almost freezing the update of the public employees wage scale in 2003 and 2004 and freezing automatic promotions from the middle of 2005 until the end of 2007. Finally, it should be noted that the transformation of some public hospitals into public corporations in 2003 led to a shift in expenditure categories. More specifically, in that year a distinct increase in social transfers in kind was roughly offset by a decline in compensation of employees and intermediate consumption. If these hospitals had remained within the general government sector, social transfers in kind would have grown less strongly and compensation of employees and intermediate consumption would have recorded higher overall changes in their ratios to GDP.

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DECOMPOSING BUDGET BALANCES FOR AUSTRIA

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1. Introduction and motivation

The Maastricht Treaty and the Stability and Growth Pact (SGP) stipulate that budget balances in EU countries should be balanced over the business cycle, since this would allow automatic stabilisers to work properly in cushioning cyclical fluctuations and to create some room for discretionary policy. Hence, in order to act in accordance with the intention of the SGP, governments should avoid pro-cyclical policies in recessions and strive for budgetary consolidation during economic booms; in other words, governments should behave counter-cyclically and react symmetrically to output fluctuations. This "ideal" notwithstanding, there is some evidence that fiscal policy behaved more pro-cyclically than counter-cyclically in the past decades. Thus the question arises to which extent a fiscal policy regime change is or would have been necessary in order for governments to comply with the spirit of the European fiscal rules.

In order to analyse this issue for a country – as we do for Austria in this paper – one has to assess whether discretionary fiscal policy has actually offset or reinforced the operation of automatic fiscal stabilisers, whether there have been significant transitory variations in the fiscal position unrelated to business cycle fluctuations, and what the behaviour of the underlying ("core") fiscal position over time has been. The variability of the latter reflects discretionary measures not related to the cycle, such as permanent consolidation measures, measures aiming at distributional and allocative/structural goals or effects of macroeconomic shocks, demographic changes, etc.

The economic cycle affects a government's fiscal position – this is all but new. Correcting budget balances for the effects of the business cycle in general gives a better measure of the policy-related part of the budget and reduces the simultaneity bias that may arise as budgets and economic growth interact. The conventional approach relies on adjusting the budget balance for the impact of the automatic stabilisers, *i.e.* decomposing the budget balance into two components: the cyclically-adjusted balance and the automatic stabiliser component (or cyclical component). Adjusting the budget balance for the impact of the automatic stabilisers is only appropriate, for example, for predicting the room for discretionary stabilisation policy measures in an economic slowdown, given a threshold for the general government deficit (since in this case the cyclical component should indeed

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be limited to effects of the automatic stabilisers). If, however, the aim is to analyse the policy behaviour related to macroeconomic developments, the adjustment should also include discretionary fiscal measures that have been a normal feature of a country's stabilisation policy (Boije, 2004).

On closer inspection, however, the cyclically-adjusted budget balance contains several components that capture different dimensions of fiscal policy, such as a core balance describing the underlying fiscal position; a component reflecting discretionary fiscal policy responses to the business cycle that can move either pro- or counter-cyclically with the output gap; and a residual component capturing all remaining shocks to the fiscal position, reflecting transitory changes in the fiscal position due to non-stabilisation-oriented discretionary policy and/or macroeconomic shocks.[1] Disregarding these latter aspects could provide an explanation for the sometimes quite substantial variations of cyclically-adjusted balances during the cycle.

Following an approach suggested by Jaeger (1998) and expanded by Brandner and Diebalek (2000), we track fiscal policy behaviour over time by decomposing the observed budget balance (as a percentage of GDP) into four unobserved components: (1) a core balance, (2) an automatic or built-in fiscal stabiliser component, (3) a component reflecting discretionary fiscal policy responses to the business cycle, and (4) a component reflecting all other transitory shocks to the fiscal position.

By means of an unobserved components (UC) model, we provide an estimate of a core balance for Austria. For this purpose we analyse the relationship between the budget balance and the cyclical development of the Austrian economy by looking at the impact of both automatic stabilisers and discretionary policies aimed at output stabilisation – with particular attention to the latter.[2] By doing this, we can assess whether fiscal policy in a broader sense was pro- or counter-cyclical or reacted asymmetrically in up- or downturns. Moreover, by looking at disaggregated data, we can answer the question whether the pro-cyclicality/counter-cyclicality was related primarily to the expenditure or the revenue side.

In Section 2 we discuss some related literature before we move on to explain the methodology chosen in Section 3. Section 4 is devoted to the discussion of the main results of our study; in Section 5 we draw some conclusions.

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1 Galí and Perotti (2003) conceptually split the cyclically-adjusted budget balance into a "systematic" or "endogenous" component (a component that reflects changes in structural spending or revenues in a systematic way in response to changes in the actual or expected cyclical conditions of the economy; corresponding to [illegible] in Section 3) and in a "non-systematic" or "exogenous" component (that captures changes in the budget variables that do not correspond to systematic responses in cyclical conditions, but are instead the consequence of exogenous political processes of extraordinary non-economic circumstances; corresponding to what we name core balance in this paper).

2 Further research will focus on the analysis of the "driving forces" of the core balance.

2. Related literature

The behaviour of fiscal policy over the business cycle has received increasing attention from researchers in recent years. The conventional wisdom is that fiscal policy should be counter-cyclical, stabilising economic growth around potential. In a recession, this would call for higher deficits, while in a boom a contractionary budget would help dampen cyclical upswings and prevent the economy from overheating. This "ideal" notwithstanding, evidence of pro-cyclicality in fiscal policy has been uncovered in a number of studies.

Galí and Perotti (2003) show that EMU countries' fiscal policies seem to have been significantly pro-cyclical in the pre-Maastricht period. In the post-Maastricht period, however, EMU countries' fiscal policies appear to be more counter-cyclical. According to Galí and Perotti, the behaviour of discretionary fiscal policy during recessions turned from being somewhat pro-cyclical to becoming counter-cyclical. EMU countries seem to have been lagging behind non-EMU countries since they pursued largely pro-cyclical policies during the recession of the early 1990s and changed their behaviour only in the early 2000s. Galí and Perotti base their study on both a panel estimate and individual country regressions. With respect to Austria, interestingly, they find a mildly counter-cyclical fiscal policy before Maastricht (a feature that is in contrast to all other EMU countries) and a stronger counter-cyclicality in the post-Maastricht period.

Hallerberg and Strauch (2002) find pro-cyclical policies for the last three decades, at least for the EU. According to Hallerberg and Strauch, discretionary measures have tended to undermine automatic stabilisers while taxes have fluctuated counter-cyclically in a conventional manner. On the expenditure side, they find that public investment displays a consistent pro-cyclical pattern. The latter was also found by Alberola *et al.* (2003).

Buti, Franco and Ongena (1997), too, state that contractionary fiscal policies prevailed during recessions and that fiscal discipline was lacking during the expansionary periods as deficits persisted during mild phases of expansions and only abated at the peaks. They conclude that the deterioration during expansions was much more marked than the strengthening of fiscal discipline during recessions, as the debt ratio grew sharply in the 1980s and the first half of the 1990s.

Pro-cyclicality of fiscal behaviour in the EMU countries has also been observed by the IMF (2004). Based on a method very similar to Galí and Perotti (2003), the study shows that the degree of pro-cyclicality reflects, inter alia, country-specific budgetary institutions, structural characteristics, such as the sensitivity to real disturbances, and inherited fiscal positions. According to this IMF study, pro-cyclical fiscal impulses turn out to be more pronounced in good times (loosening) than in bad times (tightening), which points to the difficulty of resisting pressures to increase spending or cut taxes in the face of revenue windfalls. The study, however, also finds that the European fiscal framework appears to have led to some reduction in pro-cyclical fiscal behaviour in EMU, owing to a more counter-cyclical policy stance in bad times that was not balanced out by sufficient deficit reduction in good times.

Also the European Commission (2001) comes to the conclusion that between 1970 and 2000 the deficits of EU countries did not fall during favourable cyclical periods, *i.e.* that the effects of the automatic built-in stabilisers were offset by countries' discretionary fiscal policies, namely by tax cuts and, in particular, by expenditure increases, which necessitated a tightening during economic downturns.

Gavin and Perotti (1997) detect that in Latin American countries – in sharp contrast to the industrial economies – fiscal policies have been pro-cyclical, and particularly so in recessions. For industrial countries they find asymmetries insofar as budget surpluses increase during good times; during bad times, however, the fiscal response to changes in output growth is much larger. In their view, for industrial countries this is consistent with the idea that recessions are economically and/or politically more costly than output booms, and that the fiscal policy response to them is accordingly stronger. But it is also consistent with the idea that some elements of the fiscal structure, such as unemployment compensation, are relatively insensitive to the business cycle at high levels of economic activity, but become larger in deep recessions.

As pro-cyclicality contrasts with the stabilisation function of fiscal policy, a number of explanations are offered for these results, including conflicting policy goals, information problems (real-time data problems), complexity of decision-making and (standard argument against fine tuning) implementation lags. Talvi and Vegh (2000) offer a model rationalising pro-cyclical fiscal policies primarily in developing countries but also in the industrialised world – for countries with a large variability of the tax base in general. If the latter is the case, tax smoothing would require large deficits to be run in economic downturns, and high surpluses in upswings. But finance ministers may be tempted to avoid large surpluses knowing that they will nurture political pressures to spend public monies, and prefer to run a pro-cyclical policy. Tornell and Lane (1999), on the other hand, argue that the degree of political competition increases during upswings. After all, each group or power block competing for public resources knows that governments will not run surpluses during economic expansions, but that other groups will increase their appropriate share by an even greater amount. Therefore, they will compete more intensely for resources during expansions, and less so during recessions. As a consequence, fiscal policy becomes more pro-cyclical the more fragmented and open governments are to such pressures.

Yet a range of literature also points to possible asymmetries in fiscal responses to recessions and upturns. Mayes and Virén (2004) find strong evidence of asymmetric cyclical behaviour of government deficits, with these asymmetries mainly relating to the cyclically-adjusted deficit. Structural deficits increase when output shrinks, but they (or surpluses) also tend to increase (decrease) when output expands (surpluses decrease). According to Mayes and Virén, the different cyclical effects show up in both revenues and expenditures. Revenues seem to be more sensitive to output growth in depressions than in booms. Thus, in booms, the revenue/trend output ratio remains more or less constant, while in depressions it decreases quite markedly. Expenditures seem to increase in depressions and decrease in booms. They conclude that from the viewpoint of counter-cyclical fiscal policy, the main problem appears to be behaviour in "good times" when discretionary action does not seem to help smooth the output growth path.

Also the OECD (2003) concludes – on the basis of a panel estimate – that, overall, countries conducted pro-cyclical fiscal policies in cyclical upturns and counter-cyclical policies in downturns. However, sustainability problems associated with indebtedness seem to be a key determinant of whether the fiscal stance is pro-cyclical during downturns.

Forni and Momigliano (2004), using real time data, find that fiscal policy was generally counter-cyclical during adverse economic periods. They conclude that fiscal policy was more counter-cyclical at the beginning of the 1990s than during the recent downturns.

Balassone and Francese (2004), too, highlight that fiscal policies in OECD countries have been counter-cyclical mainly in downturns. While automatic stabilisers are left free to operate during downturns, during expansions their effect is compensated by discretionary loosening, which implies that budgetary balances are not improving in upturns. Moreover, they show that overall elasticities (including the discretionary actions) are asymmetric with respect to upturns and downturns.

Tujula and Wolswijk (2004) show that fiscal policies have not operated symmetrically over the business cycle as governments have been more prone to stimulate economies in downswings via expanding budgets than to restrict economic growth in upswings via tightening budget balances.

In contrast to the above mentioned studies, Mélitz (2000) highlights that fiscal policy responds in a stabilising manner to the cycle; the automatic stabilisation through fiscal policy is, however, much weaker than generally perceived.[3] Moreover, while expansion raises tax receipts, it also raises government expenditures. Net stabilisation therefore only occurs because of a larger reaction of taxes than expenditures. His findings are in principle in line with Wyplosz (1999), who also shows the "same mildness" of the stabilising response to the cycle. According to Wyplosz' estimates an extra percent of output above potential raises the primary budget surplus by 0.18 (Mélitz' estimate, in contrast, amounts to about 0.10). This actually means weak automatic stabilisation in contrast to what is usually estimated (see van den Noord, 2000, Girouard and André, 2005). Lane (2003) finds that current government spending tends to be mildly counter-cyclical; however, the government consumption component of current spending is pro-cyclical. Hence, he concludes that the counter-cyclical behaviour of current government spending

[3] According to Wyplosz (2002) this mildly stabilizing response (coefficients of 0.1-0.2 instead of around 0.5) could be an effect of the extension of the sample period to include the 1990s, an atypical period of low growth and closing down of the deficit to meet the Maastricht convergence criteria. It may also reflect the combination of the counter-cyclical automatic stabilizers, with an elasticity of 0.5, with discretionary pro-cyclical actions.

emanates from the behaviour of government transfers (automatic stabilisers) and/or debt interest payments. The most pro-cyclical component of government spending is government investment.[4] Wage government spending is highlighted as the most important channel by which these variables affect fiscal cyclicality. Hercowitz and Strawczynski (2004) – similar to Lane (2003) – find the deficit/GDP ratio to be counter-cyclical. According to their finding, this is mostly due to recessions whereas in expansions, the deficit/GDP ratio is essentially a-cyclical.

In checking for the cycle dependency of cyclically-adjusted figures of the European Commission, Alberola *et al.* (2003) by means of a panel estimate conclude that the cyclical component seems to be overestimated, which means that the cyclically-adjusted balances tend to be systematically overestimated during downturns and underestimated during expansions. According to their findings, the overall impact seems, however, to be counter-cyclical in general. In their opinion this result might signal a problem with the computation of elasticities, which turn out to be too high; at the same time, the results could capture a systematic discretionary reaction of governments to developments in economic activity. But, as they state, it does not appear to be easy to disentangle the two possibilities from each other.

The approaches taken for investigating the cyclical-related impact of fiscal policies (from built-in stabilisers as well as from deliberate policy decision) are quite heterogenous. Some studies analyse overall changes in the budget balance (primary or total), without distinguishing between discretionary actions and automatic stabilisers (e.g. Mélitz, 2000, Balassone and Francese, 2004, Tujula and Wolswijk, 2004, Lane, 2003, Mayes and Viren, 2004, Fatás and Mihov, 2001) whereas others analyse changes in the cyclically-adjusted balances (e.g. Alberola *et al.*, 2003, OECD, 2003, Forni and Momigliano, 2004) or the impact on the level of cyclically-adjusted primary balances (e.g. Galí and Perotti, 2003).

3. A stylised framework

Several techniques have been developed to estimate the variations of budget aggregates arising from the economic cycle.[5] The conventional approach (e.g. EC, OECD, IMF) to correct budget balances for fluctuations in economic activity starts from a notional decomposition of the observed budget balance b_t into two (unobserved) components: the cyclically-adjusted budget balance bs_t, often called "structural" balance, and a cyclical component ba_t aimed at capturing the built-in stabilisers. To adequately estimate the cyclical component ba_t, various methods have been developed by international institutions such as the EC, the OECD, the

[4] Also Alberola *et al.* (2003) confirm this result.

[5] However, all these techniques are subject to a number of methodological problems, notably defining trend/potential output – a shortcoming that unfortunately is also valid for our approach.

IMF and the ECB. Within these approaches, the structural balance bs_t is defined as the difference between the observed and the cyclical balance, $bs_t = b_t - ba_t$. Obviously, any other dimension of fiscal policy, even if it is related with the cycle, shows up in the structural component.

However, if the focus is on the development of the underlying fiscal position (adjusted for all temporary impacts irrespective of whether they are "economy dependent or cyclically dependent", Braconier and Forsfält, 2004, p. 4) a direct calculation of the structural balance as a "long-run component" via specific filtering techniques (see Brandner, Diebalek and Schuberth, 1998) may be more appropriate. If so, the effects of the built-in stabilisers as well as cyclically related discretionary measures are captured in the resulting "cyclical" component $ba_t = b_t - bs_t$.

To analyse the issues raised, we set up a framework that allows distinguishing between several dimensions of fiscal policy, short-run vs. long-run, and active vs. passive. We start with a quite general decomposition:

$$b_t = \mu_t + ba_t + bd_t + \varepsilon_t \tag{1}$$

of the actual/observed balance b_t into the core balance μ_t, two cyclically related components – namely ba_t capturing the impact of the automatic stabilisers, and bd_t capturing the discretionary policy in response to the cycle – and a residual component ε_t reflecting all remaining (temporary) effects ("fiscal noise"). To be more precise, we specify:

$$ba_t = \alpha_t \cdot I_t^a \tag{2.1}$$

$$bd_t = \gamma_t \cdot I_t^d \tag{2.2}$$

I_t^a and I_t^d are indicators for the cyclical developments which will be specified later on, and α_t and γ_t are the corresponding sensitivities/elasticities. The use of different indicators of the cyclical development is motivated by the fact that in general policy-makers do not necessarily respond to variables economists have in mind.

Inserting (2.1) and (2.2) in (1) constitutes our unobserved component model specification, naturally cast as a state-space system. The measurement/signal equation:

$$b_t = \mu_t + \alpha_t \cdot I_t^a + \gamma_t \cdot I_t^d + \varepsilon_t \tag{3.1}$$

links the observed balance to its components, while the state/transition equations:

$$\mu_{t+1} = \mu_t + \eta_{t+1} \qquad \eta_t \sim \text{iid N}(0, \sigma_\eta) \tag{3.2}$$

$$\alpha_{t+1} = \alpha_t + \psi_{t+1} \qquad \psi_t \sim \text{iid N}(0, \sigma_\psi) \tag{3.3}$$

$$\gamma_{t+1} = \gamma_t + \zeta_{t+1} \qquad \zeta_t \sim \text{iid N}(0, \sigma_\zeta) \tag{3.4}$$

describe the dynamics of the states. In the estimation, the log-likelihood is constructed using the Kalman filter.[6]

Equation (3.2) specifies the core balance as a random walk, the innovations η_t capturing fiscal shocks that have a permanent or enduring impact on the level of the budget balance. Similarly, equations (3.3) and (3.4) set up the automatic sensitivity of the budget balance α_t and the policy response γ_t as random walks. While a positive (negative) sign of γ_t typically indicates a counter-cyclical (pro-cyclical) reaction of discretionary fiscal policy, the sign is interpreted just the other way round in the case of expenditure variables. In principle, all three state equations could be generalised to include exogenous variables. We take (3.1)–(3.4) as a transparent, easy-to-use device to decompose budget balances.

In the general representation (3.2)–(3.4) the states – and hence budget components – are assumed to move stochastically. If the estimation yields very small variances, this is an indication that the corresponding component is rather deterministic. In such a case, the model can be simplified by a priorily setting disturbances to zero (the states would then enter (3.1) as recursive coefficients).

Since the focus of our interest lies primarily on the impact of the policy response to cyclical developments (rather than on the automatic stabilisers), we can estimate a smaller, "reduced model" for the structural balance bs_t consisting of the measurement equation:

$$bs_t = \mu_t + \gamma_t \cdot I_t^d + \varepsilon_t \tag{4}$$

and state equations (3.2) and (3.4).

By taking the cyclically-adjusted (primary) budget balance $bs_t = b_t - ba_t$ as calculated by the European Commission as dependent variables,[7] we refrain from estimating the cyclical component, which is thus $ba_t = \alpha_t \cdot I_t^a = \alpha \cdot GAP_t$.

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[6] Estimations have been carried out with RATS v6.

[7] The cyclically-adjusted budget balance has been corrected for an estimated output gap (compositional effects are not taken into account), *i.e.* the budget balance figures are adjusted for a) the difference between actual output and estimated potential output (the output gap) and b) the difference between the actual unemployment rate and the estimated equilibrium unemployment rate (the unemployment gap).

If, however, the discretionary policy response component and the automatic stabiliser component respond to the same cyclical indicator I^c, general equation (3.1) is reduced to:

$$b_t = \mu_t + (\alpha + \gamma)_t \cdot I_t^c + \varepsilon_t \tag{5.1}$$

state equation (3.2) and:

$$(\alpha + \gamma)_{t+1} = (\alpha + \gamma)_t + \xi_{t+1} \qquad \zeta_t \sim \text{iid N}(0, \sigma_\zeta) \tag{5.2}$$

Whereas the actual budget balance is expressed as a ratio of nominal GDP, the core balance and the cyclically-adjusted balances are expressed as ratios of nominal potential GDP (since cyclically-adjusted balances should be interpreted as values of the deficits (surpluses) that would be observed if output were at some reference potential level). However, one should be aware of the fact that policy-makers, the public and international institutions such as the EC generally monitor the development of public finances relative to nominal GDP. Actual and cyclically-adjusted budget balance figures as well as revenue and expenditure figures are taken from the AMECO data base.

The indicator I_t^a is always specified as the output gap. However, at the current stage of our research, the indicator I_t^d is specified as the output gap on the one hand and split up into I_t^{d+} and I_t^{d-} on the other hand in order to capture upturns and downturns.[8]

4. Results

Estimating the impact of the discretionary policy response to the cycle only (equation 4), *i.e.* taking the cyclically-adjusted total balance in percent of potential GDP as dependent variable and the output gap as explanatory variable, gives a negative parameter value for γ of a size of about –0.35 (see Figure 1, Figure 2 and table A1). A negative value of this coefficient reveals a pro-cyclical impact of discretionary policy responses on cyclical developments.

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8 We intend to broaden the analysis to include the period *t–1* expected real GDP growth rate of period *t* on which the respective budget draft in Austria is based. This projection is part of the regular economic outlook of the Austrian Institute of Economic Research (WIFO). Even though growth does not represent an adequate proxy for cyclical conditions one has to bear in mind that politicians may just look at growth rates when taking discretionary decisions. Using real-time growth data moves the focus on the intentions fiscal policy makers had, when deciding discretionary measures, whereas the use of *ex post* output gap allows the assessment of the actual (or *ex post*) counter-/pro-cyclicality of fiscal policies (Forni and Momigliano, 2004).

Figure 1

Results for the Total Balance

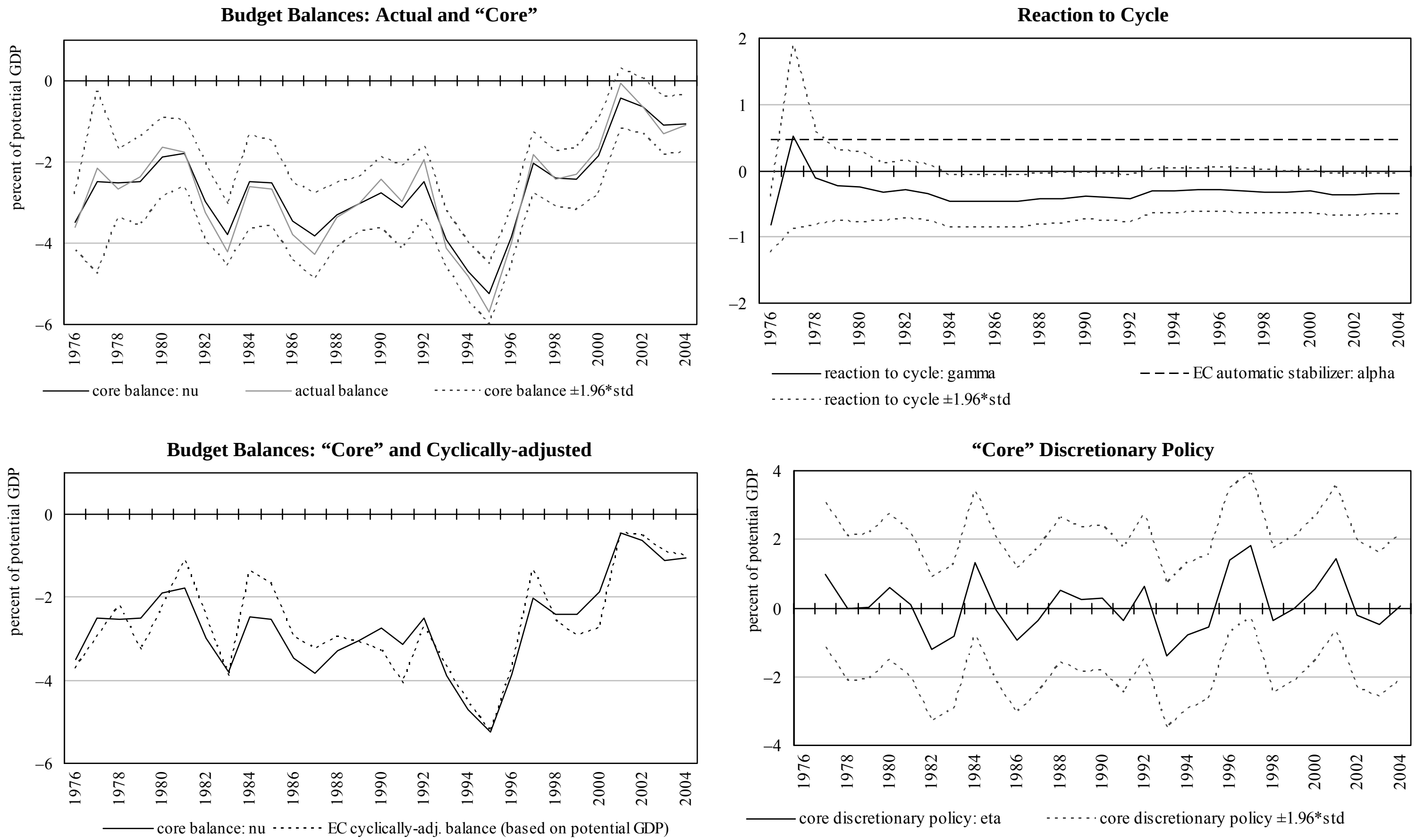
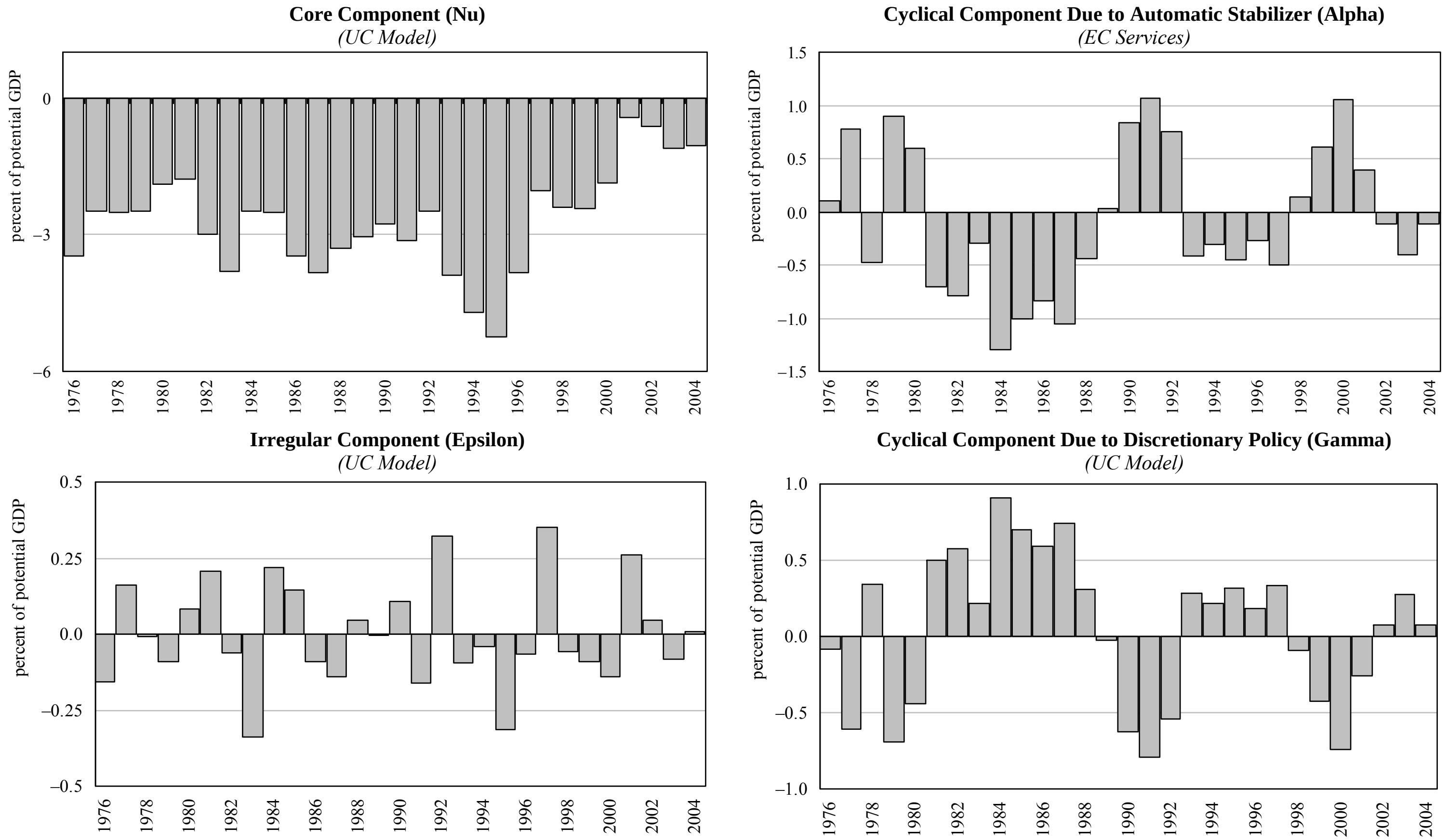


Figure 2

Decomposition of the Total Balance



The comparison of this coefficient with the size of the overall budget sensitivity as estimated by the OECD and used by the EC (+0.47) leads to the conclusion that the overall impact of fiscal policy (summing up the automatic and discretionary components) was slightly counter-cyclical in Austria in the past.[9] Taking into account the fact that the overall budget sensitivity for Austria as estimated by the OECD was lower in earlier publications, this could indicate a slightly stronger counter-cyclicality of overall fiscal policy for recent years.

Figure 1 also reveals that the core balance is slightly smoother than the cyclically-adjusted budget balance. The driving forces of the core balance were major structural problems of the Austrian economy in the early 1980s; consolidation measures in the second half of the 1980s; a major income tax reform at the end of the 1980s; the implementation of long-term care benefits in 1993; the implementation of further consolidation packages between 1995 to 1997 in order to fulfil the Maastricht fiscal criteria in 1997; and another consolidation package in 2000-01 to reach temporarily a balanced budget.

This first result is confirmed when we use the alternative specification (5.1) and look for the "overall" budget sensitivity to the output gap, *i.e.* estimating the automatic and the policy response components in one go. A positive coefficient of 0.15 signals a slightly counter-cyclical behaviour overall.[10] Repeating the estimations with the primary budget balance gives nearly identical coefficients (see Figures 1a and 2a).

This finding contrasts with Galí and Perotti's (2003) results. In their country estimates they find for the pre-Maastricht period a slightly counter-cyclical discretionary fiscal response for Austria, which got stronger in the after-Maastricht period (but the coefficients are not statistically different from zero).

This "pro-cyclical fiscal policy response" of the general government is not much of a surprise; on the one hand it can be explained by the federal structure of government in Austria, consisting of the federal government, the nine provinces and the local governments (municipalities). The provincial and local governments' fiscal policies have traditionally been aimed at balanced budgets – thus undermining the impact of the automatic stabilisers, in particular in downturns.[11] Thus, even if the federal government aims at counter-cyclical responses to cyclical developments, this

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9 However, as stated by Alberola *et al.* (2003) (by means of a panel regression) such a result could also signal problems with the estimation of the budget elasticity. They actually find a negative and significant correlation between the output gap and the structural balance which they interpret as an overestimation of the cyclical component. Consequently, in downturns structural balances tend to be overestimated while they are underestimated in expansions.

10 In order to filter out the effect of the interest expenditures we estimate the equations also with the cyclically-adjusted and unadjusted primary balance as dependent variables.

11 The resources of the provincial and local governments stem mainly from an elaborate tax sharing system and from federal transfers. The sub-levels mainly participate in cyclically sensitive tax revenues. Own sources of revenues are of less importance for the provincial governments, but of slightly more relevance for the local governments. Without any room for manoeuvre on the revenue side, the provincial and local governments in principle have to adjust their expenditures to the predetermined revenues (see Diebalek *et al.*, 2005).

Figure 1a

Results for the Primary Balance

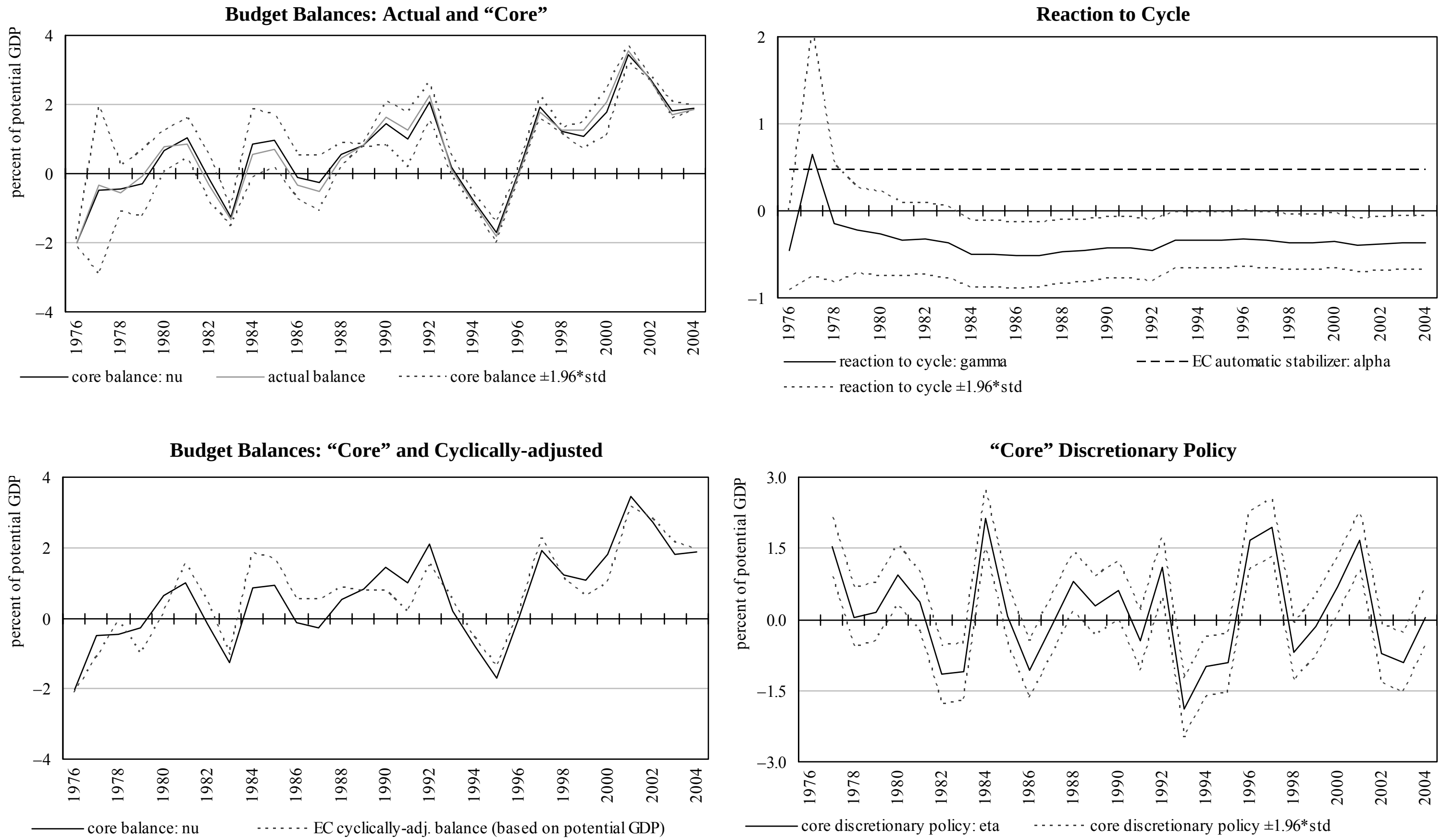
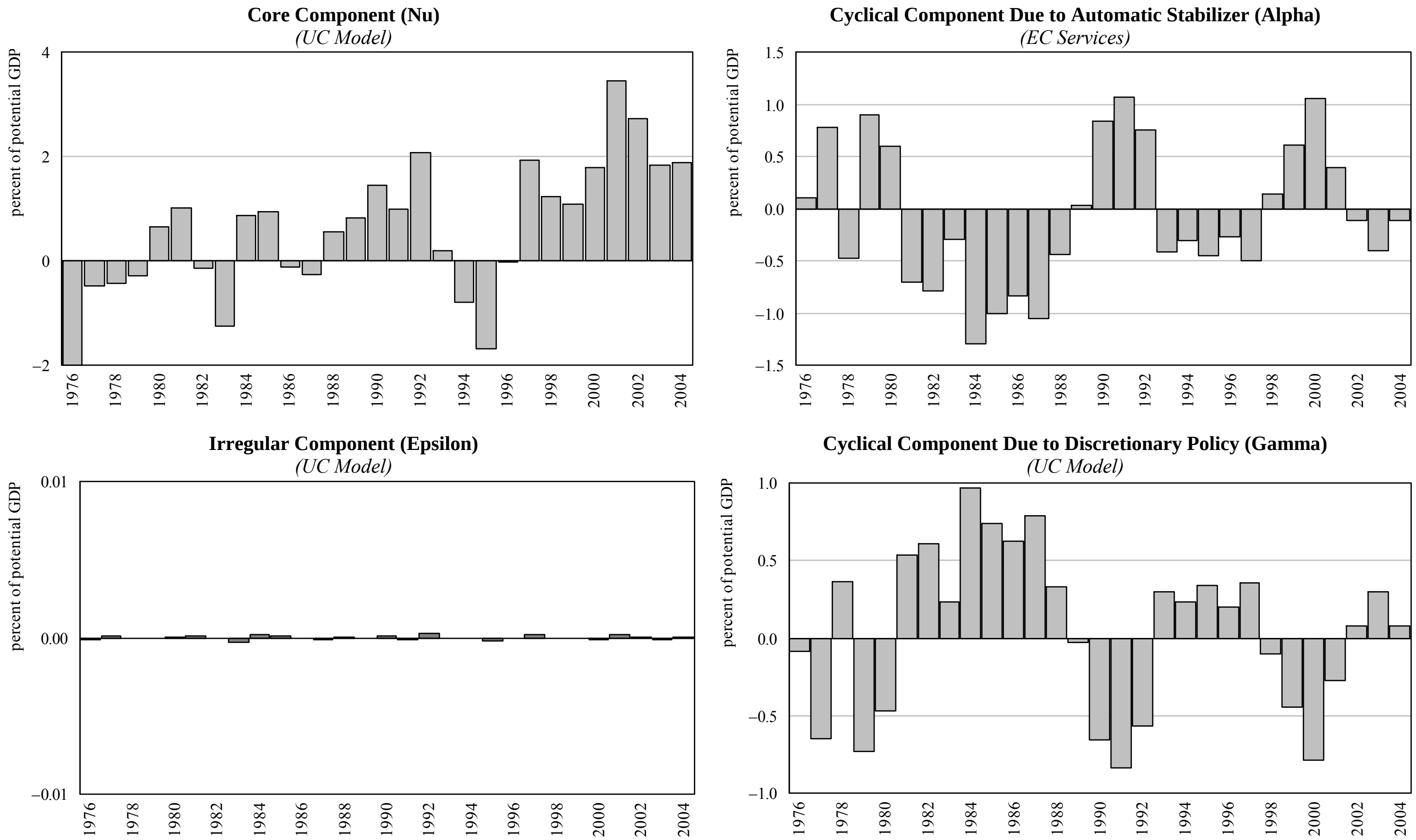


Figure 2a

Decomposition of the Primary Balance



ambition may be partly counteracted by the provincial and local governments' fiscal strategy.

Moreover, from the late 1970s to the end of the 1980s the federal government's strategy was influenced by a budget rule termed the "Seidel formula" (see Katterl and Köhler-Töglhofer, 2005), which set a threshold for the cash deficit of the federal government at a level of 2.5 per cent of GDP.

In a next step we ask whether cyclically-adjusted spending and revenues (as a share of nominal potential GDP) react in a specific pro- or counter-cyclical manner. Our estimation results indicate a relatively strong pro-cyclical discretionary response of the cyclically-adjusted revenues to the cycle (see Figures 3 and 4). On the expenditure side, the relatively minor impact of the automatic stabilisers related to the unemployment transfers seems to be completely neutralised[12] (see Figures 4 and 5).

Next we check for an asymmetric cyclical behaviour in downturns and upturns, *i.e.* taking the cyclically-adjusted (primary) budget balance as dependent variable and looking for the discretionary fiscal policy impact in upturns (periods in which the real growth rate is above the potential growth rate) and downturns (periods in which the real growth rate is below the potential growth rate). It appears that in upturns a strong pro-cyclical discretionary policy impact dominates (however, the γ coefficient is slightly smaller than the overall budget sensitivity estimated by the OECD for Austria),[13] whereas the pro-cyclical impact in downturns turns out to be comparably smaller. Hence, we can conclude that in Austria overall fiscal policy in downturns is counter-cyclical, whereas in upturns the working of automatic stabilisers is neutralised (see Figure 7). This is in principle in line with general findings based on panel regressions for OECD countries (such as those by OECD (2003), Balassone *et al.* (2004) or Forni and Momigliano (2004); these papers provide evidence for counter-cyclical behaviour in downturns and – at least the first two studies – pro-cyclicality in upturns.)

Finally we focus on the evolution of the core balances. Compared to the cyclically-adjusted budget balances the core balances exhibits slightly less variability. As mentioned in the introduction, the variability of these reflect discretionary measures not related to the cycle, such as permanent consolidation measures, measures aiming at distributional and allocative/structural goals or effects of macroeconomic shocks, demographic changes, etc. Thus Figure 8 depicts major episodes of fiscal consolidation on the one hand and the introduction of expenditure measures aiming at further improving the Austrian welfare state on the other hand, as well as the impact of structural changes in the Austrian economy.

[12] However, if the dependent variables are taken as ratios of the nominal GDP instead of potential nominal GDP we get a pronounced pro-cyclicality of the cyclically-adjusted revenues and a pronounced counter-cyclicality of the cyclicality adjusted expenditures.

[13] However, the coefficient is of the same size as the overall budget sensitivity calculated by the OeNB. Taking the OeNB's value of the overall budget sensitivity would lead to the conclusion that the impact of the automatic stabilizers is completely neutralized in upturns.

Figure 3

Results for the Total Revenues

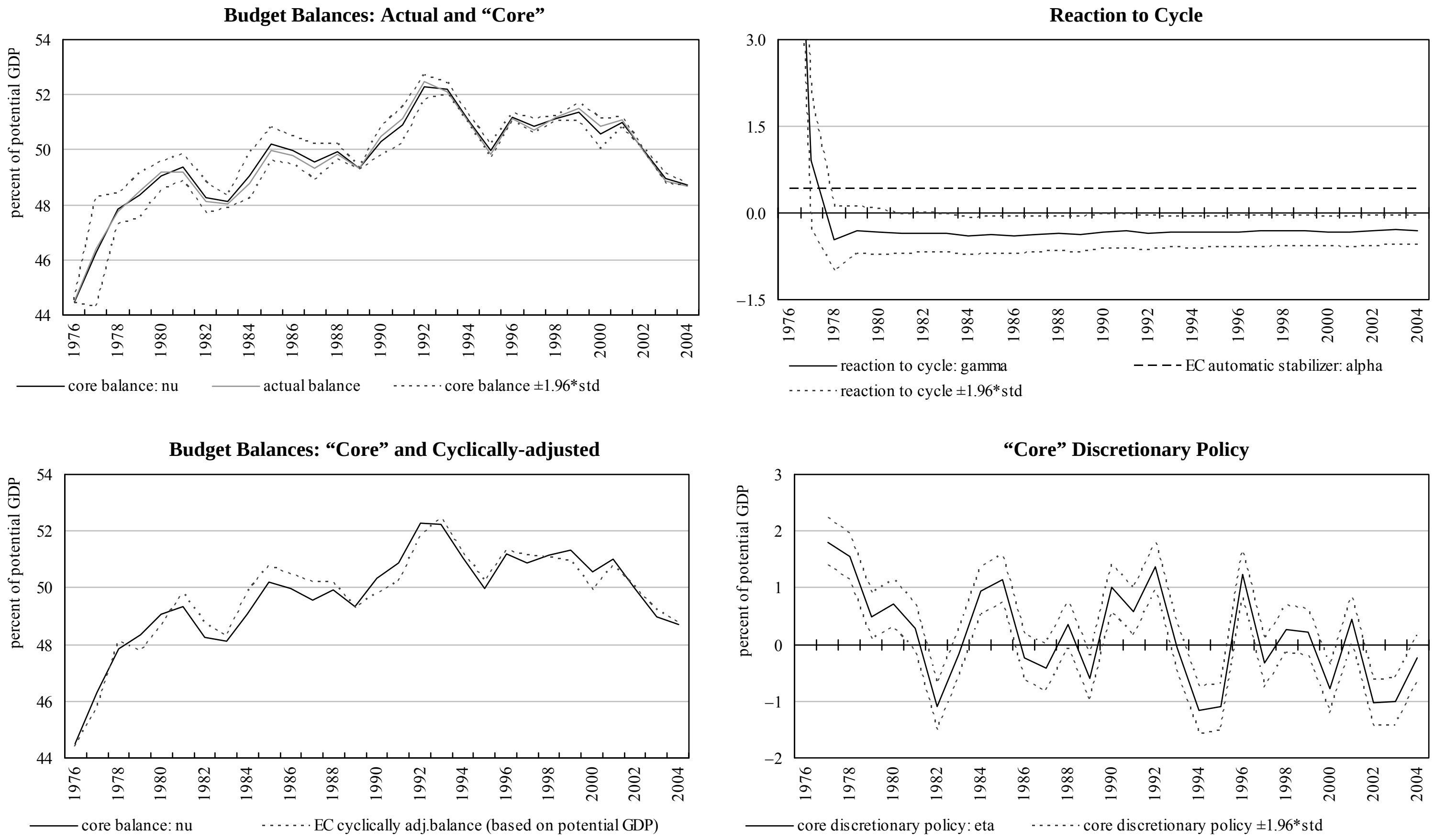


Figure 4

Decomposition of the Total Revenues

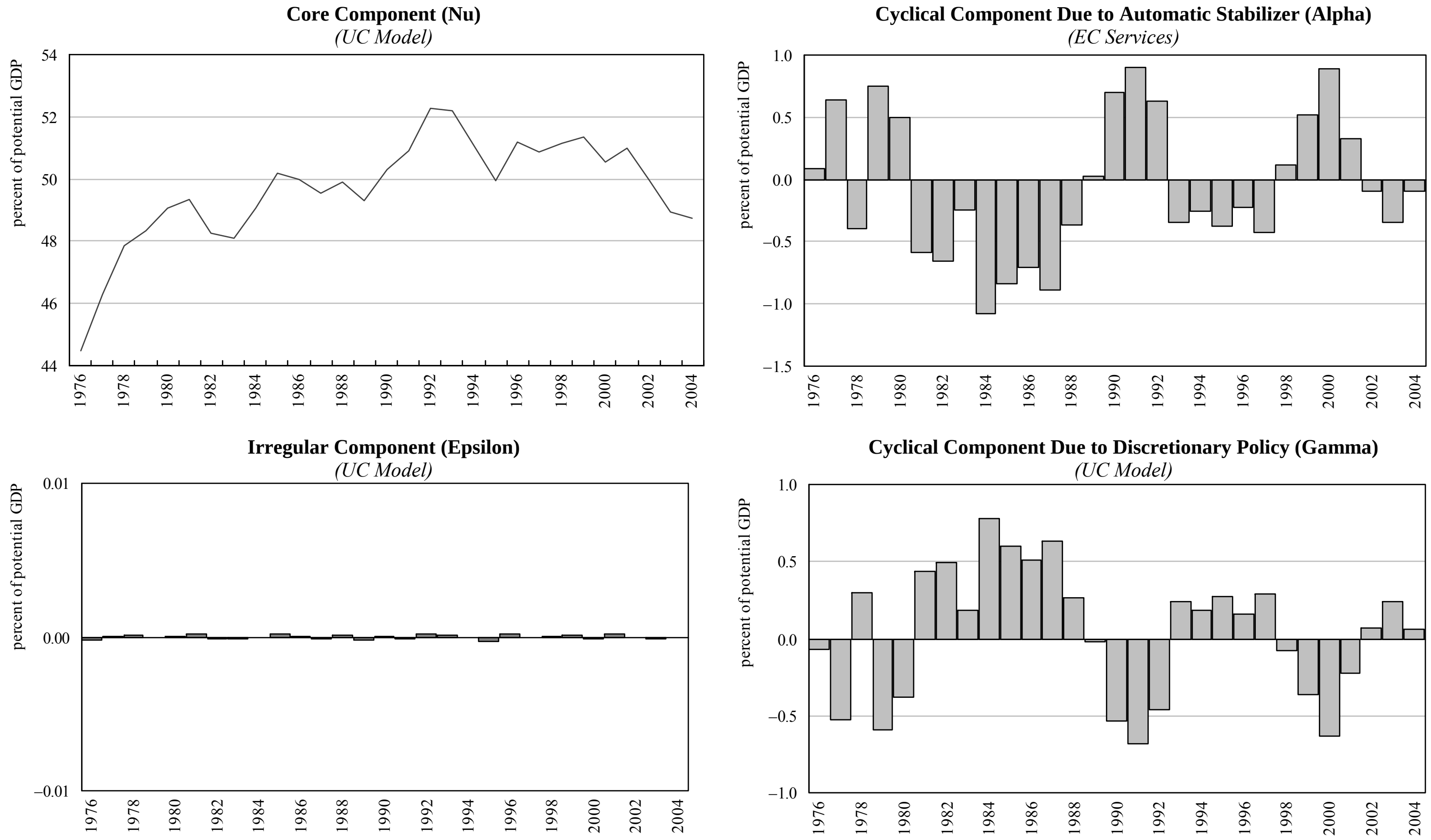


Figure 5

Results for the Primary Expenditure

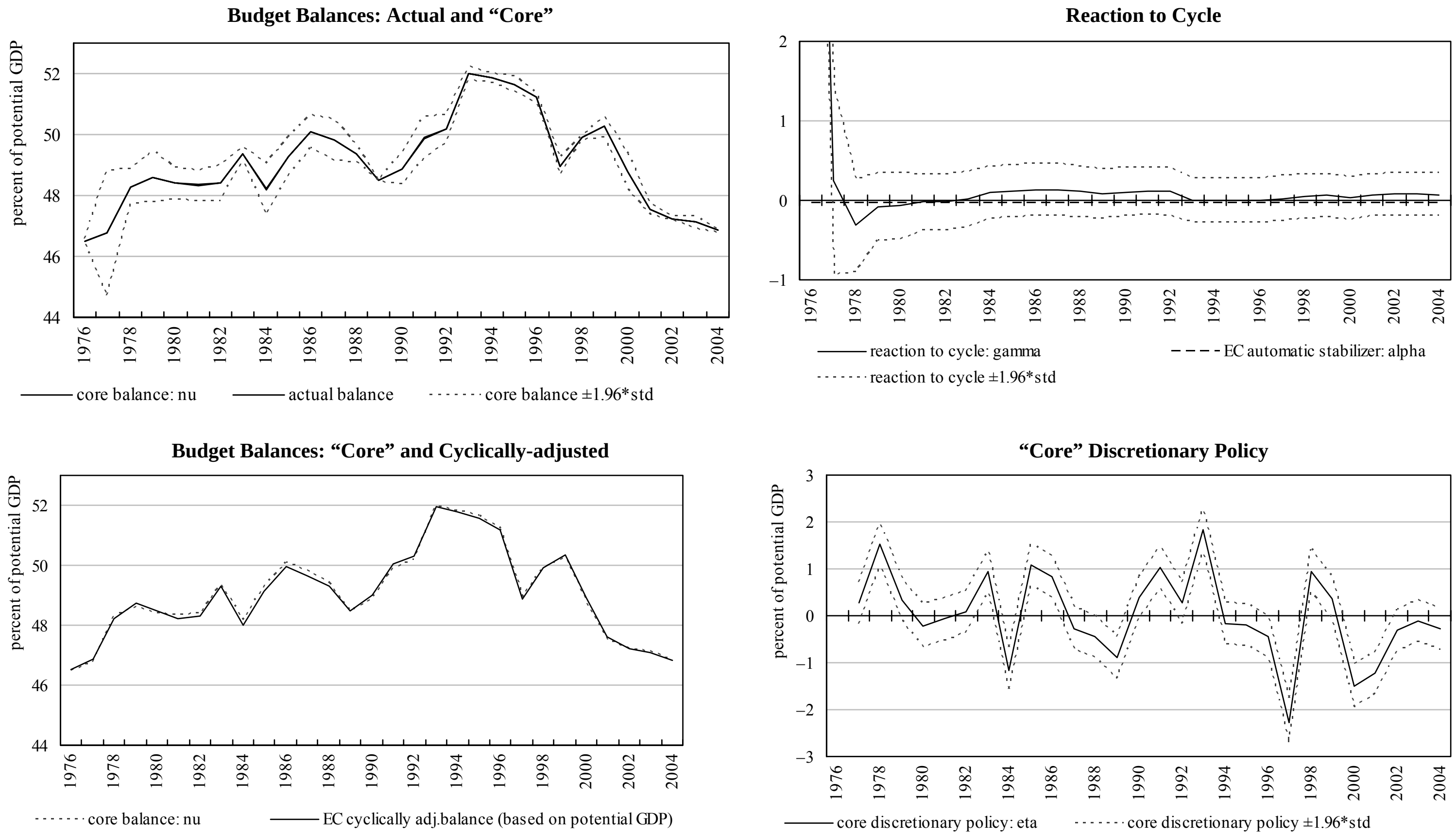


Figure 6

Decomposition of the Primary Expenditure

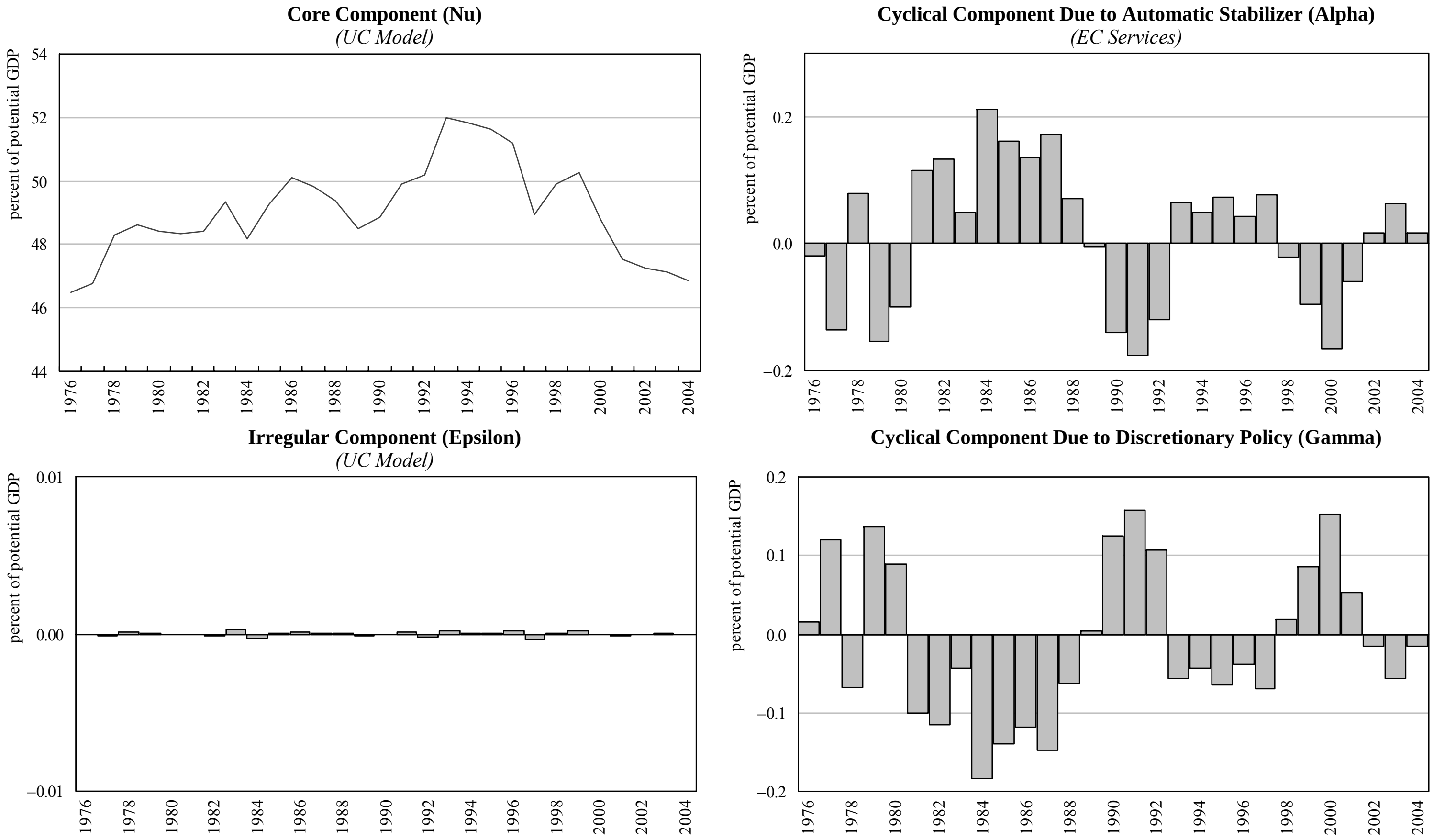


Figure 7

Results for the Total Balance

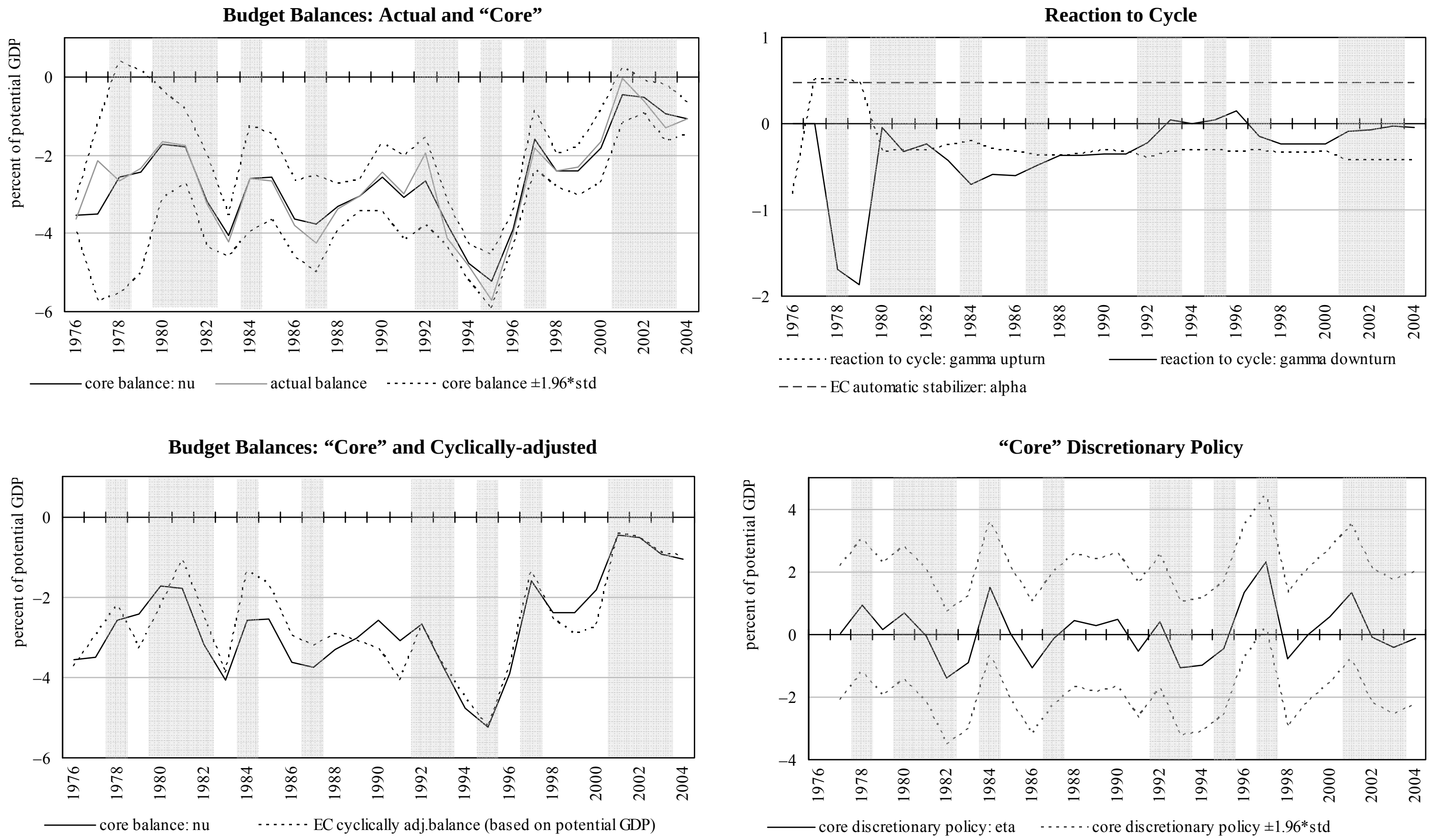
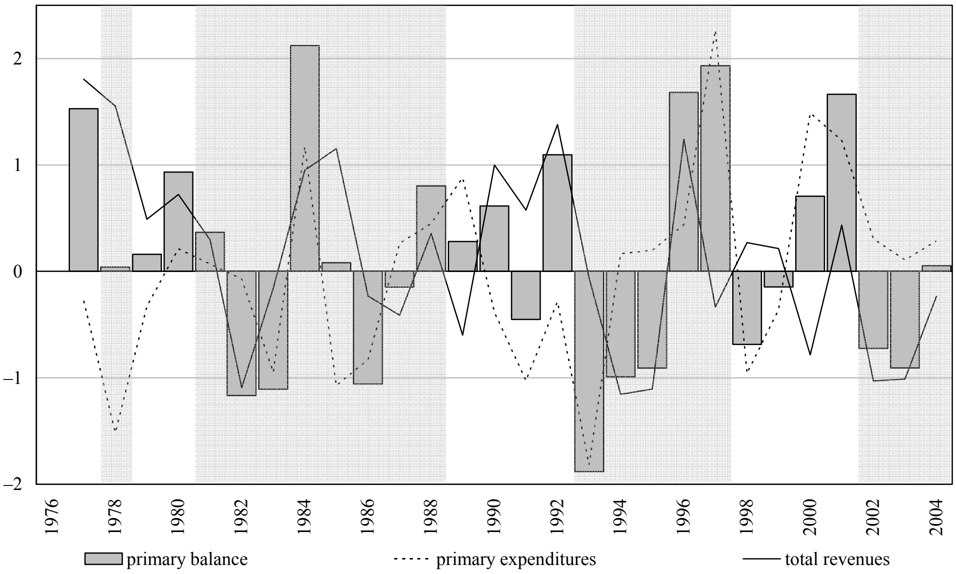


Figure 8

"Core" Discretionary Policy
(percent of potential GDP)



For example, in 1984 Austria implemented a sizeable consolidation package, including the increase of the VAT rate and other indirect taxes as well as the contribution rate of the unemployment insurance scheme. Another big consolidation package was implemented in 1996-97 in order to fulfil the fiscal Maastricht criteria. A further comparatively huge consolidation package was launched in 2000-01 with the goal of bringing the general government budget to a close to balance position. While these events resulted in an improvement of the core primary balances, they also show up in the core revenue or core expenditure ratio, respectively, or in both, depending on the composition of the consolidation packages.

The tremendous structural crisis that Austria faced at the beginning of the 1980s is also reflected in the development of the core primary balance. The worsening of the primary balance at the beginning of the 1990s was, however, caused, by the implementation of social policy measures, *i.e.* by extending the entitlement period for maternity leave payments from one to two years and in addition by implementing long-term care benefits without adequate financing measures.

5. Conclusions

Our estimation results so far highlight that, first of all, the overall effect of fiscal policy in Austria has been slightly counter-cyclical. However, our estimates also indicate that discretionary policy in response to the business cycle has been pro-cyclical. Given the federal structure enabling the provincial and local governments to implement conflicting fiscal strategies, and given the fact that the central government budget was influenced (at least on average) by the rule that the cash deficit should not exceed the threshold of 2.5 per cent of GDP, this result does not really come as a great surprise. Second, and more interestingly, there is the fact that the revenue side seems to be prone to pro-cyclical responses whereas the expenditure side shows opposite behaviour. Finally – and this finding is generally in line with other studies – our estimates imply that during economic downturns the overall impact of fiscal policy seems to be counter-cyclical, whereas in periods of economic upturn the impact of automatic stabilisers is nearly neutralised.

APPENDIX

Table 1

Estimation Results

(dependent variable: cyclically-adjusted balances; percent of potential GDP)

Parameter:	**total balance**	**primary balance**	**total revenues**	**primary expenditures**	**total balance**	**primary balance**	**total revenues**	**primary expenditures**
var(ε)	0.14	0.00	0.00	0.00	0.04	0.00	0.00	0.00
var(η)	0.86	1.15	0.79	0.84	0.95	1.04	0.74	0.85
var(ξ)	0.00	0.00	0.00	0.00	-	-	-	-
var(ξ^+)	-	-	-	-	0.00	0.00	0.00	0.00
var(ξ^-)	-	-	-	-	0.02	0.02	0.00	0.00
Final states:								
core balance (μ_T)	–1.06	1.88	48.72	46.84	–1.06	1.87	48.69	46.83
	(–0.35)	*(–0.04)*	*(0.03)*	*(0.03)*	*(0.21)*	*(0.04)*	*(0.04)*	*(0.04)*
automatic stabilizer α (*) (OECD/EC)	0.47	0.47	0.43	–0.04	0.47	0.47	0.43	–0.04
discretionary policy (γ_T)	–0.35	–0.37	–0.30	0.07	-	-	-	-
	(0.16)	*(0.16)*	*(0.13)*	*(0.14)*	-	-	-	-
in upturns (γ_T^+)	-	-	-	-	–0.42	–0.40	–0.43	0.00
	-	-	-	-	*(0.19)*	*(0.19)*	*(0.16)*	*(0.17)*
in downturns (γ_T^-)	-	-	-	-	–0.04	0.04	–0.11	0.12
	-	-	-	-	*(0.42)*	*(0.44)*	*(0.23)*	*(0.15)*

Sample period: 1976-2004; standard deviations in parenthesis.
(*) estimated by the OECD and used by the EC.

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COMMENTS ON SESSION 1: CYCLICAL ADJUSTMENT

Carlo Monticelli[*]

Introduction

First, I would like to congratulate the contributors to this session for their excellent papers and presentations. As I do not have the time to comment on each paper, I will only focus on two themes that emerged during the session:

- the uncertainty in the evaluation of the Cyclically-Adjusted Balance (CAB) and its implications for the surveillance of budgetary policy;
- oil revenues, public finance and golden eggs (the role of eggs will become apparent later).

1. Uncertainty in the estimate of the CAB

The uncertainty surrounding the estimates on CAB comes from two sources: the assessment of output gap and the evaluation of the effects of the cycle on the budget.

Policies makers were – and probably are – not fully aware of it. Orphanides (2002)[1] analyses the high inflation that marked the US in the '70s and shows that policy mistakes (recognised as such later) were done in good faith. Monetary policy decisions, in fact, were based on the "modern approach" (as succinctly expressed by the Taylor rule), but economic outcomes were disastrous, mainly as a consequence of severe misjudgements about the *natural rate* and the implied output gap.

Turning to budgetary policy, in theory the CAB allows to evaluate the policy stance by singling out the cyclical component of budgetary developments. The nominal budget balance (the only observable variable) properly reflects policy measures only when actual growth is equal to both expected growth and potential growth. Since this is generally not the case, the appropriate evaluation of the fiscal stance requires that the effects of the economic cycle be netted out from the nominal budget balance.

In practice, estimating the CAB is a tricky business. The measure of the CAB depends on the estimation of potential output and output gap. It thus suffers from the same pitfalls affecting the assessment of these two unobservable variables – be they derived from a purely statistical approach or from methods based on economic theory. Indeed, in the EU budgetary surveillance process, it took the ECOFIN

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[1] Orphanides, A. (2002), "Monetary-Policy Rules and the Great Inflation", *The American Economic Review*, Vol. 92, No. 2, pp. 115-20.

Council to endorse, in the July 2002 meeting, the use of the production function approach (instead of the purely statistical approach based on the Hodrick-Prescott filter) as the reference method for calculating output gaps, which in turn underpin, through the measure of CAB, the assessment of the Stability and Convergence programmes presented by EU Member States.

In recent years, these measurement difficulties and the related uncertainty on the "true value" of the CAB have been compounded by yet another issue: the revision in the estimates of potential output. If such revisions are not explicitly taken into account, the assessment of budgetary policies is blurred, particularly as regards one key variable: the *change* in CAB (ΔCAB) – which, after the Eurogroup resolution of October 2002, has become a major benchmark to evaluate the efforts in budgetary-adjustment by Member States.

Some algebra can help clarify this point. The CAB is in practice calculated by subtracting from the change in the nominal budget (which is observable) the effects of the business cycle, as estimated on the basis of the output gap (which for convenience can be approximated as the previous year's output gap plus the current year's difference between actual and potential growth); that is:

$$CAB_t = NB_t - \alpha OG_t \cong NB_t - \alpha\left[\left(\dot{Y}_t - \dot{Y}_t^P\right) + OG_{t-1}\right]$$

where the superscript P denotes potential, $\dot{Y}$ stands for output growth, NB for the nominal budget balance, OG for the output gap (positive when output is above potential) and α is the relevant elasticity. The change in CAB can be easily derived from this formula. Typically, this calculation of ΔCAB and the related policy assessments assume that potential output remains constant. If conversely it changes (as has often been the case in recent years), this will have an impact on ΔCAB as the formula shows:

$$\Delta CAB_t = \Delta NB_t - \alpha\left[\dot{Y}_t - \dot{Y}_t^p\right] \equiv \Delta NB_t - \alpha\left[\left(\dot{Y}_t - \dot{Y}_t^{P,SP}\right) + \left(\dot{Y}_t^{P,SP} - \dot{Y}_t^P\right)\right]$$

where SP superscript refers to the starting period's estimate of potential output.

This expression clearly shows that the traditional approach to the calculation of CAB biases the estimate of the impact of the cycle on the budget because it lumps together both the effects of the cycle and those stemming from the unexpected change in potential output, which results from the revision in its estimate due to the availability of new data. This leads to an inaccurate assessment of the policy adjustment.

In order to avoid such a bias, the measure of the change in CAB relevant for policy analysis should be calculated by correcting the nominal budget only for the effects of the cycle (the so-called automatic stabilisers), and not for the effects of (unforeseeable) changes in potential growth, *i.e.*:

$$\Delta CAB_t^{corr} = \Delta NB_t - a\left(\dot{Y}_t - Y_t^{P,SP}\right) \equiv \Delta CAB_t + \alpha(\dot{Y}_t^{P,SP} - \dot{Y}_t^P)$$

Table 1

Assessment of the Change in 2003 CAB (*ΔCAB*)

	Conventional *ΔCAB* (1) = (2)–(3)–(4)	Change in nominal balance in 2003 (2)	Correction for the cycle (3)	Correction for the change in potential (4)	Corrected ΔCAB (5) = (1)+(4) = = (2)–(3)
Germany	–0.1	–0.7	–0.8	0.2	0.1
France	–0.2	–1.1	–1.0	0.1	–0.1
Italy	0.2	–0.3	–0.7	0.2	0.4

The effects on the policy assessment of this correction are by no means negligible, as the following table illustrates for three EU countries with reference to 2003 (with respect to 2002).

2. Oil and golden eggs

Revenues from extractive industries should be an important engine for economic growth leading to sustainable development. However, some countries rich in oil, gas and minerals have under-performed relative to other countries less endowed with natural resources. Exporting energy products often was more a curse than a boon. Indeed, there seems to be a close correlation between the countries rich in natural resources and the countries with high levels of poverty. Oil revenues are a windfall gain that is tempting to consume straight away. In many oil producing countries, oil revenues are a source of corruption.

Against this background, governments' preferences (alike those of myopic consumers) can be described by hyperbolic discounting functions, which are characterised by a higher discount rate over short horizons. This preference structure creates a conflict between today's preferences, and the preferences that will be held in the future, as convincingly argued in Laibson (1997) paper[2] – where preferences are expressed as:

$$U_t = E\left[u(c_t) + \beta \sum_{t=1}^{T-t} u(c_{t+\tau})\right]$$

In analogy with the arrangements for individuals discussed by Laibson, a way to correct the distortions and inconsistencies deriving by this kind of utility function is the introduction of institutional "golden eggs", that is the creation of institutional

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[2] Laibson, D. (1997), "Golden Eggs and Hyperbolic Discounting", *The Quarterly Journal of Economic,* Vol. 112, No. 2, pp. 443-77.

and political constraints to avoid that revenues from energy exports are immediately turned into consumption (often by a small elite only), rather than financing investment and smoothing the prevision of public goods over time.

Transparency over payments and revenues related to the exploitation of natural resources can be regarded as a key way to buttress such commitments. It increases accountability and therefore the likelihood that revenues generated by such exports are used in an efficient and equitable manner. It can also reduce the risk of diversion or misappropriation of financial resources. For this reason, I would like to conclude my discussion by recalling an important institutional initiative to this end: the Extractive Industry Transparency Initiative (EITI).[3] EITI is a partnerships between government, companies, and civil society, which was established at the 2002 World Summit on Sustainable Development in Johannesburg and aims at increasing the transparency in the transactions between governments and companies within extractive industries.

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3 www.eitransparency.org

COMMENTS ON SESSION 1: CYCLICAL ADJUSTMENT

Charles Perreault[*]

Introduction

First, I would like to thank Daniele Franco and the Banca d'Italia for giving me the opportunity to attend this year's workshop. The high quality of the papers presented and ensuing discussions provided much valuable insight about the analysis of structural fiscal developments.

The papers presented in Session 1 are all linked, albeit to various degrees, through one concept: the cyclically-adjusted budget balance (CABB). More specifically, I will focus my comments on the issues raised by two specific papers, although these issues are likely to be widely shared by others.

1. Decomposing structural budget balances

The two papers which I will touch on, the one from Kremer *et al*. and the one from Brandner, Kohler-Toglhofer and Diebalek focused on the decomposition and analysis of changes to structural budget balances. This part of research on CABBs is of primary importance, as policy-makers need to understand changes to CABBs to put forward appropriate measures.

In particular, Kremer *et al*. presented a disaggregated framework for the analysis of past and projected structural developments in the main revenue and expenditure categories and the fiscal balance. They applied this framework to six European countries over the 1998-2004 period, which allows them to pinpoint the main elements responsible for the changes in the structural balance and discriminate between changes due to pure discretionary policy versus more systematically-induced changes.

On the other hand, Brandner, Kohler-Toglhofer and Diebalek used a framework that broke down the observed budgetary balance as a percentage of GDP into four components: a) the core balance; b) automatic stabilizers; c) a component reflecting discretionary fiscal policy responses to the business cycle, and; d) a component reflecting all other transitory shocks to the fiscal balance. Using this framework, they estimated the cyclical discretionary changes in the structural balance of Austria as computed by the OECD and found that discretionary fiscal policy was pro-cyclical, most notably in the case of revenues. Their results show that

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The views expressed are those of the author and do not necessarily reflect those of the Department of Finance – Canada.

over the 1976-2004 period, discretionary fiscal policy actions in response to the cycle were systematically offsetting, albeit partially, the operation of automatic stabilizers. The authors attributed these results to the structure of the Austrian federation, notably to the use of fiscal rules on the budget balance at both the federal and provincial levels.

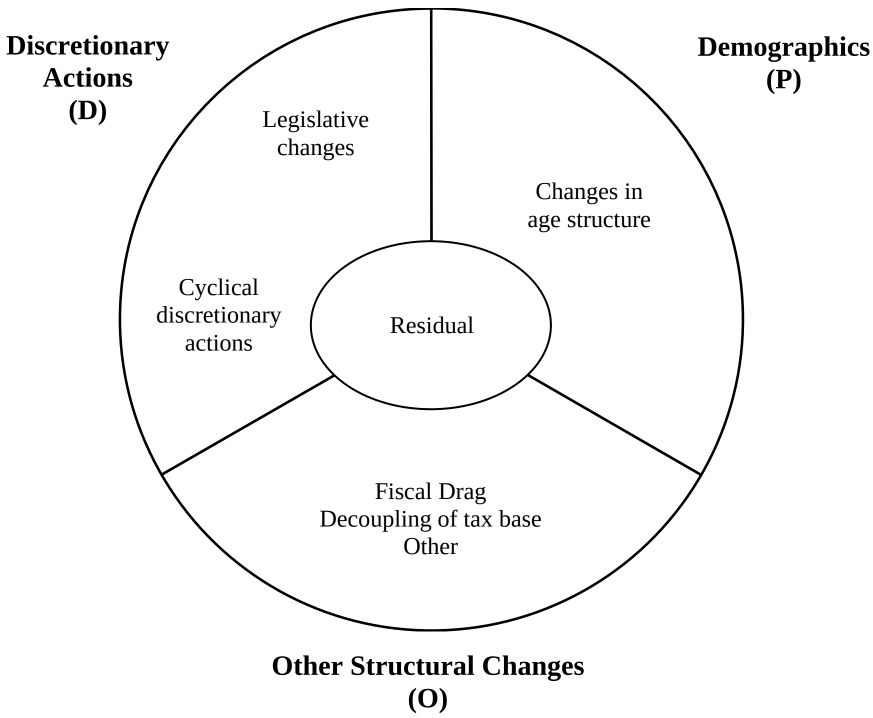
To better visualize the breakdown of structural balances made by the authors of the two papers, I will refer to an alternative approach, which was presented by Assarsson, Gidehag and Zettergren in 1999 at Banca d'Italia's First Workshop on Public Finances. Assarsson *et al*. illustrated the structural balance as being a function of three elements:

$$CABB = f(D, P, O)$$

where D refers to governments' discretionary actions, P refers to demographic changes and O to other structural changes. The simple framework provided by Assarsson *et al*. helps make a bridge between the two papers presented at this year's workshop, which mainly expanded our understanding of the "other structural changes" (Figure 1).

Figure 1

Theoretical Breakdown of the Structural Balance



This simple wheel enables a useful categorization of the contributions of the two papers and also highlights areas where further work could be devoted. There are two topics that readily come to mind, namely the evaluation of cyclical discretionary actions and the impact of demographics on the changes in the structural balance.

Using sophisticated statistical techniques, Brandner *et al*. calculated the size of cyclical discretionary actions for Austria and concluded that they often offset the impact of automatic stabilizers. However, when calculating CABBs, some cyclical discretionary actions are often captured in the cyclical component of budget balances and thus are not reflected in Brandner *et al.* calculations. This does not change their conclusions that cyclical discretionary actions partially offset automatic stabilizers, although it understates actual size of cyclical discretionary actions.

The second topic relates to a concern shared by most industrialized countries, whereby the aging of the population is expected to have an increasing impact on public finances. It is a difficult task to pinpoint the impact of government spending decisions on the changes in the structural budget balance, especially given that various forces, such as aging populations, exert pressures on public finances. Kremer *et al.* broke down the annual changes to the structural primary expenditure ratio in six categories and included a number of sub-categories, which provided additional information as to where the annual changes came from. I acknowledge that the impact of aging-related pressures on public finances are usually handled using a longer-term approach, but the Kremer *et al*. framework provide a good opportunity to deepen the analysis regarding this issue.

For example, a simple approach would be to take into account the impact of changes to population growth and composition on some expenditure categories, notably health care. By age-adjusting health spending, under certain assumptions, it would be possible to highlight the changes in health care spending that are due to the "enrichment" of health care services, which can stem from a combination of changes in the quality, quantity and mix of services provided. This would therefore provide a more precise estimation of the impact of government policy decision as compared to the ubiquitous changes induced by changes in the age structure of the population. Of course, this approach would yield little additional information on the changes to the CABB at present, but its usefulness is likely to grow in the future.

2. Simultaneity bias

More generally, there is a common issue that applies to both papers and most others that use CABB estimates: the simultaneity bias between fiscal and economic variables, whereby changes in government revenues and expenditures affect output and vice versa. When unadressed, this issue tends to result in estimators that are likely to be biased towards zero, therefore underestimating the cyclical component of the budget balance. In other words, CABB estimates are likely to be overstated.

Former colleagues at Finance Canada have addressed this issue by jointly estimating the CABB and the short-term impact of government revenues and spending on economic activity (called the indicator of fiscal policy stance or FiPS),[1] using the Generalized Method of Moments estimation technique. This approach yields statistically unbiased estimates of both the CABB and the FiPS.

The cyclical component of the budgetary balance is estimated and the cyclically-adjusted component is computed as a residual. The cyclical component is estimated in a system of equations, whereby each equation in the system represents a budgetary revenue or expenditure. For example,

$$\Delta x_{it} = \beta_I \, \Delta y_t + e_{it}$$

where Δxit represents the quarterly change in the budgetary components (*i.e.*, revenues and expenditures) expressed as a per cent of potential GDP, Δyt is the quarterly change in the output gap (actual output less potential output as a per cent of potential output) and e_{it} is a residual. The estimated coefficient, β_i, represents the percentage point change in budgetary revenues or expenditures from a one-percentage-point change in the output gap. It is possible to sum the equations for each revenue and expenditure to obtain the sensitivity of the budgetary balance to changes in the output gap,

$$\Sigma\Delta x_{it} = \Sigma\beta_I \, \Delta y_t + \Sigma e_{it}$$

The estimated sensitivity of the budgetary balance to the output gap $(\Sigma\beta_i)$ can be applied to the annual level of the output gap to approximate the level of the cyclical component of the budget balance, which is then deducted from the actual budget balance to obtain the level of the CABB.

Estimated simultaneously, the FiPS measures the amount (in percentage points) that fiscal policy adds to or subtracts from GDP growth. The FiPS equation is as follows:

$$\Delta y_t = \alpha_i \, \Delta x_{it} + \gamma z_{it} + u_t$$

where Δy_t is the quarterly change in the output gap, Δx_{it} represents the quarterly change in the budgetary revenues and expenditures, expressed as a per cent of potential GDP, γz_{it} represents exogenous determinants of economic growth, and u_t is an error term. The estimated coefficient, α_i, represents the impact on GDP growth (in percentage points) of a 1-percentage-point change in the budgetary components.

When estimating Canada's cyclically-adjusted budget balance, a statistically significant cyclical component is found for all revenues and for spending on non-wage goods and services and transfers to persons. This differs from the conventional methods employed by the OECD and IMF, whereby only personal income tax, corporate income tax, direct taxes and employment-related spending are adjusted for the business cycle. This, combined with the GMM estimation technique, leads to a much larger cyclical component. Such an approach is very useful to assess

[1] For more information on the methodology, please refer to Murchison and Robbins (2002), Proceedings of the Banca d'Italia Fourth Workshop on Public Finance, *The Impact of Fiscal Policy*.

both the cyclical component of the budgetary balance and the impact of fiscal policy on the economy. However, it might be more difficult to extend this methodology to large cross-country comparisons given the large data and modelling requirements. Nevertheless, it is a very useful tool for single country analysis.

3. General observations

There are four issues raised by these papers that are worth highlighting. First, both papers provide valuable insights into the composition and evolution of budgetary balances. Their solid methodologies have been applied in other work, which is a good indicator of their reliability. For example, Kremer *et al.* disaggregated framework for analysing changes in structural budget balances have been used by the Deutshe BundesBank in a special section on the case of Germany in its March 2006 Monthly Report.

Second, results of the analysis of structural fiscal balances often provide a different view on what is deemed "appropriate fiscal policy". For example, the findings of Brandner *et al*. show that fiscal policy in Austria was generally tightened in downturns and loosened in upturns. This leads one to wonder if, contrary to general wisdom, downturns do not provide more opportunities than upturns when it comes to fiscal consolidation. From a public policy-making perspective it is very significant. Some countries experiences in that matter, namely Finland, Sweden and Canada in the 1990s tends to support these observations.

In addition, the analysis of structural fiscal developments is a very useful tool for policy-makers with regards to determining policies appropriate to the position in the cycle and to the measures, automatic or not, already in place. However, most of the work in this field has been undertaken at the total government level. This may be suitable for unitary countries, but the interpretation of the results for federal countries could be ambiguous given the interactions between policies implemented at the federal level and those at the sub-national levels, which are often uncoordinated. Therefore, it would be useful to highlight the contribution of various government levels to the structural balance, as they sometimes explain many important fiscal policy developments as suggested by the Brander *et al*. paper.

And finally, as was demonstrated in Session 4 by the paper of Boije and Fisher, there are various ways to estimate cyclically-adjusted budget balances and as a result there are a wide array of estimations of the CABB for the same country/year. Therefore, it might be useful in the future to evaluate the uncertainty surrounding cyclically-adjusted budget balance estimates. It would provide a margin of error around the estimations, which in turn would help assess the breakdown of the structural balance and its related changes through time.

COMMENTS ON SESSION 1: CYCLICAL ADJUSTMENT

Werner Röger[*]

1. Discussion of "Measuring Cyclically Adjusted Budget Balances for OECD Countries" by Nathalie Girouard and Christophe André

The paper presents a re-estimation and re-specification of the elasticities which underlie the OECD method for calculating CAB's. I think the new estimates are an improvement compared to the previous set of estimates. Especially some country variation that was previously difficult to explain has now been substantially reduced. The OECD approach links the cyclical variation of the budget to the output gap. It essentially proceeds in two steps.

Step 1:
Calculates elasticities of tax receipts and expenditures w. r. t. to tax or expenditure bases.

Step 2:
Calculates elasticities of tax or expenditure bases w. r. t. the cyclical indicator (output gap).

1.1 Elasticities of tax receipts and expenditures w. r. t. to tax or expenditure bases

Here the issue arises whether the degree of automatic stabilisation on the expenditure side is fully taken into account. The OECD only regards unemployment related expenditure as responding in a quasi automatic manner to changes in GDP/employment but not other spending. It does not take into account systematic (but not automatic) responses of other expenditure to the cycle. However, from the estimated cyclical response of expenditure and revenue to GDP ratios to the output gap it seems that there is a cyclical expenditure response which is of the same order of magnitude as the revenue response. Consider for example the following OLS regressions for expenditure and revenues for France and Germany:

Expenditure:

$$\frac{EG}{Y} = g0 + g1 * ygap \tag{1a}$$

Revenue:

$$\frac{RG}{Y} = r0 + r1 * ygap \tag{1b}$$

[*] European Commission – DG ECFIN.

Table 1

OLS Estimates of Equation (1a) and (1b)

Country	***g*1**	***r*1**
Germany	–0.31	–0.12
France	–0.51	–0.58

Source: OLS estimates: 1972-2004, annual data.

The estimation results show similar elasticities. Thus there seems to be a systematic expenditure response. In my view it would be interesting to trace this to certain expenditure components. For example, one important element of automatic stabilisation on the expenditure side is probably the government wage bill.

1.2 Elasticities of revenue and expenditure bases w. r. t. the cyclical indicator (output gap)

Concerning these elasticity estimates one can certainly argue that a bias could occur because of endogeneity and omitted variables. Consider for example the link between the wage bill and the output gap as estimated by the OECD and expressed in equation (2):

$$\text{Wage Bill} = a0+a1*(Y\text{GAP}) \qquad (2)$$

Certainly the output gap is not exogenous w. r. t. the wage bill and the elasticity ($a1$) is probably overestimated. But even if one neglects this problem, there is another Lucas Critique type of problem that seems to apply to these specifications. Equation (2) illustrates this nicely. Notice equation (2) links a nominal variable (the wage bill) to a real variable (the output gap). The elasticity estimate is therefore subject to the monetary policy and exchange rate regime. For example, in a regime where monetary policy accommodates real shocks the elasticity of the wage bill w. r. t. the output gap is likely to be larger compared to a regime with strict inflation targeting. For example, one would expect that countries with looser monetary policy have higher elasticity estimates compared to countries with tighter monetary policy. This is indeed reflected in the OECD estimates, where countries like Greece, Italy, Portugal and Spain, which had relatively high inflation rates in the sample period show by far the highest elasticities. From this a practical problem arises. Various countries have experienced a significant regime shift after entering EMU. It is therefore questionable whether elasticity estimates which are obtained over a pre EMU sample period can still be applied to countries that have joined EMU. To avoid this problem, shorter sample periods seem to be advisable. The new OECD methodology already goes in this direction by using a panel approach which allows shortening the time dimension. It would be interesting in further work to test whether these elasticities converge further for countries belonging to EMU.

2. Discussion of "The Missing Cycle in the HP Filter: Implications for the Measurement of Cyclically-adjusted Budget Balances" by Matthias Mohr

The paper generalises the HP filter by allowing a cyclical component which is not white noise. It is shown that allowing for a better representation of the cycle essentially removes the end point bias of the HP filter. The analysis is quite illuminating in tracing the sources of the end point bias. My discussion will concentrate on the following points. First I will discuss how the TC filter is related to a general univariate filtering problem. Secondly, I have some remarks on the volatility of the trend component and finally I will briefly discuss estimation problems.

Looking at the TC filter from the perspective of a general univariate filtering problem is instructive since it allows to better spot some implicit restrictions which are imposed by the filter. A generally filtering problem usually consists in decomposing an observed series X into a trend (XT) and a cycle (XC) as defined by the following measurement equation:

$$X_t = XT_t + XC_t \tag{1}$$

In order to make the decomposition meaningful the general characteristics of the trend and the cycle must be specified. Usually the trend component is modelled as a random walk with a time varying slope coefficient:

$$XT_t = g_t + XT_{t-1} + \varepsilon_t^T \tag{2}$$

The slope coefficient can possibly be a random walk itself:

$$g_t = \gamma\, g_{t-1} + \varepsilon_t^g \qquad \text{with } \gamma \le 1 \tag{3}$$

The cyclical component is specified as a stationary AR process:

$$XC_t = \alpha(L) XC_{t-1} + \varepsilon_t^c \tag{4}$$

The TC filter is a special case with the following restrictions. The parameter γ is either 0 or 1, *i.e.* the trend component is either $I(1)$ or $I(2)$. The TC filter prefers an $I(2)$ specification. And the variance of ε_t^T is zero ($\sigma_T^2 = 0$).

Do the data favour an $I(1)$ or an $I(2)$ process? The empirical choice is difficult to make. Generally unit root tests do not reject the $I(1)$ specification but usually $I(2)$ is rejected. The true process could be $I(1)$ with γ close to 1. Generally, the error of using an $I(2)$ process, when the true process is only close to $I(2)$ is small. Though one should be aware that in forecasting the $I(2)$ specification has a stronger tendency to extrapolating the most recent growth trend, while an $I(1)$ model has a stronger mean reverting tendency.

Setting the trend innovation variance equal to zero has potentially stronger implications for the results. Generally, in Kalman Filter exercises, the trend and slope variance is estimated to be positive. The ratio of σ_T^2 to σ_g^2 usually has a significant impact on the volatility of the trend. The volatility usually increases with the size of σ_T^2. However this does not explain why the volatility of the trend component of the TC filter is more volatile than the trend component of the HP filter, since both filters impose the same restrictions. In my view, the difference is due to the signal to noise ratio.

In order to show this I have conducted two experiments with a more univariate Kalman filter model where I impose restrictions on the innovation variance of the cyclical component. In the first experiment I impose a low signal to noise ratio (SNR: 0.009), while in the second experiments I impose a high signal to noise ratio (SNR: 1.195). The following graphs show the results for the two signal to noise ratios.

In my view, the comparison of these two cases shows that the more volatile trend is probably not an intrinsic property of the TC filter but the result of a specific choice of the signal to noise ratio.

Finally, a practical problem arises. How should the parameters be estimated? The paper doesn't offer a very convincing estimation strategy. I would therefore propose an alternative, namely directly applying the Kalman filter. In this case the

Figure 1

Decomposing GDP with a Low Signal-to-noise Ratio
(percent)

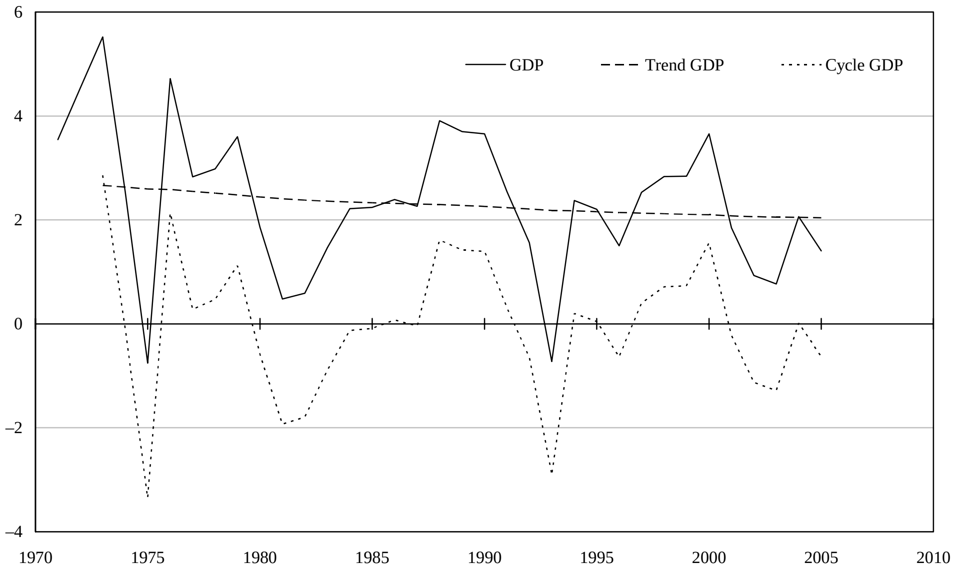
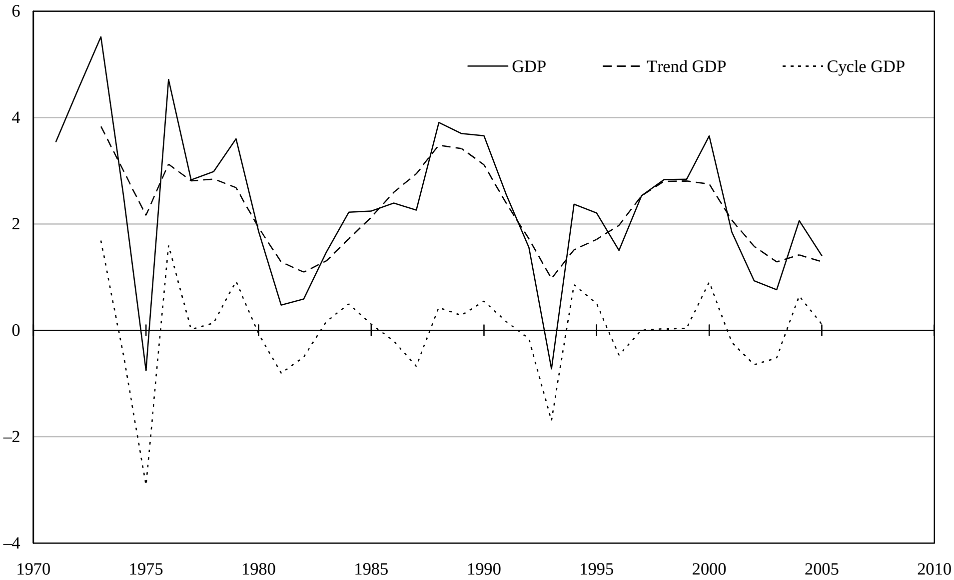


Figure 2

Decomposing GDP with a High Signal-to-noise Ratio
(percent)



parameters of the model can be estimated using maximum likelihood and statistical tests can be made within this framework. It is argued in the paper that this would be difficult from a computational point of view. However my experience suggests that this is only true in a multivariate context, while Kalman Filter estimates are fairly easily obtained in the univariate case.

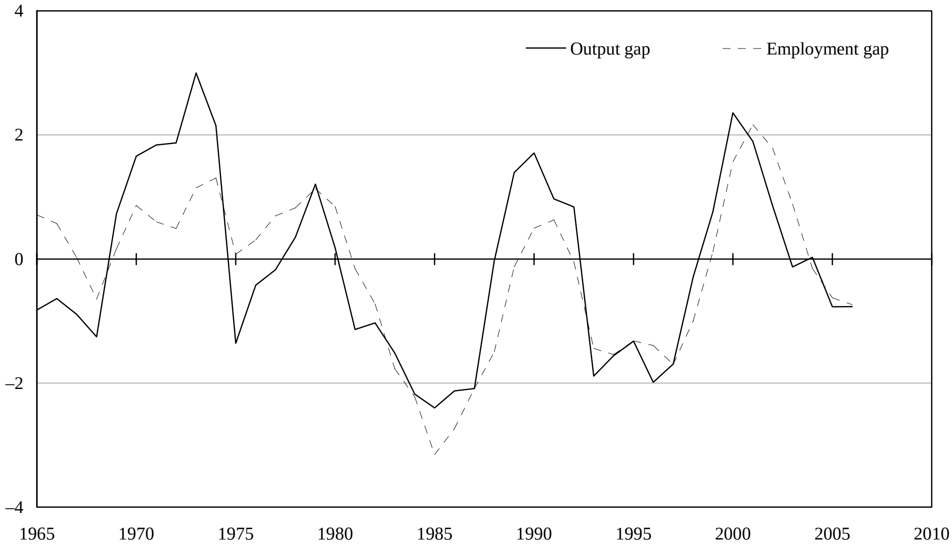
3. Discussion of "Fill the Gap – Measurement of the Cyclical Effect on the Budget" by G.P. Kiss and G. Vadas

The paper tries to combine the production function (PF) and the disaggregated approach for calculating CABs. The aim is to better exploit theoretical relationships among the variables which are used as revenue or expenditure bases in the disaggregated approach. In my view, it is a worthwhile endeavor to merge the two main approaches which are currently in use.

In the PF approach, the output gap is decomposed into gaps of factor inputs, and TFP. In order to link the PF approach to the disaggregated approach the paper suggests decomposing GDP also in its income components (wage and capital income) in order to generate tax bases for capital and labor taxes. In order to obtain a tax base for VAT the paper introduces a consumption function.

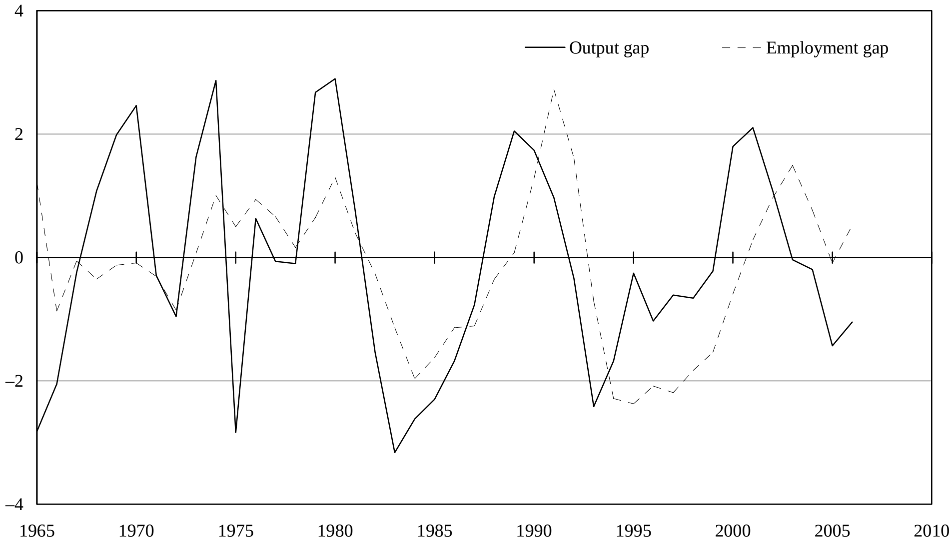
Figure 3

France: Output and Employment Gap
(percent)



Source: DG ECFIN.

Italy: Output and Employment Gap
(percent)



Source: ECFIN.

I also think that the two approaches can be combined, and a logical way to combine them is to decompose income derived from the factor input components into cyclical and trend components of income and to explicitly consider the link between consumption and the income of the individual factors of production. My discussion concentrates on the proposed output gap measure and on the link between consumption and income.

The paper proposes to only use the employment gap as a cyclical measure. A decomposition of TFP into a trend and a cyclical component is regarded as not being necessary. Here I do not follow the claim made in the paper that there are problems of estimating TFP. A consistent measure of TFP can be constructed under fairly general conditions. Also, I want to stress that there are various advantages of decomposing TFP. First, we do not have good measures of the cyclical variation of capacity. In the absence of capacity utilization, the cyclical component of TFP contains fluctuations of capacity utilization. Second, the cyclical component of TFP also contains temporary supply shocks, e.g. oil price shocks, natural disasters, strikes, and systematic sectoral shifts over the business cycle. These are non trivial effects. Standard variance decomposition exercises on GDP growth attribute about 30 to 40 per cent of the variation of GDP to stationary supply shocks. Consequently, the differences between the output gap and the employment gap are not insignificant. In particular, employment gaps tend to be smaller, at least in the first years of the sample and what is probably more important, they seem to lag the output gap as shown by the figures using France and Italy as an example.

My second point is how to link consumption to income and in particular, how to define a permanent and cyclical component of consumption. One has to decompose the individual income components into trend and cyclical components. Here I think the paper is not exploiting fully the information that is provided by the PF method. Elements from the production function could actually provide useful information for such a composition. For example, an important income component is wage income. The production function provides a decomposition of employment into a cyclical and a structural component (NAIRU and trend participation rate) but implicitly also a decomposition of wages into a cyclical and a structural component via the Phillips curve. Unfortunately other income components, in particular profit income and income from financial wealth as well as the wealth effect itself remain difficult to decompose.