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THE SIZE AND ROLE OF AUTOMATIC FISCAL STABILIZERS IN THE 1990s AND BEYOND

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by
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ABSTRACT/RÉSUMÉ

The Size and Role of Automatic Fiscal Stabilisers in the 1990s and Beyond

This paper assesses to what extent some components of government budgets affected by the macroeconomic situation operate to smooth the business cycle in individual OECD countries. It is shown that these automatic fiscal stabilisers have generally reduced cyclical volatility in the 1990s. However, in some countries the need to undertake fiscal consolidation in order to improve public finances has forced governments to take discretionary actions that have reduced, or even offset, the effect of automatic fiscal stabilisers. This paper also shows that, by preventing sharp economic fluctuations, fiscal stabilisers may raise long-term economic performance and avoid frequent changes in spending or tax rates. However, they should be employed symmetrically over the cycle in order to avoid costly debt accumulation.

JEL classification: E62, H30, H60
Keywords: fiscal policy, automatic stabilisers, business cycle, public finances

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Ce papier évalue dans quelle mesure certaines composantes des budgets publics affectées par la situation macroéconomique contribuent à lisser les cycles économiques dans chaque pays de l'OCDE. L'analyse montre qu'au cours de la dernière décennie ces stabilisateurs automatiques ont généralement eu tendance à réduire la variabilité conjoncturelle. Cependant, dans certains pays, la nécessité d'assainir les finances publiques a conduit les gouvernements à prendre des mesures discrétionnaires qui ont réduit, voire annulé, les effets des stabilisateurs automatiques. Ce papier montre aussi qu'en empêchant de trop fortes fluctuations économiques, les stabilisateurs automatiques peuvent accroître la performance économique à long terme et éviter des variations des dépenses ou des taux d'imposition trop fréquents. Ils doivent toutefois être utilisés de manière symétrique au cours du cycle pour éviter un accroissement coûteux du niveau d'endettement.

Classification JEL: E62, H30, H60
Mots-clés: politique budgétaire, stabilisateurs automatiques, cycle économique, finances publiques

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THE SIZE AND ROLE OF AUTOMATIC FISCAL STABILISERS IN THE 1990S AND BEYOND

Paul van den Noord[1]

I. Introduction

1. Many components of government budgets are affected by the macroeconomic situation in ways that operate to smooth the business cycle, *i.e.* they act as "automatic stabilisers". For example, in a recession fewer taxes are collected, which operates to support private incomes and damps the adverse movements in aggregate demand. Conversely, during a boom more taxes are collected, counteracting the expansion in aggregate demand. This stabilising property is evidently stronger if the tax system is more progressive. Another automatic fiscal stabiliser is the unemployment insurance system: in a downswing the growing payment of unemployment benefits supports demand and *vice versa* in an upswing.

2. The impact of automatic fiscal stabilisers may, at varying degrees, be reinforced by other mechanisms that operate to smooth the business cycle. For example, the behaviour of imports is sensitive to short-term fluctuations in aggregate demand and therefore help to stabilise variations in economic activity. Similarly, "permanent income" theories of consumption behaviour suggest that consumer spending responds only slowly to income fluctuations, which would tend to make private saving behaviour stabilising. On the other hand, saving behaviour can be destabilising, when a slowing economy leads to higher saving to build up reserves as a precaution against weaker earnings prospects and job security. Capital gains and losses on real and financial assets may also lead to destabilising movements in private saving. Reactions in financial markets and of monetary conditions to cyclical developments should also reinforce the fiscal stabilisation mechanisms. Indeed, estimates for the United States suggest that stabilisation through financial markets' reactions offset as much as 60 per cent of the cyclical variations in output, see Asdrubali *et al.* (1996). The role of monetary policy is central in this regard, although this depends crucially on the exchange rate regime in place. Where exchange rate arrangements permit, monetary policy adjustments designed to ensure price stability should operate to stabilise activity by generating pro-cyclical interest rate developments and at least working to encourage pro-cyclical exchange rate behaviour in a way that provides incentives for further adjustment in international trade flows. Under a fixed exchange rate regime, on the other hand, monetary policy is not available to play such a role and, in some circumstances (*e.g.* several countries participating in or shadowing the ERM in the early 1990s), may even be destabilising. Finally, cyclical variations in labour productivity prevent sharp swings in the demand for labour and thus help to stabilise unemployment.

3. Although by damping the business cycle automatic fiscal stabilisers may help to reduce the long-lasting economic damage associated with large under-utilised resources, they also entail risks for the economy. One relates to the importance of allowing stabilisers to operate symmetrically over the business cycle. If governments allow automatic fiscal stabilisers to work fully in a downswing but fail to resist the temptation to spend cyclical revenue increases during an upswing, the stabilisers may lead to a bias toward

1 . The author is indebted to Paul Atkinson, Jørgen Elmeskov, Mike Feiner and Ignazio Visco and several other colleagues in the Economics Department for comments and drafting suggestions, to Dave Rae for running simulations with the INTERLINK model and Anne Eggimann, Isabelle Duong, Nanette Mellage and Chantal Nicq for technical assistance. Special thanks are due to Marco Buti and several national delegates for stimulating discussions. Of course all errors and omissions are the author's.

weak underlying (or "structural") budget positions. The result may be rises in public indebtedness during periods of cyclical weakness that are not subsequently reversed when activity recovers. This, in turn, could lead to higher interest rates as well as requiring higher taxes (or spending reductions) to finance debt servicing. Unstable "debt dynamics" working to increase debt-GDP ratios over time, due to real interest rates that exceed economic growth rates, may aggravate this problem. A second risk arises from the fact that automatic fiscal stabilisers respond to structural changes in the economic situation as well as to cyclical developments. Consequently, if the economy's growth potential declines, and this is not appreciated by the government in a timely fashion, the operation of automatic fiscal stabilisers is likely to undermine public finance positions that might otherwise have been sound. Finally, automatic fiscal stabilisation results from the operation of tax and benefit systems that primarily serve other objectives such as income security and redistribution. These systems may delay necessary adjustment in the wake of a recession, thus contributing to poor economic performance.

4. Against this backdrop this paper assesses the size and role of automatic fiscal stabilisers in the 1990s and beyond. The next section below provides estimates of the size of automatic fiscal stabilisation as measured by the cyclical component of the budget balance over the past decade. The following sections focus on the impact of automatic fiscal stabilisers on the business cycle and on longer-run economic performance. The appendix describes the analytical framework that has been developed to measure the sensitivity of government net lending to cyclical variations in GDP, as well as the key parameters and estimates of this sensitivity for most OECD countries.

II. How large are automatic fiscal stabilisers?

5. The counter-cyclical demand impulse stemming from automatic fiscal stabilisers depends on the sensitivity of government net lending, as a share of GDP, to cyclical variations in output, and the size of those variations. Measurement is largely an unsettled issue. Widely different methods are being employed both by national governments and various international institutions (see Box 1). Each method has specific strengths and weaknesses, but whatever method is employed, the user needs to be aware of a problem of "simultaneity": the business cycle changes the fiscal position which, in turn, affects economic activity. The OECD Secretariat's approach involves three main steps:

(i) Elasticities of various forms of taxation and expenditure with respect to output are calculated to estimate the sensitivity of these items to the cycle. These have been updated for the purpose of this paper (see the appendix). On the revenue side, all tax receipts are adjusted for the cycle, with taxes being grouped into four types (indirect, business, social security and personal income tax). On the expenditure side, estimates of the automatic stabilisers are limited to the impact of the cycle on benefits paid to the unemployed (including "active labour market measures"), although debt-interest payments are also sensitive to some extent. The new elasticities are reported in Table A.1 of the annex.

(ii) Potential output is estimated on the basis of country-specific production functions that have been estimated for a sample period covering the past three decades. This work was previously reported in Giorno *et al.* (1995), and has been updated since.

(iii) The output gap and the elasticities are used to derive the impact on tax and expenditure arising from the economy's operation above or below potential. This is taken to measure the cyclical component of each item. Combining these estimates gives the full cyclical component of the budget balance and allows the simultaneous calculation of the cyclically-adjusted budget balance, i.e. the general government net borrowing or lending that would take place if the economy were operating at potential.

Box 1. **Gauging fiscal automatic stabilisers -- different approaches**

Different approaches have been developed over time to disentangle cyclical and structural components of government expenditure, (tax) revenues and balances. Most approaches start off from the observation that economic activity influences tax bases (wage bill, profits, consumption, etc.) and unemployment, which, in turn determine tax proceeds and public expenditure. The approaches differ with respect to the method employed to identify the cycle in economic activity and the way to determine the sensitivity of budget items to the cycle. The official methods also differ from one country to another.

Generally speaking, two ways to identify the cycle in economic activity co-exist. A *mechanical* approach uses smoothing devices (such as Hodrick-Prescott filters) to establish a trend level of output; the cyclical component (output gap) is the difference between actual and trend output. In some cases the de-trending of output series is dropped altogether, with the smoothing device applied directly to the tax base and unemployment series. The mechanical approach is relatively simple, transparent and requires little judgmental intervention. A major drawback is the "end point bias": the difference between actual and trend series tends to become small for recent observations, meaning that economic slack or overheating may escape the observer. This drawback has motivated the development of an alternative approach measuring *potential* rather than trend output, based on a production function. This method, which has been adopted by the OECD Secretariat, is somewhat more complex since it requires judgements on the rate of technological change, its bias (labour or capital augmenting) and, importantly, the rate of structural unemployment. However, it is less susceptible to the end-point problem for recent observations.

Methods to determine the sensitivity of budget items to the cycle can be grouped into three categories:

- A first approach is to run regressions on the observed tax proceeds and public expenditure, with as explanatory variables, discretionary changes in tax or benefit parameters, a trend and a cyclical term (the latter two may be based on trend or potential output measures). From these equations elasticities are derived that measure the impact of a (cyclical) change in output on tax revenues or expenditure (see for an example, Bismut 1995). The accuracy of this approach strongly depends on the reliability of the policy variables that are included in the regressions. If these fail to cover the whole ground of relevant policy measures, some of the policy-induced effects on the budget may end up in the estimated elasticities, which could therefore be misleading. This approach will only be fruitful if detailed information on relevant policy changes is available for a long range of years and kept up to date. The collection of such information is time consuming and this approach is therefore less suited for users that need to cover a large number of countries.

- A second group of methods derive tax and expenditure elasticities from a macro-econometric model, with standard-shock simulations calibrated to show the impact of a 1 per cent (cyclical) increase in output on budget variables. This approach has the advantage that it allows differentiating between various kind of demand shocks (consumption, exports, etc.). On the other hand, it does not resolve the data collection problem alluded to above, because, in order to give accurate results for this purpose, the tax and expenditure equations in the model need to be estimated according to the above procedure.

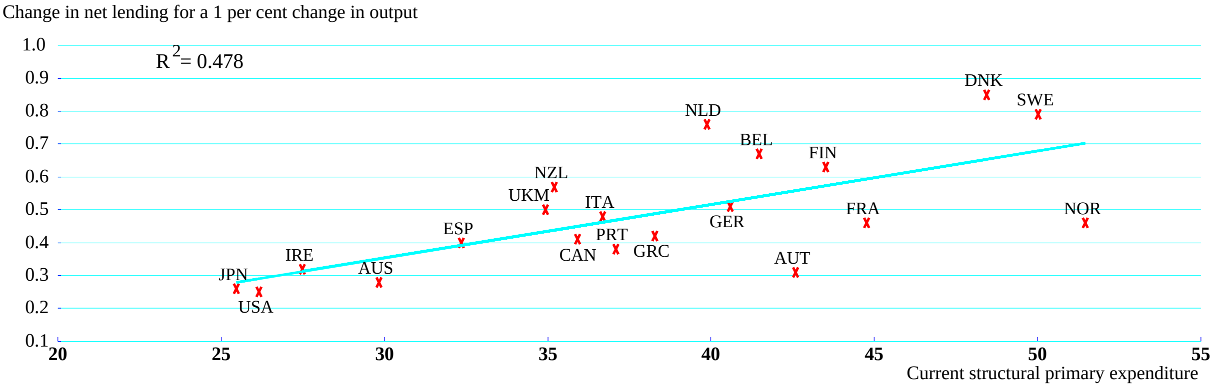
- A third approach, which has been adopted by the OECD Secretariat (see the appendix), proceeds in three steps. First, the elasticities of the relevant tax bases and unemployment with respect to (cyclical) economic activity, *i.e.* the output gap, are estimated through regression analysis. Next, the elasticities of tax proceeds or expenditure with respect to the relevant bases are extracted from the tax code or simply set to unity in cases where proportionality may be assumed. These two sets of elasticities are subsequently combined into reduced-form elasticities that link the cyclical components of taxes and expenditure to the output gap. While this method aims to strike a balance between accuracy and resource cost, it does not allow a further breakdown of the structural fiscal balance into discretionary and induced components.

In addition the OECD Secretariat has experimented with a complementary approach, using a structural VAR model to capture the effects on fiscal balances of specific economic shocks in the past in EU countries (Dalsgaard and De Serres, 1999). A main advantage relative to the above approaches is that estimates of output gaps are not required, but the results with this model are not directly comparable to those derived from other approaches. This is the case because the elasticities that are derived from the VAR model include not only the impact of automatic stabilisers, but also that of discretionary fiscal policy to the extent that it reacts in a systematic fashion to economic disturbances.

6. The most important factor determining the cyclical sensitivity of the fiscal position is the *size of the general government sector*. For the most part, 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 1). The *tax structure* also has a significant impact on the size of automatic stabilisers: the higher the taxation of cyclically sensitive tax bases, the more the tax take will vary with the business cycle and hence the greater will be the cyclical sensitivity of the fiscal position. The *progressivity* of taxes, the generosity of unemployment benefits and the cyclical sensitivity of various tax bases and unemployment, finally, are other significant factors in determining the cyclical sensitivity of the fiscal position.

Figure 1. Cyclical sensivity of the fiscal position and government size, 1999

Per cent of GDP



Note: AUS = Australia; AUT = Austria.

7. Based on the observed variations in economic activity, the cyclical component of government net lending is estimated to have peaked in the late 1980s boom at 0.6, 0.4 and 1.2 per cent of GDP in the United States, Japan and the euro area, respectively (Table 1). Conversely, the early 1990s recession prompted the cyclical component of these economies' fiscal balances to turn negative, and hence stimulatory, by roughly the same amounts. After the early-1990s recession, cyclical components diverged across the OECD area, reflecting a de-synchronisation of business cycles. In the United States the cyclical component has now returned to its late-1980s peak, whereas it has remained negative in the euro area and Japan throughout the 1990s. Not surprisingly, economies where activity has been volatile and government sectors are large display the largest cyclical fluctuations in budget balances. Finland and Sweden are the most striking examples in this regard, although at least part of the volatility registered in these countries reflects a series of one-off, rather than cyclical, shocks.

8. For a number of reasons, the above estimates are surrounded by significant margins of uncertainty. First, they are based on a combination of time-series regression and information extracted from national tax codes. Accordingly, the estimated cyclical sensitivity of budget items may be expected to reflect, at best, the "average" cyclical responsiveness of these items over a sample period. Actual year-to-year behaviour may be more erratic as specific tax bases may react atypically over the cycle. Second, the cyclical behaviour of tax yields may be changing over time due to reforms of tax systems. Reform initiatives since the mid-1980s have generally been geared to flattening personal tax rate structures, which should have worked to reduce the automatic stabilising properties of tax systems. Third, the response of tax bases to changes in activity may depend on the nature of the economic shock(s) that produced the boom or recession. For example, supply shocks that are associated with improvements in technology and changes in

labour supply may coincide with demand shocks that stem from the international trade cycle or movements in household sentiment. In theory, the change in the fiscal position that results from a supply shock is recorded as structural rather than cyclical. In practice, however, it is not allways easy to disentangle structural and cyclical influences on the budgets.

Table 1. **Cyclical component of general government financial balances**[1]

Surplus (+) or deficit (-) as a per cent of GDP

	Cyclical peak			Subsequent trough			Current situation		
	Year	Output gap	Cyclical component	Year	Output gap	Cyclical component	Year	Output gap	Cyclical component
United States	1989	2.0	0.6	1991	-1.8	-0.6	1999	2.5	0.6
Japan	1991	3.1	0.4	1995	-2.3	-0.5	1999	-3.5	-0.9
Germany	1990	2.8	1.3	1993	-1.0	-0.5	1999	-1.7	-0.9
France	1990	1.2	0.5	1993	-2.3	-1.1	1999	-0.7	-0.3
Italy	1989	1.9	0.9	1993	-3.2	-1.7	1999	-3.2	-1.5
United Kingdom	1988	5.6	2.8	1992	-2.8	-1.6	1999	0.7	0.4
Canada	1988	4.0	1.7	1992	-4.6	-2.3	1999	0.1	0.0
Australia	1989	2.1	0.6	1992	-2.8	-0.9	1999	1.2	0.3
Austria	1990	2.7	0.8	1993	-1.5	-0.5	1999	0.3	0.1
Belgium	1990	2.0	1.3	1993	-2.9	-2.1	1999	-1.2	-0.8
Denmark	1986	3.0	2.6	1993	-4.7	-4.1	1999	0.1	0.1
Finland	1989	5.9	3.4	1993	-9.2	-7.2	1999	0.4	0.3
Greece	1989	2.9	1.3	1994	-2.7	-1.2	1999	-0.6	-0.2
Ireland	1990	4.6	1.8	1994	-4.0	-1.6	1999	5.0	1.6
Netherlands	1990	1.7	1.5	1993	-1.1	-1.0	1999	1.4	1.1
New Zealand	1986	1.9	1.3	1992	-5.2	-3.2	1999	-1.6	-0.9
Norway (mainland)	1986	2.7	1.6	1990	-4.6	-3.1	1999	1.4	0.6
Portugal	1990	3.4	1.2	1994	-1.8	-0.7	1999	-0.1	0.0
Spain	1990	4.7	1.9	1996	-2.0	-0.8	1999	0.2	0.1
Sweden	1989	4.4	3.4	1993	-5.9	-5.4	1999	-0.2	-0.1
Euro area average	1990	2.4	1.2	1993	-1.9	-1.0	1999	-1.1	-0.5
OECD average[2]	1989	1.8	0.9	1993	-1.8	-0.5	1999	0.1	0.0

1. The cyclical component is calculated by subtracting the structural component, as a per cent of potential GDP, from the actual balance, as a per cent of GDP. The structural component in turn is calculated from the cyclically-adjusted tax revenues and government expenditures, based on the ratio of potential output to actual output and assumed built-in elasticities (see Appendix).
2. Excluding Czech Republic, Hungary, Iceland, Korea, Mexico, Poland, Switzerland and Turkey.

Source : OECD.

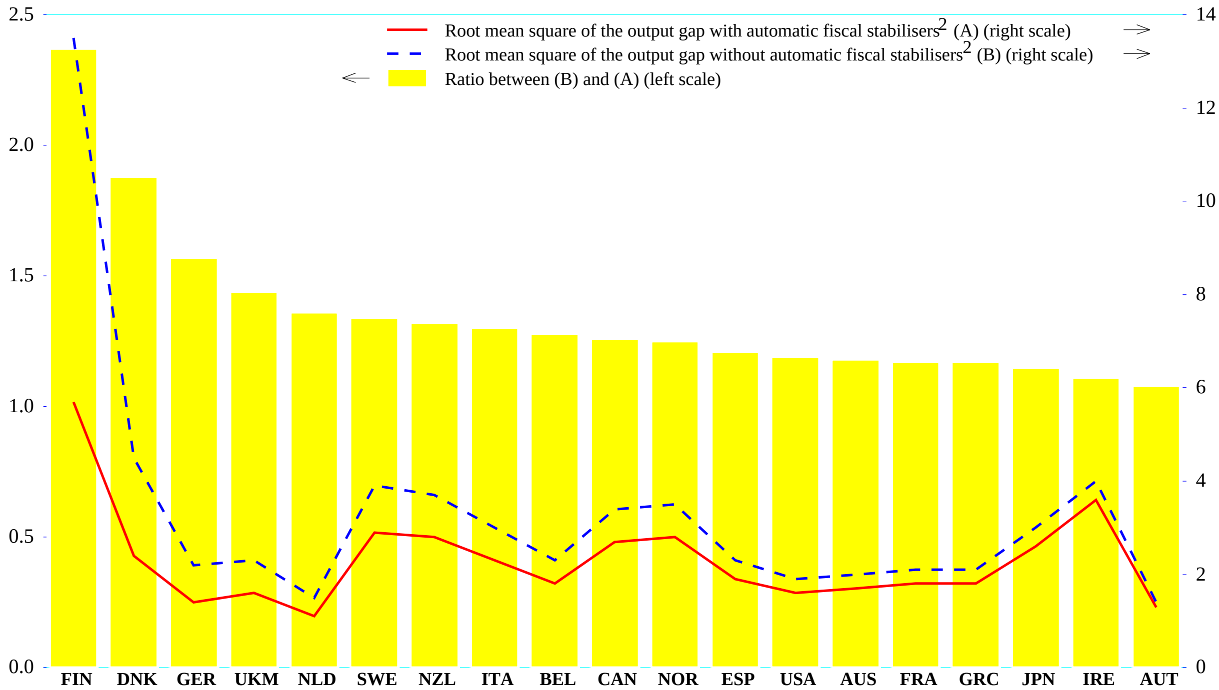
III. What impact do automatic fiscal stabilisers have on the economy?

9. A change in cyclically sensitive government spending (mainly unemployment benefits) or taxes affects spending in the economy mainly through its impact on disposable income, and hence household consumption. The Secretariat’s INTERLINK model captures the basic macroeconomic relationships that operate, and simulations have been carried out with this model to assess the degree to which automatic fiscal stabilisers have damped cyclical fluctuations over the 1990s. Fiscal stabilisers have been “switched off” in the simulations by setting tax and spending flows to their structural levels. Monetary policy is assumed to have responded to economic developments in much the same way as it has usually behaved historically, *i.e.* leaning against the business cycle to some extent. In practical terms this has been

approximated by a "Taylor rule", which implies that interest rates are raised if either inflation or the output gap rise above their baseline levels, in all countries except for those (other than Germany) that participated in the ERM throughout the 1990s until the start of monetary union and were least affected by the turbulence of the early and mid-1990s (*i.e.* France, Austria, Belgium, Denmark, the Netherlands and Spain). For the latter group of countries, nominal interest rates were kept constant. Nominal exchange rates were held fixed and the simulations run on a country-by-country basis, which means that international linkages were switched off.

10. The simulations suggest that over the 1990s the automatic fiscal stabilisers have worked to damp the cyclical fluctuations in economic activity by roughly a quarter on average (Figure 2). However, there is considerable cross-country variation, in part reflecting the relative openness of economies and differences in monetary policy responsiveness. In particular, Finland and Denmark provide clear examples where automatic fiscal stabilisers are essential: without them, output volatility in the 1990s would have been twice as high. The ranking of countries with regard to the stabilising impact of automatic fiscal stabilisers reported in Figure 2 is broadly in line with other studies, but some studies report somewhat higher levels of stabilisation for the European countries; see for example Buti and Sapir (1998).

Figure 2. Impact of automatic fiscal stabilisers[1]



1. Unchanged nominal exchange rates for all countries and a Taylor rule for interest rates for all countries except France, Austria, Belgium Denmark, the Netherlands and Spain, where interest rates were kept unchanged.

2. Defined as $\sqrt{\frac{1}{9}\sum_{t=1991}^{2000} gap_t^2}$ where $gap_t = (y - y^*)/y^*$; y = GDP and y* = potential GDP.

11. There are important qualifications to these results. First, where fiscal positions threatened to become unsustainable, even if this was due to cyclical weakness, business and financial market confidence deteriorated in a number of countries. Therefore risk premia in real long-term interest rates rose (Orr *et al.*, 1995), which had a negative influence on economic activity. When this occurs, the negative effect on private spending operates to diminish or even to reverse the supportive effects of automatic fiscal stabilisers. Such confidence effects are not incorporated in INTERLINK and, therefore, not reflected in the results reported in Figure 2. When financial markets respond to rising budget deficits this way, there is little alternative to correcting the fiscal position even if this means overriding the automatic stabilisers. Several cases have been reported where such policy responses helped to reverse increases in long-term interest rates and contributed to a brisk recovery, notably in Finland, Denmark, Ireland and Sweden (see Giavazzi and Pagano, 1990 and 1995).

12. Second, the model simulations may also understate the extent of “non-Keynesian” responses to fiscal automatic stimulus, by which is meant an increase in household saving rates in reaction to deteriorating fiscal balances. If this occurs, the demand impetus stemming from the fiscal automatic stabilisers may be smaller than expected or even negative. Such “perverse” savings reactions are all the more likely if public debt is already high, since the private sector may fear tax increases further down the road to offset a debt explosion (Sutherland, 1997). In Europe, for instance, the intense public debates prior to the ratification of the Maastricht Treaty have made the public well aware of fiscal issues, and may thus have prompted such forward-looking saving behaviour (Martinot, 1999). This could happen again if, for example, the public deficit approaches the 3 per cent of GDP benchmark in a future recession. Unfortunately, while forward-looking saving behaviour invalidates the impact of fiscal automatic stabilisers on economic activity, the adverse impact on government borrowing remains.

13. The simulations described above treat discretionary fiscal policy adjustments as if they were not influenced either by the operation of automatic stabilisers or by the situation in the economy. However, the overall degree of fiscal stabilisation reflects both the operation of the stabilisers themselves and their influence on, and interaction with, discretionary policies. Thus, if automatic stabilisers are overridden by discretionary adjustments, their impact will be neutralised. On the other hand, if they are reinforced by discretionary adjustments, the overall fiscal impulse will be stronger. Table 2 reports both the behaviour of fiscal policy and the impact of automatic stabilisers on budget balances over the past decade. It suggests that in the early-1990s recession twelve countries reinforced the automatic fiscal stabilisers through an easy stance of fiscal policy (United States, Japan, France, United Kingdom, Canada, Australia, Austria, Denmark, Finland, Norway, Portugal and Sweden) while other countries offset the working of automatic fiscal stabilisers by adopting a tight fiscal stance. As a result, on average the fiscal stance in the OECD area, as measured by the change in the structural primary balance, was neutral in the recession. With the exceptions of Japan and Norway, all countries reverted to or maintained a tight fiscal stance during the remainder of the decade.

14. A scenario simulated with INTERLINK in which a neutral fiscal stance is assumed for the 1990s suggests that the use of discretionary fiscal policy on average slashed the fluctuations in economic activity during the decade by half (Table 3). Interestingly, the *United States* obtained this result while achieving a better fiscal position than it otherwise would have realised. Discretionary fiscal policy thus acted as a powerful complement to automatic fiscal stabilisation; it contributed to both a virtuous circle of sustainable economic growth and steadily improving public finances. In *Japan* the variability of economic activity has also been significantly limited as a result of discretionary fiscal policy. However, since both automatic and discretionary fiscal policy have been mostly stimulatory over the decade they caused a dramatic deterioration of the fiscal position and the public debt-to-GDP ratio.

Table 2. **Automatic fiscal stabilisers and the fiscal stance**
Percentage of (potential) GDP

	Change in[1]					
	Overall balance		Cyclical component		Structural primary balance	
	Late-1980s peak to early-1990s trough	Early-1990s trough to 1999	Late-1980s peak to early-1990s trough	Early-1990s trough to 1999	Late-1980s peak to early-1990s trough	Early-1990s trough to 1999
United States	-1.8	7.3	-1.1	1.2	-1.1	4.6
Japan	-6.5	-4.0	-0.9	-0.4	-5.5	-2.9
Germany	-1.2	1.6	-1.8	-0.4	1.1	2.5
France	-4.4	3.8	-1.6	0.8	-2.2	3.1
Italy	0.4	7.1	-2.6	0.2	5.8	2.4
United Kingdom	-7.1	7.2	-4.4	2.0	-3.6	6.1
Canada	-4.9	9.6	-4.0	2.4	-0.5	7.2
Australia	-5.9	6.7	-1.5	1.3	-1.8	4.5
Austria	-1.7	2.0	-1.3	0.6	-0.1	1.4
Belgium	-1.8	6.2	-3.4	1.3	1.4	2.2
Denmark	-6.2	5.8	-6.7	4.2	-1.4	0.3
Finland	-13.2	10.2	-10.5	7.4	-1.7	4.5
Greece	4.4	8.5	-2.5	1.0	12.8	2.5
Ireland	0.8	5.4	-3.4	3.3	2.2	-0.3
Netherlands	2.1	3.0	-2.5	2.1	4.8	0.5
New Zealand	3.3	3.2	-4.4	2.2	5.9	-1.9
Norway (mainland)	-6.2	2.4	-4.7	3.7	-3.0	0.9
Portugal	-0.9	4.2	-1.9	0.6	-3.1	0.7
Spain	-0.9	3.6	-2.8	0.9	3.5	1.5
Sweden	-17.0	14.1	-8.8	5.3	-7.8	10.9
Euro area average	-1.4	3.9	-2.2	0.5	1.4	2.7
OECD average[2]	-3.0	3.6	-1.4	0.5	0.0	1.4

1. The cyclical component and the structural primary balance do not add up to the overall balance, the net interest payments being the residual.
2. Excluding Czech Republic, Hungary, Iceland, Korea, Mexico, Poland, Switzerland and Turkey.

Source : OECD.

15. The simulations suggest that in the *European Union* the tight stance of discretionary fiscal policy contributed to the sluggishness of the recovery from the 1993 recession. However, there was no other option in many EU countries given the poor state of public finances at the time of the Maastricht Treaty and beyond. Had fiscal automatic stabilisers been allowed to work without any discretionary adjustments in the euro area, the simulations suggest that 1999 budget deficits would on average be six times as high as their current levels. This would undoubtedly have boosted long-term interest rates, perhaps significantly, and would have extended the episode of exchange rate turbulence that marked the early and mid-1990s. Obviously this would have made the establishment of monetary union extremely difficult. Interestingly, several European countries that eased fiscal policy during the recession and tightened later (France, the United Kingdom and Sweden) had some success in terms of stabilising the economy, but at the cost of fiscal positions that were still weaker in 1999 and substantially higher debt ratios.

Table 3. **Volatility of economic activity and public finances with and without discretionary fiscal policy** [1]

	Fiscal stance in the early-1990s downturn[2]	Root mean square of output gap 1991-1999		Net lending, per cent of GDP 1999		Gross debt, per cent of GDP 1999	
		Actual	Neutral discretionary fiscal policy	Actual	Neutral discretionary fiscal policy	Actual	Neutral discretionary fiscal policy
United States	easy	1.4	3.8	1.0	-5.0	62.4	76.2
Japan[3]	easy	2.3	4.6	-6.0	16.3	97.3	22.9
Germany	tight	1.3	1.6	-1.6	-6.5	62.6	72.7
France	easy	1.8	1.7	-2.2	-0.6	65.2	48.9
Italy	tight	2.1	0.4	-2.3	-28.0	119.7	187.5
United Kingdom	easy	1.5	1.9	0.7	1.6	54.0	31.5
Canada	easy	2.7	1.9	1.6	-37.8	86.9	192.7
Australia	easy	1.7	3.4	0.6	6.2	30.3	0.0
Austria	easy	1.8	3.2	-2.1	-6.8	63.3	80.4
Belgium	tight	1.8	1.1	-1.0	-4.5	114.1	124.5
Finland	easy	5.7	8.6	-3.0	2.7	43.6	26.2
Greece	tight	1.8	4.4	-1.6	-13.4	108.8	152.0
Ireland	tight	3.1	3.8	3.4	0.5	43.9	53.2
Netherlands	tight	1.0	2.5	-0.6	-6.5	62.9	86.2
New Zealand	tight	2.8	3.2	0.0	0.6	**	**
Spain	tight	1.9	3.0	-1.4	-7.9	70.3	86.6
Sweden	easy	2.9	4.0	2.3	2.5	68.3	42.2
Euro area average[4]	tight	1.4	0.6	-1.6	-9.6	74.8	95.3
OECD average[5]	neutral	0.8	1.6	-1.0	-3.5	72.7	73.6

1. Neutral discretionary fiscal policy means holding structural tax and primary spending at their 1990 levels (as a proportion of potential GDP). The monetary policy assumption is an unchanged nominal exchange rate for all countries, and a Taylor rule for interest rates for all countries except France, Austria, Belgium, the Netherlands and Spain (their nominal interest rates were kept unchanged). For technical reasons, results for Denmark, Norway and Portugal are not available.
2. Based on the change in the structural primary balance as a percent of potential GDP between the late-1980s cyclical peak and the early-1990s cyclical trough (an increase in the balance points to a tight fiscal stance and vice versa, see Table 2).
3. Simulation ends in 1998. For technical reasons results for 1999 are not available.
4. Excluding Portugal.
5. Excluding Czech Republic, Denmark, Hungary, Iceland, Korea, Mexico, Norway, Poland, Portugal, Switzerland and Turkey.

Source : OECD.

IV. Do automatic fiscal stabilisers have an impact on longer-term performance?

16. There are a number of ways in which fiscal stabilisers may impinge on longer-term economic performance. On the positive side, achievement of longer-term objectives of sustainable economic growth, full employment and price stability, requires short-run macroeconomic stabilisation policy to ensure the maintenance of an appropriate level of aggregate demand. Recurrent large under-utilisation of resources can have damaging longer-term effects if it leads to under-investment in, and failure to maintain, physical and, more importantly, human capital. While periods of overheating may have some similar, offsetting effects in a favourable direction, it is likely that sharp fluctuations around the trend on balance have negative implications for the economy's longer-term potential (see Box 2 for a numerical experiment to illustrate this).

Box 2. **Business cycle volatility and the structural fiscal position: a numerical experiment**

The following example serves to illustrate how business cycle volatility may reduce potential output and the structural fiscal balance in the longer run if the economy is susceptible to "hysteresis", *i.e.* when a cyclical downswing becomes partly structural. This can be shown with the help of the following set of equations:

$$(1)\quad Y_t = Y_t^* + p \times \sin(t); t = 0,1,2,...$$

$$(2)\quad Y_t^* = Y_{t-1}^* + h \times \min\left[0, \left(Y_t - Y_t^*\right)\right]$$

$$(3)\quad pb^*{}_t = 0.2 \times \frac{Y_t^* - Y_0^*}{Y_0^*};$$

$$(4)\quad d_t^* = \left(1 + \frac{r - \left(Y_t^* - Y_{t-1}^*\right)/Y_{t-1}^*}{1 + \left(Y_t^* - Y_{t-1}^*\right)/Y_{t-1}^*}\right) \times d_{t-1}^* - pb_t^*$$

$$Y_0^* = Y_0 = 100; d_0^* = pb_0^* = 0$$

Equation (1) determines actual output (Y) by adding a cyclical term to potential output (Y^*). The latter is the sine of the time index (t) multiplied by a parameter p (the higher p the more volatile the cycle is). Equation (2) assumes that a negative output gap reduces potential output by a factor h due to hysteresis effects on structural unemployment -- *i.e.* in a recession structural unemployment increases. Hence, greater volatility (p) leads to higher structural unemployment and, in turn, to lower potential output (see Elmeskov and Mac Farlan (1993) for empirical evidence for this relationship). Equation (3) calculates the structural primary fiscal position as a per cent of potential GDP (pb^*). It assumes that the structural fiscal position deteriorates by 0.2 percentage point for every 1 per cent decline in potential output due to an increase in public expenditure associated with a rise in structural unemployment. Equation (4), finally, calculates the structural debt/GDP ratio as a function of the differential between the real interest rate (r) and the potential growth rate of the economy.

The impact of business cycle volatility on output and the structural fiscal balance

	Strong volatility (*p* = 4), Negative hysteresis (*h* = 0.1)				Weak volatility (*p* = 2), Negative hysteresis (*h* = 0.1)				Strong volatility (*p* = 4), No hysteresis (*h* = 0)			
Time	Actual output	Potential output	Structural primary balance[1]	Structural public debt[2]	Actual output	Potential output	Structural primary balance[1]	Structural public debt[2]	Actual output	Potential output	Structural fiscal balance[1]	Structural public debt[2]
0	100.0	100.0	0.0%	0%	100.0	100.0	0.0%	0%	100.0	100.0	0.0%	0%
5	101.9	100.0	0.0%	0%	101.0	100.0	0.0%	0%	101.9	100.0	0.0%	0%
10	103.4	100.0	0.0%	0%	101.7	100.0	0.0%	0%	103.4	100.0	0.0%	0%
15	104.0	100.0	0.0%	0%	102.0	100.0	0.0%	0%	104.0	100.0	0.0%	0%
20	103.6	100.0	0.0%	0%	101.8	100.0	0.0%	0%	103.6	100.0	0.0%	0%
25	102.4	100.0	0.0%	0%	101.2	100.0	0.0%	0%	102.4	100.0	0.0%	0%
30	100.6	100.0	0.0%	0%	100.3	100.0	0.0%	0%	100.6	100.0	0.0%	0%
35	98.3	99.7	-0.1%	0%	99.1	99.8	0.0%	0%	98.6	100.0	0.0%	0%
40	95.4	98.5	-0.3%	1%	97.7	99.2	-0.2%	1%	97.0	100.0	0.0%	0%
45	92.7	96.6	-0.7%	4%	96.4	98.3	-0.3%	2%	96.1	100.0	0.0%	0%
50	90.8	94.7	-1.1%	9%	95.4	97.3	-0.5%	4%	96.2	100.0	0.0%	0%
55	90.2	93.0	-1.4%	16%	95.1	96.5	-0.7%	8%	97.2	100.0	0.0%	0%
60	91.0	92.1	-1.6%	25%	95.5	96.1	-0.8%	12%	98.9	100.0	0.0%	0%
65	92.9	92.0	-1.6%	34%	96.4	96.0	-0.8%	17%	100.9	100.0	0.0%	0%

1. Per cent of potential output.

Box 2. **Business cycle volatility and the structural fiscal position: a numerical experiment** (continued)

The table above shows that for $p = 4$ and $h = 0.1$ (which are arbitrarily chosen) and $r = 0.02$, potential output will have fallen by 7 per cent by the end of the cycle and the structural balance by 1½ percentage points, while the potential debt/GDP ratio climbs to 34 per cent. However, if cyclical volatility is halved ($p = 2$), potential output, the structural balance and the structural debt ratio deteriorate by half as much.

It needs to be pointed out, however, that the experiment describes a second-best option. The first-best option would be to remove the sources of "hysteresis" altogether, *i.e.* prevent cyclical declines in output from affecting potential output, as is illustrated by the third simulation reported in the table.

17. Moreover, the theoretical literature strongly suggests that it is less costly to keep tax rates stable over the cycle, and hence allow automatic fiscal stabilisers to operate, than to adjust tax rates from one year to another. Such a policy may, in any event, prove to be ineffective if activity keeps moving as attempts are made to stabilise the fiscal position. Similar arguments will apply to adjusting spending parameters such as unemployment benefit rates. Automatic stabilisation can also be justified on the ground that the government faces fewer liquidity constraints and a lower risk premium than the private sector and therefore is likely to be more efficient at consumption smoothing through cyclical downturns than households are.

18. There is also a negative side, or at least there are risks, involved in using automatic fiscal stabilisers. First, unless care is taken to ensure that automatic stabilisers operate symmetrically over the business cycle, the result may be permanently higher government indebtedness and associated servicing cost. Most importantly, this involves ensuring that the stabilisers are allowed to work in booms as well as during slowdowns so that they do not bias structural budget positions toward deficits. However, permanent effects can also arise for either of two further reasons: downswings and upswings can differ in terms of their intensity; or they can differ in terms of their duration. A second order effect can also arise as a consequence of interest rate variations over the cycle. The risk of unsustainable debt accumulation is heightened by adverse debt dynamics that may emerge when real interest rates exceed growth rates. As a result, debt expands at a faster rate than GDP, hence the debt-to-GDP ratio rises unless there is a sufficiently large primary surplus. The long-run damage to economic growth that results from sustaining high public debt levels in the wake of a recession without subsequently reducing them may be substantial, because taxes, and the distortions they create, as well as real long-term interest rates would have to be higher.

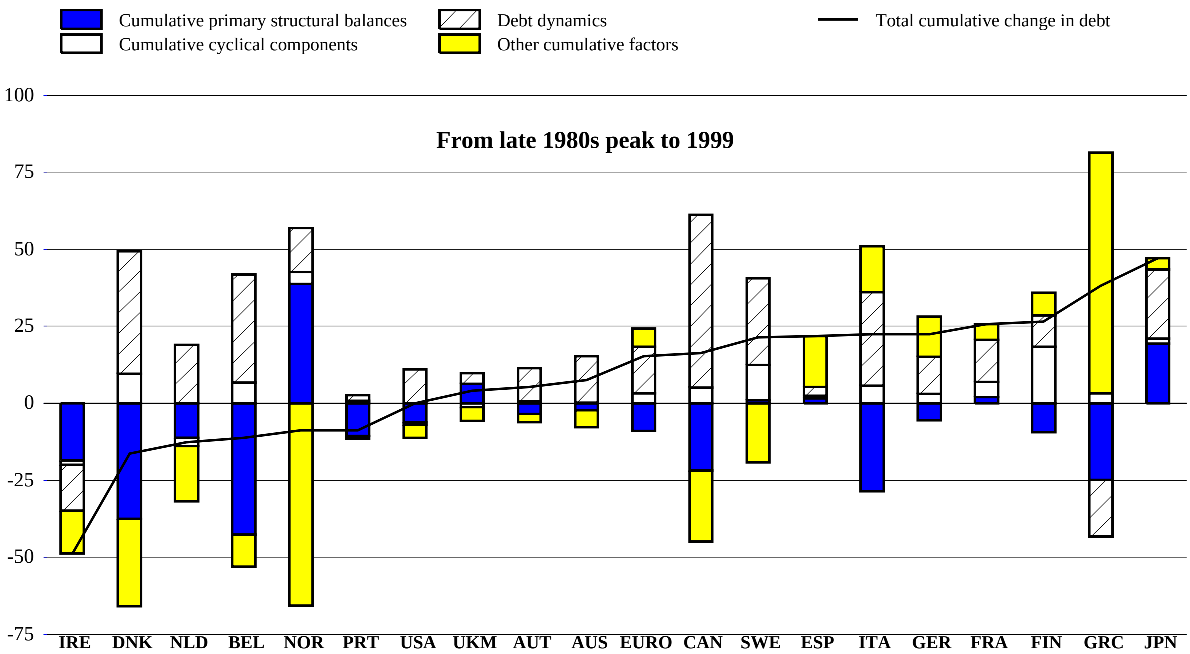
19. Figure 3 decomposes the accumulation of gross public debt relative to GDP into relevant contributing factors according to the following identity (where d represents the ratio of gross debt to GDP):

$$\Delta d = -sb - cc + \frac{r - g}{1 + g + \pi} d_{t-1} + Other$$

The first term on the right-hand side represents the impact of the structural primary balance (*i.e.* non-cyclical receipts less expenditures excluding net interest payments) as a ratio to GDP (sb) on debt formation and the second term that of the cyclical component as a ratio to GDP (cc). The third term represents the impact of endogenous debt dynamics (r = real interest rate, g = real GDP growth rate, π = inflation rate). It shows that existing debt contributes to further increases in the debt/GDP ratio if the real rate of interest exceeds the growth rate of the economy. The last term marked "*Other*" is a residual, which includes the impact of revaluation of existing debt (*e.g.* due to exchange rate movements), the net purchase of financial assets by the government and interest receipts. This analysis focuses on gross debt rather than on net debt, since the latter is more uncertain due to difficulties in assessing the true value of governments' financial assets. Moreover, in most countries gross debt has greater relevance for financial markets than net debt.

20. Figure 3 shows that, during the 1990s, the cumulative mechanical impact of automatic stabilisers on public debt formation has been broadly neutral. There are, however, a few exceptions to this general finding. In particular, in Sweden and Finland the accumulation of adverse cyclical developments explains a good deal of the sharp rise in public debt in this period. Moreover, adverse debt dynamics have been very prominent in most OECD countries during the 1990s, especially in countries that had high debt levels from the outset such as Italy, Canada and Belgium. In contrast, in Greece, also a high-debt country, debt dynamics have worked favourably due to high inflation, but (foreign-currency denominated) debt nevertheless soared in the wake of the depreciation of the exchange rate. Such poor starting positions stemmed from the earlier failure to use fiscal automatic stabilisers symmetrically during previous business cycles -- *i.e.* the tendency to let automatic stabilisers work fully in a recession while overriding them by discretionary fiscal expansion in upswings (Leibfritz *et al.*, 1994).

Figure 3. Breakdown of cumulated gross public debt
As a percentage of actual GDP



21. Most countries have succeeded in offsetting the resulting adverse debt dynamics in the 1990 by strong fiscal consolidation -- with the notable exception of Japan where massive fiscal easing contributed to the ballooning of public debt. In the future governments should guard against the asymmetric use of automatic fiscal stabilisers, although this obviously does not preclude all discretionary action, particularly for structural reasons. If, for example, the tax burden is heavy and found to exert a negative impact on economic growth, governments may aim to cut taxes even during an economic upswing. However, such tax cuts need to be matched with simultaneous reductions in expenditure in order not to weaken the fiscal positon.

22. Second, there is a risk of governments treating changes in budget positions that have structural roots as if they were the result of automatic stabilisers, or *vice versa.* This is to misjudge the underlying fiscal situation and may lead to inappropriate policies. Of central importance in judging the underlying, structural, budget position is a sound assessment of structural change, particularly as it affects the level of potential output. Once evidence suggests that changes affecting the level or the growth rate of potential output have occurred, fiscal policies should be reviewed and, where necessary, adjusted. Otherwise, fiscal policy may be set on an unsustainable course and there is a risk of provoking adverse private-sector reactions once financial markets and consumers realise this. Improving the analytical tools available to governments to gauge the economy's potential and the structural fiscal position thus appears to be important for future policy making.

23. Finally, but very importantly, automatic fiscal stabilisation is often created by mechanisms that allow people and businesses affected by changing economic circumstances to delay their adjustment to change. Such mechanisms include the functioning of social security systems, labour market institutions and many parts of tax systems whose effects on incentives have been analysed in detail in the various OECD *Jobs Strategy* publications -- see for example the most recent publication in this series, OECD (1999). These systems therefore need to be designed to ensure that the incentives to which they give rise are consistent with flexible labour and product markets that heighten the economy's ability to adapt well to change. This need not diminish or may even strengthen the automatic fiscal stabilisers. For example, shortening benefit duration strengthens work incentives without affecting the short-run automatic stabilisation properties of the unemployment insurance system. To take another example, introducing in-work benefits at the lower end of the pay scale, while providing work incentives, raise tax progressivity at the same time. In any event, when a future economic shock requires a major reallocation of resources, the role of automatic fiscal stabilisers should at best be one of temporarily easing the pain, to allow time for the necessary adjustments to take place -- not to postpone these adjustments indefinitely.

Appendix
Determining the cyclical components of budget balances

The overall purpose of calculating cyclical components of budget balances is to obtain a clearer picture of the impact of cyclical variations in economic activity on government budgets and to use this information as an indication of the degree of economic stabilisation stemming from “automatic” fiscal policy. The cyclical component of the budget balance is expected to turn positive in a boom, thereby choking off economic activity. Conversely, the cyclical component should turn negative during a recession, thereby exerting a stimulatory effect on economic activity.

1. The methodology

In practice, the cyclical components of the budget balance are calculated by subtracting the estimated structural components of tax revenues and government expenditure from their actual levels. The structural components, in turn, are calculated from actual tax revenues and government expenditures, adjusted proportionally according to the ratio of potential output to actual output and the assumed built-in elasticities. Thus:

(1) $$b^{**} = b - b^{*}$$

(2) $$b^{*} = \frac{\sum_i T_i^{*} - G^{*} + X}{Y^{*}}$$

where:

b^{**} = cyclical component of budget balance

b^{*} = structural component of budget balance (ratio to potential output)

b = actual budget balance (ratio to actual output)

G^{*} = structural current primary government expenditures

T_i^{*} = structural component for the *i*th category of tax

X = non-tax revenues *minus* interest on public debt *minus* net capital outlays

Y^{*} = level of potential output

and:

(3) $$\frac{T_i^{*}}{T_i} = \left(\frac{Y^{*}}{Y}\right)^{\alpha_i} ; \frac{G^{*}}{G} = \left(\frac{Y^{*}}{Y}\right)^{\beta}$$

where:

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

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

Y = level of actual output

α_i = elasticity of *i*th tax category with respect to output

β = elasticity of current government expenditures with respect to output (composite of the elasticity of unemployment-related expenditure with respect to output and the share of unemployment-related expenditure in total current primary expenditure)

From relationships (1), (2) and (3) the cyclical component of the budget balance is derived as follows:

(4) $$b^{**} = \frac{1}{Y}\sum_i T_i \left[1 - \left(\frac{Y^*}{Y}\right)^{\alpha_i - 1}\right] - \frac{G}{Y}\left[1 - \left(\frac{Y^*}{Y}\right)^{\beta - 1}\right] + \frac{X}{Y}\left[1 - \left(\frac{Y^*}{Y}\right)^{-1}\right]$$

This formula shows that the cyclical component of the budget balance corresponds to the cyclical components of tax revenues and current primary expenditure. These are, in turn, sensitive to the estimated output gaps, the weights of tax revenues per category and current primary expenditure and the built-in elasticities. For the purpose of accurately assessing the extent of automatic stabilisation, four different categories of taxes are distinguished, each portraying different degrees of built-in elasticity (see Table A.1):

– *Corporate tax*, which on average represents 3½ per cent of GDP in the countries covered, exhibits the highest volatility. This characteristic reflects that corporate profits, which form the bulk of the tax base, fluctuate sharply over the cycle, thus transmitting similar fluctuations to the yield of the corporate tax, while statutory tax rates are mostly proportional.[2] Accordingly, the average output elasticity of corporate income tax is estimated at around 1¼, with somewhat higher values (around 2) found for the United States, Japan, France and Austria and lower ones (less than 1) for Germany, the United Kingdom, Belgium, Finland, Greece, New Zealand and Sweden.

– As concerns *personal income tax*, whose share in GDP amounts to some 12½ per cent on average in the countries that are covered, rate progression and exemptions make for a sharper variation in revenue compared to its tax base. Indeed, as income rises, a larger share of personal income falls above the exemption limit and taxable income slides up the rate brackets. On the other hand, personal income varies less sharply than does real GDP, due to a muted short-run responsiveness of employment and wages - and hence personal earnings - to

2. This may not be the case for the *effective* tax rate. The number of profitable corporations that accrue tax liabilities varies with economic activity and hence effective rates vary with the cycle. On the other hand, the carrying forward of losses incurred during recessions tends to limit the pro-cyclical variations in the effective rate. Since the net effect is highly uncertain, the estimated elasticities reported here are based on the assumption that the effective tax rates are proportional.

variations in economic activity. With these factors broadly offsetting each other, the average GDP elasticity of personal income tax is close to 1. Note, however, that some countries (Germany, the United Kingdom, Belgium, Finland, Greece, the Netherlands and Sweden) show significantly higher values, whereas others (Japan) have substantially lower ones.

– *Social security tax*, which on average yields 12 per cent of GDP, varies less sharply than its tax base due to the existence of statutory contribution ceilings, which are defined either per individual or per household. Therefore, as income rises, a larger share of income falls above the contribution ceiling(s) and the average effective tax rate tends to drop. With, in addition, personal income portraying less volatility than GDP, the cross-country average GDP elasticity of social security tax amounts to just over ¾, with values above 1 found in the United Kingdom, Finland, Greece and New Zealand, and values less than ½ in Japan.

– *Indirect tax*, which is the largest tax category among the countries covered (14 per cent of GDP), is mostly proportional to its main tax base - private consumption - even if some countries employ higher rates for certain income-elastic (luxury) goods. Accordingly, the GDP elasticity of the tax revenue of indirect taxes amounts to almost 1 on average - however, Norway and Denmark well exceed that average whereas Japan, Australia, Austria and Ireland are significantly below it.

The built-in elasticity of *government expenditure*, finally, which reflects cyclical variations in unemployment-related spending only, is relatively minor given the small share of such spending in the total. For most countries elasticities in the 0 to -¼ range have been adopted, albeit Denmark, the Netherlands and Sweden portray significantly stronger expenditure flexibility.

Table A.1. **Tax and expenditure elasticities**

	Tax				Current expenditure	Total balance[1]
	Corporate	Personal	Indirect	Social security		
United States	1.8	0.6	0.9	0.6	-0.1	0.25
Japan	2.1	0.4	0.5	0.3	-0.1	0.26
Germany	0.8	1.3	1.0	1.0	-0.1	0.51
France	1.8	0.6	0.7	0.5	-0.3	0.46
Italy	1.4	0.8	1.3	0.6	-0.1	0.48
United Kingdom	0.6	1.4	1.1	1.2	-0.2	0.50
Canada	1.0	1.2	0.7	0.9	-0.2	0.41
Australia	1.6	0.6	0.4	0.6	-0.3	0.28
Austria	1.9	0.7	0.5	0.5	0.0	0.31
Belgium	0.9	1.3	0.9	1.0	-0.4	0.67
Denmark	1.6	0.7	1.6	0.7	-0.7	0.85
Finland	0.7	1.3	0.9	1.1	-0.4	0.63
Greece	0.9	2.2	0.8	1.1	0.0	0.42
Ireland	1.2	1.0	0.5	0.8	-0.4	0.32
Netherlands	1.1	1.4	0.7	0.8	-1.0	0.76
New Zealand	0.9	1.2	1.2	1.1	-0.4	0.57
Norway (mainland)	1.3	0.9	1.6	0.8	-0.2	0.46
Portugal	1.4	0.8	0.6	0.7	-0.2	0.38
Spain	1.1	1.1	1.2	0.8	-0.1	0.40
Sweden	0.9	1.2	0.9	1.0	-0.5	0.79
Average	1.3	1.0	0.9	0.8	-0.3	0.49
Standard deviation	0.4	0.4	0.3	0.2	0.2	0.18

1. Based on weights for 1999. Semi-elasticity, i.e. change in net lending as a percentage of GDP for a 1 per cent change in GDP.

Source: OECD.

The implied responsiveness of the net lending/GDP ratio with respect to the output gap is shown in the last column of Table A.1. The differences with the previous set of elasticities reported in Giorno *et al.* (1995), shown in Table A.2, are significant for Japan (responsiveness has been reduced), Italy (the reverse) and for several smaller countries. Overall, the cyclical responsiveness of taxes has declined somewhat since the previous estimates, but this is practically offset by a stronger estimated cyclical responsiveness of expenditures. A main difference with the previous estimates concerns corporate taxes. The previous elasticities, which were based on simulations with an early vintage of the INTERLINK model, were considerably higher. The empirical underpinnings of the revised elasticity assumptions are discussed in more detail below.

Table A.2.**Tax and expenditure elasticities, old values**[1]

	Tax					
	Corporate	Personal	Indirect	Social security	Expenditure	Total balance[2]
United States	2.5	1.1	1.0	0.8	-0.1	0.38
Japan	3.7	1.2	1.0	0.6	-0.1	0.42
Germany	2.5	0.9	1.0	0.7	-0.2	0.50
France	3.0	1.4	1.0	0.7	-0.2	0.62
Italy	2.9	0.4	1.0	0.3	0.0	0.36
United Kingdom	4.5	1.3	1.0	1.0	-0.1	0.59
Canada	2.4	1.0	1.0	0.8	-0.3	0.51
Australia	2.5	0.8	1.0	0.8	-0.2	0.52
Austria	2.5	1.2	1.0	0.5	-0.1	0.50
Belgium	2.5	1.2	1.0	0.8	-0.1	0.58
Denmark	2.2	0.7	1.0	0.6	-0.2	0.53
Finland	2.5	1.1	1.0	0.8	-0.1	0.56
Greece	2.5	1.2	1.0	0.5	-0.2	0.44
Ireland	2.5	1.3	1.0	0.5	-0.2	0.37
Netherlands	2.5	1.3	1.0	1.0	-0.2	0.64
New Zealand	2.5	0.4	1.0	0.4	-0.2	0.39
Norway (mainland)	2.5	1.2	1.0	0.9	-0.1	0.59
Portugal	2.5	1.2	1.0	0.5	-0.2	0.47
Spain	2.1	1.9	1.0	1.1	-0.3	0.62
Sweden	2.4	1.4	1.0	1.2	-0.1	0.76
Average	2.7	1.1	1.0	0.7	-0.2	0.52
Standard deviation	0.5	0.3	0.0	0.2	0.1	0.11

1. As reported in Giorno *et al.* (1995).
2. Based on weights for 1998. Semi-elasticity, i.e. change in net lending as a percentage of GDP for a 1 per cent change in GDP.

2. *The elasticity assumptions*

In two respects the method of determining the elasticities has been revised since the previous set of estimates was presented in Giorno *et al.* (1995). First, the revised approach aims to underpin the tax elasticities better by using separate estimates of the sensitivity of the tax bases to the cycle and estimates of the sensitivity of tax proceeds to changes in the tax base. Such a breakdown was already adopted for personal income tax and social security contributions, but has now been extended to corporate tax. A similar breakdown of the expenditure elasticity, into a gauge of cyclical unemployment and the sensitivity of current expenditure to cyclical unemployment, has been introduced. These breakdowns facilitate the economic interpretation of the elasticities and will make future updates easier. Second, information regarding the tax codes incorporated in the elasticities of personal income tax and social security contributions have been updated. Third, the empirical relationships between the cyclical components of the tax bases and unemployment benefits on the one hand and the output gap on the other hand have been (re-)estimated.

2.1. *Personal income tax and social security contributions*

The method used to derive the GDP elasticities for personal income tax and social security contributions can be summarised as follows. Let *Y*, *T*, *L* and *w*, respectively, denote output, tax proceeds, employment and the wage rate. The tax elasticity α is defined as:

$$\alpha = \frac{\partial T}{\partial Y}\times\frac{Y}{T} = \frac{\partial[(T/L)\times L]}{\partial Y}\times\frac{Y}{T} = \left(\frac{\partial L}{\partial Y}\times\frac{Y}{L}\right)\times\left[1+\left(\frac{\partial(T/L)}{\partial w}\times\frac{w}{T/L}\right)\times\left(\frac{\partial w}{\partial L}\times\frac{L}{w}\right)\right] \quad (1)$$

Table A.3. **Elasticities of income tax and social security contributions**

	Real wage elasticity of				Output elasticity of	
	Income tax per worker	Social security contributions per worker	Output elasticity of employment	Employment elasticity of wages	Income tax	Social security
	A		B	C	D = B x (1 + A x C)	
United States	1.3	0.9	0.6	0.0	0.6	0.6
Japan	1.8	0.8	0.3	0.3	0.4	0.3
Germany	1.5	0.8	0.6	0.8	1.3	1.0
France	1.7	1.0	0.5	0.1	0.6	0.5
Italy[1]	1.5	0.9	0.3	1.0	0.8	0.6
United Kingdom	1.5	1.0	0.8	0.6	1.4	1.2
Canada	1.4	0.5	0.7	0.5	1.2	0.9
Australia	1.6	1.0	0.6	0.0	0.6	0.6
Austria	2.2	0.8	0.4	0.3	0.7	0.5
Belgium	1.4	0.9	0.6	0.9	1.3	1.0
Denmark[2]	1.3	0.9	0.6	0.2	0.7	0.7
Finland	1.4	0.9	0.7	0.8	1.3	1.1
Greece[2]	3.1	0.9	0.6	0.8	2.2	1.1
Ireland[3]	1.5	1.0	0.6	0.5	1.0	0.8
Netherlands[3]	2.6	0.6	0.6	0.5	1.4	0.8
New Zealand[3]	1.2	1.0	0.7	0.5	1.2	1.1
Norway	1.5	0.9	0.6	0.3	0.9	0.8
Portugal	1.9	1.0	0.6	0.2	0.8	0.7
Spain[2,3]	1.8	0.8	0.6	0.5	1.1	0.8
Sweden[2]	1.3	0.9	0.6	0.7	1.2	1.0
Average	1.7	0.9	0.6	0.5	1.0	0.8

1. Employment elasticity of wages set to 1 (regression yields a value above 1).
2. Output elasticity of employment set to 0.6, which is the average for the smaller OECD countries (regression results are not plausible due to values close to or beyond the extremes 0 or 1).
3. Employment elasticity of wages set to 0.5, which is the average for the smaller OECD countries (regression yields a negative value).

This equation shows that the tax elasticity can be broken down into two sub-elasticities: one to determine variations in the number of wage earners, and one to determine variations in the tax bill per wage earner. The first term at the right hand side represents the output elasticity of employment, which serves to capture the impact of cyclical variations in employment on tax proceeds, assuming a given tax yield per worker. This sub-elasticity is typically smaller than 1 due to "*Okun's law*" that predicts that variations in output are to some extent absorbed by variations in labour productivity. The tax yield per worker, in turn, also varies with the cycle, which is captured by the last term in square brackets. This term provides a further breakdown into the impact of changes in the wage rate on the tax proceeds per worker (due to tax progressivity) and the employment elasticity of the wage rate. The latter should be interpreted as the "*Phillips curve*" effect on wages. This calculation is done for each of the 20 countries for which the relevant information is available, and is summarised in Table A.3. The first two columns, marked *A*, show the wage elasticity of the tax or social contribution yield per worker. These elasticities are calculated as the ratio of the marginal and average rates for an "average" household based on the 1996 tax codes, using the same methodology as in Giorno *et al*. (1995). The columns marked *B* and *C* in Table A.1 present the output elasticities of employment and employment elasticities of wages, respectively, based on the econometric estimates listed in Tables A.4 and A.5. The columns marked *D* show the result of the calculation using equation (1) above.

Table A.4. **Estimated short-run output elasticities of employment**

Equation: $\log (L/L^*) = a_0 + a_1 \text{ TIME} + a_2 \log (Y/Y^*)$ where L, L*, Y and Y* are actual and potential employment and output, respectively;[1]

	a_2	(t)	Adjusted R^2
United States	0.61	(7.2)	0.81
Japan	0.27	(4.5)	0.50
Germany[2]	0.62	(5.8)	0.89
France	0.50	(9.8)	0.79
Italy	0.34	(2.6)	0.80
United Kingdom	0.81	(5.7)	0.58
Canada	0.70	(11.0)	0.90
Australia	0.58	(4.0)	0.37
Austria	0.42	(6.0)	0.59
Belgium	0.57	(8.5)	0.74
Denmark	0.19	(1.7)	0.57
Finland	0.71	(8.6)	0.77
Greece	-0.06	(-0.3)	0.29
Ireland	0.58	(7.5)	0.71
Netherlands	0.64	(3.9)	0.89
New Zealand	0.74	(4.0)	0.37
Norway	0.64	(3.9)	0.46
Portugal	0.59	(3.6)	0.80
Spain	1.32	(17.9)	0.93
Sweden	0.89	(6.0)	0.84

1. Estimation period: 1985-1998, semi-annual data. Constant term and time trend are not shown. Potential employment is calculated as $(1\text{-NAWRU}) \times L^{s*}$, where NAWRU is the non-accelerating wage rate of unemployment and L^{s*} is trend labour supply.
2. Contains dummy variables to capture re-unification.

Table A.5. **Estimated short-run employment elasticities of real wages**

Equation: log (wL*/Y*) = b_0 + b1 TIME + b2 log (L/L*) where w = real wage, L* = potential employment, and Y* = potential output[1]

	b_2	(t)	Adjusted R^2
United States	0.02	(0.1)	0.64
Japan	0.34	(1.5)	0.91
Germany[2]	0.76	(8.0)	0.92
France[2]	0.08	(0.5)	0.95
Italy[2]	1.34	(3.7)	0.88
United Kingdom	0.59	(4.4)	0.65
Canada	0.46	(3.4)	0.31
Australia	0.04	(0.2)	0.66
Austria[3]	0.34	(1.7)	0.94
Belgium	0.90	(2.7)	0.43
Denmark	0.15	(0.8)	0.01
Finland	0.82	(10.9)	0.95
Greece[3]	0.81	(1.1)	0.46
Ireland	-0.19	(-0.9)	0.91
Netherlands	-0.11	(-0.0)	0.96
New Zealand	-0.17	(-1.0)	0.72
Norway	0.26	(3.4)	0.32
Portugal[4]	0.15	(0.5)	0.13
Spain	-0.56	(-3.6)	0.72
Sweden	0.69	(5.2)	0.81

1. Estimation period: 1985-1998, semi-annual data. Constant term and time trend are not shown.
2. Contains dummy variables.
3. Contains an additional quadratic time trend variable.
4. Equation reads: d log w = b_1 + b_2 d log L.

2.2. *Corporate income tax*

The elasticity for the corporate income tax is based on the assumption that the tax rate is strictly proportional, such that cyclical variations in the tax yield correspond to fluctuations in the tax base, *i.e.* corporate income. If *Z* denotes corporate income, the corporate tax elasticity can be broken down as follows:

$$\alpha = \frac{\partial T}{\partial Y}\times\frac{Y}{T} = \frac{\partial Z}{\partial Y}\times\frac{Y}{Z} = \frac{\partial(Y-wL)}{\partial Y}\times\frac{Y}{Z} = \left[1-\left(1-\frac{Z}{Y}\right)\times\left(\frac{\partial L}{\partial Y}\times\frac{Y}{L}\right)\times\left(1+\frac{\partial w}{\partial L}\times\frac{L}{w}\right)\right]\times\frac{Y}{Z} \tag{2}$$

The proportionality assumption implies that the tax elasticity is equal to the elasticity of the tax base (profits) with respect to output. The latter, in turn, is a function of the elasticity of the wage bill with respect to output, with the opposite sign. The elasticity of the wage bill, finally, comprises two sub-elasticities with respect to output, one for employment and one for wages, as shown in the right-hand side of the formula above. As can be checked easily, the overall elasticity α is equal to unity in case the output elasticity of employment is equal to 1 and the employment elasticity of real wages equal to 0: in that (extreme) case the wage bill and profits both vary in proportion to output. In practice variations in employment are less volatile than variations in output while wages show a cyclical pattern, therefore α should differ from 1 and is most likely larger than 1. Table A.6 shows the result of the calculations. The first column *A* contains the average profit shares in national income (*Z/Y*) over the cycle, column *B* the output elasticities of employment and column *C* the employment elasticities of wages. Note that columns *B* and *C* correspond to columns *B* and *C* in Table A.3. Column *D*, finally, combines the components into the reduced form output elasticity of corporate tax, using equation (2) above.

Table A.6. **Elasticities of corporate tax**

	Profit share in GDP	Output elasticity of employment	Employment elasticity of wages	Output elasticity of corporate tax
	A	B	C	$D = \frac{\{1 - (1 - A) \times B \times (1 + C)\}}{A}$
United States	30.8%	0.6	0.0	1.8
Japan	37.4%	0.3	0.3	2.1
Germany	33.8%	0.6	0.8	0.8
France	35.2%	0.5	0.1	1.8
Italy	46.7%	0.3	1.0	1.4
United Kingdom	30.6%	0.8	0.6	0.6
Canada	31.0%	0.7	0.5	1.0
Australia	39.8%	0.6	0.0	1.6
Austria	33.9%	0.4	0.3	1.9
Belgium	37.8%	0.6	0.9	0.9
Denmark	32.7%	0.6	0.2	1.6
Finland	34.7%	0.7	0.8	0.7
Greece	56.2%	0.6	0.8	0.9
Ireland	43.5%	0.6	0.5	1.2
Netherlands	37.9%	0.6	0.5	1.1
New Zealand	42.4%	0.7	0.5	0.9
Norway	40.1%	0.6	0.3	1.3
Portugal	41.9%	0.6	0.2	1.4
Spain	44.2%	0.6	0.5	1.1
Sweden	29.8%	0.6	0.7	0.9
Average	38.0%	0.6	0.5	1.3

2.3. Current primary expenditure

Current primary expenditure (*G*) of general government is assumed to fluctuate in proportion with unemployment-related expenditure. So, if *U* is unemployment, *UB* unemployment benefits and L^s labour supply, the appropriate formula reads:

(3)
$$\beta=\frac{\partial G}{\partial Y}\times\frac{Y}{G}=\left(\frac{UB}{G}\right)\times\left(\frac{\partial UB}{\partial Y}\times\frac{Y}{UB}\right)=\left(\frac{UB}{G}\right)\times\left(\frac{\partial U}{\partial Y}\times\frac{Y}{U}\right)=\left(\frac{UB}{G}\right)\times\left(\frac{\partial L^s-\partial L}{\partial L}\times\frac{\partial L}{\partial Y}\times\frac{Y}{U}\right)=$$
$$=-\left(\frac{UB}{G}\right)\times\left(\frac{\partial L}{\partial Y}\times\frac{Y}{L}\right)\times\left[\left\{\left[1-\left(\frac{\partial L^s}{\partial L}\times\frac{L}{L^s}\right)\right]\Big/\left(\frac{U}{L^s}\right)\right\}-1\right]$$

It is assumed that unemployment-related expenditure is strictly proportional to unemployment; unemployment benefit rates are seen to be independent of the cycle. Variations in unemployment, in turn, are broken down into two components, capturing variations in employment (the second term in parentheses at the right hand side) and in the labour force (the last term in brackets). The latter term also contains the level of the structural unemployment rate. Note that the expected sign of this elasticity is negative: a cyclical upswing in output should lower unemployment-related expenditure and *vice versa*. Note also that if the labour force does not react to the cycle, the elasticity collapses into a simple expression containing only the output elasticity of employment, appropriately weighted by the share of unemployment-related expenditure in total current primary expenditure. The results of the calculations are shown in Table A.7.

Table A.7. **Elasticities of current primary expenditure**

	Output elasticity of employment	Employment elasticity of labour supply	Trend unemploy-ment rate	Share of unemploy-ment related in total current primary expenditure	Output elasticity of unemployment related expenditure	Output elasticity of current primary expenditure
	A	B	C	D	E = - A x {(1 - B)/C -1}	F = D x E
United States	0.6	0.3	5.7%	1.4%	-7.0	-0.1
Japan	0.3	0.5	2.7%	2.0%	-4.7	-0.1
Germany	0.6	0.8	8.7%	8.6%	-0.8	-0.1
France[1]	0.5	0.0	10.0%	6.7%	-4.5	-0.3
Italy	0.3	0.2	9.5%	5.2%	-2.5	-0.1
United Kingdom	0.8	0.3	8.4%	3.9%	-5.5	-0.2
Canada	0.7	0.2	9.3%	4.4%	-5.0	-0.2
Australia	0.6	0.2	9.0%	6.0%	-4.4	-0.3
Austria	0.4	0.8	5.5%	4.0%	-1.2	0.0
Belgium[1]	0.6	0.0	11.3%	9.4%	-4.4	-0.4
Denmark[1]	0.6	0.0	9.9%	11.9%	-5.6	-0.7
Finland	0.7	0.1	10.4%	8.5%	-5.2	-0.4
Greece	0.6	1.0	8.9%	2.9%	0.6	0.0
Ireland	0.6	0.3	13.0%	13.9%	-2.7	-0.4
Netherlands	0.6	0.2	6.3%	12.7%	-7.7	-1.0
New Zealand	0.7	0.3	7.2%	5.7%	-6.7	-0.4
Norway	0.6	0.5	4.9%	3.5%	-6.1	-0.2
Portugal	0.6	0.5	5.7%	4.8%	-4.2	-0.2
Spain	0.6	0.1	20.2%	6.8%	-2.1	-0.1
Sweden	0.6	0.4	4.6%	7.8%	-7.0	-0.5
Average	0.6	0.3	8.6%	6.5%	-4.3	-0.3

1. Employment elasticity of labour supply set to 0 (regression yields a negative value).

Columns *A* and *B* contain the output elasticities of employment and employment elasticities of the labour force, respectively. The "trend" unemployment rate (NAWRU) and the share of unemployment-related expenditure in total current primary expenditure are shown in columns *C* and *D*, respectively. Column *E* shows the output elasticity of unemployment-related expenditure, which is multiplied by the share of unemployment-related expenditure in total current primary expenditure in column *F* to obtain the overall elasticity β. The estimated equations on which the employment elasticities of labour supply are based are shown in Table A.8. In cases where negative values were found the elasticities have been set to 0.

Table A.8. **Estimated short-run employment elasticities of the labour force**

Equation: $\log (L^s/L^*) = c_0 + c_1 \text{ TIME} + c_2 \log (L/L^*)$ where L^s = labour suply, L and L* are actual and potential employment[1]

	c_2	(t)	Adjusted R^2
United States	0.29	(3.7)	0.92
Japan	0.50	(7.4)	0.90
Germany[2]	0.80	(9.7)	0.90
France	-0.11	(-2.1)	0.97
Italy	0.22	(1.7)	0.62
United Kingdom	0.30	(8.2)	0.94
Canada	0.24	(8.9)	0.97
Australia	0.23	(3.3)	0.32
Austria	0.79	(19.1)	0.97
Belgium	-0.13	(-1.2)	0.47
Denmark	-0.16	(-0.9)	0.58
Finland	0.07	(1.8)	0.93
Greece	1.05	(10.4)	0.82
Ireland	0.26	(2.4)	0.93
Netherlands	0.18	(1.7)	0.85
New Zealand	0.28	(6.5)	0.65
Norway	0.49	(12.5)	0.88
Portugal[3]	0.54	(5.9)	0.93
Spain	0.10	(1.8)	0.07
Sweden	0.42	(11.9)	0.90

1. Estimation period: 1985-1998, semi-annual data. Constant term and time trend are not shown.
2. Contains dummies.
3. Equation reads: $d \log L^s = c_1 + c_2 \, d \log L$.

2.4. Indirect tax

To calculate the elasticity for indirect tax the assumption has been made that the relevant tax base fluctuates in proportion with private consumption. Based on this assumption, the elasticity for indirect tax corresponds to the output elasticity of consumption, which is shown in Table A.1. These elasticities are based on estimation results that are summarised in Table A.9.

Table A.9. **Estimated short-run output elasticities of real private consumption**

Equation: $\log (C/Y^*) = d_0 + d_1 \text{ TIME} + d_2 \log (Y/Y^*)$ where C = private consumption, Y and Y* are actual and potential output[1]

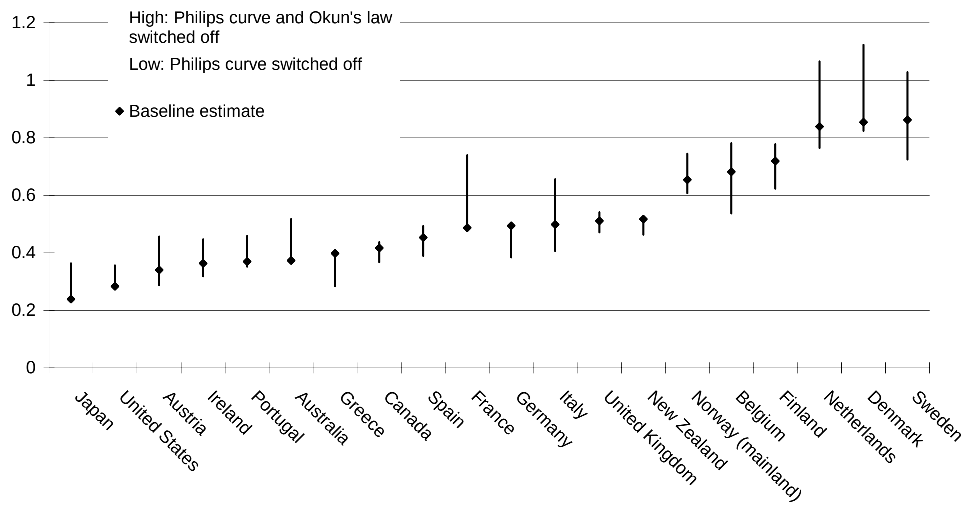
	d_2	(t)	Adjusted R^2
United States	0.94	(12.6)	0.88
Japan	0.46	(7.5)	0.79
Germany	0.95	(3.6)	0.65
France	0.68	(7.1)	0.73
Italy	1.36	(7.7)	0.74
United Kingdom	1.10	(9.0)	0.77
Canada	0.73	(10.4)	0.85
Australia	0.40	(3.5)	0.43
Austria	0.53	(2.0)	0.54
Belgium	0.89	(8.9)	0.79
Denmark	1.59	(15.0)	0.91
Finland	0.90	(11.6)	0.91
Greece	0.75	(3.1)	0.57
Ireland	0.47	(2.5)	0.91
Netherlands	0.74	(4.3)	0.52
New Zealand	1.15	(4.3)	0.26
Norway	1.58	(11.6)	0.83
Portugal	0.64	(5.7)	0.74
Spain	1.20	(12.5)	0.89
Sweden	0.86	(5.3)	0.88

1. Estimation period: 1985-1998, semi-annual data. Constant term and time trend are not shown. Estimated with 2SLS method to correct for simultaneity.

3. *Sensitivity analysis*

The above methodology assumes that employment varies less than proportionally with output (Okun's law), while wages display some sensitivity to cyclical variations in employment (Philips curve). It may be useful to quantify the impact of these assumptions on the estimated cyclical sensitivity of government net lending as a share of GDP. The last column of TableA.1 provides such estimates for the baseline case, the average of which for the countries considered is 0.5. Two alternative sets of semi-elasticities have been calculated. In the first alternative set, the Phillips curve has been switched off, such that wages are assumed not to vary with employment over the cycle (the short-run employment elasticity of wages is zero), hence tax progressivity does not play any role. As a result the semi-elasticities fall by on average 0.05, to 0.45, with some marked variation across countries (Figure A.1). In Sweden, for example, the semi-elasticity drops from around 0.8 to 0.6, whereas several other countries display virtually no change. In the second alternative, Okun's law has been switched off in addition. Hence employment varies proportionally with output (the output elasticity of employment is equal to 1), whereas wages are constant. Under this assumption the personal income and social security tax bases as well as unemployment-related expenditure vary more sharply than in the baseline case, whereas corporate taxes vary less sharply. Given the small share of corporate taxes, however, the semi-elasticities increase, as is shown in Figure A.1. While on average the semi-elasticities rise from 0.5 to 0.6, the variation across countries is again significant, with the biggest increases found in France, Denmark and the Netherlands.

Figure A.1. Cyclical sensitivity of government net lending: range estimates



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