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ESTIMATING PRUDENT BUDGETARY MARGINS FOR EU COUNTRIES: A SIMULATED SVAR MODEL APPROACH

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INTRODUCTION

The Maastricht Treaty imposes a debt limit of 60 per cent of GDP and a deficit ceiling of 3 per cent of GDP for countries participating in stage III of EMU. The Stability and Growth Pact goes further and specifies the circumstances under which a deficit can be regarded as excessive, speeds up the procedure and defines the sanctions in the event of excessive deficits.

The imposition of such debt and deficit ceilings does not necessarily impose a binding constraint on the use of counter-cyclical fiscal policy because countries can run a structural deficit that is well below 3 per cent of GDP. How far below 3 per cent is likely to be enough to allow the government deficit to play its role as a shock absorber in times of an economic slowdown or recession? The answer to this question depends on the size of economic shocks, the sensitivity of deficits to those shocks, and the extent to which the authorities might want to go beyond automatic stabilisation.

To shed some light on these issues a structural VAR model has been estimated for eleven of the fifteen EU countries, capturing the effects of economic shocks on the deficits that have historically prevailed in each country. Based on the estimated distributions of these shocks, stochastic simulations are performed to build up probabilities of breaching the 3 per cent ceiling in the future. Fiscal policy is assumed unchanged in the simulations in order to capture the pure movements in the deficit stemming from automatic stabilisation and other sources not originating from fiscal impulses (*i.e.* movements due to supply shocks, real private demand shocks and monetary shocks). The likelihood of exceeding the ceiling increases with the initial budget deficit and with the time horizon considered, since over a longer period of time there is an increased probability of a sequence of unfavourable events hitting the economies.

The approach followed here should be seen as complementary to other studies (referred to below), in which measures of historical output gaps are combined with estimated budget elasticities to derive prudent budgetary margins. The main advantage relative to these studies is that estimates of output gaps are not required and it also considers a wider range of contingencies than looking at historical deficit episodes can reveal. Even though the probability distribution of each shock is based on past observations, the occurrence of shocks is drawn randomly in the stochastic simulation and non-zero probabilities may thus be attached to events that have never occurred simultaneously in history but may happen sometime in the future. More generally, by considering a wide range of time horizons and degrees of confidence, the method provides an explicit meaning of the concept of prudent fiscal stance. The findings generally validate the "close-to-balance" rule stipulated by the Stability and Growth Pact for the eight euro-countries included in the study (Germany, France, Italy, Austria, Belgium, the Netherlands, Spain and Finland). With cyclically adjusted balanced budgets, these countries would face a reasonably high likelihood (*i.e.* above 90 per cent) of not breaking the 3 per cent deficit limit over a three to five-year horizon without having to resort to discretionary fiscal tightening. The budgetary requirements appear to be somewhat higher for the non-euro countries included in the study (the United Kingdom, Sweden and Denmark).

The next section presents a review of other studies providing estimates of prudent budget margins or which apply structural VAR techniques to examine fiscal policy issues. The two-step methodology used in this paper is presented in the subsequent section. The choice of variables and the results of the VAR estimates are then discussed and estimates of prudent budget margins over different horizons and levels of confidence presented. Various sensitivity by analysis are shown before the concluding section.

LITERATURE OVERVIEW

The Stability and Growth Pact (SGP) is designed both to limit the extent to which budgetary developments in individual countries impinge on their neighbours, particularly via their effects on interest rates, and to make future bail-out requests unlikely. Elaborating on the Maastricht Treaty's fiscal rules, the Pact sets a 3 per cent of GDP limit on budget deficits, though with an escape clause for modest temporary overshoots due to exceptional circumstances such as a severe recession. It compels governments *i*) to bring budgets back towards sustainable trend positions, and *ii*) to adopt a symmetric approach to let automatic stabilisers work over the cycle. The Pact is underpinned by the "excessive deficit procedure" – which has been in force since the start of stage two of EMU in January 1994 – involving surveillance and possible penalties. The most common criticism of these rules is that by focusing on actual rather than structural deficits, they could tie the hands of government with regard to fiscal stabilisation policy. To limit such risk, the SGP states that a "close-to-balance" or surplus budgetary stance in the medium term would be required in order to provide sufficient scope for flexibility over the cycle.

As an empirical matter, the answer to what constitutes a prudent budgetary margin could be found in several ways. A simple approach consists in doing a retrospective application of the excessive deficit procedure. This involves assessing past policy in terms of an institutional framework and incentive structure that did not exist at the time, which, in turn, probably leads to finding "too many" retrospective excessive deficit episodes. Such an exercise was carried out by Buti *et al.* (1997) for the EU countries over the 1961-1996 period. Based on movements in deficits and growth during 50 episodes of recession or abrupt slowdown in growth, they conclude that an excessive deficit would have occurred in eleven cases if the budget had initially been balanced, but in 28 cases if the starting point had been a deficit of 2 per cent of GDP – *i.e.* more than a doubling of the risk of running into excessive deficits. They also conclude that the risk of incurring an excessive deficit is high in the case of protracted recessions, even if the starting point is a balanced budget. The same conclusion is drawn with respect to exceptionally severe recessions in which real GDP falls by more than 2 per cent.

An alternative approach consists of looking at the maximum negative output gap observed in the past for each country and, on the basis of the average cyclical sensitivity of that country's budget, derive the distance that would be needed from the 3 per cent deficit limit in order to be able to accommodate such a shock in the future. Table 1 summarises historical declines in output relative to potential and applies elasticities of the response of deficits to output changes, as drawn from the

Table 1. **Sensitivity of fiscal deficits to changes in output gaps**

	Estimated effect of 1 per cent increase in output gap on the fiscal deficit (per cent of GDP)			Fiscal balance required to avoid a deficit higher than 3 per cent of GDP for an increase in output gap of 3 per cent	Mean value of the maximum output gap recorded in recessions
	OECD	EC[1]	IMF[1]		1975-97
ermany	0.5	0.5	0.5	–1.6	–2.8
rance	0.6	0.5	0.6	–1.3	–2.5
taly	0.3	0.5	0.4	–2.0	–2.9
nited Kingdom	0.5	0.6	0.6	–1.5	–2.7
ustria	0.5	0.5	0.6	–1.5	–1.8
elgium	0.6	0.6	0.6	–1.3	–2.2
enmark	0.6	0.7	0.8	–1.3	–3.0
inland	0.6	0.6	0.6	–1.3	–4.8
reece	0.4	0.4	0.4	–1.7	–2.2
reland	0.4	0.5	0.5	–1.7	–4.7
etherlands	0.6	0.8	0.7	–1.1	–1.8
ortugal	0.5	0.5	0.4	–1.5	–3.9
pain	0.6	0.6	0.7	–1.2	–3.0
weden	0.7	0.9	1.1	–0.8	–2.2

. Recent European Commission estimates shown are from Buti *et al.* (1997), "Budgetary policies during recessions – retrospective application of the 'stability and growth pact' to the post-war period", *Economic Papers 121*, European Commission, May 1997. The figures for the International Monetary Fund are based on OECD Secretariat calculations using data supplied by the IMF.

ource: OECD *Economic Outlook 62*, December 1997.

OECD INTERLINK model.[1] For most euro area countries, a structural deficit below 1.5 per cent of GDP would be enough to avoid breaching the 3 per cent threshold for an output gap of 3 per cent, which roughly corresponds to the mean value of the maximum output gaps recorded in recessions in the major EU economies during 1975-1997. Based on the largest negative output gap recorded in each country over the 1970-1997 period, and applying roughly the same elasticities, the International Monetary Fund (1998*a*) notes that structural deficits in the range of 0.5 to 1.5 per cent of GDP (depending on the country) would allow the full operation of automatic stabilisers without exceeding the reference value for most euro-area countries.[2] Another recent study (Buti *et al.*, 1998) reckons – using the same methodology, but applied to the European Commission's measure of output gaps – that structural deficits between 0 and 1 per cent of GDP would be appropriate for most EU countries. These results are interpreted as providing support to the "close-to-balance" rule recommended in the Pact.

A third approach is based on time-series estimation techniques of which the structural VAR model used in the present paper is one application. Roodenburg *et al.* (1998) use a univariate time-series analysis of GDP data to assess the order of magnitude of the necessary safety margin for the Netherlands. Their analysis indicates that under a scenario of 2 per cent trend growth per year, a cyclically-adjusted budget deficit of 0.5 per cent of GDP would give the authorities about 90 per cent confidence of not breaching the 3 per cent threshold. The multivariate VAR methodology has been used recently by Becker (1997) to test the extent of Ricardian behaviour in private households, by Koren and Stiassny (1998) to look at the causality between taxation and expenditure, and by Bruneau and de Bandt (1997) to investigate the contribution of fiscal shocks to real output dynamics in Germany and France, as well as the correlation of fiscal policy shocks between these two countries.

To our knowledge, however, no study has so far focused on the issue of prudent budgetary margins using the methodology presented in this paper, although a recent study has estimated budgetary safety margins for France using a two-variable VAR model and taking into account the possibility that a deficit above 3 per cent of GDP is "allowed" by the Stability and Growth Pact if it occurs simultaneously with a severe economic downturn (IMF, 1998*b*). The study finds that, for France, a structural deficit of around 1 to 1.5 per cent of GDP would provide 90 per cent confidence that an excessive deficit will not occur. A balanced structural budget would provide 99 per cent confidence.

METHODOLOGY

The derivation of prudent budgetary margins is based on a two-step approach. In the first step, a four-variable VAR model is estimated to capture the effects on the government net lending ratio of economic shocks that have prevailed in the past in each EU country. In the second step, stochastic simulations of the estimated VAR equations are performed to build up probabilities of breaching the 3 per cent deficit ceiling in the future.

Methodology of structural VAR models

The main purpose of the VAR model is to decompose the fluctuations in the general government net lending to GDP ratio into different sources of structural disturbances (*i.e.* shocks that can be given an economic interpretation). One of these disturbances can be interpreted as a change in discretionary fiscal policy. In addition to the fiscal policy shock (εf_t), the VAR model identifies an aggregate supply shock (εs_t), a real private demand shock (εd_t) and a nominal shock (εm_t). Following an approach pioneered by Blanchard and Quah (1989), the identification is obtained by imposing a set of restrictions on the long-run effect of each disturbance on the level of the four variables included in the VAR model: the change in the ratio of government net lending to GDP ($\Delta nlgq_t$), real output growth (Δq_t), the inflation rate (Δp_t) and a measure of private-sector savings (Δpsq_t).[3]

The model can be expressed in its moving-average representation, *i.e.* a formulation that shows the cumulative effect on the current level of the variables of current and past structural shocks:

$$\Delta Z_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + \ldots = A(L)\varepsilon_t \qquad [1]$$

where

$$\Delta Z_t = \begin{bmatrix} \Delta q_t \\ \Delta nlgq_t \\ \Delta psq_t \\ \Delta p_t \end{bmatrix} \text{ and } \varepsilon_t = \begin{bmatrix} \varepsilon s_t \\ \varepsilon f_t \\ \varepsilon d_t \\ \varepsilon m_t \end{bmatrix}$$

and where the matrix lag polynomial A(L) contains all the parameters that measure the response over time of the variables of the system to previous economic disturbances. The main difficulty arises from the fact that the elements of the matrix A_0, which measures the contemporaneous effect of each structural shock on all the variables, can not be directly estimated due to simultaneity problems and therefore must somehow be identified from reduced-form parameters. To identify the set of structural parameters contained in A_0, the VAR model is first estimated in its reduced VAR form:

$$\Delta Z_t = B_1\Delta Z_{t-1} + \ldots + B_k\Delta Z_{t-k} + u_t \qquad [2]$$

where k is the number of lags included in the estimated VAR and $E(u_t u'_t) = \Sigma$, the variance-covariance matrix of reduced-form residuals. Assuming that the variables included in the VAR are stationary, the reduced-form system can also be rewritten in its moving-average representation linking the current values of the variables to contemporaneous and past reduced-form residuals.

$$\Delta Z_t = u_t + C_1 u_{t-1} + \ldots = C(L)u_t \qquad [3]$$

Comparing equations [1] and [3], the reduced-form residuals, which have no economic meaning *per se*, can be expressed as a linear combination of the economic disturbances according to the following relation:

$$u_t = A_0 \varepsilon_t \qquad [4$$

Hence, the variance-covariance matrix of the reduced-form shocks can be related to that of the structural shocks as follows:

$$E(u_t u^T_t) = A_0 \Omega A_0^T = \Sigma \qquad [5]$$

where $\Omega = E(\varepsilon_t \varepsilon^T_t)$ is the variance-covariance matrix of the structural disturbances. In order to identify the elements of the matrix A_0 a first set of restrictions is imposed on Ω. It is assumed that the four structural shocks are mutually uncorrelated so that the off-diagonal elements of Ω are all zero. In addition, the variance of each structural shock is normalised to unity so that Ω can be written as an identity matrix, which allows for a direct relation between the variance-covariance matrix of the reduced-form residuals and the A_0 matrix:

$$E(u_t u^T_t) = \Sigma = A_0 A_0^T \qquad [6]$$

The matrix of contemporaneous effects A_0 contains n^2 elements (where n is equal to four, the number of dependent variables). Since the estimated covariance matrix of reduced-form residuals Σ is symmetrical, equation [6] provides $[(n^2 - n)/2] + n$ restrictions on the matrix A_0. Thus, $(n_2/2) - (n/2)$ extra restrictions must be imposed for complete identification, which means that six additional restrictions are needed in the context of this application.

One possibility, which has long been the traditional approach in VAR modelling, would be to impose arbitrary zero (or exogeneity) restrictions on the contemporaneous effects of the shocks on the variables of the system. This amounts to assume that certain shocks only have delayed effects on some of the variables of the model. While this may be appropriate in some specific applications, such restrictions may be harder to justify in the present context given the presumed high degree of simultaneity between variables such as output, inflation and government balances. The approach used instead involves imposing restrictions on the matrix of long-term effects of structural shocks, which are often easier to justify on the basis of relatively well-accepted theoretical frameworks. Combining equations [1], [3] and [4], the following relationship between the matrix of long-term effects of structural shocks A(1) and the equivalent matrix of reduced-form shocks C(1) is obtained:

$$A(1) = C(1)A_0 \qquad [7]$$

Since the matrix C(1) contains known elements (*i.e.* that are derived from the reduced-form estimates), the elements of A_0 can be identified by imposing the six additional restrictions on the matrix of long-run effects A(1). Three of the six restrictions imposed come from the assumption that neither fiscal policy nor the other demand shocks have permanent effects on output, so that the long run output level is exclusively determined by supply shocks. Evidently, many theoretical frameworks would predict that aggregate demand shocks, such as a change in fiscal policy or a shock to private savings, could have some effect on output in the long run via relative price changes and their implications for capital accumulation, or if hysteresis effects are present. However, the same models generally predict that the long-run effects of demand-side shocks on production are fairly muted relative to the effects of productivity or labour-supply shocks of comparable magnitudes.

Two additional restrictions are based on the assumptions that real private demand shocks and nominal shocks only have temporary effects on the ratio of government net lending to GDP. While these shocks can have important short-run effects on government balances, mainly via the automatic stabilisers mechanism, the presumption is that in the long run, the government net lending to GDP ratio is unaffected by demand shocks other than those induced by fiscal policy. In contrast, no restriction is imposed *a priori* on the long-run effect of a permanent supply shock on the net lending ratio. The sixth and final restriction assumes that nominal shocks have a permanent effect on the aggregate price level (or the inflation rate) but leaves all other variables of the system unchanged in the long run.[4]

This sort of identifying procedure inevitably entails a certain degree of arbitrariness and regardless of how strongly one believes in the theoretical underpinnings of the set of restrictions, the accuracy of the estimates still largely depends on the restrictions' identifying power which may arguably be relatively weak for some countries.[5]

Methodology to derive prudent budgetary margins

Once the VAR model is estimated and the identification of the structural shocks is achieved, techniques of stochastic simulations are used to assess the risk of breaching the 3 per cent deficit level over different time horizons and for given initial budget balances.[6] Each stochastic simulation generates a hypothetical path for the four variables of the model. These paths are based on the random drawing, at each time period, of values for each of the structural disturbances from their estimated distribution as well as on their propagation via the estimated lag structure of the VAR model. A different path for the level of the net lending ratio over a ten-year horizon is thus generated in each experiment based on a combination of supply, private demand and nominal shocks whose relative size are determined by their estimated variance. As noted above, fiscal policy shocks are turned off in the simulations in order to capture the pure effects from automatic stabilisation and other induced changes to the budget balance (*e.g.* interest rate changes, changes to potential output, etc.). It should be stressed, however, that only the *unexpected* change in fiscal policy is treated as a fiscal shock and turned off in the simulations. To the extent that fiscal policy has reacted in a systematic and predictable fashion to other economic disturbances in the past, such a fiscal reaction function is captured by the lag structure of the VAR system and therefore plays an active role in the simulations.

For illustrative purposes, Figure 1-A shows three hypothetical simulated paths for semi-annual budget balances. For each simulation, the minimum value of the net lending ratio reached over the relevant time horizon is extracted. In the example of Figure 1-A, this implies that for an horizon of one year, the net lending ratios corresponding to points A, B and C would be selected. If the relevant horizon is extended to three years, then points B, D and E are extracted instead. Based on a thousand simulations, the minimum values of net lending ratios extracted are ranked in ascending order to form a distribution. Such a distribution of minimum net lending ratios can be drawn for each relevant horizon, up to ten years. As illustrated in Figure 1-B, the shorter the horizon, the closer to the initial balance will the distribution be. This is because shocks are assumed to be symmetrically and normally distributed and a short horizon does not allow for significant propagation. The longer the time horizon, the higher the probability of a sequence of unfavourable events hitting the economy and, hence, the further away from the initial level is the distribution of minimum net lending ratios centred.[7] The distribution of budget balances also tends to get wider and flatter as the time horizon increases as shown in Figure 1-B.

Once a distribution over the 1 000 minimum net lending levels is obtained for a specific time horizon, the government net lending ratios associated with different levels of cumulated probabilities can be derived. To do so, each distribution is sliced into percentiles corresponding to different levels of probabilities. For instance, the value ranked in the 100th position in the distribution of a thousand observations (or the 10th percentile) can be interpreted as the minimum net lending ratio that may be reached with a 90 per cent confidence level.

Figure 1-A. **Three hypothetical simulated paths for the budget balance**

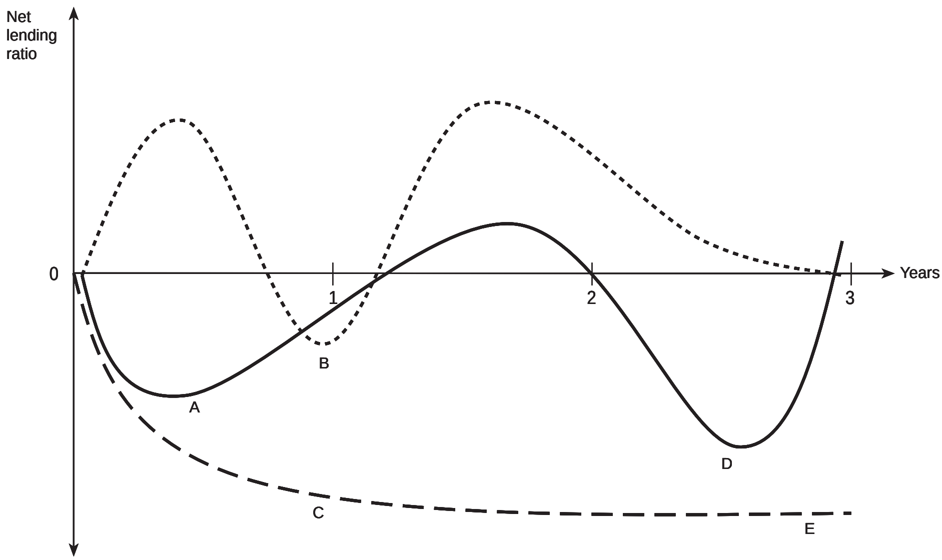
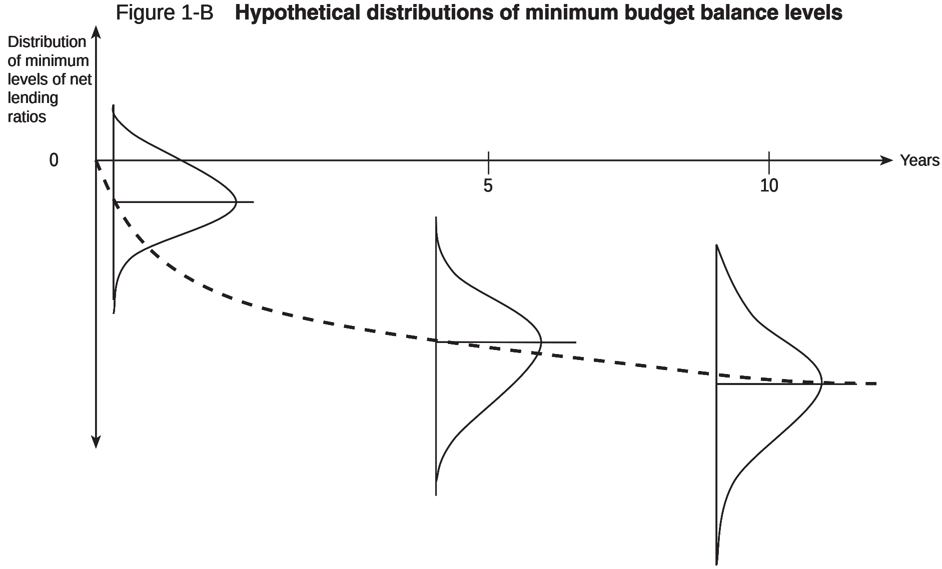


Figure 1-B **Hypothetical distributions of minimum budget balance levels**



Source: Authors.

CHOICE OF VARIABLES AND MAIN RESULTS FROM THE VAR ESTIMATES

The methodology described in the above section is applied to 11 of the 15 EU countries, including eight members of the Euro-area (Germany, France, Italy, Austria, Belgium, Finland, the Netherlands and Spain) and three non-members (the United Kingdom, Denmark and Sweden).[8] For each country, a four-variable VAR model is estimated using semi-annual data generally spanning from the early 1960s to most recently available observations (generally 1996 or 1997).[9] In each case, real output (q_t) is GDP in volume terms, and the government net lending ratio ($nlgq_t$) is measured as a ratio of government net lending on a national accounts basis to nominal GDP. Inflation (Δp_t) is either the GDP or consumption deflator. Finally, different variables are used across countries to measure net private sector lending.

The choice for the latter is based on the following National Accounts flow identity:

$$S - I = (G - T) + (X - M) \qquad [8]$$

where S and I are private-sector savings and investment, G and T are public-sector spending and revenues and X and M are exports and imports of goods and services (including also transfers, interest payments, etc.). The accounting identity [8] simply reflects that in an open economy the excess of private savings over investment is used to either finance a public-sector deficit or to generate an external account surplus. Re-writing [8] in ratios of nominal GDP, and expressing the public-sector budget balance as net lending yields:

$$nlpq = cbq - nlgq \qquad [9]$$

where *nlpq* is the ratio of net private savings to nominal GDP, *cbq* is the current balance as a ratio of nominal GDP, and *nlgq* is public net lending as a ratio of nominal GDP.

Based on the identity [9], the variable used in the VAR to capture real private-sector demand shocks is generally either the private net lending ratio ($nlpq_t$) or the current account as a per cent of nominal GDP (cbq_t). However, in some cases, the gross saving ratio of households ($savq_t$) or real private consumption (cpv_t) are used in order to obtain a longer sample period or better empirical results. As mentioned above, one additional restriction in choosing the real private demand variable is that any subset of variables in the VAR-system should not be co-integrated since this would violate the assumptions of uncorrelated shocks as well as the long-term restrictions imposed on the system.

The set of variables chosen for each country is shown in column 2 of Table 2.[10] Since the VAR equations must be estimated with stationary variables, they are

Table 2. **Model overview**

ountry sample period)	Model	Lags[1]	Exogenous variables	Main features/results
Germany (1961:1-1997:2)	Δq, $\Delta nlgq$, Δcpv, $\Delta pgdp$	4	Constant	– Inflation rate is stationary: entered in level – A 1 per cent point discretionary increase in net lending ratio temporarily lowers output by about 1 per cent after three semesters (peak) – A permanent output (supply) shock has no significant long-run effect on the net lending ratio
France (1972:1-1997:2)	Δq, $\Delta nlgq$, $\Delta nlpq$, $\Delta^2 pcp$	2	Constant	– A 1 per cent point discretionary increase in net lending ratio temporarily lowers output by about 0.25 per cent after one semester (peak) – A 1 per cent permanent positive output (supply) shock leads to a permanent increase in the net lending ratio of about 0.5 percentage points
Italy (1961:1-1996:2)	Δq, $\Delta nlgq$, Δcbq, $\Delta^2 pcp$	4	Constant Linear trend	– Current account as a ratio of output is stationary: entered in level – A 1 percentage point discretionary increase in net lending ratio temporarily lowers output by about 0.5 per cent after two years (peak) – A 1 per cent permanent positive output (supply) shock leads to a permanent increase in the net lending ratio of about 0.4 percentage points
United Kingdom (1965:2-1996:2)	Δq, $\Delta nlgq$, $nlpq$, $\Delta^2 pgdp$	4	Constant Linear trend	– Net private lending ratio stationary: entered in level – A 1 percentage point discretionary increase in net lending ratio temporarily lowers output by about 0.7 per cent after three semesters (peak) – A permanent output (supply) shock has no significant long-run effect on the net lending ratio
Austria (1966:1-1995:2)	Δq, $\Delta nlgq$, $\Delta savq$, $\Delta pgdp$	3	Constant Linear trend	– Inflation rate is stationary: entered in level – A 1 percentage point discretionary increase in net lending ratio temporarily lowers output by about 0.8 per cent within one semester (peak) – A 1 per cent permanent positive output (supply) shock leads to a permanent increase in the net lending ratio of about 0.2 percentage points
Belgium (1963:1-1996:2)	$\Delta^2 pgdp$, Δq, $\Delta nlgq$, $\Delta nlpq$	4	Constant Linear trend	– Net private lending is defined excluding transfers to extend data availability – Inflation ranked first in the VAR – A 1 percentage point discretionary increase in net lending ratio temporarily lowers output by about 0.7 per cent after three semesters (peak) – A permanent positive inflation shock raises output by 1.5 per cent in the long run but has no significant long-run effect on the net lending ratio – A 1 per cent permanent positive output (supply) shock has no significant long-run effect on the net lending ratio

Table 2. **Model overview** *(cont.)*

ountry sample period)	Model	Lags[1]	Exogenous variables	Main features/results
Denmark (1962:1-1996:2)	Δq, $\Delta n\mathrm{lg}q$, $\Delta nlpq$, $\Delta^2 pcp$	2	Constant Linear trend	– Net private lending is defined excluding transfers to extend data availability – Net government lending defined less capital transfers and other capital transactions to extend data availability – A 1 percentage point discretionary increase in net lending ratio temporarily lower output by about 0.3 per cent after one semester (peak) – A 1 per cent permanent positive output (supply) shock leads to a permanent increase in the net lending ratio of about 0.6 percentage points
Finland (1961:1-1997:2)	Δq, $\Delta n\mathrm{lg}q$, $\Delta savq$, $\Delta^2 pcp$	2	Constant Dummy in 1989:2	– Dummy in 1989:2 to capture collapse in exports – Results strongly influenced by the large negative output shock of the early 1990s – A 1 percentage point discretionary increase in net lending ratio temporarily lowers output by about 0.3 per cent within one semester (peak) – A 1 per cent permanent positive output (supply) shock leads to a permanent increase in the net lending ratio of about 0.4 percentage points
Netherlands (1970:2-1996:2)	Δq, $\Delta n\mathrm{lg}q$, $\Delta savq$, $\Delta^2 pgdp$	2	Constant Linear trend Dummy in 1975:1	– Dummy in 1975:1 to allow for change in trend growth rate of real GDP – A 1 percentage point discretionary increase in net lending ratio temporarily lowers output by about 0.5 per cent after one semester (peak) – A 1 per cent permanent positive output (supply) shock leads to a permanent increase in the net lending ratio of about 0.4 percentage points
Spain (1964:1-1995:2)	$\Delta^2 pgdp$, Δq, $\Delta n\mathrm{lg}q$, cbq	2	Constant Linear trend	– Inflation ranked first in the VAR – Current account as a ratio of output is stationary: entered in level – A 1 percentage point discretionary increase in net lending ratio temporarily lowers output by about 0.5 per cent after one year (peak) – A permanent positive inflation shock raises output by 0.6 per cent in the long run but has no significant long-run effect on the net lending ratio – A 1 per cent permanent positive output (supply) shock leads to a permanent increase in the net lending ratio of about 0.2 percentage points

Table 2. **Model overview** *(cont.)*

ountry sample period)	Model	Lags[1]	Exogenous variables	Main features/results
Sweden (1962:1-1997:1)	$\Delta^2 pcp$, Δq, $\Delta n\text{lg}q$, $\Delta savq$	2	Constant Linear trend Dummy in 1976:1	– Net private lending is defined excluding transfers to extend data availability – Dummy in 1976:1 to capture shift in behaviour of net lending ratio – Inflation ranked first in the VAR – A 1 percentage point discretionary increase in net lending ratio temporarily lowers output by about 0.3 per cent after one semester (peak) – A 1 per cent permanent positive inflation shock raises output by 0.6 per cent in the long run and leads to a permanent increase in the net lending ratio of about 0.9 percentage points – A 1 per cent permanent positive output (supply) shock leads to a permanent increase in the net lending ratio of about 0.9 percentage points

. The number of lags has been chosen on the basis of the likehood ratio test (5 per cent critical value) over a span of one to six lags (*cf.* De Serres and Guay, 1995).

generally included in first-difference form.[11] In an economic sense, the inclusion of net lending ratios in first differences implies that the model does not rule out the possibility of ever-increasing debt ratios, which indeed has been a characteristic for most EU-countries during the past 25 years. Likewise, by including inflation in first differences for all countries (except for Germany and Austria where inflation is included in levels), the possibility of a permanent increase in the rate of inflation is not ruled out by assumption. The ranking of the variables in the second column of Table 2 corresponds to the ranking in the VAR system. In most countries, the ranking is consistent with the set of long-run restrictions described in the previous section.[12]

Since no restrictions are imposed on the short-run effect of the shocks, it is possible to verify whether the identified shocks behave in a way that is consistent with economic interpretation. For instance, real output and inflation are expected to move in opposite directions following a supply shock and in the same direction following a demand shock. Moreover, the fiscal policy shock is expected to move the net lending ratio and output in opposite directions in the short term – or in other words, a tightening of fiscal policy is expected to temporarily lower the level of output.

The main features of the key impulse responses are reported in the last column of Table 2.[13] Regarding first the **response of government net lending** as a ratio of GDP to each of the four shocks, the main characteristics across countries generally confirm the *a priori* assumptions:

- The net lending ratio (*i.e.* the fiscal surplus) increases significantly (at the 90 per cent confidence level) in response to a contractionary fiscal shock, both in the short and long term.
- A positive supply shock raises the net lending ratio in all countries in the short term except for Germany, where output improves more than the fiscal balance, leading to a lower ratio. Long-run effects are significant in seven countries: France, Italy, Denmark, Finland, the Netherlands, Spain and Sweden. The long-run effect of supply shocks on the net lending ratio is one of the main factors driving the outcome of the stochastic simulations.
- The net lending ratio responds positively, but not always significantly, to a positive inflationary shock (exceptions are the United Kingdom and Spain). It responds mostly negatively to a negative real private demand shock, but again not always in a significant way. In Germany and Sweden, however, positive (negative) real private demand shocks deteriorate (improve) the net lending ratio in the short term, with the effect being significant only in the latter country. For Germany this is due to the fact that nominal GDP increases more than government net lending, thus giving rise to a decreasing net lending ratio, while for Sweden the model suggest that output improves initially in the face of a domestic savings shock. This reaction could

be due to favourable terms of trade effects and/or interest rate crowding in. Long-run effects from monetary shocks and real private demand shocks on the government's net lending ratio are ruled out by assumption.

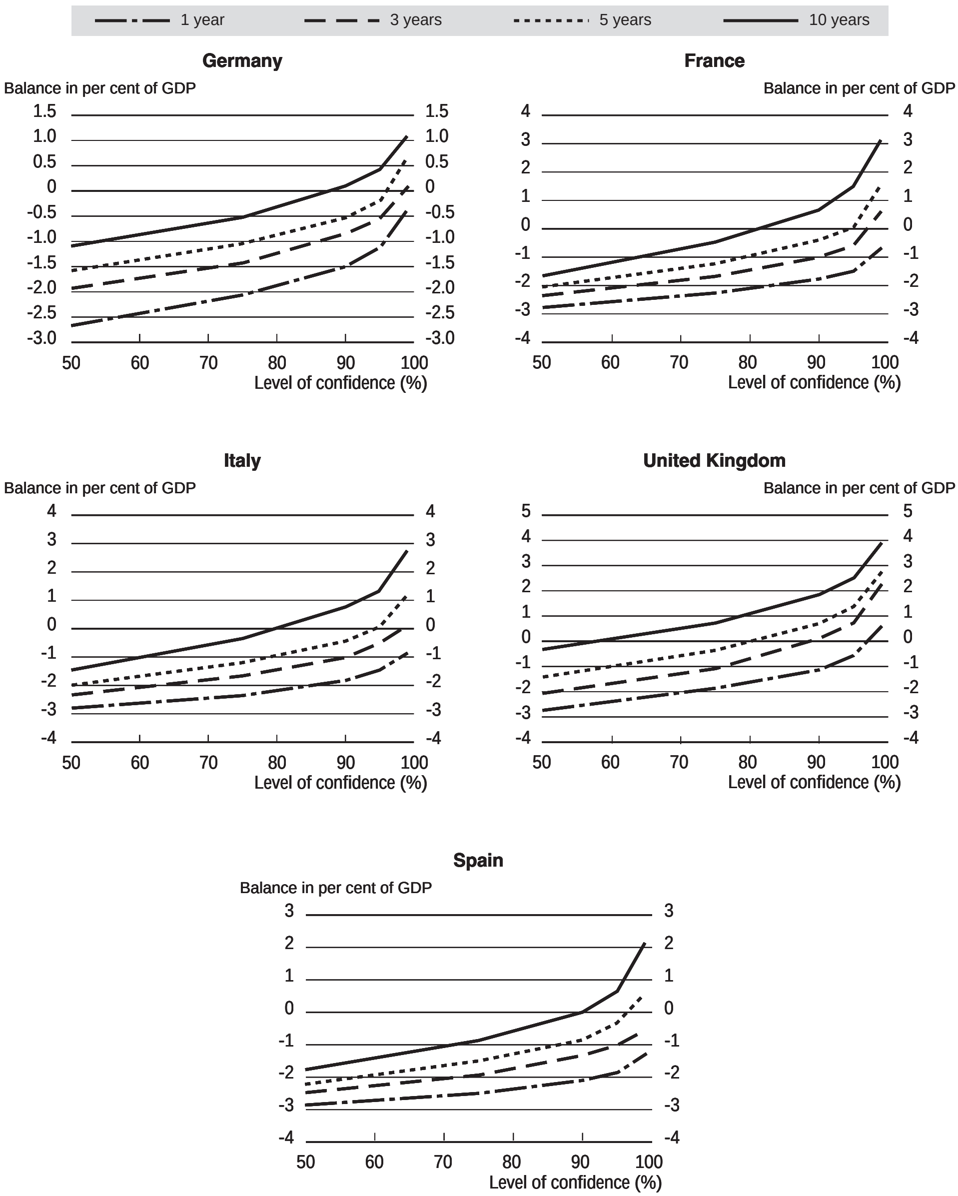
Positive supply shocks raise output significantly in both the short and the long term. Contractionary fiscal shocks lowers output in the short run[14] in all countries, although typically not in a significant way. In all cases, a change in the stance of fiscal policy towards consolidation thus leads to a temporary decline in activity (and *vice versa*) with an elasticity that varies from 0.25 to about 1 per cent. The response of inflation (price level in the case of Germany and Austria) to supply shocks and fiscal shocks show the expected signs for most countries: a positive supply shock (raises output and) lowers inflation in the short term, and a contractionary fiscal shock lowers (output and) inflation.[15] These effects, however, are not significant in most countries. Finally, for most countries there is a clear tendency for private savings to decrease in the event of a restrictive fiscal shock. To an extent that differs across countries, this result suggests the presence of crowding-in effects and/or some degree of income smoothing or partially Ricardian behaviour in the private sector.

RESULTS OF THE STOCHASTIC SIMULATIONS

The results of the simulations for each country are shown in Figure 2 for different time horizons and levels of confidence. The budgetary requirements to avoid breaking the 3 per cent ceiling rises in the desired level of confidence and the time horizon considered, since over longer time horizons the probability of a series of adverse events hitting the economies increases. For Germany, for example, the simulation results suggest that if the government was to aim for a *cyclically-adjusted* deficit of 1 per cent of GDP, the *actual* deficit would, with a 90 per cent likelihood, remain within the 3 per cent limit over a horizon of three years without a need to adjust fiscal policy in a pro-cyclical fashion. This horizon would be extended to ten years if Germany instead opted for a cyclically-adjusted balanced budget.

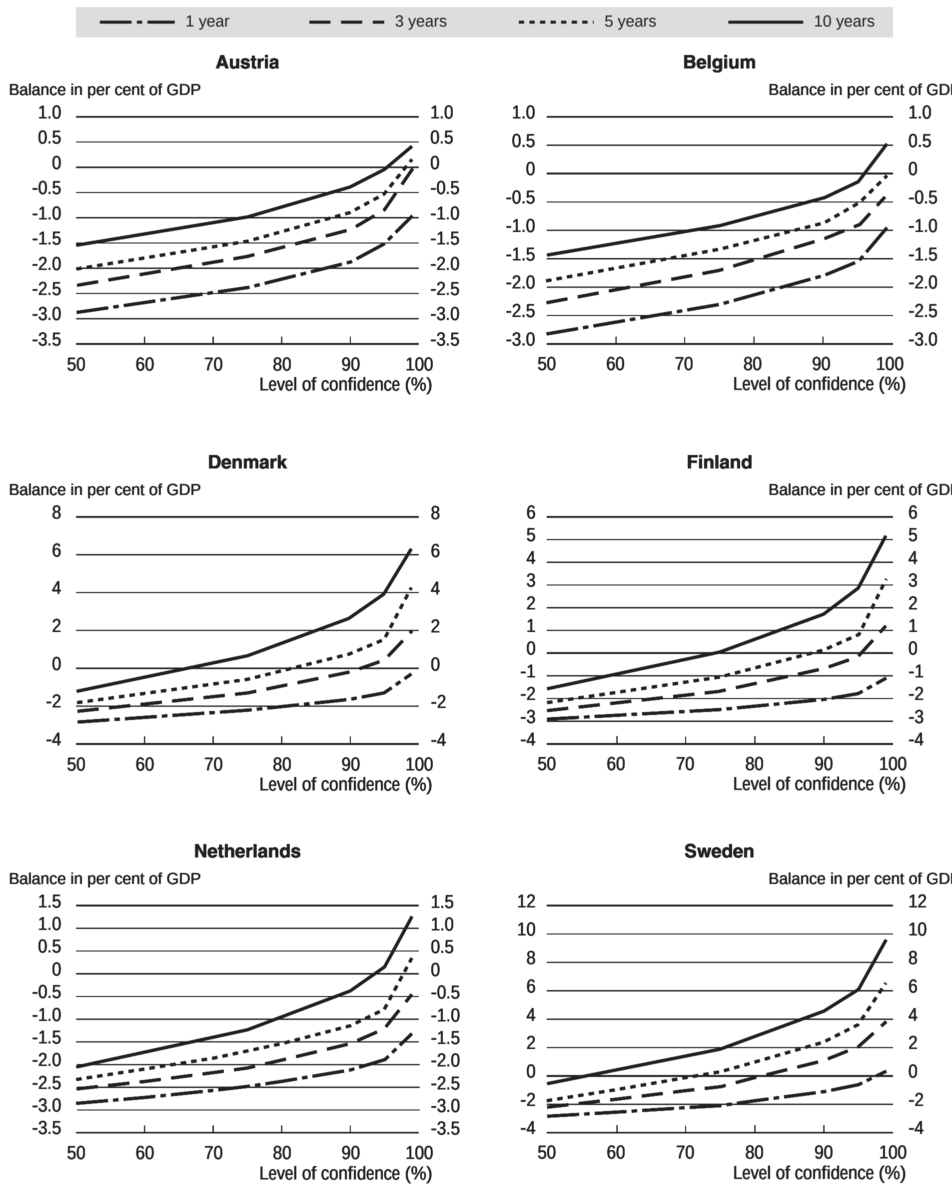
Another way to interpret the result is (as can be seen from Figure 2) that the likelihood of remaining within the 3 per cent threshold for a cyclically-adjusted deficit of one per cent of GDP would drop from 90 per cent to only 50 per cent if the time horizon considered by policy makers extends from three to ten years. The results also reveal that most countries face relatively similar trade-offs between budget targets and levels of confidence. Cyclically-adjusted budgetary positions around balance, or even small deficits, would thus provide most countries with a 90 per cent likelihood of keeping the deficit within the 3 per cent margin over a three to five-year horizon without having to resort to discretionary pro-cyclical fiscal tightening (Figure 3). However, for the three countries outside the euro-area (the United Kingdom,

Figure 2. **Cyclically adjusted balance required to meet the 3 per cent deficit criterion with different levels of confidence**



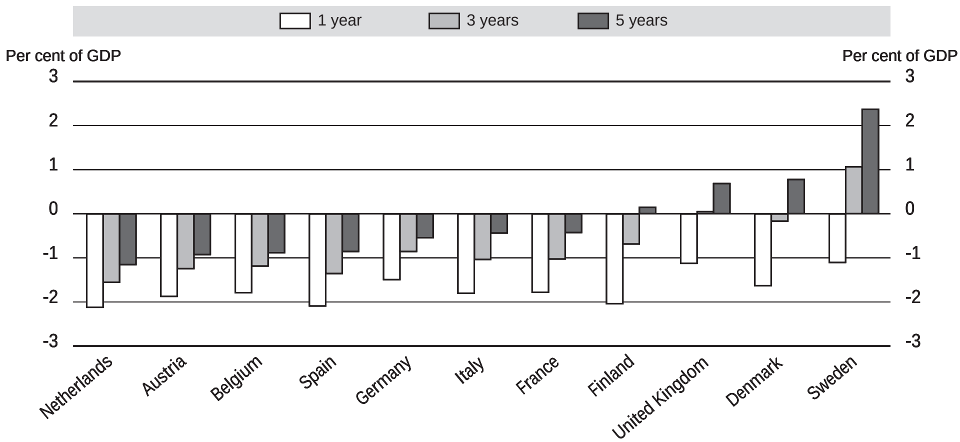
Source: Authors' calculations.

Figure 2. **Cyclically adjusted balance required to meet the 3 per cent deficit criterion with different levels of confidence** *(cont.)*



Source: Authors' calculations.

Figure 3. **Cyclically-adjusted government balances required to meet the 3 per cent of GDP deficit criterion with 90 per cent confidence over different time horizons**



Source: Authors' calculations.

Denmark and Sweden) the requirements are somewhat higher – *i.e.* surpluses in the range of 0.7 – 2.4 per cent of GDP would be needed over a five years horizon.

The results indicate that the medium-term deficit targets – as set out in the individual countries' Stability programmes (for euro-area countries) and Convergence programmes (for non-euro countries) that were submitted to the European Commission in the in the fall of 1998 (Table 3) – appear to be overall prudent, at least with respect to a three-year horizon. Stated differently, the simulation results imply that if governments aim for a cyclically-adjusted deficit (or surplus) corresponding to the level specified in their own respective programmes, the actual deficit will, with a likelihood of close to 90 per cent, remain within the 3 per cent limit over a three-year horizon. However, over a horizon extended to five years, the likelihood of not breaching the ceiling drops to around 70-80 per cent for the four largest economies and Austria, whereas it remains above the 90 per cent confidence level for the rest of the countries (Figure 4).

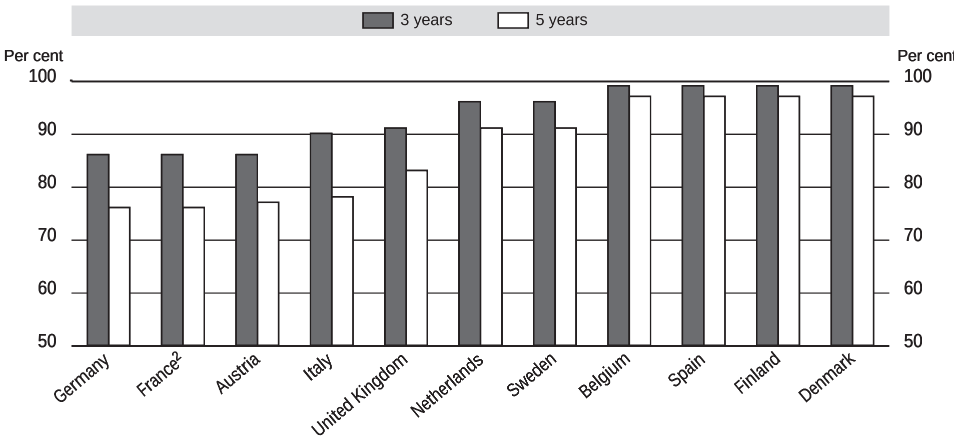
This suggests that a cyclically-adjusted deficit target of 1-1.5 per cent of GDP around 2002 in Germany, France, Italy and Austria, as well as a balanced budget in the United Kingdom, might not provide a strong medium-term hedge against breaking the 3 per cent limit, though a five-year horizon might appear sufficiently long to policymakers to steer the deficit in the appropriate direction without unduly

Table 3. **Official medium-term programmes to comply with the Stability and Growth Pact**[1]

	Deficit 1998	Debt 1998	Deficit target 2002	Debt ratio 2002	Expenditure ratio 2002	Underlying annual GDP growth Projection	
	As a per cent of GDP[2]					1999	2000-02
ustria	2.2	64.4	1.4	60.0	48.9	2.8	2.3
elgium	1.3	117.5	0.3	106.8	46.2	2.4	2.3
inland	–1.1	51.9	–2.3	43.2	45.4	4.0	2.6
rance	2.9	58.2	0.8-1.2	57.1-58.3	50.6-51.5	2.4-2.7	2.5-3.0
ermany	2.1	61.0	1.0	59.5	45.0	2.0	2.5
reland[3]	–1.7	59.0	–1.6	43.0	28.1	6.7	6.1
taly[3]	2.6	118.2	1.0	107.0	48.3	2.5	2.9
etherlands	1.3	68.6	1.1	64.5	43.8	2.3	2.3
ortugal	2.3	58.0	0.8	53.2	39.8	3.5	3.3
pain	1.9	67.4	–0.1	59.3	41.2	3.8	3.3
enmark[3]	–1.1	59.0	–2.6	49.0	< 48.6	1.7	2.0
reece[3]	2.4	107.8	0.8	99.8	39.3	3.7	4.2
weden[3]	–1.5	74.2	–2.5	58.0	58.0	2.2	2.5
nited Kingdom	–0.8	47.9	–0.2	42.0	40.1	1.0	2.6

. Submitted to the European Commission in December, 1998.
. Negative numbers denote a surplus.
. Deficit target, debt ratio, expenditure ratio and underlying annual GDP growth projections are for 2001 instead of 2002 and 2000-02, respectively.
ource: European Commission and national authorities.

Figure 4. **Likelihood that the official budget target[1] will allow compliance with the deficit limit**



1. As stated in the medium-term stability or convergence programmes (December 1998).
2. The programme for France presents two different scenarios with a projected deficit in 2002 of respectively 0.8 and 1.2 per cent of GDP. The latter is used as reference here.

Source: Authors' calculations.

exacerbating the cycle, providing action is taken early enough. On the other hand, more ambitious medium-term targets may be desirable if one considers additional factors such as the implications of population ageing on pension and health care costs.

It should be stressed that the study does not address the question of excessive deficits, *i.e.* to what extent deficits above 3 per cent of GDP will co-exist with severe recessions (fall in real GDP of at least ¾ per cent) or by other means be exempted from the excessive deficit procedure in the ECOFIN council. This implies, that the *de facto* risk of having to undertake pro-cyclical fiscal tightening during an economic downturn is slightly lower than indicated by the simulations. This caveat, however, is likely to be of minor importance to the policy implications of the simulation results since historically only some 10 per cent of the episodes of deficits above 3 per cent of GDP (for EU-15) have occurred simultaneously with a drop in real GDP of more than 0.75 per cent (and only 2-3 per cent have occurred when real GDP was falling by more than 2 per cent). Another reason is that deficits sometimes lag behind real activity such that the provisions of the Stability and Growth Pact concerning severe economic downturns may not apply in the same years as the deficit exceeds the 3 per cent limit. Finally, the results are obtained using semi-annual data. Since the Stability and Growth Pact is concerned solely with *annual* budget outcomes, the derived levels of confidence could be biased (even though the raw semi-annual data used are annualised). However, sensitivity analysis using the averages of two consecutive semi-annual observations to convert the results into calendar years does not display significant differences to the results obtained by semi-annual data (typically the cyclically adjusted net lending ratio for any given level of confidence and time horizon would deviate by a maximum of 0.1-0.2 percentage point of GDP).

It should also be emphasised that the estimated budgetary requirements do not, or only partly, capture more recent changes to political and budgetary frameworks as well as to economic structures, and that particular historical episodes may be dominating the results for some countries. The most notable examples are Finland and Sweden, both of which have been experiencing extreme changes in the budget balances since 1990. These episodes imply that the VAR model identifies some excessive shocks for Finland and Sweden, which in turn lead to results for prudent budgetary margins that are somewhat higher than what would be relevant when considering the current economic environment and policy framework in the two countries. In order to better capture likely future shocks for these two economies, it was thus chosen to base the results on an average of shocks experienced by the four major EU-economies rather than past shocks in the countries themselves.[16]

The simulation results should be considered policy-relevant mainly for time horizons no longer than five years since beyond that horizon the cumulative effects of non-linearities in the economic variables (which may not be properly captured by the model) could blur the results.[17] Moreover, planning horizons of up to five years are quite common for fiscal policy.

The differences in the results across countries can largely be explained by three factors:

- The variance of the change in the deficit: higher variance implies higher budgetary requirements;
- The importance of fiscal policy shocks – relative to the other three types of shocks – in explaining movements in the deficit: the more important is the role of fiscal shocks, the lower the budgetary requirement (because fiscal shocks are turned off in the simulations);
- The quality of the VAR model, *i.e.* how much of the volatility in the four variables is captured by the lag structure of the model and how much remains in the residuals. Intuitively, it may not matter much whether the unconditional variance of the variables is captured ultimately by the variance of the residuals or by the lag structure. However, it may have some

influence on the final results given that one of the shocks (*i.e.* the fiscal shock) is turned off in the simulations.

Government net lending-to-GDP ratios for the eleven countries are shown in Figure 5. The least volatile deficits over the 1960-97 period have been found in Germany, France, Austria and the Netherlands, whereas deficits in Italy, Finland and Sweden have had the largest volatility. Based on movements in deficit levels, one might expect to find more stringent budget requirements in the latter countries to provide for an adequately prudent budgetary margin. However, for purposes of automatic stabilisation, it is important to distinguish between the cyclical change in the deficit and its long-term drift. A large variance of the deficit level reflects, in most cases, the presence of a unit root and should therefore not necessarily be interpreted as a meaningful indication of the sensitivity of the budget balance to business cycles developments. Indeed, since the deficit is included in the VAR in first differences, it is the variance of the *change* in the deficit level – rather than the variance of the level – that has a determining influence on the outcome (in the sense that the higher the variance, *ceteris paribus*, the more stringent the budget requirements will be).

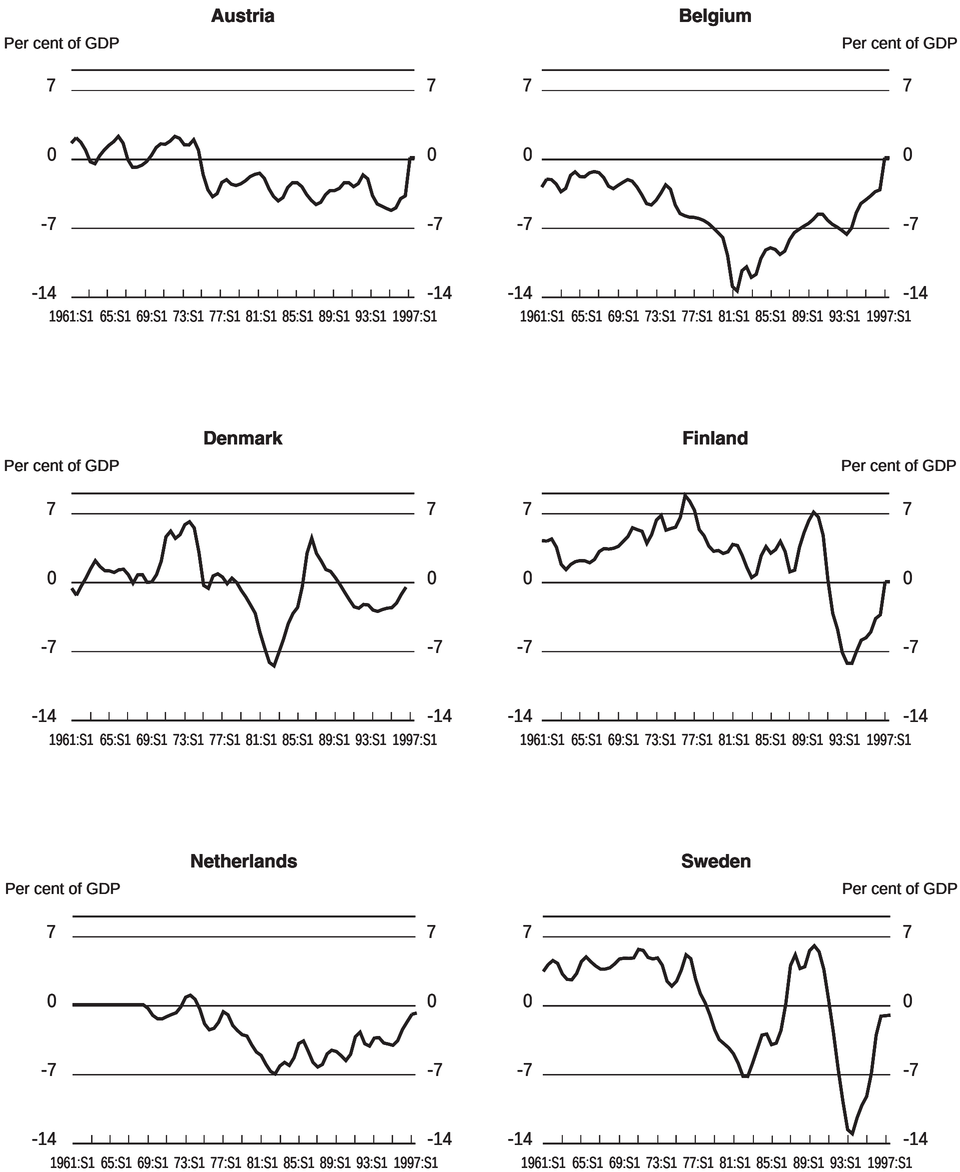
The cases of the United Kingdom and Italy are illustrative in this respect. Italy has had much higher volatility in the government net lending-to-GDP ratio than the United Kingdom, but Italy's deficit has shown a long and relatively smooth downward trend followed by a long and smooth correction, whereas the UK deficit ratio has been dominated by two major cycles (Figure 5). The implication is that volatility of the first difference of the deficit ratio has been lower in Italy than in the United Kingdom. This would tend to imply a lower budget requirement in Italy than in the United Kingdom. Figure 6 shows a relatively close link between the variance of the first difference of the deficit ratio and the budgetary requirement (here illustrated by the case with 90 per cent confidence and a three-year horizon). The volatility of the change in the deficit indicates that countries like Austria, Belgium, the Netherlands and Spain would face relatively low budgetary requirements, whereas Finland and, in particular, Sweden[18] would need significantly better budget positions to achieve the same safety margin. Germany, France, the United Kingdom, Italy and Denmark are in intermediate positions.

The relative importance of fiscal policy shocks in explaining the movements in the deficit also has an important influence on the cross-country differences. If a large part of the unpredicted movement in the deficit is accounted for by fiscal-policy-induced shocks, then the budgetary requirement would be relatively low given that such shocks are turned off in the simulations. This partly explains the somewhat less stringent safety margin needed in Germany relative to France and Italy (over 1-3 per cent horizons) despite a comparable variance in the change in the deficit ratio. On the opposite side, the very stringent requirements obtained for

Figure 5. **Government net lending in per cent of GDP**

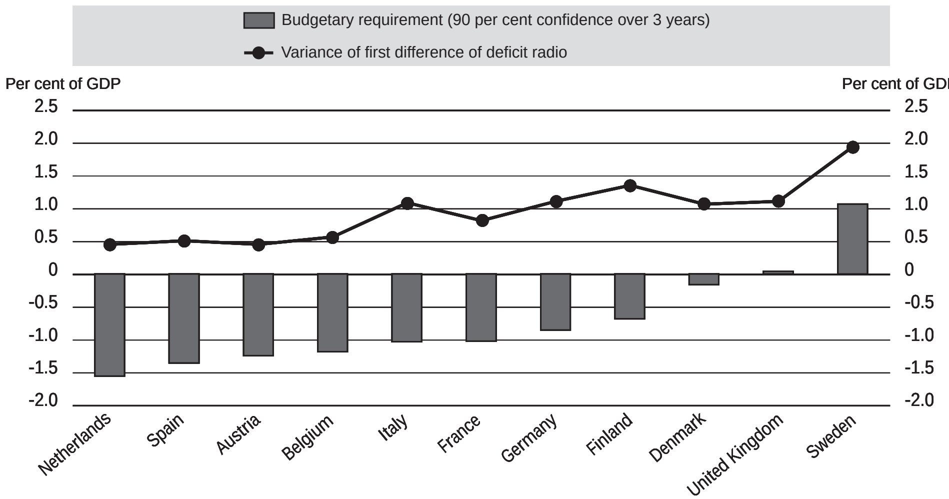
Source: OECD, *Economic Outlook 63* databank.

Figure 5. **Government net lending in per cent of GDP** *(cont.)*



Source: OECD, *Economic Outlook 63* databank.

Figure 6. **Cyclically-adjusted budget balance requirements and volatility in deficits**



Source: Authors' calculations.

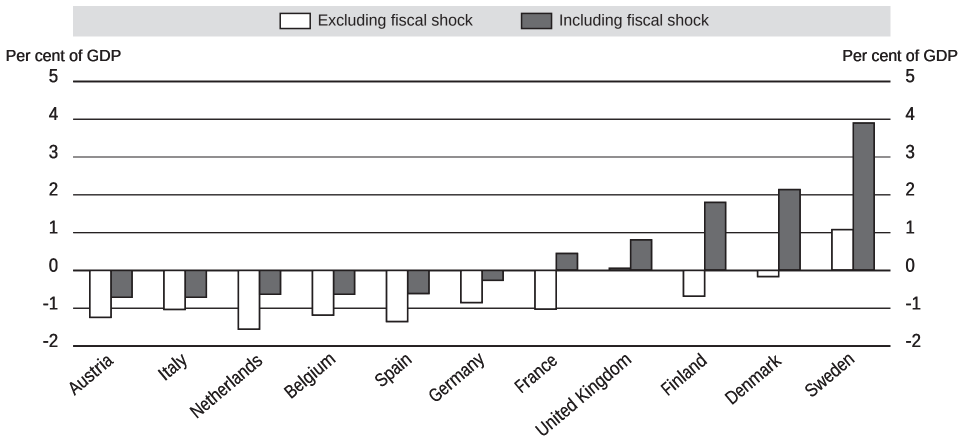
Denmark and Sweden are partly attributable to the strong influence exerted by supply shocks on the deficit in the long run.

Finally, variations in the quality of the four estimated equations of the VAR model can also explain some of the cross-country differences in the results. Poorly estimated VAR equations mean that a larger portion of the fluctuations in the variables are accounted for by the model's residuals. In turn, this implies that larger shocks are drawn during the simulations. The effects are not unambiguous, however, since a poorly estimated model may display a lower propagation of the shock – and hence a lower budgetary requirement.

SENSITIVITY ANALYSIS

In order to asses the implication for the results of leaving out the fiscal shock, the simulations have also been carried out when including all four shocks (Figure 7). It turns out, as expected, that the inclusion of the fiscal shock raises the budgetary requirements (additional volatility requires higher margins). However, the relative ranking of countries remains fairly unchanged – and the stricter require-

Figure 7. **Cyclically adjusted government balances required to meet the 3 per cent of GDP deficit criterion with 90 per cent confidence over a 3 year horizon**



Source: Authors' calculations.

ments for Finland, the United Kingdom, Denmark, and Sweden are maintained. The inclusion of the fiscal shock changes the results most significantly in France and the three Nordic countries. This could capture a genuine relatively large effect from fiscal policy decisions on past budgetary dynamics, but it could also be a result of the model allocating too much weight to fiscal shocks. In any case, the robustness of the country ranking to the inclusion of all four shocks implies that the exact interpretation of the shocks is not decisive for the relative requirements for the countries – *i.e.* even if the model does not accurately capture what is "true" demand (fiscal, real private and monetary) and supply shocks the relative position of countries remains nearly unaltered.

Simulations have also been carried out in order to assess the sensitivity of the results to changes in the variable measuring real private demand. Table 4 shows that uniformly using net private lending (in first differences) only implies marginal changes for the countries where other variables have been used in the baseline model – *i.e.* the budgetary requirement changes by less than 0.2 per cent of GDP in all cases (except for Finland). Simulations have also been carried out to test the impact of ranking inflation last – instead of first – for Spain, Belgium and Sweden. Once again, the budgetary requirements change only slightly, *i.e.* less than 0.4 per cent of GDP for a five years horizon and 90 per cent confidence. Finally, the

Table 4. **Sensitivity of results to a change in the variable measuring real private demand**

	Three year horizon (90 per cent confidence)		Five year horizon (90 per cent confidence)	
	Base model	With D1NLPQ	Base model	With D1NLPQ
Germany (D1CPV)	–0.85	–0.74	–0.54	–0.43
France (D1NLPQ)	–1.02	–	–0.42	–
Italy (CBQ)	–1.03	–0.91	–0.43	–0.40
United Kingdom (NLPQ)	0.04	–	0.68	–
Spain (CBQ)	–1.35	–1.43	–0.85	–0.88
Austria (D1SRATIO)	–1.25	–1.30	–0.92	–0.89
Belgium (D1NLPQ)	–1.18	–	–0.88	–
Netherlands (D1SRATIO)	–1.55	–1.52	–1.15	–1.13
Finland (D1SRATIO)	–0.68	0.28	0.14	1.48
Denmark (D1NLPQ)	–0.16	–	0.77	–
Sweden (D1SRATIO)	1.06	0.90	2.37	2.16

Note: The variable measuring real private demand in the base model is indicated in the parenthesis. A "–" implies that NLQP or D1NLQP is used as the base model for the country concerned.
Source: Authors' calculations.

sensitivity of the results to a change in the lag length has been examined and found to be fairly low, although with the three Nordic countries exhibiting a non-negligible sensitivity (Table 5). Taken together these sensitivity results imply that the budgetary

Table 5. **Sensitivity of results to a change in the lag length of the VAR model**

	Three-year horizon (90 per cent confidence)			Five-year horizon (90 per cent confidence)		
	Optimal lag minus one	Optimal lag	Optimal lag plus one	Optimal lag minus one	Optimal lag	Optimal lag plus one
Germany	–0.25	–0.85	–0.75	0.13	–0.54	–0.35
France	–1.04	–1.02	–1.12	–0.30	–0.42	–0.58
Italy	–0.80	–1.03	–1.36	0.10	–0.43	–0.83
United Kingdom	0.34	0.04	–0.20	1.20	0.68	0.42
Spain	–0.97	–1.35	–1.24	–0.33	–0.85	–0.45
Austria	–1.37	–1.25	–1.50	–1.00	–0.92	–1.22
Belgium	–1.13	–1.18	–1.04	–0.73	–0.88	–0.57
Netherlands	–1.40	–1.55	–1.73	–0.82	–1.15	–1.40
Finland	–0.06	–0.68	–0.81	1.24	0.14	–0.05
Denmark	–0.38	–0.16	1.00	0.80	0.77	2.98
Sweden	2.41	1.06	2.01	5.00	2.37	3.95

Source: Authors' calculations.

requirements found by using different country-specific models are fairly robust compared with applying exactly the same model for all countries (*i.e.* same variables, ordering and lag length).

CONCLUSION

A two-step methodology has been used to estimate prudent budgetary margins, *i.e.* cyclically adjusted balances that would allow automatic fiscal stabilisers to fully operate over the business cycle while preventing the general government deficit to breach the limit of 3 per cent of GDP set under the Stability and Growth Pact. A structural VAR model has been estimated for 11 EU countries, capturing the effects on the deficit of economic shocks that have historically prevailed in each country. Based on the estimated distributions of these shocks, stochastic simulations have then been performed to build up probabilities of breaching the 3 per cent ceiling in the future. During each simulation, fiscal policy was assumed to be unchanged in order to purely capture the movements in the deficit stemming from automatic stabilisation and other sources not originating from fiscal impulses (*i.e.* movements due to supply shocks, real private demand shocks and monetary shocks). Under this methodology, budget targets become more stringent as longer-term horizons are considered, because the probability of a sequence of unfavourable events hitting an economy increases over time.

The simulation results suggest that, for the majority of countries, if governments were to aim for a *cyclically-adjusted* budget deficit between 1.0 and 1.5 per cent of GDP, the *actual* deficit would, with a 90 per cent likelihood, remain within the 3 per cent limit over a three-year horizon, without the need to adjust fiscal policy in a pro-cyclical fashion. This horizon would be extended to five years and above if governments opted for a "close-to-balance" budget rule, defined as a cyclically-adjusted deficit between zero and 1 per cent of GDP. Given that such a horizon encompasses the average length of a business cycle, these results largely endorse the recommendations of the SGP and the conclusions reached by Buti *et al.* (1998). For Finland, the United Kingdom and Denmark (in ascending order), moderate (cyclically-adjusted) surpluses would be needed to minimise the risks of breaching the 3 per cent limit over a five year horizon, whereas the requirement for Sweden is a more substantial surplus to achieve to same level of confidence.

The results indicate that the medium-term deficit targets – as set out in the individual countries' Stability programmes (for euro-area countries) and Convergence programmes (for non-euro countries) – submitted to the European Council appear to be overall prudent, at least with respect to a three-year horizon. Over longer horizons, however, the results suggest that for the four largest economies and Austria, the deficit targets might not provide as strong a hedge against breaching the 3 per cent of GDP deficit limit. The results also suggest that cross-country differences in medium-term budget targets are well justified in light of the past record on fluctuations in net lending ratios.

NOTES

1. Such estimates of elasticities are, of course, subject to uncertainty, temporal instability, and in particular, they could be affected by EMU participation. In any case, the OECD Secretariat estimates are similar to those used by the IMF and the European Commission.
2. Taking the variation in output gaps into consideration, the IMF shows how a structural budgetary position between balance and a deficit of 1 per cent of GDP would accommodate full automatic stabilisation within the 3 per cent limit with 95 per cent confidence (assuming output gaps in all the euro-area countries are drawn from the same normal distribution).
3. For a review of topics in structural VAR econometrics, see Amisano and Giannini (1997).
4. This set of restrictions assumes that all the variables in the system should be integrated of the same order but should not be co-integrated.
5. As described below, the set of restrictions has been slightly modified for a few countries in order to obtain impulse responses that seemed more compatible with economic priors.
6. Interpreted as the cyclically-adjusted level of government net lending.
7. Likewise, the distribution of maximum values would be centred around increasingly higher surpluses.
8. There are no government accounts for Luxembourg, while it has not been possible to obtain well-specified models for Portugal and Greece, partly due to problems with the government account data for these countries. Ireland has been excluded since government accounts data only goes back to 1977, implying potential problems with too few degrees of freedom.
9. Semi-annual data was chosen in order to get sufficient degrees of freedom for the models. One problem with using semi-annual data for fiscal analysis is that budget balances follow yearly patterns and semi-annual data may thus be misleading in some cases. Moreover the data for the other variables – especially for some of the smaller countries – sometimes exhibit an apparently excessive erratic behaviour from one semester to another.
10. All the data are taken from the *OECD Outlook Data Bank* and are measured on a *National Accounts* basis.
11. Standard unit root tests have been used to determine the order of integration.
12. Exceptions are Spain, Belgium and Sweden where the change in inflation is ranked first in the VAR rather than last. In those cases, permanent inflation shocks (which are interpreted as monetary shocks) can have permanent effects on output and the net lending ratio. The re-ordering is justified in those cases by the finding that under the baseline ranking, the disturbances interpreted as supply shocks in fact behaved as demand shocks (*i.e.* a positive shock raises both output and inflation). This can be interpreted as evidence of hysteresis. It turns out that the ranking of inflation has only marginal effects for the final outcomes of the stochastic simulations for these three countries (*i.e.* the results are invariant to whether inflation is ranked first or last in the system).

13. Given space limitations, impulse response figures are not shown in this paper but are available upon request from the authors or can be found in the working paper version (Dalsgaard and de Serres, 1999, website www.oecd.org/eco/eco).
14. Fiscal policy is restricted to have temporary effects on the level of output.
15. Exceptions to this are Belgium, Spain, the United Kingdom and Sweden where inflation rises at impact and then starts falling after two to four semesters.
16. Based on the country-specific shocks instead of the average of the major-four country shocks the budget requirement over a five-years horizon and 90 per cent confidence would be 3.7 per cent of GDP for Sweden (instead of 2.4) and 1.4 per cent of GDP for Finland (instead of 0.1).
17. This is particularly true for countries where the aggregate supply shock is found to have a permanent effect on the budget balance (in addition to the fiscal shock itself which is turned off during simulations). In such cases, the variance of the simulated budget balance tends to increase continuously with the length of the horizon.
18. Besides the volatility of the deficit, several studies have found a somewhat higher sensitivity of the budget to cyclical movements in output for Sweden than for other EU countries (*cf.* Table 1).

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