MONITORING BUDGETARY DISCIPLINE:
SOME SIMPLE INDICATORS[1]

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This paper aims at defining simple indicators to help monitor the rules of budgetary discipline laid down in the Treaty on European Union and the Stability and Growth Pact. The first part of the paper examines the conditions of convergence of the debt ratio to a stable value. These conditions are formulated in terms of two "convergence parameters", which describe the adjustment of the primary balance ratio through time and determine the qualitative dynamics of the debt and primary balance ratios. When there are fluctuations in real GDP growth, the process of convergence of these ratios is characterised by a long-term trend (either monotonic or generating a low-frequency cycle determined by the convergence parameters) and by a high-frequency cycle induced by the sensitivity of the primary balance to real GDP growth. It is therefore necessary to take into account the impact of the growth cycle on fiscal variables to assess convergence. The second part of the paper is an empirical approach to estimate this impact, and derives some indicators that might be useful for the analysis of fiscal policies in EU countries.

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1. Introduction

The Treaty on European Union (the Treaty) established, as the basic rule of budgetary discipline, that Member States shall avoid excessive government deficits (Article 104c(1)). In Article 104c(2), it disposed that the Commission shall monitor the developments of the budgetary situation and of the stock of government debt with a view to identifying gross errors. In particular, it shall examine compliance with budgetary discipline on the basis of the following two criteria:

(a) whether the ratio of the planned or actual government deficit to gross domestic product exceeds a reference value, unless:

   - either the ratio has declined substantially and continuously and reached a level that comes close to the reference value;

   - or, alternatively, the excess over the reference value is only exceptional and temporary and the ratio remains close to the reference value:

(b) whether the ratio of government debt to gross domestic product exceeds a reference value, unless the ratio is sufficiently diminishing and approaching the reference value at a satisfactory pace.

The reference values are specified in the Protocol (no 5) on the excessive deficit procedure annexed to the Treaty as:

   - 3% for the ratio of the planned or actual government deficit to gross domestic product at market prices;

   - 60% for the ratio of government debt to gross domestic product at market prices.

Finally, in Article 104c(3), the Treaty says that, if a Member State does not fulfil the requirements under one or both of these criteria or if, notwithstanding the fulfilment of the requirements, the Commission is of the opinion that there is a risk of an excessive deficit in a Member State, the Commission shall prepare a report. At a later stage, the Stability and Growth Pact further developed and clarified these rules and procedures (see ECB Monthly Bulletin, May 1999, "The implementation of the Stability and Growth Pact" for more details).

While a large and still growing body of literature exists that analyses the rationale of these criteria of budgetary discipline, the more basic issue of how to monitor their implementation in practice has received much less attention. It is necessary, of course, to check whether the current values of the deficit and debt ratios are below the reference values of the Treaty. But these current values are affected by the cyclical

position of the economy and this complicates very much the assessment of the underlying financial position of the government and the potential risks of incurring in excessive deficits. This paper deals with the definition of simple indicators to help monitor compliance with these criteria when the fluctuations in GDP are explicitly taken into account (For earlier work on fiscal indicators see, for example, Blanchard [1990], Blanchard Chouraqui, Hagemann and Sartor [1990], Horne [1991], and Mongelli [1999]).

We firstly focus the analysis on the debt criterion, whilst trying to answer two questions: What are the conditions for convergence of the debt ratio to a stable value or range of values below the 60% of GDP reference set up in the Treaty? If the debt ratio is increasing above the reference value, how can the risks that it might follow an explosive path be assessed? To address these issues we will start with a simplified framework. In a continuous time setting, in which the debt and primary balance ratios cannot jump instantaneously to the desired target values and monetary financing of the deficit is banned (Article 104 of the Treaty), the dynamics of the debt ratio depends on the current value of the debt ratio, on the differential between the rates of interest and GDP growth (both in either nominal or real terms) and on the current value of the primary balance ratio. We will ignore in the analysis the so-called deficit/debt adjustments, which account for changes in the debt not directly linked to the deficit (proceedings from privatisations, revaluation effects, financial operations, etc.). We also initially assume constant prices and interest and GDP growth rates in order to find the conditions on the continuous adjustment of the primary balance ratio that would guarantee a gradual convergence of the debt ratio to a given target. These conditions are two. They refer to the minimum value that should take two convergence parameters determining the velocity of reaction of the primary balance ratio to its deviations from the value that would keep the debt ratio constant at its target value, and to the deviations of the debt ratio from its target value. These conditions depend on the (constant) interest-growth differential, but not on the target value for the debt ratio.

However, the hypothesis of a constant interest-growth differential is very unrealistic. What happens when this differential fluctuates cyclically as we observe in reality? To answer this question we maintain the assumption of constant prices and interest rate but suppose that the rate of real GDP growth fluctuates following a regular cycle. This change makes the analysis much more complex from the formal point of view,

particularly if we also take into account that fiscal variables and, therefore the primary balance, are sensitive to the cyclical position of the economy. In this more interesting framework, the debt and primary balance ratios no longer converge to point values but rather to a stable limit cycle, which is determined by the fluctuations in real GDP growth, the sensitivity of the primary balance ratio to them, and the values of the two convergence parameters. Nevertheless, the conditions of convergence found previously are still valid and guarantee the stability of the limit cycle. To examine the dynamics of convergence of the debt and primary balance ratios to this region of stability, we use a discrete time simulation model. The simulations show that the qualitative dynamics of the convergence process is a combination of two influences. One is that of the convergence parameters, which determines either a monotonic trend or a low-frequency cycle in the long-term behaviour of the ratios. The other is the sensitivity of the primary balance ratio to the cyclical fluctuations in real GDP growth, which determines a high-frequency cycle in both ratios. Therefore the conclusion is that, in order to monitor the convergence of the debt ratio to a stable range of values, it is essential to estimate the influence of the cyclical position of the economy on it through the sensitivity of the primary balance ratio to real GDP growth.

However, when examining the influence of the cyclical position of the economy on the primary balance and debt ratios we should also take into account that they are affected not only by changes in real GDP growth, but also by changes in the GDP deflator. Consequently, the second part of the paper empirically examines past reactions of fiscal ratios-to-GDP to the current financial position of the government, to inflation and to real GDP growth, and proposes some simple indicators of budgetary discipline for the analysis of fiscal policies in EU countries. Fiscal variables normally show certain sensitivity to fluctuations in real GDP growth. For example, progressive taxes have an elasticity greater than one and transfers to households an elasticity smaller than one with respect to real GDP growth. These effects should be shown by the procyclical fluctuation of the taxes-to-GDP ratio and the countercyclical fluctuation of the transfers-to-GDP ratio. Similarly, public expenditure on goods and services might have a dampening effect on aggregate demand changes if its elasticity with respect to output is less than one or, in other words, if its ratio-to-GDP fluctuates countercyclically. Such

fluctuations of the revenue and primary expenditure ratios would jointly determine procyclical fluctuations in the primary balance and debt ratios.

Finally we consider the fact that, when fiscal policies are constrained by institutional arrangements such as the rules of the Treaty and the Stability and Growth Pact (SGP), the budget must allow for a 'safety margin' to avoid deficits higher than 3% of GDP in the case of a possible deterioration of the general government financial position as a result of adverse cyclical developments. The main rule of budgetary discipline of the SGP is the commitment of Member States to respect the medium-term objective of budgetary positions close to balance or in surplus. This objective would allow all Member States to deal with normal cyclical fluctuations, while keeping the government deficit at, or below, the reference value of 3% of GDP. The second part of the paper presents an empirical approach to estimate the sensitivity of fiscal variables to real GDP growth (section 3), and the results of the estimates for EU countries (section 4). These results provide some information to define indicators potentially useful to analyse fiscal policies in the institutional framework of the Treaty and the SGP through some simple indicators (section 5). The first one provides a benchmark to monitor convergence of the debt ratio to below the 60% of GDP reference value of the Treaty. The second one is helpful to monitor the fluctuations of the overall budget balance ratio and assess the risks that it breaches the 3% of GDP reference value of the Treaty. The main conclusions are summarised in section 6.

2. The dynamics of the debt and primary balance ratios

2.1 *The dynamics of the debt and primary balance ratios in continuous time*

If there is no possibility of monetarily financing the deficit, the dynamics of the debt level (B) in a continuous time setting (where the variables cannot jump discontinuously) is determined by the equation $dB = r \cdot B - S$, where dB is the time derivative of B, r is the rate of interest (both nominal and real, because we will assume constant prices) and S is the primary balance. The dynamics of the debt-to-GDP ratio (b=B/Y) is given by the equation:

$$db = \left(\frac{1}{Y^2}\right) \cdot [dB \cdot Y - B \cdot dY] = (r - g) \cdot b - s \qquad [1]$$

where $g = dY/Y$ is the rate of change in (nominal and real) GDP, and $s = S/Y$ is the primary balance-to-GDP ratio. We will also assume that r and g are exogenously given[2], that $r > g$ and that, for the time being, they are constant. If we represent the differential equation $db = (r-g)b-s$ in the (b,s) plane (Graph 1), the straight line $s = (r-g)b$ shows the points for which the debt ratio is constant ($db = 0$). Given the initial value of the debt ratio (b_0) and a constant primary balance ($s = s_0$), the debt ratio will be stable only if $s_0 = (r-g)b_0$, but otherwise it will not converge to a finite value. If $s_0 < (r-g)b_0$, the debt ratio will increase continuously, and if $s_0 > (r-g)b_0$, it will decrease continuously. Hence, for any given initial value of the debt ratio, there is a single value of the primary balance ratio that guarantees the stability of the debt ratio. A useful indicator in this respect is the <u>primary gap</u>, showing the difference between the actual primary balance ratio and the value that would be compatible with maintaining a stable government debt ratio (see Blanchard [1990]).

Graph 1
**Dynamics of the debt ratio when the primary balance is constant**
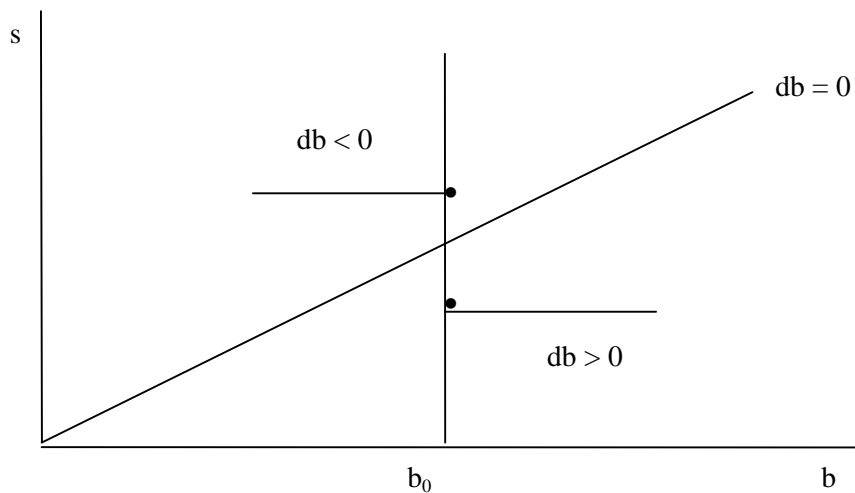
If the convergence target of fiscal policy is to attain a certain level of the debt ratio (b*), starting from given initial conditions (b_0, s_0), the primary balance target should be s*=(r-g)b*. When s*≠s_0 and fiscal policy cannot be immediately adjusted to attain the target (b*, s*) or it is costly[3] to do so, a possible fiscal policy rule would be to adjust gradually in each period the current value of the primary balance to the target value proportionally to the distance between both. In this case, the change in the primary balance ratio will be determined by the differential equation ds=-v(s-s*), where v is a positive constant. Now the joint dynamics of the debt and primary balance ratios is described by a linear system of differential equations:

$$db = (r - g)b - s$$
$$ds = -v(s - s*)$$

[2]

The solution of this system is a saddlepoint, as represented in Graph 2, where the convergence path to the equilibrium point (b*,s*) is a straight

Graph 2

A saddlepoint equilibrium of debt and primary balance ratios

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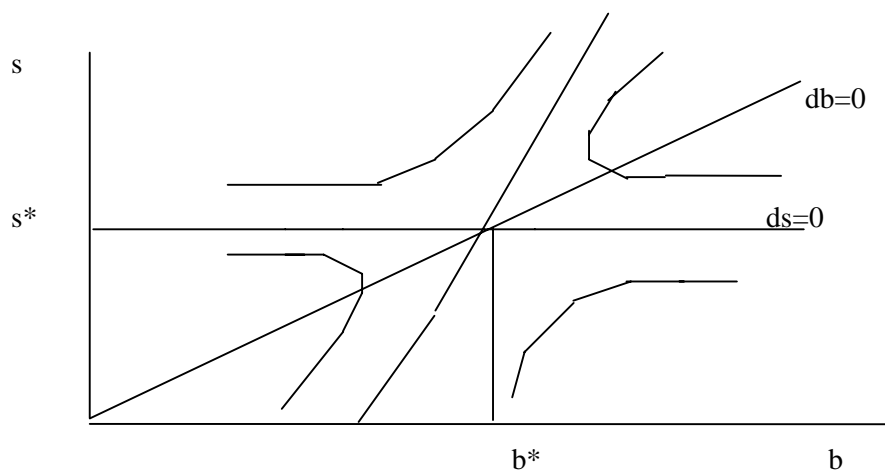
[3]   We will not consider the possible existence of adjustment costs. Our purpose is not to derive a formula for the optimum path of the primary balance and debt ratios in order to minimise the costs of adjustment. Instead, we try to find the conditions under which these ratios converge to stable values.

line with slope v+(r-g). This system is not globally stable and, if the initial conditions of the economy are not on the convergence path, the equilibrium point will not be attained. The conclusion is that the assumed fiscal policy rule is not sufficient to guarantee global convergence, unless the initial primary balance ratio can be adjusted in one jump to put the economy on the convergence path.

Is there any alternative fiscal policy rule to gradually converge, without requiring a jump (which might not be feasible) in the initial conditions of the debt and primary balance ratios? A possible rule can be to adjust the primary balance ratio taking into account not only the distance between the current value and the target value of the primary balance, but also the distance between the current level of the debt ratio (b) and the objective of convergence (b*). With the implementation of this rule the primary balance ratio would also be adjusted in a certain proportion u>0 of the current difference b-b*, and the new system of linear differential equations describing the dynamic behaviour of the ratios would be:

$$
\begin{aligned}
db &= (r-g)b - s \\
ds &= u(b-b^*) - v(s-s^*)
\end{aligned}
\qquad [3]
$$

In terms of deviations from equilibrium, this system is of the form dx=Ax, where x is the column vector [(b-b*), (s-s*)], and A is the matrix of constant coefficients:

$$
A = \begin{bmatrix} r-g & -1 \\ u & -v \end{bmatrix}
$$

The stability properties of the system equilibrium (b*, s*) and the dynamics of convergence (or divergence) of the debt and primary balance ratios to this equilibrium position depend on the roots of the characteristic equation: $\lambda^2 - tr(A) \cdot \lambda + \det(A) = 0$, where tr(A)=(r-g)-v and det(A)=u-v(r-g). The roots of the characteristic equation are:

$$
\lambda_{1,2} = 0.5 \cdot \left[tr(A) \pm \sqrt{tr(A)^2 - 4\det(A)} \right] = 0.5 \cdot \left[\{(r-g)-v\} \pm \sqrt{[v+(r-g)]^2 - 4u} \right]
$$

and the conditions for the equilibrium to be globally stable, guaranteeing convergence from any initial position, are tr(A)<0, and det(A)>0:

• The first condition of global convergence without jumps requires that the velocity of adjustment of the primary balance ratio to the discrepancy between its current value and the target should be greater than the differential between the rates of interest and growth (v>r-g).

- The second condition stipulates that the velocity of adjustment of the primary balance ratio to the discrepancy between the current and the target levels of the debt ratio should be greater than the product of v times the differential of the rates of interest and growth; i.e., $u>v(r-g)$.

Note that the values of the parameters that guarantee global convergence do not depend on the target ratios ($b*$, $s*$), but only on the interest-growth differential. If both conditions are met, the debt and primary balance ratios tend to converge to the equilibrium of the system whatever might be the starting point and the equilibrium is thus globally stable. However, the dynamics of convergence of the debt and primary balance ratios depends on the relative values of the convergence parameters (u, v). From the right-hand side of the last expression it is possible to summarise the qualitative behaviour of this dynamic system, depending on the values of the two parameters, in Graph 3.

Graph 3

Qualitative behaviour of the debt and primary balance ratios
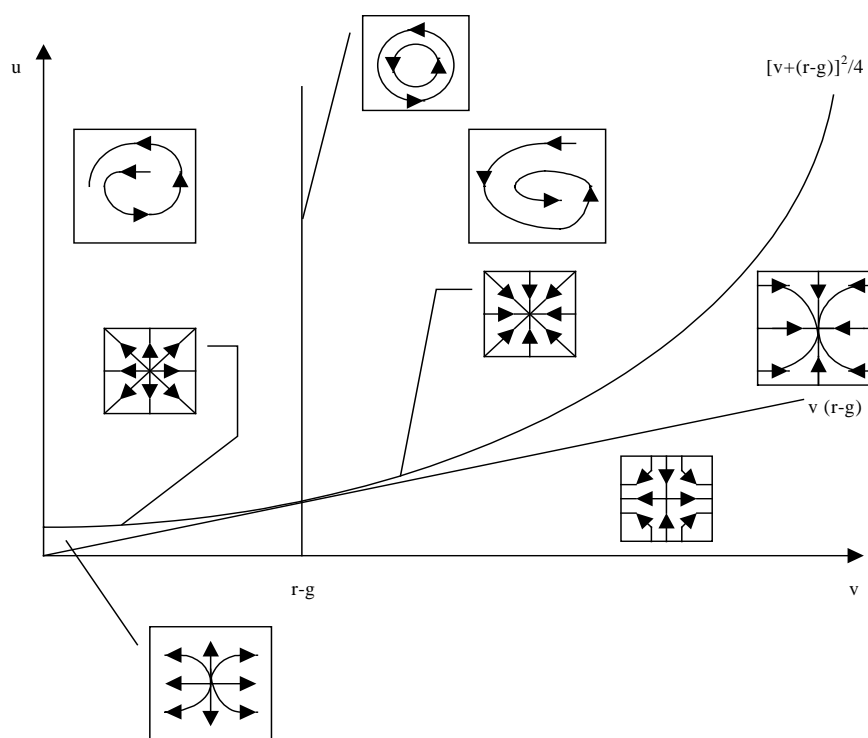
The system equilibrium is a saddlepoint for values of u smaller than v(r-g), since det(A)<0. On the other hand, when v<(r-g) the system is unstable, since tr(A)>0. The values of the convergence parameters that make the equilibrium of the system globally stable are those to the right of the vertical line at (r-g) and above the straight line with slope (r-g). Within this region, any pair of values of u and v guarantees convergence whatever the starting point of the debt and primary balance ratios. Long-term convergence of these ratios to the equilibrium of the system will be monotonic for values of u located at or below the curve $[v + (r - g)]^2 / 4$, and cyclical for values above it. Note that, when u>[v+(r-g)]^2/4, the roots of the characteristic equation are complex, and the debt and primary balance ratios follow a counter-clockwise spiral path, which is convergent if v>(r-g), closed if v=(r-g), or divergent if v<(r-g).

2.2   *Cyclical fluctuations in real GDP growth and the sensitivity of the primary balance*

In the previous section it has been assumed that the real GDP rate of growth was constant. Now we can address the issue of what happens when this rate fluctuates cyclically around a constant average g* and the primary balance ratio changes procyclically, increasing when g>g* and decreasing when g<g*. We could consider a new system reformulating the second equation of the previous system [3] to allow the primary balance ratio to be influenced by the cyclical position of the economy:

$$ds = u \cdot (b - b*) - v \cdot (s - s*) + \alpha \cdot [g - g*] \qquad [4]$$

where α is a positive constant reflecting the sensitivity of the primary balance to the deviations of the current growth rate g –which is now a function of time- from its average value g*. In this case, the dynamic system we have considered becomes considerably more difficult to solve analytically. In particular, it can be seen in Graph 3 that the cyclical fluctuations of g (when prices and the rate of interest are kept constant, as before, to simplify things) change the frontiers which limit the different regions in the (u, v) plane. Hence, depending on the (constant) values of the convergence parameters, the qualitative behaviour of the system may change in different phases of the cycle.

To see what might happen in this case, we assume that the convergence parameters (u, v) are such that v>(r-g) and u>[v+(r-g)]^2/4, and that they are big enough to guarantee that the system does not change

its qualitative behaviour and remains globally stable along the cycle. Starting from the constant growth equilibrium of the system (b*, s*, g*), we suppose that the growth rate declines from g* (in t=0) to g<g* (in t=1). This would increase the slope (r-g) of the straight-line db=0 in Graph 4, and will simultaneously induce a reduction in the primary balance ratio and an increase in the debt ratio, say from (b*, s*) to (b_1, s_1), because of the impact of lower growth on the budget.

Graph 4

Departure from the initial equilibrium position
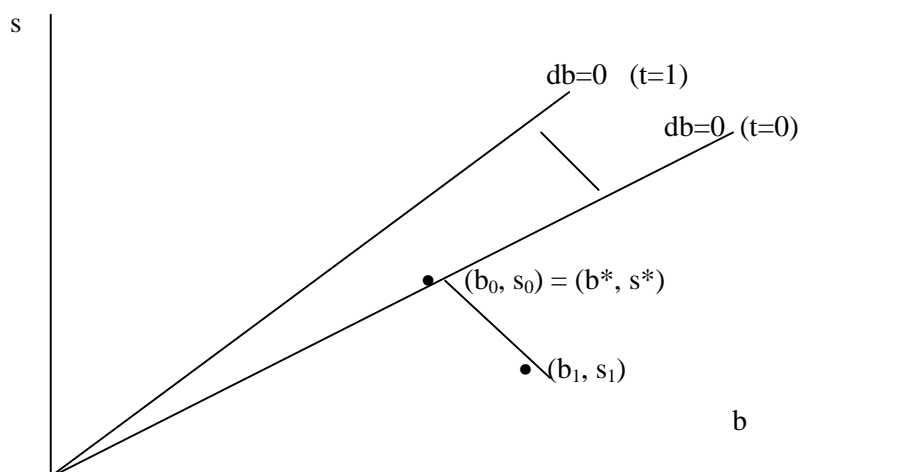
Now there are two forces of contrary signs operating on the primary balance ratio. On the one hand, while the growth rate remains below the average g*, the cyclical sensitivity of the budget tends to deteriorate the primary balance. On the other hand, the parameters determining long-term convergence will tend to increase the primary balance ratio as long as its current value is below its target value (s*) and the debt ratio is above its target value (b*). The short-term divergence from the initial equilibrium position will depend on the amplitude of the growth cycle and on the cyclical sensitivity of the budget, but assuming that this sensitivity is bounded, the recovery of growth after the trough of the cycle will eventually reinitiate a convergence movement towards the initial equilibrium. Note, however, that in case the growth rate follows a

cyclical path around g*, the initial equilibrium will never be restored again, and we can guess from the previous argument that the dynamic behaviour of the debt and primary balance ratios will follow a closed circular path (a limit cycle) around the target values (b*, s*).

2.3   A discrete time approach to the dynamics of convergence

To understand the qualitative dynamics of this more complex cyclical equilibrium, it is useful to reformulate it as a system of difference equations in discrete time, whose behaviour can be simulated in a computer. We assume, as before, that there is no possibility of monetarily financing the deficit, that the primary balance and debt ratios cannot be adjusted in one period to attain the desired target values and ignore deficit/debt adjustments. The dynamics of the debt level (B) in a discrete time setting (where as before) is determined by the equation

$$B_t = (1+r) \cdot B_{t-1} - S_t \qquad [5]$$

where t=0,1,2… The dynamics of the debt ratio is then:

$$b_t = \frac{1+r}{1+g} b_{t-1} - s_t \qquad [6]$$

The budget constraint of the government is $D_t = T_t - G_t - rB_{t-1}$, where T are receipts, G is primary expenditure, rB are interest payments, and $S_t = T_t - G_t$ is the primary balance. Let us assume that $T_t = C_t + \tau Y_t$, where C_t represent discretionary measures to preserve convergence in the long-term and τ is a positive constant. On the expenditure side, assume that primary expenditure grows at a constant rate equal to the average growth rate of GDP: $G_t = (1+g^*)G_{t-1}$. Then, the primary balance ratio-to-GDP is:

$$s_t = c_t + \tau - \frac{1+g^*}{1+g_t} \gamma_{t-1} \qquad [7]$$

where $c_t = C_t/Y_t$ and $\gamma_t = G_t/Y_t$ are the corresponding ratios with respect to GDP. From the previous definitions, and assuming that the convergence policy rule is $c_t - c_{t-1} = u \cdot (b_{t-1} - b^*) - v(s_{t-1} - s^*)$, we can derive the following system of difference equations:

$$b_t - b_{t-1} = \frac{r - g_t}{1 + g_t} b_{t-1} - s_t$$

$$s_t - s_{t-1} = u(b_{t-1} - b^*) - v(s_{t-1} - s^*) + \frac{g_t - g^*}{1 + g_t} \gamma_{t-1}$$
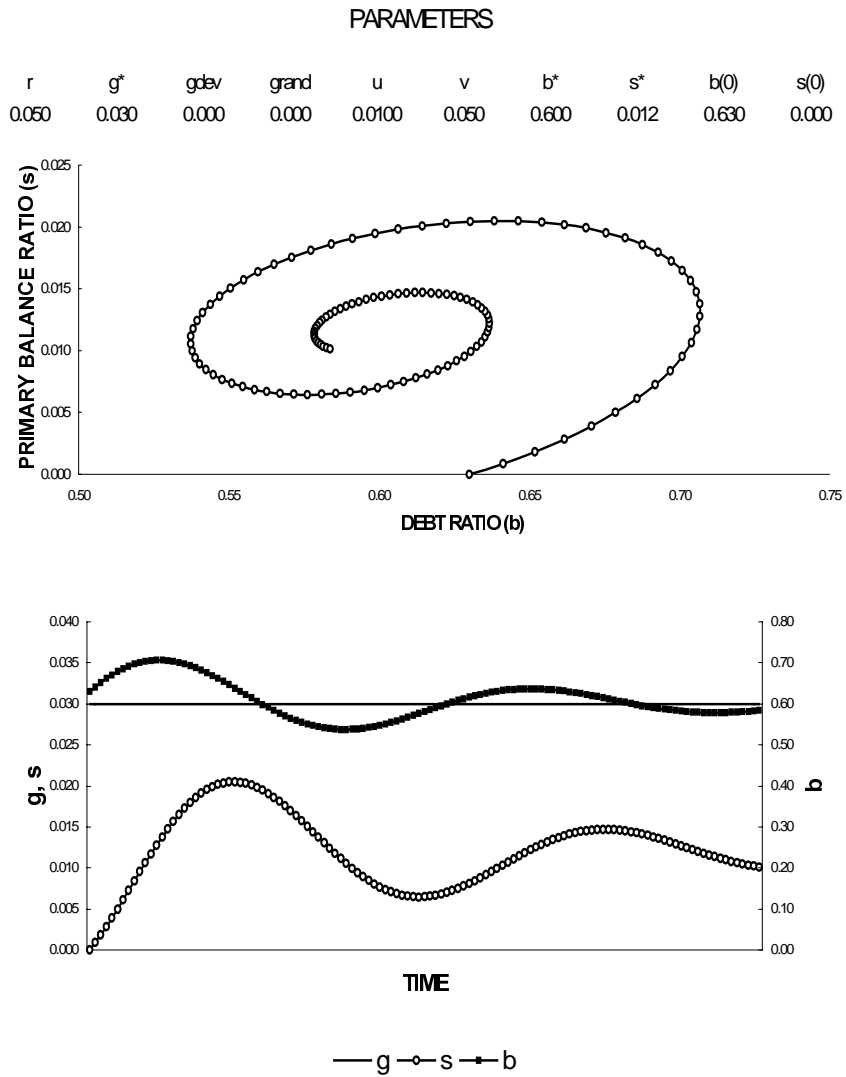
$$[8]$$

This system is a discrete time equivalent to the last differential equations system we considered in the previous section. The dynamic behaviour of this system can be simulated easily. In the following simulation exercises we will assume c_0=0 and $\tau = 0.4 = \gamma_0$. The assumptions of this simulation model are to some extent arbitrary. They have been selected in order to rationalise the main 'stylised facts' unveiled by the empirical approach followed in the second part of the paper. As in the continuous time case, the key features of the model are the procyclical response of the primary balance ratio to the fluctuations in real GDP growth and its reaction to the financial position of the government in the last period.

We can firstly simulate the convergence to equilibrium in case of constant growth g=g* and with the parameter assumptions specified in Graph 5. The parameter g_{dev} shows the maximum deviation of growth from the average, and g_{rand} is a parameter allowing for random shocks on the current growth rate, which we will assume equal to zero throughout the simulation exercises presented here.

The initial position of the system is b0=63% and s0=0. The rates of interest (r=5%) and growth (g=3%) are constant. Assuming that the primary balance is adjusted in each period by 1% of the discrepancy between the current debt ratio and the target b*=60%, plus 5% of the discrepancy between the current primary balance ratio and the target s*≅1.165%, the system slowly converges towards the equilibrium point, following a cyclical path. Note that, as growth is constant, the dynamics of the primary balance ratio is solely determined by the assumed values of the convergence parameters, since there are no growth fluctuations affecting the budget.

Taking into account the influence of cyclical fluctuations in the growth rate on the primary expenditure ratio and on the convergence path of the debt and primary balance ratios, we can consider now the case in which the rate of growth fluctuates cyclically around its average (g*=3%), following a regular path with a maximum deviation of 1.5 percentage points up and down (gdev=0.015). This system does not

Graph 5

Convergence to equilibrium (b*,s*) with constant growth g*

PARAMETERS

r	g*	gdev	grand	u	v	b*	s*	b(0)	s(0)
0.050	0.030	0.000	0.000	0.0100	0.050	0.600	0.012	0.630	0.000

converge any more to an equilibrium point (b*, s*), but to a limit cycle like the one represented in Graph 6. However, given that the system starts from an initial position very close to the equilibrium limit cycle, the dynamics of the debt and primary balance ratios describe an almost

invariant cycle from the start, and there is no possibility to observe the convergence path of these ratios to the regular cycle defining the equilibrium of the system. On the other hand, if the real GDP growth rate does not follow a perfectly regular cycle, but is subject to random shock, the smooth cycle of these ratios shown in graph 6 would look very different. As a result, the assessment of whether the fluctuations of the debt and primary balance ratios are restricted to a stable range or indicate some risks of divergence is much more difficult to make.

Graph 6

A limit cycle equilibrium when growth fluctuates regularly

PARAMETERS

r	g*	gdev	grand	u	v	b*	s*	b(0)	s(0)
0.050	0.030	0.015	0.000	0.0100	0.050	0.600	0.012	0.630	0.000
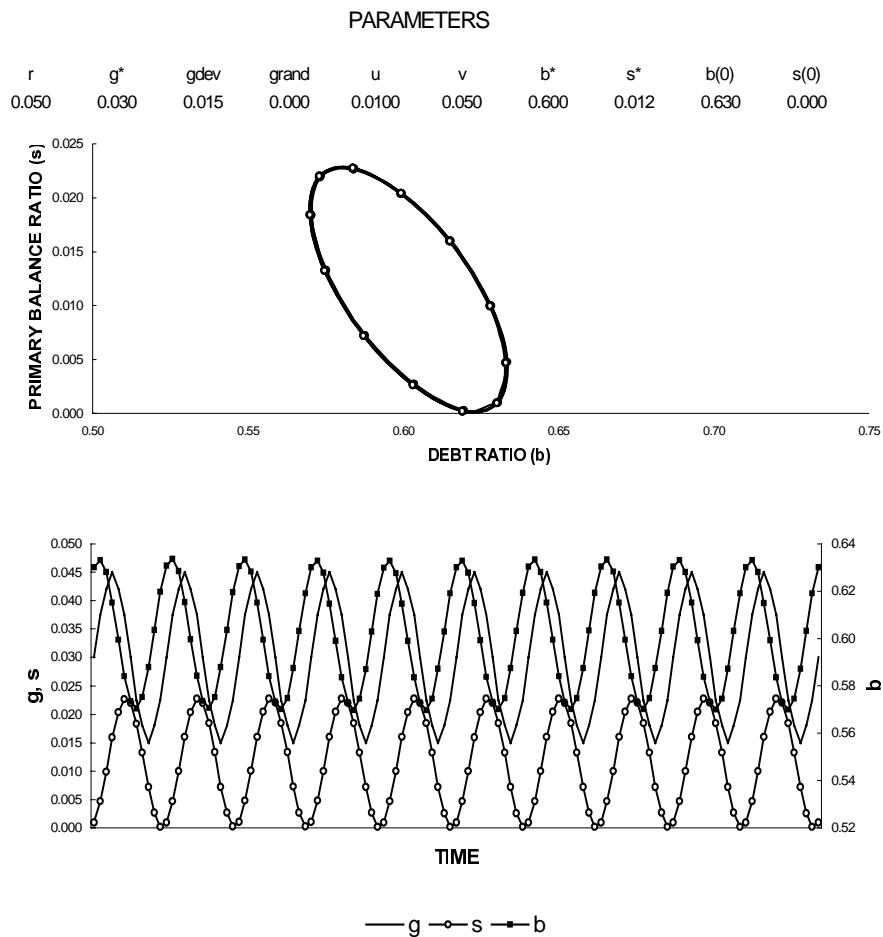
Now there are two cyclical influences affecting the primary balance ratio. One is generated by the convergence parameters. The other one has its origin in the constant growth of primary expenditure, which induces countercyclical fluctuations in the primary expenditure ratio and procyclical fluctuations in the primary balance ratio. The relative sizes of these two influences determine the shape of the limit cycle. The estimates of these two influences are crucial to monitor whether the observed fluctuations of the ratios are stable or divergent.

The cyclical behaviour of the fiscal variables included in this simulation model reproduces the stylised facts found in the empirical approach taken in the second part of this paper. To show the co-movements of the different variables we examine the response of the overall balance to the cyclical position of the economy, measured by the deviation of current growth from the average (g_t-g^*). The (overall) budget balance ratio-to-GDP (d_t) is $d_t = s_t - \rho_t$, where ρt is the ratio-to-GDP of interest payments. Hence, the change in the budget balance ratio can be expressed as:

$$d_t - d_{t-1} = (c_t - c_{t-1}) - (\gamma_t - \gamma_{t-1}) - (\rho_t - \rho_{t-1}) \qquad [9]$$

We can represent graphically the change in the overall balance ratio as the sum of the contributions of revenue $(c_t - c_{t-1})$, primary expenditure $-(\gamma_t - \gamma_{t-1})$, and interest payments $-(\rho_t - \rho_{t-1})$. Graph 7 shows, in the left-hand scale, the deviations of the growth rate from its average and, in the right-hand scale (which is double size of the left-hand one in order to facilitate the reading of the graph), the changes in the budget balance ratio as well as the separate contributions of its three components, along a typical cycle. This graph also summarises the main stylised facts found in the empirical approach of the second part of this paper.

The procyclical change in the budget balance ratio results from the counter-cyclical change in the primary expenditure ratio. This is a consequence of maintaining primary expenditure growing at a constant rate (g^*), while output growth fluctuates around this rate. The fluctuations in the revenue ratio are a consequence of the convergence policy. The cyclical pattern of changes in the ratio-to-GDP of interest payments is identical to the one described for the revenue ratio, and so its

contribution to the changes in the budget balance ratio is exactly the opposite in sign and almost the same in size.

Graph 7

Budget balance response to the cyclical position of the economy
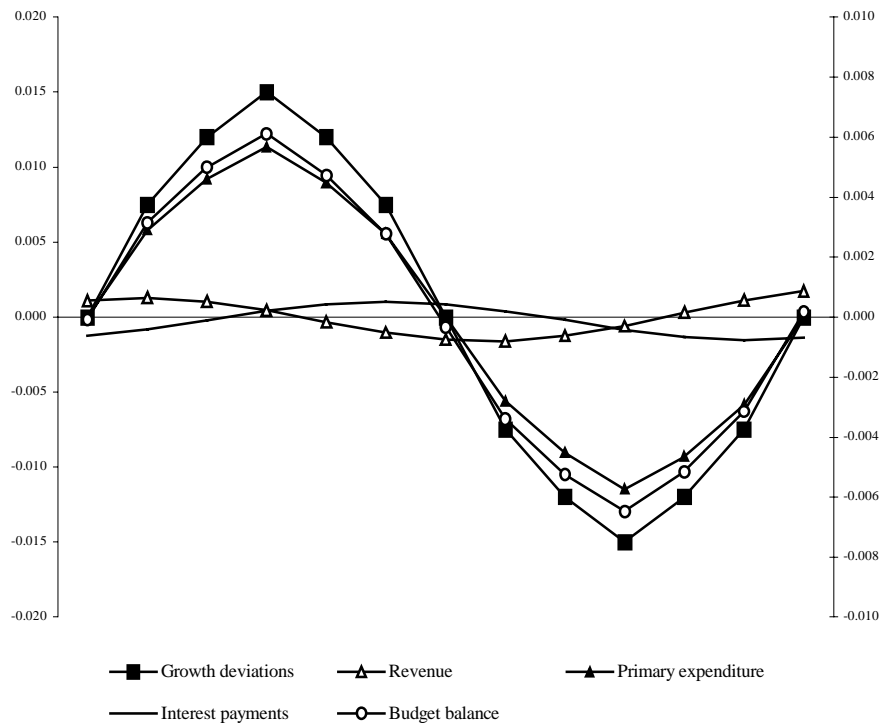
To get an idea of the convergence path of the variables towards this regular equilibrium cycle, let us assume that the system starts from a position in which the debt ratio is 80%, keeping all the other parameter values unchanged. We can see in the lower part of Graph 8 that the time path of the debt and primary balance ratios in the process of convergence is characterised by two cycles of different time length. The longer one is determined by the values of the 'convergence parameters' (u, v), while the shorter one is determined by the impact of the growth cycle on the budget.

Graph 8

Convergence towards the equilibrium limit cycle

PARAMETERS

r	g*	gdev	grand	u	v	b*	s*	b(0)	s(0)
0.050	0.030	0.015	0.000	0.0100	0.050	0.600	0.012	0.800	0.000

—— g —○— s —■— b
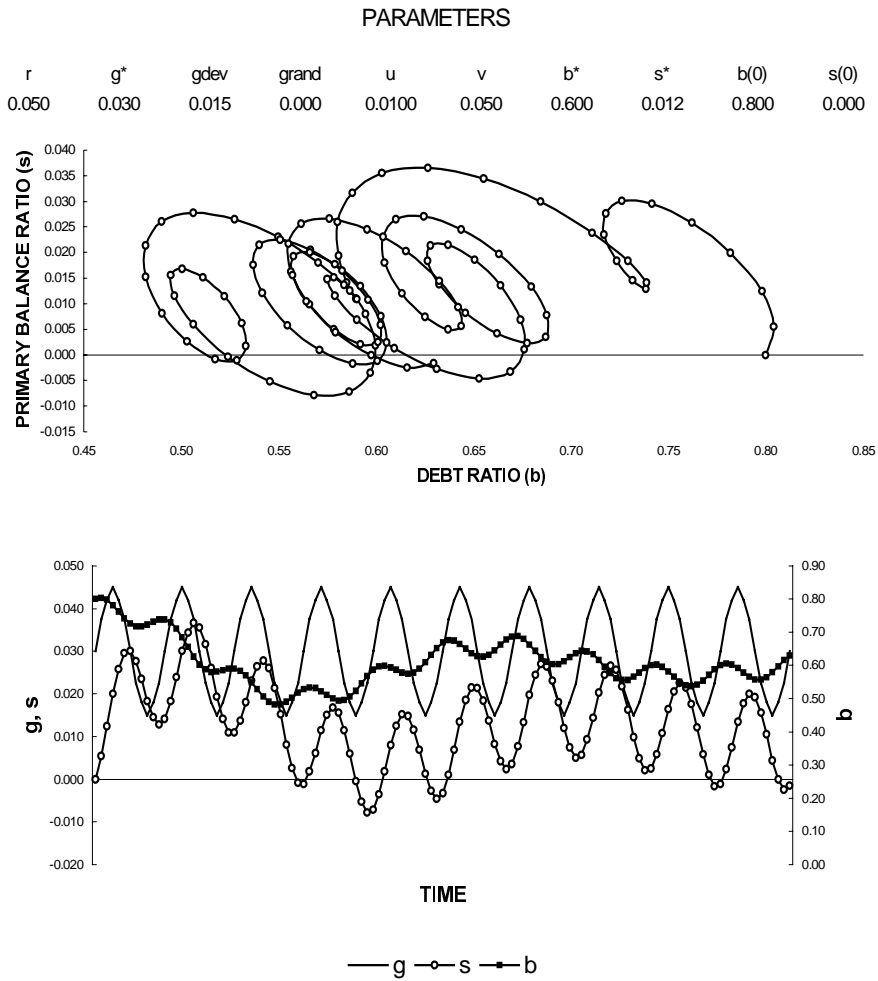
There are three main conclusions we can draw from simulating the dynamic behaviour of this economy under different assumptions. Firstly, the cyclical patterns of the debt and primary balance ratios can be quite complicated, even in a deterministic system without random shocks. Secondly, when the 'convergence parameters' are small and the debt and primary balance ratios are not close to the equilibrium limit cycle, the process of convergence can be very slow, making it difficult to assess the

progress in convergence at a given point in time. Thirdly, in a stochastic setting, where the growth rate is subject to random shocks, the qualitative dynamics of the debt and primary balance ratios may change dramatically, depending on the 'state of nature' realised, i. e. on the sequence of random shocks affecting the growth rate of the economy. There are, however, two qualitative features in the dynamic behaviour of the system, which are invariant or robust with respect to the 'state of nature' realised. On the one hand, the existence either of a long-term monotonic trend and a short-term cycle or of two cycles of different length, and on the other, the short-term fluctuations associated with the sensitivity of the budget to the cyclical position of the economy. The implication of these conclusions for empirical analysis is that it is important to separate the short-term influence of the 'growth cycle' on the budget from the longer-term evolution of the debt and primary balance ratios, which might show the possible convergence or divergence of the debt ratio.

3. Empirical approach

An important issue for the analysis of fiscal policies in the short-term and the dynamic of convergence is the sensitivity of fiscal variables to cyclical developments and their reactions to the current levels of the debt and deficit ratios. On the one hand, the cyclical sensitivity of the budget to real output growth entails short-term adjustments the ratios to GDP of fiscal variables, which jointly determine procyclical fluctuations in the primary and overall budget balances as a percentage of GDP. On the other hand, when fiscal policies are constrained by institutional arrangements such as those of the Treaty and the SGP, the budget must allow for a 'safety margin' to avoid deficits higher than 3% of GDP, even in the case of a possible deterioration of the general government financial position as a result of adverse cyclical developments. A cyclical downturn will normally push upwards the debt and deficit ratios and might entail a risk of excessive deficit, even if they remain below the reference values of the Treaty. An increase in these ratios when economic activity slows down can be just a temporary setback in the process of fiscal consolidation or might signal a risk of divergence from this process. To assess this risk, it is necessary to estimate the influence of the cyclical position of the economy on fiscal variables.

The standard approaches to this issue adopted by different international institutions such as the OECD (see Giorno, Richardson, Reseveare and van den Noord [1995]), the Commission (see European Commission [1995]), and the IMF (see World Economic Outlook, October 1993 and May 1995), estimate the elasticities of fiscal variables to real GDP and then apply these elasticities to the output gap of the economy to calculate the impact of the cycle on the level of the ratios to GDP of fiscal variables. However, in order to monitor the implementation of the rules of budgetary discipline contained in the Treaty and the SGP it is not necessary to estimate the output gap of the economy and to calculate the cyclically adjusted levels of fiscal variables. These rules make no reference whatsoever to the output gap or to the levels of cyclically adjusted fiscal variables. Instead, they refer to changes in real GDP as the relevant variable to take into account the influence of the cyclical position of the economy on the budgetary position of the government. Hence, it is enough to estimate the impact of changes in real GDP on the budget balance and this can be done in different ways. The standard approaches estimate the elasticities to real GDP of some components of receipts and expenditure (those not considered ex-ante of a discretionary nature) and then calculate the 'automatic' response of the budget balance as a weighted average of the elasticities of these components, where the weights are given by the ratio of each component to GDP.

Here we follow a different approach that might be considered as complementary to the standard one. Firstly, we do not distinguish ex-ante between discretionary and automatic components of the budget balance, because such distinction is not always clear. Secondly, we estimate directly the impact of real GDP changes on the ratios to GDP of fiscal variables instead of their elasticities. This part of the paper presents our approach to estimate the sensitivity of fiscal ratios to real GDP growth and inflation, as well as their reactions to the current levels of the primary balance and debt ratios, and specifies the econometric method used for the estimates. Our empirical approach is based on estimates of the sensitivities to real GDP growth of the main fiscal variables defining the general government budget constraint, as percentages of GDP. Given any fiscal variable V, let us assume that V is a differentiable function of one (without loss of generality) variable $c(t)$ controlled by the government, of the GDP deflator $p(t)$, of GDP at constant prices $y(t)$ and

of other variables, which the government cannot control and whose influence will not be explicitly considered in this analysis:

$$V=V[c(t), p(t), y(t)]$$

The analysis will be focused on the time path of the ratio V/Y, as a function of time, where Y(t)=p(t)y(t) is GDP at current prices.

Differentiating totally the function V/Y with respect to time yields:

$$d(V/Y) = \frac{dV \cdot Y - dY \cdot V}{Y^2} =$$

$$= (1/Y) \cdot \{(\partial V/\partial c) \cdot dc + (\partial V/\partial p) \cdot dp + (\partial V/\partial y) \cdot dy\} - \{dp \cdot y + dy \cdot p\} \cdot (V/Y^2) =$$

$$= (1/Y) \cdot [(\partial V/\partial c) \cdot dc + \{(\partial V/\partial p) - (V/p)\} \cdot dp + \{(\partial V/\partial y) - (V/y)\} \cdot dy]$$

The right hand side of this last expression presents the change in V/Y as the sum of three effects, relative to the level of Y: a policy effect, a price effect and a real effect. Taking into account that $(\partial V/\partial p)(1/y) = \partial (V/y)/\partial p$ and $(\partial V/\partial y)(1/p) = \partial(V/p)/\partial y$, the right hand side can be further rearranged in the following way:

$$d(V/Y) = \left(\frac{1}{Y}\right) \cdot \left[\frac{\partial V}{\partial c}\right] \cdot dc + \left[\frac{\partial(V/y)}{\partial p} - \frac{(V/y)}{p}\right] \cdot \pi + \left[\frac{\partial(V/p)}{\partial y} - \frac{(V/p)}{y}\right] \cdot g \quad [10]$$

The first term on the right hand side of this expression $[(1/Y)(\partial V/\partial c)dc]$ reflects the partial change in V as a function of the changes in the control variable and scaled to the level of real GDP. It measures the change which would be observed in V, relative to the level of GDP, as a result of government policy and in case inflation and real growth are equal to zero.

The second term on the right hand side shows the <u>inflation effect</u> on V/Y as the product of <u>the inflation sensitivity</u> $\{[\partial(V/y)/\partial p]-[(V/y)/p]\}$ of V/Y, times the rate of inflation $\pi=dp/p$. The inflation sensitivity of the ratio V/Y is equal to the price elasticity of V minus one times the ratio V/Y.

The third term on the right hand side shows the effect of real GDP growth on V/Y, and has been denominated the <u>growth effect.</u> It is the product of the rate of change in real GDP, g=dy/y, times the <u>growth sensitivity</u> $\{[\partial(V/p)/\partial y]-[(V/p)/y]\}$ of V/Y. The growth sensitivity of the ratio V/Y is equal to the elasticity of V with respect to real GDP minus one times the ratio V/Y.

It would be tempting to interpret the inflation and growth effects as the 'automatic' or 'induced' part of the changes in the ratio V/Y, when the policy variable is constant. Similarly, the effects of changes in the policy variable c(t) would be interpreted as the 'discretionary' or 'policy induced' part of the change in the ratio V/Y, for given levels of prices and output. This interpretation, however, is not always unambiguous when the function V is not known and will not be pursued here.

Instead, we want to estimate an equation of the following type:

$$(V_t/Y_t) - (V_{t-1}/Y_{t-1}) = a\,(b_{t-1} - b^*) + b\,(s_{t-1} - s^*) + \alpha\,(g_t - g^*) + \beta\,(\pi_t - \pi^*)$$

where the variables with an asterisk represent the (unknown) targets or references for adopting fiscal policy decisions. However, the terms of this equation can be rearranged in this way:

$$(V_t/Y_t) - (V_{t-1}/Y_{t-1}) = [-a\,b^* - b\,d^* - \alpha\,g^* - \beta\,\pi^*] + a\,b_{t-1} + b\,s_{t-1} + \alpha\,g_t + \beta\,\pi_t$$

To estimate this equation we make the following approximations:
$d(V/Y) = (V_t/Y_t) - (V_{t-1}/Y_{t-1}) = Ch_t(V/Y)$, where $Ch_t(V/Y)$ is the annual change in V/Y,
$dy/y = (y_t - y_{t-1})/y_{t-1} = g_t$, where g_t is the annual rate of change of GDP at constant prices,
$dp/p = (p_t - p_{t-1})/p_{t-1} = \pi_t$, where π_t is the annual rate of change of the GDP deflator,
and run the following regression:

$$Ch_t(V/Y) = C + a\,b_{t-1} + b\,s_{t-1} + \alpha\,g_t + \beta\,\pi_t + u_t \qquad [11]$$

where C is a constant, a and b are parameters reflecting the reaction of the variable V/Y to the debt and primary balance ratios in t-1, respectively; α and β are the estimates of the sensitivities of V/Y to real growth and inflation, respectively; and u_t is the residual term.

4. Results of the empirical approach

To study the responsiveness of fiscal variables to the financial situation of the general government, represented by the debt and primary balance ratios of the previous period, as well as their sensitivities to cyclical developments, represented by the current real growth and

inflation rates, we have estimated the equation specified in the previous section for the fifteen EU countries. The source of the data is the Annual Macroeconomic series (AMECO, Autumn 1998) database provided by DGII of the EU Commission. To keep this paper short, we have restricted ourselves to the three main fiscal variables considered in the dynamic analysis: receipts, primary expenditure and the primary balance[4].

As a first step, we have estimated the regressions for the longest period for which statistical information is available in the different countries. Usually debt series are the shortest ones, and in seven countries (Denmark, Germany, Greece, Ireland, Luxembourg, Portugal, and the United Kingdom) they only start in 1990, making the inclusion of this variable in the respective regressions impossible. The main results of the estimates are reported in Tables 1 to 3.

4.1   *General government receipts*

The estimates of the equations for general government receipts are very poor (see Table 1). Most of the explanatory variables show statistically insignificant coefficients, which in many cases are also of the wrong or unexpected sign. The coefficients of correlation are always very low, and in half of the cases, practically null. Such results suggest that the aggregate of government receipts has not responded in a systematic and significant way either to the financial position of the government in the previous period or to the current cyclical position of the economy. Examining in more detail the results of these regressions, we can draw five main sets of stylised facts.

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[4]   The basic series, all of them expressed in national currencies, are the following. Gross Domestic Product at current market prices (code __0000000UVGD, where the two first positions are for the country code), Gross Domestic Product at 1990 market prices (code __1000000OVGD), Total expenditure of the general government (code __0000000UUTG), Net lending (+) or net borrowing (-) of the general government (code __0000000UBLG), Actual interest payments of the general government (code __0000000URIG), and General government consolidated gross debt Maastricht definition (code __0000000UDGGM). Implicit GDP deflators, primary expenditure, primary balance and total receipts of the general government are calculated from these series.

Table 1

General Government Receipts

COUNTRY	PERIOD	Constant	Debt(-1)	P. Balance(-1)	Growth	Inflatio	R2a	DW
BELGIUM	1970-1997	2.20 [1.71]	-0.02 [1.96]	0.06 [0.79]	-0.21 [2.69]	0.10 [1.16]	0.50	2.56
DENMARK	1971-1997	1.09 [1.08]	- -	-0.10 [1.05]	0.00 [0.01]	-0.04 [0.47]	0.05	2.16
GREECE	1980-1997	1.1 [0.83]	-	-0.06 [0.50]	-0.22 [1.28]	-0.01 [0.11]	0.14	2.61
GERMANY	1961-1997(*)	-0.39 [1.21]	- -	-0.15 [1.80]	0.02 [0.29]	0.12 [1.50]	0.1	1.96
SPAIN	1971-1997	1.95 [1.37]	-0.02 [1.27]	-0.11 [0.89]	-0.06 [0.70]	-0.03 [0.49]	0.15	2.03
FRANCE	1978-1997	-1.84 [1.31]	0.05 [1.51]	-0.05 [0.38]	-0.16 [1.65]	0.20 [2.69]	0.53	2.25
IRELAND	1971-1997	2.45 [2.72]	- -	-0.28 [1.84]	-0.27 [2.29]	-0.13 [1.56]	0.40	2.22
ITALY	1971-1997	0.06 [0.05]	0.01 [0.83]	-0.14 [1.10]	-0.32 [3.20]	0.03 [0.64]	0.33	2.18
LUXEMBOURG	1971-1997	0.72 [0.51]	- -	-0.11 [0.53]	-0.44 [3.25]	-0.14 [1.29]	0.57	2.05
NETHERLAND	1976-1997	0.75 [0.31]	0.00 [0.08]	-0.29 [1.17]	-0.30 [1.53]	0.16 [0.84]	0.41	1.85
AUSTRIA	1981-1997	-2.68 [0.86]	0.04 [1.00]	-0.06 [0.21]	-0.28 [1.25]	0.41 [1.27]	0.29	1.89
PORTUGAL (***)	1961-1997	1.39 [2.25]	- -	-0.13 [1.48]	-0.08 [1.12]	-0.04 [1.15]	0.09	1.83
FINLAND	1976-1997	-0.69 [0.33]	0.02 [0.50]	0.01 [0.05]	-0.24 [1.93]	0.20 [1.17]	0.22	1.82
SWEDEN	1981-1997	-2.44 [0.45]	0.03 [0.43]	-0.02 [0.25]	0.16 [0.51]	0.12 [0.51]	0.17	2.08
UNITED KINGDOM	1961-1997	0.74 [1.30]	- -	-0.05 [0.67]	-0.26 [2.20]	0.01 [0.18]	0.18	1.06

(*) Excluding the years 1990 and
(**) Missing data in 1988-1996.
(***) Missing data in 1980-

Firstly, government receipts have not reacted to debt levels in any country. The coefficient of the debt ratio in the previous period is always non-significant, and showing the wrong sign in Belgium and Spain, meaning that the receipts ratio would decline when the debt ratio increases and vice versa.

Secondly, in contrast with this result, the sign of the coefficient of the primary balance ratio in the previous period is practically always of the expected negative sign, except in Belgium, meaning that the ratio of receipts to GDP rises when the primary balance decreases, and the other way around. However, the coefficients are always statistically non-significant.

Thirdly, the most striking result is the negative sign of the growth sensitivity of general government receipts as a percentage of GDP in almost all countries. Only in Germany and Sweden, the receipts ratio increases when the rate of growth of real GDP is higher. In the remaining EU countries, the contrary tends to happen. Moreover, in Belgium, Ireland, Italy, Luxembourg, Finland and the United Kingdom, the reaction of total receipts to cyclical developments has not been statistically insignificant, meaning that the receipts ratio has tended to increase during cyclical downswings and to decrease during upswing phases.

Fourthly, government receipts as a percentage of GDP have often reacted to inflation with the expected positive sign, except in Denmark, Spain, Ireland, Luxembourg and Portugal. Only in France, however, has this reaction been statistically significant.

Fifthly, it is worth noting that, while total government receipts in absolute nominal values change more or less in proportion to nominal GDP changes, and thus the receipts ratio does not change very much, this is a result of two approximately countervailing influences. On the one hand, the level of receipts responds rather insufficiently to increases in the real growth rate, and so the growth sensitivity of the receipts ratio is generally negative. On the other hand, the level of receipts reacts rather more than proportionally to the acceleration of prices, as shown by the positive sign of its inflation sensitivity.

4.2   *General government primary expenditure*

The results of the estimates for general government primary expenditure (see Table 2) are more robust from the statistical point of view than those reported for government receipts. The coefficients of the explanatory variables have generally the correct sign, and many of them are also significant. The coefficients of correlation are estimated around

or above 0.5 in ten countries, and only in four of them around or below 0.3. However, while the reaction of the primary expenditure ratio to real GDP growth is generally strong and significant, its response to inflation and to the financial position of the government in the previous period is generally much less significant. A closer examination of the estimated coefficients supports this general conclusion.

Firstly, although the response of the primary expenditure ratio to the debt level as a percentage of GDP in the previous period is always negative (null in France), meaning that a rise in the debt ratio results in a decline in the primary expenditure ratio, in half of the countries examined such response has not been very systematic and, consequently, the estimated coefficients are not highly significant. It should be mentioned, however, that in the two countries with the highest levels of debt ratios (Belgium and Italy) and in Spain, the coefficients are clearly significant.

Secondly, the insufficient reaction of the primary expenditure ratio to its lagged value in a majority of EU countries is also evidenced by the low significance of the coefficients estimated for the level of the primary balance in the previous period. Although the sign is positive in all cases (except in Ireland), it is significantly different from zero only for Belgium, Germany, Luxembourg, Austria and Portugal.

Thirdly, the strongest result of these estimates is the high and very significant negative growth sensitivity of the primary expenditure ratio. In contrast with the generally wrong sign and lack of statistical significance of the growth sensitivity shown by the receipts ratio, the primary expenditure ratio is of the expected negative sign in all countries without exception, although insufficiently significant in Greece, Ireland and Austria. This means that, 'real' public primary expenditure (defined as its nominal value deflated by the GDP deflator) has reacted less than proportionally to real GDP growth.

Fourthly, the inflation sensitivity of the primary expenditure ratio is negative (the expected sign) in half the countries, whereby only in Finland it is marginally significant. In Greece and Germany it is also significant, but positive, meaning that it has a destabilising influence on inflation, because the 'price' component of public primary expenditure (defined as its nominal value divided by GDP at constant prices) overshoots the changes in the inflation rate.

Table 2

General Government Primary Expenditure

COUNTRY	PERIOD	Constant	Debt(-1)	P. Balance(-1)	Growth	Inflation	R2a	DW
BELGIUM	1970-1997	8.72	-0.07	0.43	-0.52	-0.08	0.85	1.98
		[8.38]	[9.73]	[6.76]	[8.16]	[1.15]		
DENMARK	1971-1997	0.99	-	0.05	-0.61	0.09	0.50	2.23
		[1.00]	-	[0.49]	[4.03]	[1.07]		
GREECE	1980-1997	-3.80	-	0.38	-0.03	0.33	0.25	2.54
		[1.57]	-	[1.79]	[0.11]	[2.04]		
GERMANY	1961-1997(*)	-0.63	-	0.21	-0.35	0.18	0.64	1.51
		[2.00]	-	[2.54]	[5.49]	[2.45]		
SPAIN	1971-1997	5.04	-0.06	0.16	-0.35	-0.11	0.61	1.75
		[4.30]	[3.99]	[1.61]	[4.60]	[1.89]		
FRANCE	1978-1997	0.34	0.01	0.23	-0.49	0.13	0.61	1.76
		[0.21]	[0.31]	[1.43]	[4.51]	[1.58]		
IRELAND	1971-1997	0.72	-	-0.02	-0.20	0.02	0.00	1.55
		[0.51]	-	[0.09]	[1.10]	[0.15]		
ITALY	1971-1997	5.78	-0.05	0.10	-0.58	-0.02	0.64	2.05
		[4.13]	[3.60]	[0.75]	[5.64]	[0.35]		
LUXEMBOURG (**)	1971-1997	-0.33	-	0.43	-0.74	-0.12	0.83	1.60
		[0.29]	-	[2.50]	[6.87]	[1.41]		
NETHERLANDS	1976-1997	3.70	-0.05	0.33	-0.46	0.03	0.48	1.60
		[1.90]	[1.93]	[1.66]	[2.93]	[0.17]		
AUSTRIA	1981-1997	2.19	-0.03	0.66	-0.38	-0.03	0.25	1.51
		[0.66]	[0.64]	[2.11]	[1.57]	[0.09]		
PORTUGAL (***)	1961-1997	1.64	-	0.28	-0.27	-0.01	0.29	1.22
		[1.95]	-	[2.29]	[2.95]	[0.27]		
FINLAND	1976-1997	3.95	-0.06	0.17	-0.52	-0.24	0.83	2.01
		[2.95]	[2.00]	[1.43]	[6.40]	[2.26]		
SWEDEN	1981-1997	6.41	-0.07	0.07	-0.85	-0.16	0.75	2.72
		[1.44]	[1.21]	[0.94]	[3.26]	[0.85]		
UNITED KINGDOM	1961-1997	1.04	-	0.11	-0.46	0.00	0.33	1.34
		[1.81]	-	[1.31]	[3.88]	[0.02]		

(*) Excluding the years 1990 and 1991.
(**) Missing data in 1988-1996.
(***) Missing data in 1980-1981.

Fifthly, it is well known that government primary expenditure in absolute nominal values changes more sluggishly than nominal GDP, and therefore its ratio to GDP fluctuates countercyclically. This is not just a 'denominator effect', as shown by the differences in size and statistical significance of the sensitivities of this ratio to growth and inflation. The so-called 'denominator effect' has the same impact on the ratio whatever the origin ('real' or 'inflationary') of a change in nominal GDP (the denominator of the ratio). However, the response of the primary expenditure ratio is different depending on the origin: sizeable and

systematic if the origin is real, but much smaller or even of the contrary sign in half the cases, and generally non-significant, when the origin is inflationary.

4.3   General government primary balance

Given that the empirical approach adopted is linear and preserves the additivity of the fiscal variables linked by the accounting identity of the general government budget constraint, the estimated coefficients of the variables in the primary balance equation are equal to those of the receipts minus those of the primary expenditure equations. However, the results obtained for the primary balance equation show that the effects reflected in the primary expenditure equations are, in a majority of cases, stronger than those found in the receipts equations and therefore dominate them (see Table 3). A general conclusion is that the primary balance ratio has reacted more to its own lagged value than to the debt ratio in a majority of EU countries, and with respect to the cyclical sensitivities of the primary balance, there is also a majority of EU countries where they are significant. Some more specific points on the way in which the coefficients of the receipts and primary expenditure equations interact are the following stylised facts.

Firstly, the primary balance ratio reacts systematically to the debt ratio of the previous period only in countries with the highest debt ratios and in Spain (among those for which we have sufficient information). The sign of response in the other countries is also positive, meaning that the primary balance tends to improve when the debt ratio increases, but not unambiguously different from zero. These reactions come from the primary expenditure ratio.

Secondly, the primary balance reacts negatively to its own lagged value in all EU countries, as a kind of self-correcting mechanism. However, this reaction is clearly different from zero only in Belgium, Germany, Spain, Luxembourg, the Netherlands, Austria and Portugal. Both the receipts and primary expenditure ratios contribute to this reaction.

<div align="right">**Table 3**</div>

General Government Primary Balance

COUNTRY	PERIOD	Constant	Debt(-1)	P. Balance(-1)	Growth	Inflation	R2a	DW
BELGIUM	1970-1997	-6.52	0.06	-0.37	0.31	0.17	0.53	2.25
		[4.71]	[5.48]	[4.34]	[3.62]	[1.95]		
DENMARK	1971-1997	0.10	-	-0.14	0.61	-0.13	0.44	1.58
		[0.09]	-	[1.42]	[3.62]	[1.40]		
GREECE	1980-1997	4.94	-	-0.44	-0.19	-0.34	0.01	2.44
		[1.65]	-	[1.68]	[0.51]	[1.70]		
GERMANY	1961-1997(*)	0.24	-	-0.36	0.37	-0.06	0.50	1.95
		[0.59]	-	[3.41]	[4.49]	[0.70]		
SPAIN	1971-1997	-3.08	0.04	-0.27	0.28	0.07	0.39	2.43
		[2.34]	[2.18]	[2.39]	[3.34]	[1.15]		
FRANCE	1978-1997	-2.19	0.03	-0.28	0.33	0.07	0.24	1.65
		[1.06]	[0.79]	[1.35]	[2.35]	[0.61]		
IRELAND	1971-1997	1.73	-	-0.26	-0.07	-0.15	0.01	1.55
		[1.57]	-	[1.40]	[0.48]	[1.48]		
ITALY	1971-1997	-5.72	0.06	-0.24	0.26	0.05	0.37	2.04
		[3.31]	[3.57]	[1.48]	[2.03]	[0.79]		
LUXEMBOURG (**)	1971-1997	1.04	-	-0.54	0.31	-0.02	0.28	1.96
		[0.69]	-	[2.35]	[2.12]	[0.13]		
NETHERLANDS	1976-1997	-2.96	0.05	-0.63	0.17	0.13	0.21	2.29
		[1.45]	[1.76]	[2.98]	[1.01]	[0.82]		
AUSTRIA	1981-1997	-4.85	0.07	-0.72	0.09	0.44	0.24	1.35
		[1.66]	[1.79]	[2.60]	[0.43]	[1.45]		
PORTUGAL (***)	1961-1997	-0.25	-	-0.41	0.19	-0.03	0.32	1.64
		[0.30]	-	[3.42]	[2.16]	[0.58]		
FINLAND	1976-1997	-4.65	0.08	-0.16	0.28	0.44	0.60	1.50
		[2.46]	[1.98]	[0.95]	[2.40]	[2.91]		
SWEDEN	1981-1997	-8.86	0.10	-0.09	1.01	0.28	0.66	2.12
		[1.29]	[1.13]	[0.80]	[2.52]	[0.95]		
UNITED KINGDOM	1961-1997	-0.30	-	-0.16	0.20	0.01	0.08	1.21
		[0.48]	-	[1.79]	[1.55]	[0.17]		

(*) Excluding the years 1990 and 1991.
(**) Missing data in 1988-1996.
(***) Missing data in 1980-1981.

Thirdly, the growth sensitivity of the primary balance is positive in thirteen of the fifteen EU countries, and statistically significant in ten of them. In Greece and Ireland it is negative but non-significant. In the Netherlands, Austria and the United Kingdom it is also non-significant.

Fourthly, the inflation sensitivity of the primary balance has the wrong (negative) sign in Denmark, Greece, Germany, Ireland, and Portugal, but is statistically significant only in Finland and perhaps in Belgium (in both cases with the expected positive sign).

Finally, it should be stressed that these preliminary conclusions possibly depend on the choice of the sample period for each country, which has been conditioned by the availability of data on public debt. The conclusions obtained deserve further scrutiny, on a more dissaggregated and country-by-country basis, to reach more robust statistical results. In particular, the problem of structural breaks in the series should be addressed, because it has been checked that, for certain countries (i.e. Denmark, Austria, the United Kingdom, Finland), this might be an important issue.

5. Application of the estimates to the analysis of fiscal policies

5.1   Monitoring the convergence of the debt ratio

When the debt ratio is below the 60% of GDP reference value of the Treaty, the debt criterion of budgetary discipline is satisfied. On the contrary, if the debt ratio exceeds that reference, compliance with budgetary discipline requires that the ratio is sufficiently diminishing and approaching the reference value at a satisfactory pace. But when the debt ratio is not only above 60% of GDP but also increasing, the debt criterion is not fulfilled, as there exists some risk that the debt ratio follows an explosive path. How can we assess such risk? How can we monitor whether the financial position of the government is under control and the debt ratio is converging to a stable range of values below 60% of GDP? The conditions of convergence of the debt ratio to a stable value worked out in the first part of the paper are useful to define some indicators that might help answer such questions. These conditions were derived in the simplest setting (with constant interest rate and real GDP growth among other assumptions), and depend on the interest-growth differential, but not on the target value of the debt ratio. However, we have shown that they are still valid if we allow the interest-growth differential to fluctuate cyclically and accept that the primary balance ratio is sensitive to the cyclical fluctuations of real GDP growth, retaining the hypothesis of constant interest rates. Now we are interested in addressing the previous questions on the path of convergence of the debt ratio, with the help of some indicators to monitor the cyclically adjusted changes in the primary balance ratio $ds-\alpha(g-g^*)$.

To answer these questions we must first characterise the current financial position of the government, as defined by the values of the debt and primary balance ratios (b, s). Given the reference value of the Treaty for the debt criterion ($b^T = 0.6$) and the present value of the interest-growth differential, the intersection of the vertical line through b^T and the straight line (r-g)b defining the points for which the debt ratio is stable, divides the plane in four regions (see graph 9). Monitoring the convergence of the debt ratio first requires the location of the current financial position of the government in one of these regions.

Graph 9

A map of risks to the convergence of the debt ratio
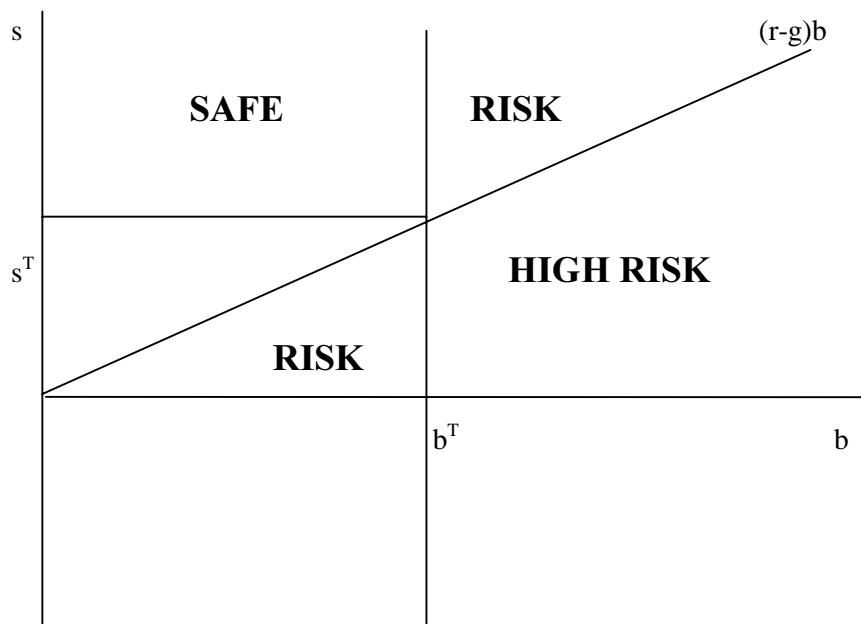
If the point (b,s) is to the left of the vertical line on b^T and above the line (r-g)b, public finances are in a <u>safe region</u>, as they are not only in compliance with the debt criterion of the Treaty (b≤ b^T), but also in the process of further reducing the debt ratio since s>(r-g)b. As long as the financial position of the government remains in this region, there is no cause for concern.

On the contrary, if the point (b,s) is to the right of the vertical line b^T and below the line (r-g)b, public finances are not in compliance with the debt criterion of the Treaty. The debt ratio is higher than the reference value (b> b^T) and it tends to increase further as s<(r-g)b. This is a <u>very risky region</u> as there are clear risks of losing control of public finances due to the divergent evolution of the debt ratio. In these circumstances, there is no other alternative than to raise the primary surplus as quickly as possible in order to reach, at the very minimum, the line (r-g)b and stabilise the debt ratio. To monitor the process of stabilisation of the debt ratio, it is useful to define two indicators, one giving a necessary condition and the other a sufficient condition for stabilisation, as follows:

$$ds - \alpha(g - g*) > (r - g)db \qquad [12]$$

$$ds - \alpha(g - g*) > [1 + (r - g)]db \qquad [13]$$

where db = (r-g)b-s is the increase of the debt ratio in this region. The first indicator requires that the velocity of increase in the debt ratio slows down or, in geometrical terms, that the point (b,s) gets closer to the line (r-g)b of stabilisation of the debt ratio. The second indicator requires that the debt ratio stops growing, or in geometrical terms, that the path of the debt ratio crosses upwards through the line (r-g)b. In that case, the government financial position goes to a less risky region since the debt ratio, although still higher than the reference value b^T, starts to decline.

The main reason why the area above the line (r-g)b and to the right of b^T is a <u>risky region</u> is that the path of the debt ratio might turn back again to the region below it. To monitor convergence of the debt ratio in this area, the first point to check is whether the primary surplus is high enough to guarantee that the debt ratio "is sufficiently diminishing and approaching the reference value at a satisfactory pace", as requested by the budgetary discipline rule of the Treaty. This must be assessed on a judgmental basis. In that case, we can use two other indicators in order to monitor further progress towards convergence. The first one is a necessary and sufficient condition of convergence indicator of the financial position of the government to the safe region. The second one is also a sufficient condition for convergence to the safe region.

$$ds - \alpha(g - g*) > \frac{s - s^T}{b - b^T}db \qquad [14]$$

where $s^T = (r-g)\ b^T$. Condition [14] requires that the velocity of convergence is kept high enough to avoid the return of public finances to the very high risk region. In geometrical terms, this condition establishes that the slope of the path followed by the point (b,s) is never steeper than that of the straight line connecting this point with the reference point (b^T, s^T). This guarantees that this path enters the safe region at $b=b^T$ with a primary surplus $s>s^T$, which is enough to induce further declines in the debt ratio. The second one is also a sufficient condition for convergence to the safe region and is given by the inequality in [12], which now has a different interpretation from the one it had in the highly risky region. In fact, inequality [12] is a more strict condition of convergence to the safe region than inequality [14], as it requests that, once the velocity of decline in the debt ratio is judged sufficient, such velocity does not slow down until the safe region has been reached. In geometrical terms, this condition is equivalent to requesting that the point (b,s) does not come closer to the line (r-g)b of stabilisation of the debt ratio until it enters the safe region.

Finally, the area to the left of the vertical line b^T and below the line (r-g)b is also a risky region, as the primary balance is not high enough to prevent the debt ratio growing. Moreover, this region might be entered in the process of convergence, following a path coming from the safe region and implying a simultaneous decline in the primary surplus ratio and an increase in the debt ratio. To monitor convergence in this region, we can use the necessary condition for stabilisation of the debt ratio defined in [12] and the sufficient condition for convergence to the safe region defined in [14]. Lack of compliance with condition [12] implies an increase in the risk of losing control of public finances as the debt ratio hedges at an increasing speed towards the high risk region. On the contrary, compliance with condition [14] guarantees re-entry into the safe region.

5.2   *Monitoring the fluctuations of the overall budget balance ratio*

The growth sensitivities of fiscal variables as a percentage of GDP reflect their average short-term response to cyclical developments in the past, providing information that can be of interest to analyse fiscal policies. In particular, the growth sensitivity of the (overall) budget balance can be used to help assess the risks of reaching overall budget

deficits higher than 3% of GDP, with respect to the average historical experience of the sample period. Furthermore, the statistical significance of the estimated coefficients of growth sensitivity for the different fiscal variables allows a measure of the degree of uncertainty associated with these indicators to be derived.

To make these calculations, it is necessary to have as precise as possible estimates of the historical growth sensitivities of the overall budget balance. In Table 4 we present the results of estimating the real growth sensitivity of the overall budget balance for the maximum number of years for which the estimated growth sensitivity of the overall balance has remained broadly stable in each country. In general, the values found are higher than those estimated for the primary balance ratio and presented in Table 3 (in several cases substantially so), and also more robust from the statistical point of view. To facilitate the assessment of these results, Table 4 also includes the values of the growth sensitivities of the overall budget balance used by the EU Commission, the OECD and the IMF to calculate the cyclically adjusted budget balance. Finally, the aggregate growth sensitivities for the euro area and the whole of the EU have been calculated using as weights the 1997 values of GDP at current market prices in ECU.

Changes with respect to the estimates for the primary balance are not statistically significant in most countries. The growth sensitivities of the overall balance estimated for Belgium, Denmark, Germany, France, Ireland, Italy, Luxembourg, the Netherlands and Sweden are within one standard deviation of the values previously estimated for the primary balance, or not far from it. The main differences between the growth sensitivities of primary and overall budget balance ratios are those observed in the UK, Finland, Austria and Denmark. For the United Kingdom, the estimate in Table 4 is four times bigger than the value shown in Table 3, and also substantially higher than those reported by other institutions. In Austria, the growth sensitivity of the overall balance ratio is statistically significant (being three times bigger than that of the primary balance ratio), but still remains somewhat below the value generally used. For Finland, the growth sensitivity of the overall balance ratio is double that of the primary balance ratio, and practically coincides with the values used in other institutions. Finally, the estimated growth sensitivity for Denmark coincides with the value used by the UE Commission, being in between the values reported by the OECD and the IMF.

Table 4

Growth Sensitivity of General Government
Net Lending (+) or Net Borrowing (-)

| COUNTRY | PERIOD | OWN ESTIMATES | | | OTHER ESTIMATES | | |
		Growth	t-ratio	R2a	EU COMM	OECD	IMF
BELGIUM	1970-1997	0.29	2.79	0.36	0.6	0.6	0.6
GERMANY	1961-1997(*)	0.43	5.79	0.62	0.5	0.5	0.5
SPAIN	1977-1997	0.42	2.58	0.22	0.6	0.6	0.7
FRANCE	1971-1997	0.46	4.70	0.51	0.5	0.6	0.6
IRELAND	1981-1997	0.07	1.05	0.04	0.5	0.4	0.5
ITALY	1971-1997	0.43	3.68	0.50	0.5	0.3	0.4
LUXEMBOURG (**)	1961-1997	0.23	3.47	0.35	-	-	-
NETHERLANDS	1971-1997	0.40	2.93	0.28	0.8	0.6	0.7
AUSTRIA	1961-1997	0.39	5.32	0.50	0.5	0.5	0.6
PORTUGAL	1961-1997	0.34	3.36	0.27	0.5	0.5	0.4
FINLAND	1981-1997	0.66	6.62	0.73	0.6	0.6	0.6
EURO AREA (***)	-	0.43	-	-	0.53	0.50	0.54
DENMARK	1971-1997	0.70	4.58	0.44	0.7	0.6	0.8
GREECE	1981-1997	0.22	0.56	0.11	0.4	0.4	0.4
SWEDEN	1971-1997	0.90	3.25	0.47	0.9	0.7	1.1
UNITED KINGDOM	1981-1997	0.85	5.14	0.63	0.6	0.5	0.6
EU (***)	-	0.51	-	-	0.55	0.51	0.57

(*) Excluding the years 1990 and 1991.
(**) Missing data in 1988-1990
(***) Weights: 1997 GDP at current market prices in ECU.
Source: For the other estimates, OECD Economic Outlook 62, December 1997, Table 13, page 24.

The comparison of the different estimates shows several important discrepancies. The values we estimate are generally lower than those used by other institutions. They are much lower in Ireland, where we have not been able to find a significant sensitivity; and also in Belgium, the Netherlands and Greece, where the sensitivity is around half of the value assumed by others; as well as in Spain and Portugal. For Sweden, our estimate coincides with the value provided by the EU Commission, and both are in the middle of the range given by the OECD and the IMF.

In contrast, the values found for Germany, France and Italy do not differ substantially from other estimates. The noticeable differences existing in the growth sensitivities estimated by different institutions for several countries tend to cancel out when they are aggregated for the euro area, and even more so for the fifteen Member States of the EU. It should be stressed, however, that the growth sensitivities we estimate reflect the average reaction of the overall budget balance to the cyclical position of the economy along the sample period, irrespective of whether this reaction was automatic or discretionary. In contrast, the estimates used by other institutions are presented as capturing the effects of automatic stabilisers only, that is, excluding any discretionary reaction of fiscal policy to cyclical developments. To the extent that these estimates are reliable, the lower values found in our estimates indicate that the discretionary component of fiscal policy has tended to damp the effects of automatic stabilisers in the past.

The estimates of the growth sensitivities of the budget balance in EU countries for a certain sample period can be used to assess, according to past experience, the risks of incurring deficits higher than 3% of GDP in case of adverse growth developments. Article 2 of Council Regulation (EC) No 1467/97 of 7 July 1997 on speeding up and clarifying the implementation of the excessive deficit procedure says that the excess of a government deficit over the 3 per cent reference value shall be considered exceptional and temporary when resulting from an unusual event outside the control of the Member State concerned and which has a major impact on the financial position of the general government, or when resulting from a severe economic downturn. The excess over the reference value shall be considered temporary if budgetary forecasts as provided by the Commission indicate that the deficit will fall below the reference value following the end of the unusual event or the severe economic downturn. The Commission shall, as a rule, consider an excess over the reference value resulting from a severe economic downturn to be exceptional only if there is an annual fall of real GDP of at least 2%. However, the Council, when deciding whether an excessive deficit exists, shall in its overall assessment take into account any observations made by the Member State showing that an annual fall of real GDP of less than 2% is nevertheless exceptional in the light of supporting evidence, in particular on the abruptness of the downturn or on the accumulated loss of output relative to past trends. In any case, according to the Resolution of the European Council on the Stability and Growth

Pact (Amsterdam, 17 June 1997), the Member States commit themselves not to invoke the benefit of this last possibility unless they are in severe recession; in evaluating whether the economic downturn is severe, the Member States will, as a rule, take as a reference point an annual fall in real GDP of at least 0,75%.

A useful indicator for this purpose is the <u>SGP borderline indicator</u> (SGPBI), which can be defined as the value of the actual budget balance as a percentage of GDP minus the product of the growth sensitivity of the overall balance estimated on average for the sample period times the sum of the current percentage change of real GDP plus 0.75%.

$$SGPBI = d - \alpha(g + 0.75)$$

Hence, the SGPBI adjusts the overall balance ratio (d) by the impact on the overall balance that a change in economic activity from the current growth rate (g) to a recession of 0.75% would have. Thus, it is a simple indicator to be interpreted as the level that would attain the budget balance as a percentage of GDP in case of a decline of 0.75% in real GDP, and taking as a benchmark the growth sensitivity of the overall balance estimated for the average of the sample period. Of course, this indicator provides just a benchmark to assess the current or expected financial position of the government. The degree of risk incurring excessive deficits (and the margin of safety required to avoid this possibility) depends on many other factors that this indicator does not take into account, and particularly on the likelihood of a sharp decline in output growth.

On the basis of the growth sensitivities for EU countries presented in Table 4, and taking as a starting point the EU Commission Autumn 1998 forecasts for real GDP growth and budget balances up to the year 2000, it is possible to calculate the SGP borderline indicator to illustrate the use of the SGPBI for the analysis of the expected developments of the general government financial position[5]. These calculations for the 15 EU countries and the aggregates for the euro area and the EU are shown in Table 5, together with the actual budget balance outcome projected by the EU Commission.

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[5]   For an interesting analysis of a hypothetical retrospective application of the SGP, using the methodology of the European Commission, see Buti, Franco and Ongena [1997].

Table 5

General Government Net Lending (+) or Net Borrowing (-). Actual and Expected Values in Comparison with the Stability and Growth Pact Borderline Indicator

COUNTRY	1993	1994	1995	1996	1997	1998	1999	2000
BELGIUM	-7.1	-4.9	-3.9	-3.2	-2.0	-1.3	-1.2	-1.0
-SGPBI	-6.9	-5.8	-4.7	-3.9	-3.1	-2.3	-2.1	-2.0
GERMANY	-3.2	-2.4	-3.3	-3.4	-2.7	-2.6	-2.2	-2.2
-SGPBI	-3.0	-3.9	-4.1	-4.3	-3.9	-4.1	-3.5	-3.7
SPAIN	-7.0	-6.4	-7.3	-4.7	-2.6	-2.1	-1.6	-1.3
-SGPBI	-6.8	-7.6	-8.8	-6.0	-4.4	-4.0	-3.5	-3.1
FRANCE	-5.7	-5.7	-4.9	-4.1	-3.0	-2.8	-2.3	-1.9
-SGPBI	-5.5	-7.4	-6.2	-5.2	-4.4	-4.6	-3.8	-3.5
IRELAND	-2.4	-1.7	-2.2	-0.4	0.9	2.1	3.4	4.6
-SGPBI	-2.7	-2.3	-3.1	-1.0	0.1	1.3	2.8	3.9
ITALY	-9.5	-9.2	-7.7	-6.7	-2.7	-2.6	-2.3	-2.0
-SGPBI	-9.3	-10.4	-9.3	-7.3	-3.6	-3.7	-3.5	-3.4
LUXEMBOURG	1.7	2.8	1.9	2.9	3.0	2.2	2.0	2.0
-SGPBI	-0.5	1.7	0.8	2.0	1.8	1.1	1.0	0.8
NETHERLANDS	-3.2	-3.7	-4.0	-2.2	-0.9	-1.3	-1.3	-0.6
-SGPBI	-3.8	-5.3	-5.2	-3.8	-2.6	-3.2	-2.7	-2.1
AUSTRIA	-4.2	-5.0	-5.1	-3.7	-1.9	-2.2	-2.1	-1.9
-SGPBI	-4.7	-6.2	-6.2	-4.7	-3.1	-3.7	-3.5	-3.3
PORTUGAL	-6.1	-6.0	-5.7	-3.3	-2.5	-2.3	-2.0	-1.8
-SGPBI	-6.0	-7.0	-7.0	-4.6	-4.0	-4.0	-3.4	-3.3
FINLAND	-8.0	-6.4	-4.7	-3.4	-1.1	0.7	1.8	2.1
-SGPBI	-7.7	-9.9	-8.6	-6.3	-5.6	-3.1	-1.0	-0.4
EURO AREA	-5.5	-5.1	-4.9	-4.1	-2.5	-2.3	-1.9	-1.7
-SGPBI	-5.4	-6.5	-6.2	-5.1	-3.9	-3.9	-3.3	-3.2
DENMARK	-2.6	-2.5	-2.2	-0.6	0.5	1.2	2.5	2.7
-SGPBI	-4.0	-5.5	-4.9	-3.5	-2.4	-1.1	0.6	0.7
GREECE	-13.8	-10.0	-10.7	-7.6	-4.0	-2.4	-2.1	-1.9
-SGPBI	-13.6	-10.6	-11.3	-8.3	-4.9	-3.4	-3.1	-2.9
SWEDEN	-12.3	-10.3	-7.0	-3.5	-0.8	0.9	1.4	2.3
-SGPBI	-10.9	-14.0	-11.2	-5.3	-3.1	-2.5	-1.8	-1.1
UNITED KINGDOM	-7.9	-6.8	-5.5	-4.7	-2.1	-0.1	0.1	-0.2
-SGPBI	-10.3	-11.2	-8.5	-7.3	-5.7	-2.9	-1.6	-2.6
EU	-6.2	-5.5	-5.1	-4.2	-2.3	-1.8	-1.4	-1.3
-SGPBI	-6.4	-7.5	-6.7	-5.5	-4.1	-3.6	-2.9	-2.9

Source: EU Commission, Autumn 1998 forecast.

There are two main conclusions we can draw from this table. The first one is that public finances in most euro area countries are not yet in a position close enough to balance to avoid significant risks of excessive government deficits in adverse economic circumstances. The second

conclusion is that, in the course of the next two years, while real GDP is expected to grow at rates close to potential, and historically low real interest rates are assumed to remain constant, fiscal policies in some countries will not gain enough room for manoeuvre to significantly reduce those risks. This means that stronger procyclical measures than in the past would probably be warranted in those countries to prevent excessive deficits in severe recessions. These conclusions are robust to the use of the alternative estimates of the growth sensitivities of overall budget balances provided by international institutions.

6. Conclusions

This paper has presented some indicators of budgetary discipline that may be useful for the analysis of fiscal policies in EU countries. One group of indicators is helpful to assess the minimum cyclically adjusted change in the primary balance ratio required for monitoring the convergence of the debt ratio to a range of values below the 60% reference set up in the Treaty. Another indicator is the Stability and Growth Pact Borderline Indicator (SGPBI), which might help assess the risks incurring government deficits higher than 3% of GDP in case of a less than severe recession (in the limit, a decline of 0,75% in real GDP).

These indicators are relatively straightforward and have a clear connection with the rules of budgetary discipline stipulated in the Treaty and the SGP. Apart from that, their main advantage is that no estimate of the output gap prevailing in the economy is required to calculate them. Instead, the influence of the cyclical position of the economy on the financial position of the government is captured by the difference between actual and trend real GDP growth. However, a final note of caution is warranted. The estimates of the growth sensitivities of fiscal variables are notoriously uncertain and basically reflect the historical experience of fiscal policies. These important shortcomings are fully apparent in our empirical approach, but can also be predicated of the alternative estimates. Hence, the use of these indicators in the assessment of current and expected deficit and debt developments should be made with the utmost prudence. A much more reliable set of estimates, reflecting the present sensitivities of fiscal variables to the cyclical position of the economy rather than their average historical values, would be necessary to draw firm conclusions from these indicators.

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