SUSTAINABILITY OF EU PUBLIC FINANCES

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Abstract

We use a policy rule framework and focus on the response of the primary surplus to accumulated public debt as a test for sustainability. The evidence we report suggests that sustainability was prevalent in many EU countries before Maastrischt, but also that the Maastricht impulse induced the shift towards sustainability in some of them. Additionally, although a clear distinction emerges in terms of the visibility of the Maastricht stress between the euro bloc, on the one hand, and the non-euro EU countries, the US and Japan, on the other, there is no evidence of bloc differences in terms of the long term soundness of public finances. On the basis of our analysis and results, we argue that questions regarding the proper balance between fiscal stabilization and discipline in EMU are legitimate, and stress the potential policy relevance of the reaction of the primary surplus to accumulated debt in this debate.

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The views expressed are those of the authors and are not attributable to the European Commission.

1. INTRODUCTION

The Stability and Growth Pact (SGP or the Pact thereof) is the fiscal pillar of EMU (Economic and Monetary Union). It was adopted in Amsterdam on 7 June 1997 with the stated objective of aiming at a proper balance between fiscal discipline and the macroeconomic stabilization role of fiscal policy. The Pact establishes a small and relatively simple set of rules, which embeds and completes the fiscal provisions already adopted in the Treaty of Maastricht five years before. Member States should adhere to the objective of budgetary positions close to balance or in surplus in the medium term, while avoiding excessive deficits in the short term. The obligation for Member States to avoid excessive deficits had already been established in Article 104 of the Treaty, while the medium-term objective was instituted in the Resolution of the European Council on the SGP. Compliance with the Treaty obligation of avoiding excessive deficits is assessed on the basis of two criteria, namely whether the government deficit exceeds the reference value of 3% of GDP and whether the government debt exceeds the 60% of GDP, unless it is decreasing at a 'satisfactory pace'. The reference values of 3% and 60% were not included directly in Article 104, but in a Protocol annexed to the Treaty. This rules-based framework is complemented by a series of institutional arrangements, such as an expedited procedure to correct excessive deficits and, eventually, to impose sanctions, or the obligation to present stability (Member States having adopted the euro) or convergence (otherwise) programmes, which set the medium-term fiscal targets and the adjustment path towards them.

Since the very moment of its conception, the Pact has been the subject of numerous criticisms, very often reflecting contradictory views. However, the debate has significantly gathered momentum since 2002, when budgetary developments in some Member States have put the Pact under serious stress. Although, by lowering deficits and debt levels, the SGP has helped to deliver macroeconomic stability, the experience of these first five years with the policy framework of EMU points to a number of shortcomings. The Pact has not only been ineffective to avoid excessive deficits in some Member States, but it has failed to correct them within the legally

established deadlines. Moreover, the Pact has not provided incentives to avoid pro-cyclical policies in good times, while the need to bring deficits below 3% may have led to heterodox accounting practices and to pro-cyclical bias in the recessive phase of the cycle in other cases. Last but not least, debt ratios have actually increased in some cases or, at least, they have not decreased at the expected pace.

Academics familiar with the current debate have made several proposals to reform the SGP, including, among others, the areas of the independent enforcement of the rules (Wren-Lewis, 2003), the focus on the structural budget balance (Buiter and Grafe, 2003), and the consideration of the area wide aggregate budget balance (Casella, 2000). Buti, Eijffinger and Franco (2003) provide a throughout review and assessment of those proposals. Their own position, however, is that none of the proposals provides a Pareto improvement of the SGP, which they defend as the right benchmark to be improved through incremental steps. As early as November 2002, the European Commission itself put forward a number of proposals aimed at improving the implementation of the Pact. These included, among other, making of sustainability a core policy objective, which would add a long-run dimension to the Pact's overall objective of balancing fiscal stabilization and discipline. However, the sustainability criterion has not been yet translated into a fully operational rule.

In this line, the role that long term solvency should play in the Pact is at the core of the current debate. A solvent government is one that satisfies its intertemporal budget constraint, according to which current debt must be equal to the present value of future primary surpluses. This in turn is equivalent to the so-called transversality condition, which states that the present value of future government debt issues converges to zero as time approaches infinity. This condition will be satisfied by any stable (i.e. bounded) debt path, but the condition does not exclude explosive paths for government debt, as long as their trends are dominated by the discount factor. When a government is solvent its fiscal policy is sustainable.

On theoretical grounds, sustainability is a key reference for discipline. If sustainability is guaranteed one must provide very solid reasons to justify further restrictions to ensure fiscal discipline. In this sense, the SGP is questionable. Its emphasis on excessive deficits and its medium term requirement of a balanced budget imply that its target is to

stabilize nominal debt in the medium term. This certainly makes public finances sustainable, but sustainability can be guaranteed with softer requirements. In particular, as we discuss in this paper, just a small adjustment of the primary surplus in response to debt accumulation is sufficient to make fiscal policy sustainable. In this sense, the SGP may be missing a proper balance between stabilization and discipline.

One possible explanation for its hard line approach to sustainability is that the Pact is a son of its time. The fathers of the Treaty in Maastricht in 1992 and of the Pact in Amsterdam five years later seemed to be particularly concerned by deficits and the stabilising role of fiscal policy and much less by debt ratios, which seem to be considered as deficit-driven. The history of fiscal policy in the EU had been characterised by systematic pro-cyclical policies, where deficits rose in expansions and were just contained in recessions, thus putting constant pressure on debt ratios, which displayed an apparently explosive behaviour in a number of Member States (see, for instance, European Commission, 2000, Part I). In such circumstances, high deficits seemed to be 'the problem' and putting a limit to them would be 'the solution'. Similarly, a medium-term objective of achieving budgetary positions close to balance or in surplus would not only allow the Member States to deal with normal cyclical fluctuations, while keeping the deficits relatively low, but also to avoid past policy mistakes. As a result, under reasonable hypotheses about interest and growth rates, and assuming sound accounting practices, solvency would be guarateed and debt ratios would be kept below 60% or would decrease at a more or less satisfactory path[1]. The EMU fiscal-policy framework would impose a strict sufficient condition for sustainability.

The strictness of the SGP is also probably connected with the widespread conception during most of the 1990s that public finances were in an unsustainable path in a number of Member States (see, for instance, European Commission, 2000). However, to our knowledge, there has been no systematic formal attempt to establish such a fact. Analysing the sustainability of public finances in the EU seems particularly relevant under the current circumstances, when an eventual reconsideration of the Pact rules may end up with a stronger emphasis on debt and sustainability parameters. In particular,

[1] It is worth noting that nor the Pact, neither the Treaty gives a definition of what a 'satisfactory path' is.

there is a case to ask whether the Pact restored sustainability or there was not such a thing as a sustainability problem, in the sense that the fiscal policies applied in the Member States already tended to guarantee government solvency. In the latter case, arguing for a more flexible stabilization margin than the one embeded in the Pact gains legitimacy.

Within this context, we provide an empirical assessment of the sustainability of public finances in the EU countries based on the response of the primary surplus to accumulated debt. The USA and Japan are also included as background reference. We analyze the sample period 1977-2002 and address three questions. First, has fiscal behavior been sustainable during the last 25 years? Second, can we distinguish between sub-periods of higher degree of sustainability or, in other words, is there evidence of a structural break in the 1990s, which could be associated with EMU? Third, what degree of sustainability: just solvency or even a stable debt path?

The paper is organized as follows. Section 2 discusses the methodology. Section 3 presents preliminary estimations. Section 4 searches for evidence of a structural break. Section 5 contains the benchmark models for our analysis. Section 6 reports a robustness exercise. Section 7 looks at sustainability parameters. Section 8 contains our conclusions, stressing the potential policy relevance of the response of the primary surplus to accumulated public debt.

2. A POLICY RULE APPROACH

We build on the framework developed in Ballabriga and Martinez-Mongay (2003), which models the fiscal authority as setting its fiscal policy instrument following a simple behavioral rule. We attach no normative content to the rule, but rather see it as an *ad hoc* positive tool useful for describing actual policy behavior.

Our specification of the fiscal rule takes the government primary surplus as the policy instrument and assumes that the fiscal authority sets its target for that instrument as a

function of two economic indicators: the deviation of the inherited public debt from target and the output gap. Formally, we have:

$$s_t^* = \alpha + \delta(d_{t-1} - d^*) + \gamma\, x \qquad (1)$$

where "*" represents target values, s and d are primary surplus and debt, respectively, both relative to the output level, and x is the output gap as a percent of potential output. Two alternative assumptions for the output gap will be considered. One takes the fiscal authority as backward-looking and responding to the previous period gap, so $x = x_{t-1}$. The alternative takes a forward-looking authority that responds to the expected output gap, so $x = E(x_t / \Omega_{t-1})$, where E is the expectation operator and Ω_{t-1} is the information set at the end of period *t-1*, when the fiscal authority sets its target for period *t*.

We find model (1) plausible because it provides a formal stylized way of explaining fiscal behavior by focusing on two key dimensions of government concern, and therefore relevant for actual policy choices, namely, government solvency and output stabilization. In addition, the model is convenient for our analysis because it provides a simple framework to test sustainability: As we argue next, $\delta > 0$ is sufficient to guarantee solvency (Bohn, 1998).

Sustainability Test

In order to elaborate on Bohn´s result, we focus on the flow government budget constraint and proceed in two steps. First, we use it to derive the transversality condition for solvency. Second, we combine it with reaction function (1) and check the parametric conditions that generate a debt dynamics compatible with the required transversality condition for solvency.

The flow government budget constraint expressed in real terms and using the long run average interest rate can be written as follows:

$$b_t = (1+r)b_{t-1} - (\tau_t - g_t + \Delta m_t) \qquad (2)$$

where b is real government debt, r is the real interest rate, τ-g the real primary surplus, and Δm is the change in base money in real terms. If (2) is solved for b_{t-1}, forwarded one period, and then iterated forward, the result after k iteration is the following:

$$b_t = \sum_{i=0}^{k} (1+r)^{-i} (\tau_{t+i} - g_{t+i} + \Delta m_{t+i}) + (1+r)^{-k} b_{t+k} \qquad (3)$$

As k approaches infinity, expression (3) shows that the government will satisfy its intertemporal budget constraint, in the sense that government debt will be equal to the present value of future primary surpluses, when the second right-hand-side term converges to zero:

$$\lim_{k \to \infty} (1+r)^{-k} b_{t+k} = 0 \qquad (4)$$

Expression (4) is the transversality condition for solvency.

To see then whether a government that behaves according to reaction function (1) is solvent, we can combine (1) and (2) and check if the resulting path for debt satisfies condition (4). Noting that $\tau - g = y * s$, where y is real output, and assuming that target and actual primary surplus coincide ($s = s^*$), we substitute (1) in (2) to get:

$$b_t = (1+r) b_{t-1} - \left(y_t (\alpha - \delta\, d^* + \delta\, d_{t-1} + \gamma\, x) + \Delta m_t \right) \qquad (5)$$

which, using $y_t d_{t-1} = (1+\phi) y_{t-1} d_{t-1} = (1+\phi) b_{t-1}$, where ϕ is the long run real output growth rate, and after rearranging, becomes:

$$\left[1 - (1 + r - (1+\phi)\delta) L \right] b_t = Z_t \qquad (6)$$

$$\text{with} \qquad Z_t = -y_t (\alpha - \delta\, d^* + \gamma x) - \Delta m_t$$

where L is the lag operator. Expression (6) is a first order difference equation with the following general solution:

$$b_t = \frac{Z_t}{1-(1+r-(1+\phi)\delta)L} + C(1+r-(1+\phi)\delta)^t \qquad (7)$$

where *C* is a constant.

Provided that the first righ-hand-side term is finite, expression (7) clearly shows that a positive δ is sufficient to guarantee that debt will grow at an exponential order lower that 1+*r*, and so that solvency condition (4) will be satisfied, since the discount factor will dominate. This does not exclude, however, an explosive path for debt. Guaranteeing a stable, non-explosive, debt path requires $|1+r-(1+\phi)\delta| < 1$.

In order to test for a structural break in the response to accumulated debt, eventually associated to the adoption of the Maastricht Treaty, we will modify (1) as follows:

$$s_t^* = \alpha + \delta(d_{t-1} - d^*) + D\delta(DD_{tT})d_{t-1} + \gamma\ x \qquad (8)$$

where DD_{tT} is a dummy variable with value 1 for $t \geq T$, and 0 otherwise. The sufficient condition for sustainability then becomes $\delta + D\delta > 0$.

Empirical Specification

Albeit plausible and convenient, the proposed fiscal rule may still be seen as a too stylized representation. The policy process tends to have a strong inertia, which in the case of fiscal policy could be explained to a large extent by the political difficulty of changing past spending commitments and carrying out regular and drastic adjustments in tax codes. In addition, policy consists not only of endogenous reactions to economic evolution, as (1) and (8) suggest, but also of unexpected actions. Consequently, in order to gain empirical relevance, we introduce inertia and shocks in our specification through the following partial adjustment model:

$$s_t = (1-\rho)s_t^* + \rho\ s_{t-1} + \nu_t \qquad (9)$$

where $0 \leq \rho \leq 1$. According to (9), the current value of the fiscal policy instrument partially adjusts from last period value towards the current government target by a fraction of $(1-\rho)$. Moreover, the value of the instrument is affected by a zero mean i.i.d. shock ν, which reflects the effect of non-systematic actions. More specifically, ν may incorporate variability stemming from the imperfect control of the fiscal process (e.g. "political" shocks) or true fiscal policy actions, that is, non-systematic, discretionary policy shocks.

(1)-(8) and (9) define our model of fiscal behavior. As just mentioned, the introduction of inertia aims at improving empirical relevance and so enhancing the credibility of the structural parameters estimates in the reaction function (1)-(8), which remain the relevant behavioral parameters, except in the extreme case of a random walk model ($\rho = 1$), and are the basis for our sustainability argument.

3. PRELIMINARY ESTIMATION

As a starting point, we abstract from possible in-sample structural breaks and estimate the model defined by (1) and (9). Since we find the traditional argument of implementation lags in fiscal policy compelling, the assumption of a backward-looking fiscal authority will define our benchmark. Under this assumption and after substitution of (1) in (9) we get the following model for the evolution of the government primary surplus:

$$s_t = (1-\rho)\tilde{\alpha} + (1-\rho)\delta\, d_{t-1} + (1-\rho)\gamma\, x_{t-1} + \rho\, s_{t-1} + \nu_t \qquad (10)$$

where $\tilde{\alpha} = \alpha - \delta\, d^*$.

Table 1 shows the basic results of estimating (10) for our sample of 16 countries (14 EU Member States plus US and Japan) over the period 1977-2002. The estimates have been obtained by the non-linear least squares (NLLS) method. As can be seen, inertia is mostly significant and the constant term mostly negative, as its dependence in target

debt would suggest. The estimated response to debt is positive in all countries except in Japan, where it is negative and non-significant. Albeit positive, debt reactions are not significant either in Germany, France, Ireland, the Netherlands and Finland. It is worth noting that the UK exhibits the largest reaction to debt (1.47) although the precision of the estimate is not high. Regarding output stabilization, the response to the output gap is mostly non-significant. The exceptions are Denmark and the US with counter-cyclical policies, and Germany and Japan, which display pro-cyclical policies. Galí and Peroti (2003) explore in more detail the output stabilization dimension of fiscal policy in the EU, US and Japan, searching for a Maastricht effect. By contrast, our focus is on the debt dimension.

4. EVIDENCE OF STRUCTURAL BREAK

Since the sample period includes a pre and a post-Maastricht period, there is a question as to whether the estimates of the debt reaction have remained constant over time. Under the assumption of a backward-looking fiscal authority and after substitution of (8) in (9), we get the following model for the evolution of the government primary surplus with a structural break in the response to debt:

$$s_t = (1-\rho)\tilde{\alpha} + (1-\rho)\delta\, d_{t-1} + (1-\rho)D\delta(DD_{tT}d_{t-1}) + (1-\rho)\gamma\, x_{t-1} + \rho\, s_{t-1} + \nu_t \qquad (11)$$

where $\tilde{\alpha} = \alpha - \delta\, d^*$.

Our first task will be to look for an in-sample break in the fiscal reaction to debt accumulation that can be arguably identified as a Maastricht effect. This is not a simple task since consolidation processes started and lasted differently in different countries (see European Commission, 2000). Although fiscal consolidation seems to start in a number of countries already in 1992-93, the link with a hypothetical Maastricht effect appears remote. The adjustment enacted in the early 1990s seems to respond to the need to correct imbalances originated by the pro-cyclical policies implemented during the previous expansion (1989-1991), and so in spite of a difficult economic juncture. As a

matter of fact, as shown in Figure 1, this was not the first time that a pro-cyclical tightening took place to correct fiscal loosening in good times. Although certainly less intense, the decade of the eighties also includes an episode of fiscal consolidation taking place out of the expansive phase of the cycle. A stronger connection between fiscal consolidation and EMU can be found in the acceleration of the process observed in Figure 1 during the period 1996-1999, which might well respond to the need to comply with the Maastricht criteria in order to qualify for the euro. It is worth mentioning that both episodes of fiscal consolidation took place after fast debt accumulation. Therefore, fiscal consolidation in the 1980s is a precedent suggesting that sustainable fiscal behavior might not be just the consequence of a Maastricht correction.

Having this in mind, and since the breaking point is not obvious, we carry out a formal grid search to detect whether DD_{tT} is statistically significant. We opt for a grid search through the 90s, estimating model (11) with the full sample 1977-2002 and DD_{tT} defined for T = 92, 93,….2000. The result is in Table 2, which reports NLLS estimates and t-statistics for the break dummy coefficient, highlighting in bold years and countries for which the coefficient is statistically significant. Several facts deserve emphasis.

First, 1996 concentrates the largest number of significant dummies in the euro area, suggesting, as mentioned above, that the definite green light to the adoption of the euro given in the European Council of Madrid (December 1995) could be taken as the origen of a fiscal shift in most eurozone countries. On the other hand, a significant shift towards fiscal consolidation is already detected since the early 90s in Greece, Italy and the Netherlands.

Second, there are, however, some outstanding exceptions. Germany and Portugal shifted towards lower debt reaction in the early 90s, whereas Finland shows no sign of shift in behavior.

Third, Sweden aside, it can be argued that non-euro EU countries public finances show signs of independence from Maastricht stress: There is no evidence of shift in behavior in the UK, while, in Denmark, the adjustment took place in 1998, much later than in the euro area countries.

Finally, the results for the US and Japan seem compatible with their recent fiscal history. The US case reflects the fiscal consolidation of the 90s, whereas the case of Japan makes visible the shift towards an expansionary fiscal policy that has in fact accelerated debt accumulation.

5. SELECTED MODELS

Based on the grid search reported in Table 2 we have selected the models for our analysis. In the euro area, the shift in fiscal behavior is placed in 1996, except in the cases of Germany, in 1993, Portugal, in 1992, and Finland, with no break dummy[2]. For non-euro EU countries the choice is 1996 for Sweden, 1998 for Denmark, and no break dummy in the case of the UK. Finally, 1993 and 1992 are selected for the US and Japan, respectively. The estimation results of these models are reported in Table 3.

In terms of the overall specification, we can see that the Durbin-Watson statistic (DW) moves in general around acceptable levels, suggesting that the models are reasonably successful in capturing the systematic variability of government primary surpluses. On the other hand, in terms of specific explanatory factors, the inertia component is significant in most cases and presents a wide range of values, from a maximum of 0.85 in UK to a minimum of 0.29 in the Netherlands. Where inertia is concerned, no distinguishing pattern between euro and non-euro or EU and non-EU countries can be found. Similarly, the constant term is mostly significant and negative, as one would expect given its dependence on target debt (see expression (11)). As for the response to the output gap, it seems possible to draw a line between euro and non-euro EU groups. For the euro group, the response to output fluctuations is mostly non-significant. The exceptions are Spain and Portugal, which seem to have applied a counter-cyclical policies, and Germany, which displays a pro-cyclical fiscal behavior. Outside the euro area, Denmark and Sweden tend to display a clearer counter-cyclical fiscal policy, but the response to the cycle is not significant in the UK. Finally, the US has behaved counter-cyclically, whereas Japan shows no significant reaction to the output gap.

[2] Although earlier fiscal consolidation efforts are visible in Greece, Italy and the Netherlands, 1996 is also selected in these cases in order to provide a more homogeneous clustering.

Turning now to the response to debt, Table 3 provides a clearer and more interesting picture than the preliminary results reported in Table 1. There are several aspects that deserve emphasis. First, half of the euro area countries (B, D, GR, I, IRL, P) are characterized by a significant positive average response to debt accumulation over the full sample period. Of those, four (B, GR, I, IRL) reinforce that response with a positive Maastricht shift towards fiscal consolidation, and the other two (D, P) weaken their response. Second, the remaining euro area countries in our panel (E, F, NL, A, FIN) do not display a significant response to debt accumulation over the full sample, but made a positive Maastricht correction, except Finland. Third, with the exception of the UK, the non-euro EU block has both a positive significant response over the full sample and a positive correction in the 90s. Finally, the US positive response to debt accumulation is the result of the shift over the 90s, in contrast with Japan, where the behavioral shift in the 90s offsets the average positive reaction over the full sample.

6. SENSITIVITY ANALYSIS

The rational for our benchmark specification is that the implementation of fiscal policy actions takes time, due in particular to complexities inherent to the budgetary processes in democratic countries, which justifies the dependence of current fiscal adjustments on past cyclical conditions.

Alternatively, we could adopt a forward-looking specification. Its rational would be that although policy makers have in effect simple rules in mind, they generally look forward, using sophisticated methods to forecast their target objectives. As a consequence, target instruments are set according to a rule that focuses on expectations about deviations from target objectives rather than on past economic performance.

Forward-looking specifications seem more appropriate descriptive tools for monetary policy decision making practice than for the more rigid fiscal policy decision making process. However, it could still be argued that fiscal authorities look forward when setting their instruments, and we have considered this alternative as a robustness test.

The forward-looking rule takes $x = E(x_t / \Omega_{t-1})$ in (8). A ready-for-estimation version of the rule is then obtained by rewriting (8) in terms of the realized variables and their corresponding forecasting errors and combining it with (9). The resulting expression is the following:

$$s_t = (1-\rho)\tilde{\alpha} + (1-\rho)\delta\, d_{t-1} + (1-\rho)D\delta(DD_{tT}d_{t-1}) + (1-\rho)\gamma\, x_t + \rho\, s_{t-1} + \varepsilon_t \qquad (12)$$

with $\quad \tilde{\alpha} = \alpha - \delta\, d^*$

$$\varepsilon_t = -(1-\rho)\gamma(x_t - E(x_t / \Omega_{t-1})) + \nu_t$$

so the error term is a combination of forecasting errors and a zero mean i.i.d. exogenous policy shock ν_t. The model has been estimated by non-linear GMM, with the own lagged output gap and the lag of a proxy for the external output gap as instruments[3].

The grid search through the 90s for this version of the model is reported in Table 4. As can be seen, the overall picture is basically the same as in the backward-looking version. The most noticeable difference is that now there is evidence of a behavioral shift in Finland (1993-94). Minor differences in statistical significance, like the earlier shift in Sweden (1994) and the US (1992), are also detected when comparing Tables 2 and 4.

Based on the grid result of Table 4, we have made a selection of models that coincides with that of Table 2, except in the cases of Finland, which now incorporates a 1993 dummy, Sweden with a 1994 dummy, and the US, whose dummy is now defined for 1992. The estimation results are reported in Table 5, and convey the same overall message that the backward-looking version. The most noticeable changes concentrate on the output stabilization dimension, not our focus, in FIN, DK, and S. Specifically, the counter-cyclical character of their fiscal policy is reinforced and estimated with higher precision. As for the reaction to accumulated debt, Finland shows a qualitative different picture, with a strong significant Maastricht correction which almost offsets a negative average response over the full sample, but in quantitative terms its overall response remains non-positive, $\delta + D\delta < 0$. Similarly, the weaker response of Sweden,

now with a non-significant average full sample coefficient, and the stronger response of the Netherlands, now with a significant average full sample response, do not change the conclusion in terms of sustainability, as their overall response $\delta + D\delta$ remains positive.

7. ARE EU PUBLIC FINANCES SUSTAINABLE?

As explained in section 2, our argument for sustainability is based on Bohn (1998), who proved that with a reaction function of type (1)-(8), a positive, however small, reaction of the primary surplus to debt accumulation is sufficient to guarantee government solvency. A nice feature about this sustainability test is that it does not depend on the relative evolution of the real interest and growth rates.

Proceeding along the lines of section 2, we can combine our reaction function (8) with the flow government budget constraint (2) and check the parametric conditions that will be compatible with the required transversality condition for solvency. Specifically, using $\tau - g = y * s$, where y is real output, and abstracting from fiscal inertia ($s = s^*$), so that the focus is on structural behavior, we can substitute (8) in (2) to get for $t \geq T$ (when DD_{tT} is 1):

$$b_t = (1+r)b_{t-1} - \left(y_t(\alpha - \delta\, d^* + (\delta + D\delta)d_{t-1} + \gamma x) + \Delta m_t\right) \tag{13}$$

a first order diference equation which, using $y_t d_{t-1} = (1+\phi)b_{t-1}$, can be rearranged and solved to get:

$$b_t = \frac{Z_t}{1-(1+r-(1+\phi)(\delta + D\delta))L} + C(1+r-(1+\phi)(\delta + D\delta))^t \tag{14}$$

where C is a constant.

[3] See the data appendix for details.

Two aspects of solution (14) are relevant for our purposes. The first is that, as claimed in section 2, and independently of the relative size of r and ϕ, a small positive $(\delta+D\delta)$ is sufficient to reduce the exponential order of the second right hand side term, so the debt dynamics involved in the transversality condition (4) is dominated by the tendency towards zero of the discount factor, thus guarateeing solvency. The second aspect is that a sustainable behavior does not necessarily mean that government debt follows a stable non-explosive path, which in our model requires $|1+r-(1+\phi)(\delta+D\delta)|<1$.

Table 6 contains the information to apply these results to our panel of countries. Several points deserve to be highlighted.

First, according to our results, all the euro area countries, except Finland, satisfy our condition for solvency (a positive value in column 1). As reported in section 5, sustainability in four of these countries (E, F, NL, A) is the consequence of a Maastricht correction. This correction is enough to generate a stable path for debt (a value less than 1 in column 4) under the average growth and interest rate conditions that characterized these countries between1996 and 2002. Second, among the EU non-euro countries, only the UK fails to satisfy our test, and displays an underlying explosive path for public debt. In contrast, Denmark and Sweden behavior is sufficient to guarantee both solvency and a bounded path for debt. Finally, in our non-EU group, the US public finances are sustainable, although with a non-stable debt dynamics, whereas Japan does not satisfy our sustainability test and displays an explosive public debt dynamics.

It needs to be emphasized that our condition for solvency is sufficient, but not necessary[4]. Therefore, the test failure for Finland, UK and Japan does not imply that these countries have insolvent public finances.

On the other hand, it may seem puzzling that countries like the US, UK or Finland be characterized by an explosive debt dynamics when their recent evolution shows stable or declining debt-GDP ratios. However, debt-GDP ratios are affected by factors (e.g.

[4] For instance, a policy of debt stabilization would keep the debt level constant, thus guaranteeing the transversality condition for solvency (4). However, the policy would make our test fail, as it would tend to generate uncorrelated time series for the primary surplus and debt to GDP ratios: A fluctuating (interest rate correlated) primary surplus ratio along with a decreasing debt ratio (provided a positive output growth).

GDP growth and interest rates) that make long-run debt behavior difficult to detect. In particular, the decline in the US debt-GDP ratio (*d* in our notation) during the 90s is to a large extend explained by its vigorous GDP growth. But this is not incompatible with an ever increasing long-run pattern for outstanding real government debt (*b* in our notation), as our estimates based on the sample 1979-2002 suggest.

8. CONCLUSIONS

This paper provides an empirical assessment of the sustainability of public finances, in the sense of government solvency, in the EU, and in the US and Japan, using a simple policy rule approach and focusing on the response of the primary surplus to accumulated debt during the period 1977-2002.

Turning to the three questions posed in the introduction, and according to our empirical results, we conclude that, on the basis of the fiscal solvency criterion applied:

1. many EU countries have managed to maintain their public finances in a sustainable path both before an after Maastricht. This is the case of Belgium, Germany, Greece, Italy, Ireland and Portugal, within the euro area, and Denmark and Sweden among the Member States not participating in the euro. In all of them, except in Germany and Portugal, solvency has been further enhanced in the nineties. However, leaving aside these latter two countries, while the structural break in the euro area countries (Belgium, Greece, Italy and Ireland) can be identified at around 1996, the increase in the reaction of the primary surplus to debt took place well before or later in Sweden and Denmark;

2. in four euro area countries, Spain, France, the Netherlands and Austria, solvency was ensured only from 1995-1996 onwards. In the four countries, the reaction of the primary surplus to the stock of debt had been nil before the mid-1990s;

3. only in two EU countries, one in the euro area, Finland, and one outside, the UK, fiscal behavior cannot be classified as either sustainable or unsustainable according to our test;

4. finally, where the two non-EU countries are concerned, solvency was clearly enhanced since the very early 1990s in the US, while, in the case of Japan, the fiscal developments during the last decade would have undermined government solvency.

Overall, our results, which are robust to backward/forward fiscal stabilization assumptions, imply that, in terms of sustainability, the only outstanding difference among the countries in our panel is that the euro bloc was subject to a Maastricht effect, which underpinned fiscal solvency. However, our results do not allow us to conclude that solvency or its improvement is a characteristic of EMU. Sustainability tends to be the dominant characteristic in either group of the sample. Where government sustainability is concerned, there does not seem to be any clear distinguishing long term fiscal behavioral pattern between the euro area, the non-euro EU countries, and the US and Japan

In this sense, it seems convenient to stress that we find no support for the common view that tends to present the sustainability of EU public finances as the consequence of the fiscal provisions of the Treaty and the Stability and Growth Pact. According to our empirical results, this turns out to be the case in only a small subset of euro area countries. Overall, fiscal discipline, understood as long term solvency, appears to be more widespread than commonly claimed.

Somehow, this may come as a surprise, but it just reflects the fact that there are softer alternative approaches to deal with fiscal discipline than the one embeded in the SGP. On this basis, there is a legitimate open question regarding the possibility of improving the balance between stabilization and discipline, with increased margin for the former, by moving from a deficit-based to a more debt-based fiscal rule. Our analysis and results suggest that the primary surplus and its response to accumulated debt could play a relevant role in the reformed rule.

DATA APPENDIX

A1. Data Sources

Most of the data used in this analysis comes from the OECD Economic Outlook. The only exceptions are the goverment debt serie for Denmark and Ireland, which come from AMECO, the official annual data base of the Directorate General for Economic and Financial Affairs of the European Commission.

A2. External Output Gap Indicator

This indicator has been constructed for each country in our panel as a trade-weighted average of external gaps, using yearly changing weights and excluding the corresponding country. The OECD countries used in the averaging process are EU14 (i.e. EU members except Luxembourg), US, Japan, Australia, New Zealand, Norway, Iceland, and Switzerland.

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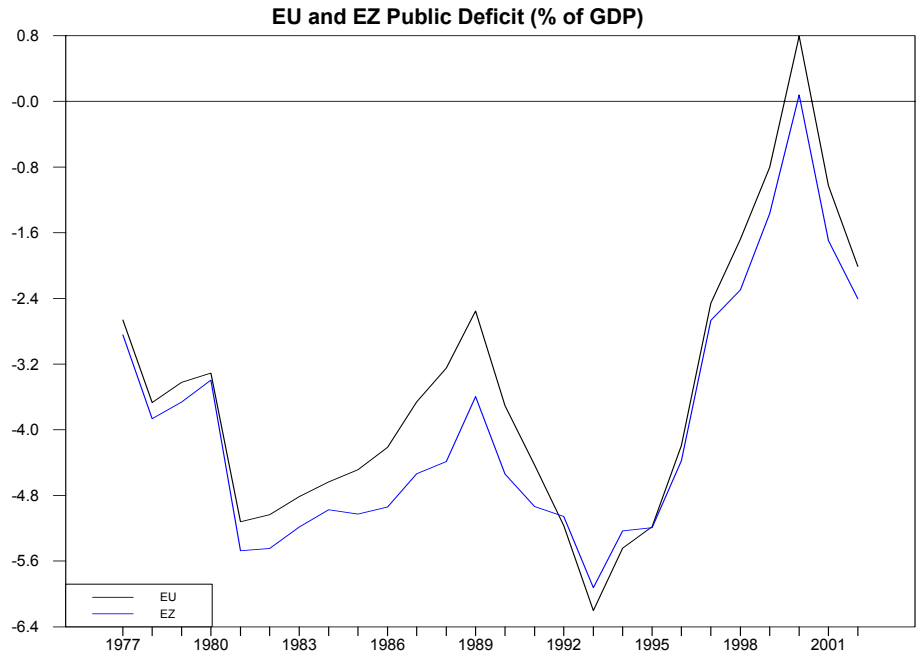
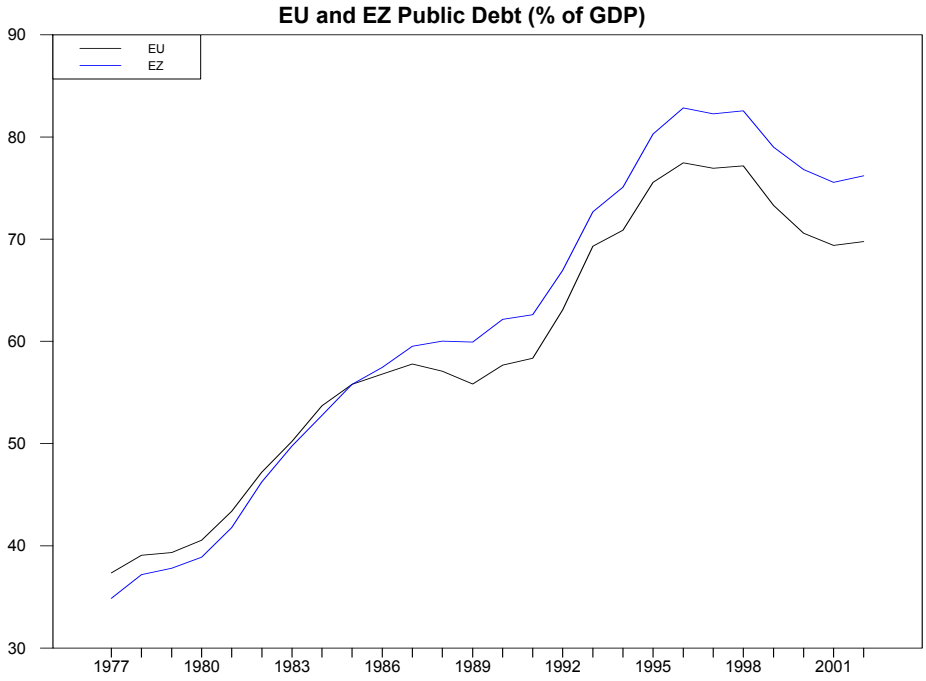
Figure 1. EU and EZ Fiscal Indicators



EU: Average (1977-02)= -3.5 Average (1992-02)= -3.0 Average (1996-02) = -1.6
EZ: Average (1977-02)= -3.9 Average (1992-02)= -3.3 Average (1996-02) = -2.1



EU: Average (1977-02) = 59.3 Average (1992-02) = 72.1 Average (1996-02) = 73.5
EZ: Average (1977-02) = 61.8 Average (1992-02) = 77.3 Average (1996-02) = 79.3

Table 1. Backward-looking Model

Country	ρ	$\tilde{\alpha}$	δ	γ	DW
B	0.82 (9.79)	-13.3 (-2.34)	0.14 (2.97)	-1.32 (-1.04)	2.92
D	0.38 (2.75)	-1.72 (-1.52)	0.04 (1.4)	-0.36 (-3.32)	2.08
GR	0.61 (5.02)	-9.04 (-4.77)	0.13 (5.75)	0.37 (1.57)	2.21
E	0.64 (5.66)	-7.19 (-4.66)	0.13 (5.87)	0.15 (0.90)	1.98
F	0.73 (4.54)	-3.59 (-1.2)	0.06 (1.28)	-0.37 (-0.62)	1.72
I	0.46 (3.17)	-15.0 (-10.09)	0.14 (10.74)	0.27 (1.00)	2.38
IRL	0.89 (18.78)	-2.28 (-0.23)	0.06 (0.52)	-2.04 (-1.73)	2.06
NL	0.7 (4.98)	-5.22 (-1.26)	0.09 (1.41)	0.29 (0.90)	2.08
A	0.43 (2.61)	-1.83 (-2.19)	0.04 (2.30)	0.31 (1.98)	1.48
P	0.11 (0.86)	-9.70 (-10.18)	0.18 (9.02)	0.04 (0.54)	1.59
FIN	0.85 (2.94)	-8.67 (-0.30)	0.31 (0.45)	0.28 (0.17)	1.42
DK	0.33 (1.88)	-4.31 (-2.52)	0.12 (4.27)	1.47 (6.01)	1.21
S	0.77 (5.86)	-27.31 (-1.92)	0.43 (2.05)	1.35 (1.88)	1.23
UK	0.84 (10.06)	-79.26 (-1.97)	1.47 (1.95)	0.78 (1.66)	2.22
US	0.63 (3.17)	-5.90 (-1.40)	0.10 (1.39)	0.42 (2.00)	1.22
JP	0.97 (12.14)	9.11 (0.29)	-0.21 (-0.36)	-5.28 (-3.00)	1.50

NOTE: NLLS estimation of model (10). Sample period 1977-2002. Standard errors are heteroscedatic and autocorrelation consistent. The t-statistics in parenthesis.

Table 2. Debt-dummy Grid in the Backward-looking Model

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000
B	0.01	0.02	0.02	0.02	**0.03**	**0.03**	**0.04**	**0.03**	**0.04**
	0.69	1.44	1.40	1.89	**2.90**	**5.02**	**4.08**	**2.36**	**2.76**
D	-0.02	**-0.03**	**-0.03**	**-0.03**	-0.02	-0.001	0.002	0.002	-0.004
	-0.94	**-2.48**	**-2.59**	**-2.28**	-1.04	-0.06	0.10	0.09	-0.15
GR	0.06	**0.06**	**0.06**	0.00007	**0.03**	**0.02**	0.02	0.004	-0.005
	1.63	**2.30**	**3.91**	0.001	**2.01**	**1.95**	1.09	0.20	-0.29
E	-0.04	-0.27	-0.006	0.01	**0.03**	0.02	0.01	0.02	0.01
	-0.72	-0.78	-0.10	0.48	**2.14**	1.20	0.60	1.70	1.45
F	**-0.10**	**-0.08**	0.04	0.04	**0.06**	0.02	-0.0005	0.005	-0.02
	-3.85	**-2.33**	0.33	0.82	**2.20**	0.72	-0.01	0.19	-0.69
I	**0.03**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	0.003	0.005	0.005
	4.79	**2.46**	**2.25**	**3.26**	**3.05**	**3.27**	0.24	0.54	0.58
IRL	-0.11	-0.08	0.0003	0.07	**0.19**	**0.20**	**0.20**	0.12	0.26
	-0.80	-0.70	0.0036	0.88	**3.26**	**2.91**	**2.16**	0.63	1.27
NL	0.03	**0.04**	**0.03**	**0.04**	**0.05**	**0.05**	**0.05**	0.05	0.006
	1.18	**2.61**	**2.35**	**3.54**	**5.39**	**4.57**	**3.15**	1.97	0.14
A	-0.008	-0.01	0.005	0.02	**0.03**	**0.03**	0.02	**0.02**	**0.03**
	-0.52	-0.83	0.51	1.40	**2.20**	**2.87**	1.95	**2.17**	**3.19**
P	**-0.03**	**-0.03**	**-0.03**	**-0.02**	**-0.02**	-0.01	-0.01	-0.007	-0.009
	-3.27	**-5.47**	**-6.38**	**-2.65**	**-2.43**	-1.78	-1.26	-0.80	-1.05
FIN	5.21	0.26	0.24	0.09	0.08	0.10	0.07	-0.05	0.02
	0.19	0.52	1.62	0.72	0.65	0.73	0.51	-0.16	0.12
DK	-0.002	0.00054	0.002	-0.002	0.01	0.02	**0.03**	**0.04**	**0.02**
	-0.13	0.03	0.13	-0.12	0.95	1.81	**2.51**	**3.95**	**2.38**
S	-0.31	-0.05	0.08	0.07	**0.07**	0.05	0.04	-0.05	0.01
	-0.41	-0.37	1.37	1.76	**2.14**	1.29	1.08	-0.42	0.17
UK	-0.01	0.002	0.10	0.009	0.0002	0.018	-0.014	-0.11	-0.01
	-0.25	0.05	0.19	0.19	0.004	0.31	-0.17	-0.54	-0.08
US	0.02	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	0.01	-0.08	-0.14
	0.83	**2.16**	**3.19**	**2.97**	**3.06**	**2.01**	0.39	-0.51	-0.70
JP	**-0.12**	**-0.11**	**-0.10**	**-0.10**	-0.08	-0.05	-0.13	-0.09	0.67
	-5.89	**-7.18**	**-4.65**	**-2.53**	-0.72	-0.20	-1.25	-0.51	0.08

NOTE: NLLS estimation of model (3) for DD_{iT}, T= 92,....,2000. Sample period 1977-2002. Each cell contains the dummy coefficient (first row) and the t-statisitc (second row). Standard errors are heteroscedatic and autocorrelation consistent.

Table 3. Backward-looking Model with Selected Debt-dummy

Country	ρ	$\tilde{\alpha}$	δ	Dδ	γ	DW
B	0.71 (6.45)	-12.27 (-3.20)	0.12 (3.92)	0.02 (2.89)	-0.59 (-0.80)	2.81
D	0.26 (1.75)	-4.34 (-3.73)	0.12 (3.46)	-0.03 (-2.4)	-0.24 (-2.52)	2.02
GR	0.48 (3.62)	-7.09 (-4.66)	0.08 (3.13)	0.03 (2.01)	0.31 (1.93)	2.00
E	0.44 (2.69)	-3.65 (-2.57)	0.05 (1.68)	0.03 (2.13)	0.32 (2.65)	1.79
F	0.55 (4.18)	1.32 (0.58)	-0.06 (-1.14)	0.05 (2.19)	-0.15 (-0.61)	1.61
I	0.22 (0.97)	-13.14 (-10.54)	0.11 (8.68)	0.01 (3.05)	0.15 (0.84)	2.16
IRL	0.83 (18.01)	-21.82 (-2.54)	0.23 (2.53)	0.19 (3.25)	-0.57 (-1.95)	2.13
NL	0.29 (2.15)	-2.58 (-1.62)	0.03 (1.70)	0.04 (5.38)	0.19 (1.51)	1.85
A	0.34 (2.65)	-0.32 (-0.30)	0.27 (0.10)	0.02 (2.19)	0.22 (1.81)	1.70
P	-0.03 (-0.30)	-10.85 (-13.51)	0.22 (12.27)	-0.03 (-3.26)	0.13 (2.40)	2.27
FIN	0.85 (2.94)	-8.67 (-0.30)	0.31 (0.45)		0.28 (0.17)	2.18
DK	0.23 (1.45)	-4.29 (-2.75)	0.11 (4.61)	0.02 (2.51)	1.42 (6.75)	1.40
S	0.54 (4.03)	-12.05 (-3.70)	0.16 (2.42)	0.06 (2.14)	1.38 (3.60)	1.20
UK	0.84 (10.06)	-79.26 (-1.97)	1.47 (1.95)		0.78 (1.66)	1.40
US	0.39 (1.88)	-0.47 (-0.21)	-0.31 (-0.08)	0.03 (2.16)	0.42 (3.36)	1.30
JP	0.72 (10.81)	-5.93 (-3.64)	0.12 (4.45)	-0.12 (-5.88)	0.20 (0.98)	2.43

NOTE: NLLS estimation of model (3) with DD_{tT}, T=1996, except T=1992 for P and JP, T=1993 for D and US, T=1998 for DK, and no dummy for FIN and UK. Sample period 1977-2002. Standard errors are heteroscedatic and autocorrelation consistent. The t-statistics in parenthesis.

Table 4. Debt-dummy Grid in the Forward-looking Model

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000
B	-0.02	0.01	0.02	0.02	**0.03**	**0.03**	**0.03**	0.03	0.03
	-0.24	0.15	1.13	1.23	**2.29**	**4.94**	**3.41**	1.43	1.25
D	-0.04	**-0.05**	-0.03	-0.04	-0.01	0.03	0.02	-0.00	-0.06
	-1.76	**-2.98**	-1.09	-1.65	-0.29	0.62	0.46	-0.00	-0.97
GR	**0.08**	**0.06**	**0.05**	0.01	**0.04**	0.02	0.01	-0.00	-0.01
	2.73	**2.72**	**3.78**	0.12	**2.20**	1.93	1.03	-0.01	-0.42
E	0.00	1.32	0.02	0.02	**0.03**	0.01	0.01	0.01	0.01
	0.01	0.12	0.50	0.89	**2.81**	0.72	0.04	1.37	1.04
F	**-0.09**	**-0.08**	-0.03	0.02	**0.04**	0.02	0.00	0.00	-0.02
	-3.15	**-2.26**	-0.57	0.33	**2.17**	1.02	0.20	0.08	-0.80
I	**0.03**	**0.02**	0.02	**0.02**	**0.02**	**0.02**	0.00	0.01	0.01
	4.71	**2.34**	1.45	**2.68**	**3.35**	**3.12**	0.17	0.86	0.98
IRL	-4.20	0.01	0.06	0.12	**0.21**	**0.26**	**0.28**	0.27	0.27
	-0.03	0.07	0.68	1.28	**3.44**	**3.63**	**2.72**	1.19	0.63
NL	0.03	**0.03**	0.03	**0.04**	**0.05**	**0.05**	**0.05**	**0.06**	0.01
	1.17	**2.34**	1.68	**2.83**	**4.54**	**4.02**	**3.19**	**2.25**	0.19
A	-0.00	-0.01	0.01	0.02	**0.03**	**0.03**	0.02	**0.02**	**0.03**
	-0.09	-0.49	0.64	1.65	**2.27**	**2.66**	1.56	**2.22**	**4.03**
P	**-0.02**	**-0.03**	**-0.03**	**-0.02**	**-0.02**	**-0.02**	-0.01	-0.01	-0.01
	-2.86	**-2.01**	**-6.32**	**-3.27**	**-2.90**	**-2.11**	-1.55	-1.01	-1.23
FIN	-17.9	**0.29**	**0.12**	0.03	0.03	0.04	0.04	0.02	0.04
	-0.01	**4.56**	**2.22**	0.64	0.57	0.88	1.18	0.50	1.02
DK	0.00	-0.00	-0.01	-0.00	0.01	0.02	**0.02**	**0.03**	0.02
	0.00	-0.27	-0.97	-0.25	0.91	1.76	**2.87**	**3.53**	1.00
S	0.01	-0.01	**0.07**	**0.07**	**0.07**	**0.05**	0.03	-0.04	0.02
	0.18	-0.01	**3.30**	**4.25**	**7.71**	**2.59**	1.25	-0.39	0.48
UK	-0.02	-0.001	0.01	0.01	-0.001	0.02	-0.02	-0.10	-0.03
	-0.47	-0.11	0.12	0.18	-0.03	0.27	-0.20	-0.55	-0.19
US	**0.03**	**0.04**	**0.04**	**0.04**	**0.04**	0.03	-0.00	-0.09	-0.11
	2.56	**2.89**	**3.45**	**3.47**	**2.69**	1.47	-0.02	-0.95	-1.07
JP	**-0.13**	**-0.11**	**-0.10**	**-0.10**	-0.09	-0.07	-0.14	-0.10	2.48
	-6.02	**-7.83**	**-4.81**	**-3.39**	-0.94	-0.41	-1.19	-0.44	0.02

NOTE: Non-linear GMM estimation of model (4) for DD_{tT}, T= 92,...,2000, with x_{t-1} and lagged external gap as instrumental variables. Sample period 1977-2002. Each cell contains the dummy coefficient (first row) and the t-statisitc (second row). Standard errors are heteroscedatic and autocorrelation consistent.

Table 5. Forward-looking Model with Selected Debt-dummy

Country	ρ	$\tilde{\alpha}$	δ	Dδ	γ	DW
B	0.74 (4.72)	-10.02 (-2.88)	0.10 (3.14)	0.02 (2.29)	-0.61 (-0.37)	2.82
D	0.42 (2.41)	-3.93 (-2.32)	0.11 (2.26)	-.04 (-2.67)	-0.36 (-1.64)	1.87
GR	0.42 (3.25)	-5.87 (-5.14)	0.06 (2.88)	0.03 (2.20)	0.23 (1.15)	1.80
E	0.40 (2.51)	-3.39 (-2.25)	0.05 (1.84)	0.02 (2.81)	0.36 (2.32)	1.94
F	0.43 (2.14)	0.36 (0.20)	-0.03 (-0.76)	0.04 (2.16)	0.13 (0.66)	1.36
I	0.16 (0.75)	-13.42 (-9.54)	0.11 (7.69)	0.01 (3.35)	0.07 (0.32)	1.90
IRL	0.84 (19.54)	-21.23 (-2.13)	0.22 (1.99)	0.20 (3.43)	-0.87 (-1.70)	2.02
NL	0.35 (2.51)	-4.01 (-2.09)	0.06 (2.33)	0.04 (4.54)	0.14 (0.72)	1.90
A	0.39 (3.23)	-0.01 (-0.01)	0.32 (0.01)	0.02 (2.26)	0.36 (1.87)	1.80
P	0.03 (0.37)	-10.60 (-18.15)	0.21 (15.42)	-0.02 (-2.86)	0.14 (2.35)	2.02
FIN	0.30 (1.14)	8.07 (4.23)	-0.33 (-3.71)	0.29 (4.56)	1.06 (8.06)	1.76
DK	0.44 (5.37)	-2.25 (-3.00)	0.08 (5.68)	0.02 (2.86)	1.71 (9.34)	2.29
S	0.41 (2.78)	-6.44 (-1.75)	0.05 (0.97)	0.07 (3.30)	2.03 (8.76)	1.67
UK	0.84 (9.55)	-73.97 (-1.71)	1.39 (1.71)		0.92 (1.86)	2.15
US	0.50 (4.05)	1.56 (0.97)	-0.03 (-1.22)	0.03 (2.55)	0.72 (4.18)	1.34
JP	0.72 (10.99)	-6.24 (-3.89)	0.12 (4.78)	-0.12 (-6.01)	0.15 (0.61)	2.49

NOTE: Non-linear GMM estimation of model (4) with x_{t-1} and lagged external gap as instrumental variables, and with DD_{tT}, T=1996, except T=1992 for P, US and JP, T=1993 for D and FIN, T=1994 for S, T=1998 for DK, and no dummy for UK. Sample period 1977-2002. Standard errors are heteroscedatic and autocorrelation consistent. The t-statistics in parenthesis.

Table 6. Parametric Information for Sustainability.

Country	$(\delta + D\delta)^{(1)}$	$r^{(2)}$	$\phi^{(2)}$	$[\ 1+r-(1+\phi)(\delta+D\delta)\ ]$
B	0.12+0.02	0.054	0.021	0.91
D	0.12-0.03	0.044	0.025	0.95
GR	0.08+0.03	0.021	0.020	0.91
E	0.0+0.03	0.036 0.026	0.025 0.034	1.01 0.99
F	0.0+0.05	0.049 0.042	0.022 0.024	1.00 0.99
I	0.11+0.01	0.039	0.021	0.92
IRL	0.23+0.19	0.034	0.055	0.59
NL	0.0+0.04	0.047 0.022	0.023 0.029	1.01 0.98
A	0.0+0.02	0.044 0.042	0.024 0.022	1.02 1.02
P	0.22-0.03	0.044	0.031	0.85
FIN	0.0+0.0	0.044	0.026	1.04
DK	0.11+0.02	0.069	0.020	0.94
S	0.16+0.06	0.047	0.019	0.82
UK	0.0+0.0	0.038	0.023	1.04
US	0.0+0.03	0.046 0.042	0.031 0.032	1.01 1.01
JP	0.12-0.12	0.040	0.029	1.04

(1) From Table 3 with non-significant coefficients set equal to zero.
(2) First row: Average value over the period 1977-2002. Second row: Average 1993-2002 for the US, and average 1996-2002 for E, F, NL, A.