ASSESSING FISCAL SUSTAINABILITY IN THEORY AND PRACTICE

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1 Introduction

As in academic, official, and other circles where fiscal policy is discussed, fiscal sustainability has been an often-voiced concern in the IMF. But just as elsewhere, the precise concern is sometimes unclear because the term fiscal sustainability does not have an exact meaning. Mainly, this reflects the way in which the literature on fiscal sustainability has evolved, with practical indicators of sustainability being derived independently of, rather than emerging from, the theoretical framework that is generally used to analyze sustainability. Thus one common practical approach to assessing sustainability uses nonincreasing government debt as a benchmark to distinguish sustainable fiscal policies from those that are unsustainable. However, the theoretical literature focuses on whether current fiscal policy can be continued into the distant future without threatening government solvency, which does not necessarily imply that debt has to be nonincreasing.

The main purpose of this paper is to provide an overview of approaches to assessing fiscal sustainability, and to describe how different approaches have been used in IMF work. The paper is organized as follows. Section II summarizes the general analytical background to assessing fiscal sustainability, beginning with the present value budget constraint, which is the benchmark against which solvency is determined,

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and then turning to sustainability tests and the role of uncertainty. Section III looks at the way in which fiscal sustainability has been assessed in different types of IMF work. Section IV examines the link between fiscal and external sustainability, which is an important issue in the context of IMF work. Section V contains concluding comments.

2 Analytical Background

The Theoretical Framework

Most analytical discussions of fiscal sustainability take as their starting point a representative agent model in which the government must satisfy both an intertemporal budget constraint and, in every period, a static budget constraint. In a simple, closed-economy version of such a model (where there is no need to be concerned about complications created by external debt), and abstracting from monetary considerations, the static budget constraint is

$$B_{t+1} = R_t B_t + D_t \tag{1}$$

where B_t is the beginning period stock of government debt (i.e., bonds outstanding), $R_t = 1 + r_t$ is the discount factor applying between periods t and $t+1$, and D_t is the primary fiscal deficit (i.e., it excludes interest payments). Solving equation (1) forward gives the intertemporal budget constraint

$$B_t = -\sum_{j=0}^{\infty} R(t,t+j)^{-1} D_{t+j} + \lim_{T\to\infty} R(t,t+T)^{-1} B_{t+T+1} \tag{2}$$

where $R(t,t+j) = \prod_{k=0}^{j} R_{t+k}$ is the discount factor applying between periods t and $t+j$. From equation (2), sustainability (or solvency) requires that the present value of future primary surpluses must exceed the present value of future primary deficits by a sufficient amount to cover the difference between the initial debt stock and the present value of the terminal debt stock.

If the present value of the terminal debt stock is positive,

equation (2) can be satisfied even if a government rolls over its debt in full every period by borrowing to cover both principal and interest payments. However, O'Connnell and Zeldes (1988) have demonstrated that this is not feasible with a finite number of agents (as in the representative agent model). The intuition is straightforward. If the government was running such a Ponzi game it would imply that some individual would have to be holding government bonds at some infinite point in the future. As a result, this individual would have lower consumption in at least one period, and therefore lower welfare, compared to a situation where he or she chooses not to hold the debt at all. The option of holding a debt that will be continuously rolled over is strictly dominated by that of holding no debt at all. As a result, a government attempting to run a Ponzi game will find that no rational individual is willing to hold its liabilities, and it cannot therefore roll over its debt in full in every period.

A no-Ponzi game restriction is typically regarded as synonymous with sustainability, which implies that the transversality condition, $\lim_{T\to\infty} R(t,t+T)^{-1} B_{t+T+1} \leq 0$, has to hold. In fact, this condition will hold as an equality since private agents cannot end up being indebted to the government, and as a consequence sustainable fiscal policy has to respect the present value budget constraint (PVBC)

$$B_t = -\sum_{j=0}^{\infty} R(t,t+j)^{-1} D_{t+j} \,. \tag{3}$$

Sustainability thus requires that today's government debt is matched by an excess of future primary surpluses over primary deficits in present value terms.

The Policy Implications of the PVBC

What sort of fiscal policies are consistent with the PVBC? Perhaps the most important consequence of the PVBC is that it does not rule out either large primary deficits or high debt, just as long as the future primary surpluses required to respect the PVBC are a viable policy option. The transversality condition simply constrains the debt to grow no faster than the interest rate. If there are prolonged periods when the interest rate is high, the debt can grow faster than the economy and an

unbounded ratio of debt to output is possible (see McCallum, 1984). However, Barro (1989) and Kremers (1989) note that such a possibility does not seem sensible, and therefore argue for a constraint on the size of primary fiscal surpluses, because the government cannot raise more revenue than the economy generates as income. In this case, the condition $-D_{t+j} < \phi Y_{t+j}$ must hold, where Y_{t+j} is output and $\phi < 1$, which implies that

$$B_t < \sum_{j=0}^{\infty} R(t,t+j)^{-1} \phi Y_{t+j} \tag{4}$$

is the necessary condition for sustainability. This would imply that, if the interest rate is greater than the growth rate, the debt ratio needs to be bounded.

The PVBC also has some other implications. As McCallum (1984) points out, while permanent primary deficits are inconsistent with the PVBC, permanent overall deficits (i.e., inclusive of interest payments) may be sustainable. This can be seen most clearly if one imagines a country running a small primary surplus every period to cover a fraction of the interest costs of the debt. There will be an overall deficit in every period, but the debt will grow less fast than the interest rate and thus be regarded as sustainable (in that it satisfies the transversality condition). Perhaps more strangely, the PVBC implies that the government cannot run a small primary deficit followed by primary balance thereafter, since this would be inconsistent with the transversality condition. Similarly, in a growing economy with a relatively low interest rate, the debt ratio could be asymptotically falling to zero but at the same time be regarded as unsustainable. For example, a debt growing at a rate slightly above the rate of interest will, if the growth rate of output is greater than the growth rate of the debt, result in a declining debt ratio despite violating the transversality condition. Finally, it should be noted that representative agent models divorce the fortunes of the real economy from the activities of government. Thus sustainability judgments based on the PVBC are made without reference to any economic variables except the stock of government debt, projected primary surpluses and deficits, and the interest rate on government debt.

Sustainability Tests

Testing whether the PVBC holds

If the PVBC holds for historical data, then the null hypothesis

$$\lim_{T\to\infty} R(t,t+T)^{-1} B_{t+T+1} = 0 \tag{5}$$

will not be rejected in statistical tests. The appropriate sustainability test is then to see if the historical process that generates fiscal data is likely to result in the PVBC eventually being violated. If so, fiscal policy—and thus the data generating process—will have to be changed and current policy should be regarded as unsustainable. The classic test is that of Hamilton and Flavin (1986), who apply the Flood-Garber (1980) test for price bubbles to the PVBC for the postwar United States. Specifically, they take the equation

$$B_t = A_0(1+r)^t - E_t \sum_{j=0}^{\infty} R(t,t+j)^{-1} D_{t+j} + \varepsilon_t \tag{6}$$

and test whether the bubble term $A_0 = 0$. The bubble term turns out not to be significant, and the hypothesis that postwar U.S. fiscal policy should be regarded as sustainable cannot be rejected.

Hamilton and Flavin also suggest that a sufficient condition for the PVBC to hold is that, if the primary balance is a stationary series, $A_0 = 0$ must imply that B_t is also stationary. It should be noted that this is a sufficient but not necessary condition for sustainability; fiscal policy could be sustainable even if debt is nonstationary. They find that nonstationarity can be rejected and that the PVBC therefore is not violated. In contrast, Trehan and Walsh (1988) find debt in the United States to be nonstationary. However, they argue that if the PVBC holds, if debt and deficits are integrated, and if interest rates are constant, then a necessary and sufficient condition for sustainability is that debt and primary balances are cointegrated. This can be seen by rewriting equation (1) as

$$B_{t+1} - B_t = rB_t + D_t \tag{7}$$

from which it follows that if B_t is integrated of order one then $B_{t+1} - B_t$ is stationary by definition. This in turn implies that $rB_t + D_t$, the overall balance, is stationary and that, if the interest rate is constant, B_t and D_t are cointegrated with a cointegrating vector (1, *r*). Broadly speaking, if cointegration tests suggest that debt and primary fiscal surpluses move together, (i.e., as the debt increases, so too do primary surpluses) then fiscal policy is sustainable. Trehan and Walsh (1988) test this hypothesis and find that cointegration is not rejected for postwar U.S. data. Trehan and Walsh (1991) also show that an alternative condition for the PVBC to hold is that $r_t B_t + D_t$ is stationary (i.e., if the interest rate is not constant). This condition is also found to hold for postwar U.S. data.

A number of other stationarity and cointegration tests yield different results. Hakkio and Rush (1991) look at whether government revenue and spending inclusive of interest payments are cointegrated and find that U.S. fiscal policy since the 1980s appears to have been unsustainable. Wilcox (1989) shows that when the transversality condition holds, the present value of government debt $R(t,t+j)^{-1} B_{t+j+1}$ is stationary and has an unconditional mean of zero. He finds mixed evidence on stationarity and rejects an unconditional mean of zero, thus concluding that postwar U.S. fiscal policy has been unsustainable. Corsetti and Roubini (1991) find that this result does not carry over to a sample of OECD countries. Kremers (1989) adds the constraint that a fiscal surplus cannot be larger than output, in which case stationarity of the debt ratio is both a necessary and sufficient condition for the PVBC to hold. He finds inconclusive evidence on the stationarity of the debt ratio and concludes that postwar U.S. fiscal policy may have been unsustainable. Finally, Roberds (1991) shows that the transversality condition implies cross-equation restrictions on the stochastic processes generating debt and deficits in a VAR framework, and finds strong evidence that such restrictions are rejected for the United States, again suggesting unsustainable fiscal policy.

Sustainability Indicators

A separate strand of the empirical literature focuses on

indicators of how far fiscal policy departs from sustainability[1]. It should be noted that such indicators are not backed by a formal definition of sustainability. Instead, they rely on a more intuitive notion of what distinguishes sustainable from unsustainable fiscal policy. Thus Buiter (1985) argues that sustainable fiscal policy should maintain the ratio of public sector net worth to output at its current level. He then calculates the permanent primary deficit necessary to achieve this objective, which is given by

$$\bar{d} = (r_t - n_t)w_t \tag{8}$$

where $d_t = \frac{D_t}{Y_t}$ is the ratio of the primary deficit to output, $w_t = \frac{W_t}{Y_t}$ is the ratio of net worth to output, and n_t is the growth rate. The sustainability indicator suggested by Buiter is

$$\bar{d} - d_t = (r_t - n_t)w_t - d_t \tag{9}$$

which is the difference between the constant wealth primary deficit and the current primary deficit. A negative value suggests that the current primary deficit is too large to stabilize the net worth ratio and that fiscal policy should thus be regarded as unsustainable.

While easy to interpret, one problem with the Buiter indicator is that it is difficult in general to obtain accurate information on the true size of government net worth. Blanchard (1990) gets around this problem by looking at the change in policies required to maintain the current debt ratio. He then develops two indicators of sustainability. The primary gap indicator is based on the permanent primary deficit necessary to stabilize the debt ratio. The latter is given by

$$\bar{d} = (n_t - r_t)b_t \tag{10}$$

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[1] See Horne (1991) for further discussion.

where $b_t = \frac{B_t}{Y_t}$ is the ratio of debt to output. The primary gap indicator is then

$$\bar{d} - d_t = (n_t - r_t)b_t - d_t . \tag{11}$$

A negative value for this indicator suggests that the current primary deficit is too large to stabilize the debt ratio and that fiscal policy is thus unsustainable.

For an alternative perspective, Blanchard proposes a tax gap indicator, which is based on the permanent tax to output ratio necessary to stabilize the debt ratio. This is given by

$$\bar{t} = g_t - (n_t - r_t)b_t \tag{12}$$

where g_t is the ratio of government noninterest spending to output. The tax gap indicator is

$$t_t - \bar{t} = t_t + (n_t - r_t)b_t - g_t \tag{13}$$

which is the difference between the constant debt tax ratio and the current tax ratio. A negative value for this indicator suggests that current taxes are too low to stabilize the debt ratio given current spending polices. The primary gap and tax gap indicators are obviously the same, but they differ in their emphasis. The former points to the reduction in the primary deficit required for sustainability of the debt, while the latter indicates the increase in the tax ratio required for sustainability of the debt given current spending policies.

Blanchard also suggests a medium-term tax gap indicator, which is the difference between the current tax ratio and that necessary to stabilize the debt ratio over the next *N* years (assuming constant interest and growth rates). The debt-stabilizing tax ratio is then given by

$$\bar{t} = \frac{1}{N}\sum_{i=0}^{N}\left(g_{t+i} - (n_{t+i} - r_{t+i})b_{t+i}\right) = \frac{1}{N}\sum_{i=0}^{N} g_{t+i} - (n_t - r_t)b_t \tag{14}$$

and the medium-term tax gap indicator is

$$t_t - \bar{t} = t_t + (n_t - r_t)b_t - \frac{1}{N}\sum_{i=0}^{N} g_{t+i} \,. \tag{15}$$

The interpretation of this indicator is similar to that of the tax gap indicator, but it is forward looking and requires a projection of future spending. It measures how much the tax ratio needs to rise over the next N years to stabilize the debt ratio given current and expected future spending policies.

The indicators suggested by Buiter and Blanchard are useful in that they are quite simple and have a ready intuition that should appeal to most economists and policymakers. They have also been applied fairly widely[2]. Their simplicity and ease of interpretation notwithstanding, the principal weakness with such indicators is that they are based on arbitrary definitions of sustainability, namely a constant ratio of either net worth or debt to output. As noted above, adhering to the PVBC does not even require that the debt ratio needs to be bounded, let alone constant. For countries that are heavily indebted or with large negative net worth, sustainable fiscal policies may necessitate a reduction in debt or an increase in net worth (relative to output). Conversely, for countries that have little debt or with significant net worth, fiscal policies may still be sustainable even if they lead to an increase in debt or lower net worth. These possibilities are not captured by the Buiter and Blanchard indicators, although some flexibility can be imparted by varying debt or net worth targets. But generally speaking, the simpler tests of sustainability using these indicators and their relative ease of interpretation comes at a cost in terms of the limited scope of the sustainability assessments they imply. However, one saving grace in this regard is that if fiscal policies are sustainable according to one of the indicators, and if the growth rate is less than the interest rate, then the PVBC will also be satisfied. The indicators therefore embody a prudent approach to sustainability testing in many cases where the fiscal position is characterized by high debt and primary deficits.

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[2] A good example is provided by Buiter and Patel (1992), who use the Buiter indicator to examine fiscal sustainability in India.

Sustainability and Uncertainty

In the discussion above, sustainability has been examined in an environment where there is no uncertainty. However, Bohn (1991, 1995) makes the important point that policies which are sustainable in a certain world may no longer be so with uncertainty. To see this, the theoretical framework needs to be modified in two ways. First, with uncertainty the discount factor R_t is determined by the marginal rate of substitution between time t and $t+1$, which can differ considerably from the interest rate on government debt[3]. Second, future values of key economic variables can vary across different states of the world, and future discounted deficits in the PVBC must therefore be expressed in expected value terms. The intertemporal budget constraint then has to be written

$$B_t = -E_t \sum_{j=0}^{\infty} \frac{\beta^j u'(C_{t+j})}{u'(C_t)} D_{t+j} + \lim_{T\to\infty} E_t \frac{\beta^{T+1} u'(C_{t+T+1})}{u'(C_t)} B_{t+T+1} \qquad (16)$$

where C_{t+j} is aggregate consumption, $u(\cdot)$ is the utility function of the representative agent, β^j is the rate of time preference, and D_{t+j} and C_{t+j} vary across different states of the world. Bohn (1995) shows that there is a stochastic analogue to the O'Connell and Zeldes (1988) argument that rules out Ponzi games which applies across states of the world. In this case, to be considered sustainable, fiscal policy must satisfy the transversality condition

$$\lim_{T\to\infty} E_t \frac{\beta^j u'(C_{t+T+1})}{u'(C_t)} B_{t+T+1} = 0 \qquad (17)$$

which says that, in expected value terms, government debt discounted by the representative agent's rate of time preference needs to go to zero. Equation (17) implies that the intertemporal budget constraint becomes

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[3] In a certain world, discounting by the marginal rate of substitution or by the risk-free interest rate would be equivalent.

$$B_t = -E_t \sum_{j=0}^{\infty} \frac{\beta^j u'(C_{t+j})}{u'(C_t)} D_{t+j} \tag{18}$$

so that a government with a positive debt stock must run a primary surplus in some states of the world in some subsequent period. It is therefore perfectly possible that a country with a positive debt stock could run a primary deficit in expected value terms but fiscal policy could still be regarded as sustainable.

The distinction between the deterministic and stochastic versions of the PVBC matters because much of the empirical literature tests sustainability by looking at whether $\lim_{T\to\infty} E_t(1+r)^{-T} B_{t+T+1} = 0$ is satisfied rather than looking at whether equation (17) holds. However, it is clear that the former is not a necessary condition for sustainability when the economy is stochastic, and that a growth rate of debt above the risk-free interest rate does not necessarily imply unsustainable behavior. Consequently, Bohn (1998) argues that some of the cointegration tests of sustainability described earlier may actually give misleading results. As an alternative test, he argues that, if the primary surplus responds positively to an increase in debt then, even in an uncertain world, the government's fiscal policy reaction function can be viewed as sustainable. Such a test reduces to examining whether $\alpha > 0$ in the equation

$$d_t = \alpha b_t + \delta \mathbf{Z}_t + \varepsilon_t = \alpha b_t + \mu_t \tag{19}$$

where Z_t is a vector of determinants of the primary surplus and ε_t is an error term. If d_t and b_t are nonstationary, while μ_t is stationary, equation (19) is equivalent to the cointegration test suggested by Trehan and Walsh (1988). However, if either d_t or b_t are stationary, then omitting $\mathbf{Z}_t$ results in biased coefficient estimates. From postwar U.S. data, there appears to be robust evidence that $\alpha > 0$, suggesting that U.S. fiscal policy has been sustainable.

3 IMF Assessments of Fiscal Sustainability

The Broad Approach

Fiscal sustainability is an issue that surfaces on a regular basis in discussions between IMF staff and country authorities, both in the context of surveillance and program work. It is also a topic that has been emphasized in the context of IMF work on fiscal transparency and fiscal vulnerability[4]. To gauge whether a country's fiscal position is sustainable, the following steps are often followed.

- Based on the latest macroeconomic data, a projection is made—usually over a five-year horizon—assuming that current policies are maintained. This is the baseline scenario. Such a scenario would typically provide details for key variables from the real sector, external, monetary, and fiscal accounts: output growth, investment, and inflation; imports, exports, the current account, and reserves; money supply, domestic credit, and interest rates; and revenue, noninterest expenditure, and interest payments.

- From the fiscal projection and the amount of monetary financing that could be made available to cover future fiscal deficits, debt is projected and sustainability is then assessed. While different criteria are used to assess sustainability, an increasing debt ratio is generally regarded as a cause for concern, since it will typically be accompanied by a deterioration in key macroeconomic indicators (i.e., low growth, rising inflation, increasing external debt and/or falling reserves) over the medium term.

- If the debt dynamics indeed look unfavorable, then an alternative adjustment scenario is prepared which will typically define a path for the debt ratio which results in stability over the medium-term and

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[4] The IMF's Code of Good Practices on Fiscal Transparency requires that the annual budget should be presented in a medium-term framework that emphasizes fiscal sustainability, while Hemming and Petrie (2000) suggest that unsustainable debt dynamics are a major source of fiscal vulnerability.

favorable developments in macroeconomic indicators[5]. Attention is then focused on the adjustment in the primary balance required to meet the debt target, and the fiscal measures that can generate this adjustment. In the process, an attempt is made to account for the effect of fiscal adjustment on other economic variables (most notably growth and interest rates, since these directly influence sustainability calculations), so the final adjustment scenario may only be reached after a process of iteration which could require a respecification of the debt target[6].

Presenting two scenarios, one based on current policies and the other with a fiscal adjustment that will eventually stabilize the debt ratio, perhaps has its closest parallel in Blanchard's primary gap indicator. Under the current policies scenario, projections are made for the future debt ratio such that

$$b_{t+i+1} = \sum_{k=1}^{i+1} \rho(t+k, t+i) d_{t+k-1} + \rho(t, t+i) b_t \tag{20}$$

where $\rho(t+i, t+j) = \prod_{k=i}^{j} \frac{R_{t+k}}{1+n_{t+k}}$ is the discount factor between $t+i$ and $t+j$ adjusted for the growth rate of the economy. The series $\left\{ d_{t+j} \right\}_{j=0}^{i}$ represents the baseline scenario primary balance. This is then compared with the adjustment scenario that stabilizes the debt ratio at some point i in the future, which implies that the primary balance series $\left\{ \overline{d}_{t+j} \right\}_{j=0}^{i}$ satisfies

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[5] Quite often, a scenario with policies that are weaker than those currently in place is prepared to illustrate the costs of relaxing the fiscal policy stance. In the context of assessing fiscal vulnerability, Hemming and Petrie (2000) also propose stress-testing of the baseline fiscal scenario by examining the impact of extremely adverse developments on fiscal outcomes.

[6] Under usual circumstances in countries with a debt problem, fiscal adjustment is expected to have beneficial effects on both growth and interest rates via confidence effects, lower country risk premia etc. However, excessively harsh adjustment could have the opposite effect, which might justify a different target (normally specified as reaching the original debt target at a later date).

$$b_t = \sum_{k=1}^{i+1} \rho(t+k, t+i)\bar{d}_{t+k-1} + \rho(t, t+i)b_t. \tag{21}$$

This is similar to the primary gap, or the adjustment in the primary balance necessary to stabilize the debt ratio over the medium term. But unlike Blanchard's univariate measure of the primary gap, this measure of the necessary amount of medium-term adjustment is given by a vector of primary adjustments for years *t* to *t+i*, $\left\{d_{t+j} - \bar{d}_{t+j}\right\}_{j=0}^{i}$. Of course, in contrast to the Blanchard approach, there is no unique solution to equation (21). There are many paths for the primary balance that can stabilize the debt ratio over the medium term. Typically in IMF work, there is a strong preference for an adjustment path that is front-loaded (i.e., where there is greater fiscal adjustment in the earlier years), although the qualification in footnote 6 applies. Front-loading is equivalent to implicitly imposing the additional constraint that

$$\Delta\bar{d}_{t+j} = \theta_{t+j}\Delta\bar{d}_{t+j-1}, \tag{22}$$

where $\Delta\bar{d}_{t+j} = \bar{d}_{t+j} - \bar{d}_{t+j-1}$ and $\theta_{t+j} < \theta_{t+j-1} < 1$, j = 1,...,i. The parameters $\left\{\theta_{t+j}\right\}_{j=1}^{i}$ are policy variables chosen according to the relative preference for strong or weak fiscal adjustment in the early years. A series where θ_{t+j} is small and declines sharply over time would represent a sharp up-front adjustment and would be regarded as a strong fiscal program that quickly moves a country back towards sustainability.

A special case of such an adjustment path is given by a series where $\theta_{t+j} = 0,$ which implies that all the adjustment would be carried out in the first year *t*, and thereafter the primary balance would be kept constant relative to output. This is the basis of an exercise that is quite often undertaken in the IMF, as illustrated by IMF (1996) on which Table 1 is based. It reports, for G-7 countries, the sustained change in the primary balance required from 1995 on to return net public debt either to its 1978–80 average (in percent of GDP) or to 30 percent of GDP by

2010. While it cannot be claimed that such rapid adjustment is in general necessary (or where necessary always desirable), the figures reported in Table 1 provide a useful basis for comparing fiscal sustainability across countries. In particular, it emphasizes the importance of looking at both debt and primary balances in assessing sustainability. In the mid-1990s, nobody would have questioned that Italy faced a more serious debt sustainability problem than other G-7 countries, despite its high primary surplus. There would have been more surprise at the adjustment required in France and the United Kingdom to meet a 30 percent of GDP debt target they did not exceed by much, which reflects their relatively large primary deficits.

Table 1. G-7 Sustainable Fiscal Balances
(in percent of GDP)

	Net debt 1978–80 average	Net Debt 1995	Primary balance 1995	Required change in primary balance[1] Scenario I	Scenario II
Canada	12.6	66.7	1.8	4.2	3.0
France	-0.6	35.1	-2.0	5.7	3.7
Germany	11.0	49.1	-0.3	4.2	2.9
Italy	54.4	108.9	3.3	6.0	7.6
Japan	14.4	9.8	-2.5	2.5	1.5
United Kingdom	46.3	40.8	-2.5	3.0	4.1
United States	25.6	56.4	0.5	2.3	2.0

Source: IMF (1996).

(1) In Scenario I the debt target is the 1978–80 average (in percent of GDP), and in Scenario II the debt target is 30 percent of GDP.

By contrast, when IMF staff are focusing on one country, with its individual problems that require a particular perspective, they may look at much more than a simple debt target. For example, in the case of the Philippines, Gerson and Nellor (1997) look at the adjustment required to the level of taxation needed to maintain overall fiscal balance and, at

the same time, to ensure constant expenditure on public infrastructure investment. Their analysis more closely approximates Blanchard's tax gap approach, but with the modification that sustainability is defined as overall fiscal balance rather than a constant debt ratio. Such a criterion is in fact a stronger sustainability requirement, assuming positive economic growth, since it implies a declining rather than a constant debt ratio. Specifically, the sustainable tax ratio is defined as

$$\bar{t} = g_t + r_t b_t \tag{23}$$

which implies that

$$(1 + n_t) b_{t+1} = b_t \tag{24}$$

where $\sum_{i=1}^{N} g_{t+i}$ is projected future primary expenditure, with the additional restriction that expenditure on public infrastructure is kept constant as a share of output. Gerson and Nellor conclude that fiscal policy in the Philippines is sustainable according to conventional criteria, but that prospective fiscal developments, and in particular the need to meet infrastructure needs, will require substantial fiscal adjustment over the medium term to maintain sustainability. They also provide an example of applying the Wilcox (1989) test of whether the present value of government debt is stationary and has an unconditional mean of zero, and find strong evidence that past fiscal policy was unsustainable.

In the case of Indonesia, Bascand and Razin (1997) look at the sustainability of the fiscal position by examining the relationship between the government's sustainable level of net liabilities and the actual level of government net liabilities. Sustainable net liabilities are defined as the maximum level of net liabilities that the government could bear given its current primary deficit, namely

$$\bar{l} = \frac{d_t}{n_t - r_t} \tag{25}$$

and sustainability is determined by looking at the difference between actual and sustainable net liabilities, with net liabilities measured as total debt less the market value of the government's oil reserves and foreign exchange reserves. This is given by

$$l_t - \bar{l} = l_t - \frac{d_t}{n_t - r_t} = \frac{\bar{d} - d_t}{n_t - r_t} \tag{26}$$

where $\bar{d}$ is primary deficit that is consistent with constant net liabilities. Rather than focus on the amount of primary adjustment needed to maintain a constant stock of net liabilities, Bascand and Razin look instead at the amount of additional wealth needed to support the current primary deficit. These are clearly two sides of the same coin. They conclude that there is no fiscal sustainability problem in Indonesia, but that there is potential vulnerability to interest rate and growth shocks which is increasing over time.

Measuring Debt

Gross debt and net debt

The IMF work on fiscal sustainability in G-7 countries discussed above is based on net debt. However, gross debt is more commonly used in analyses of debt sustainability, especially in developing countries. Gross debt is the total stock of outstanding government financial liabilities. In most cases, liabilities are measured at face value, although Cox (1985) argues that it is the market value of the debt that is relevant since this is what it would cost the government to retire its debt. For many countries, however, information on the market value of government debt is simply not available, since it requires a painstaking issue-by-issue calculation of the market value of outstanding bonds based upon actual market quotations. Moreover, since the market for government debt is very thin for some issues, it is doubtful whether the market value calculated in this way would truly represent the

underlying economic value of government debt[7]. For developing countries in particular, the distinction between market and face value can be quite dramatic, since much of their debt is contracted on concessional terms, so the true cost of the debt is much overstated by its face value.

Independently of how it is measured, it could anyway be argued that gross debt typically misrepresents the true sustainability position of the government, since the government often has financial assets that could be quickly liquidated to repay the debt. Indeed, as Chalk and Hemming (1999) argue, it may be optimal for a government to have a portfolio which combines debt and financial assets. Such a situation is a common occurrence in many countries, particularly those endowed with natural resources (e.g., Norway). Looking at the net debt picture can significantly change the assessment for fiscal sustainability for some countries.

Table 2. G-7 Debt Indicators, 1998
(in percent of GDP)

	Gross debt	Net debt	
		Including social security assets	Excluding social security assets
Canada	95.8	62.3	62.3
France	58.2	48.4	48.4
Germany	61.1	52.4	52.5
Italy	118.7	112.4	112.4
Japan	117.9	30.5	79.1
United Kingdom	62.7	42.7	42.7
United States	62.1	48.4	56.1

Source: IMF (1999).

[7] Market value is also difficult to assess because the government is a large player in debt markets. If it were to start repaying its outstanding liabilities, it would almost certainly raise the market value of the remaining stock.

As Table 2 illustrates, Japan is a clear example. Gross debt was 118 percent of GDP at the end of 1998. However, the government held financial assets equivalent to 87½ percent of GDP, giving a net debt of 30½ percent of GDP. But of these assets, 48½ percent of GDP in government bonds was held by the social security system, and these are matched by unfunded pension liabilities, so the net debt was in fact 79 percent of GDP. For the remaining assets equivalent to 39 percent of GDP, there is then an issue as to their true worth. In particular, the recovery value of assets on-lent through the Fiscal Investment and Loan Program is thought to be considerably below book value.

Unfunded pension liabilities

It has been noted that Japan's social security system holds government bonds equivalent to 48½ percent of GDP that are earmarked to meet unfunded pension liabilities. In fact, social security pension liabilities exceed this item by a large margin, as Table 3 indicates.

Table 3. G-7 Pension Debt and Contribution Gaps
(in percent of GDP)

	Net pension debt 1995–2050	Contribution gap
Canada	67.8	2.0
France	113.6	3.3
Germany	110.7	3.4
Italy	75.5	2.5
Japan	106.8	3.3
United Kingdom	4.6	0.1
United States	25.7	0.8

Source: Chand and Jaeger (1996).

Net pension debt is the present value of the difference between the projected primary expenditure and revenue (at current contribution rates) of the social security pension system through 2050. In Japan this was 107 percent of GDP in 1995, implying a large unfunded liability. However, the unfunded liability is larger in some other G-7 countries where the social security system holds few if any assets.

To eliminate these unfunded liabilities requires significant adjustment, as reflected in the contribution gaps—that is the increase in the contribution rate required over 1995–2050 to eliminate the unfunded liability by 2050—reported in Table 3. The existence of large unfunded liabilities can completely transform debt sustainability calculations. Rather than satisfying the PVBC, when pensions are included sustainability requires that

$$B_t - A_t^s = -\sum_{j=0}^{\infty} R(t,t+j)^{-1} D_{t+j} - \sum_{j=0}^{\infty} R(t,t+j)^{-1} SS_{t+j} \tag{28}$$

where A_t^s are the net financial assets of the social security system and SS_{t+j} are future social security deficits. Net debt, including social security assets, must therefore be backed by future budget surpluses defined inclusive of social security expenditure and revenues. $A_t^s - \sum_{j=0}^{\infty} R(t,t+j)^{-1} SS_{t+j}$ therefore represents the unfunded liability of the social security system.

Table 4 reports the adjustment required to stabilize net public debt and eliminate unfunded liabilities, that is the sum of change in the primary balance and the contribution gap. The figures in Table 4 clearly illustrate the long-term fiscal challenges that face those G-7 countries that have a high level of government debt and unfunded pension debt, although the legitimacy of adding public debt to unfunded pension liabilities has been questioned (see Hemming, 1999). Table 4 also points to a pitfall of debt sustainability comparisons which hold debt ratios constant. In contrast to the earlier discussion, Italy looked relatively well-placed to meet the overall adjustment target implied by Table 4, but this is only because it starts from such a high debt level. Setting a shared debt target, say 30 percent of GDP as in Table 1, would make Italy's position look much worse. It should also be noted that setting a 2050 end-point for

the net pension debt calculations in Table 3 is fairly arbitrary. In particular, the United States will age quite rapidly after 2050, and its position would look correspondingly worse as a result.

Table 4. G-7 Modified Sustainable Fiscal Balances
(in percent of GDP)

	Net debt, 1994	Change in primary balance	Overall adjustment[1]
Canada	71.6	2.5	4.5
France	42.4	1.0	4.3
Germany	52.5	1.3	2.1
Italy	112.9	-1.2	1.3
Japan	33.2	0.5	3.8
United Kingdom	37.7	0.3	0.4
United States	63.3	0.7	1.5

Source: Chand and Jaeger (1996).
(1) Change in the primary balance plus the contribution gap from Table 3.

Sustainability with Nonrenewable Resources

For the most part, the approach to assessing fiscal sustainability discussed above can be applied to the majority of countries (although perhaps its bias is towards advanced economies). However, when a country is well-endowed with nonrenewable resources, the usual approach can often give a misleading impression about fiscal sustainability. This is because measures of net debt capture only the financial assets of the government. The simplest approach to assessing sustainability taking into account resource wealth is to treat it as if it were the same as financial wealth. Assuming that resource wealth is worth the equivalent of the net present value of the revenue flows it produces, this is given by

$$RW_t = \sum_{j=0}^{\infty} R(t,t+j)^{-1} T(res)_{t+j} \tag{29}$$

where $T(res)_{t+j}$ is the revenue received by the government from exploiting the resource (in the form of royalties, profits tax, dividends, or other related revenues). Rewriting the present value budget constraint as

$$B_t = -\sum_{j=0}^{\infty} R(t,t+j)^{-1}\left(D(nonres)_{t+j} - T(res)_{t+j}\right) \tag{30}$$

where B_t is net debt and $D_{t+j} = D(nonres)_{t+j} - T(res)_{t+j}$ and $D(nonres)_{t+j}$ is the primary deficit excluding resource revenue. Combining equations (29) and (30) yields

$$-RW_t + B_t = -\sum_{j=0}^{\infty} R(t,t+j)^{-1} D(nonres)_{t+j} \tag{31}$$

which says that the fiscal position is sustainable only if the net present value of primary nonresource deficits is equal to net worth including the value of nonrenewable resources. Drawing down resource wealth to build financial assets or pay down debt does not impact sustainability (i.e., it does not change $-RW_t + B_t$ or $D(nonres)_t$), while running down resource wealth to fund government spending clearly worsen sustainability.

Testing equation (31) is closely linked to the Buiter approach outlined above, but its information requirements are demanding. In particular, it requires a judgement on the net present value of the stock of proven (and perhaps potential) resources in the face of uncertain future prices. Liuksila, Garcia, and Bassett (1994) apply this approach to Egypt, Indonesia, Mexico, Nigeria, Saudi Arabia, and Venezuela. To establish the value of the resource, in these countries it is oil, they make the additional assumptions that exploitation increases over time to ensure a constant ratio of oil revenue to output and that the value of the resource wealth is equivalent to the net present value of future revenue flows. Also, rather than evaluate the present value budget constraint or produce an indicator of how far current policies are from sustainable policies, the likely future path of net worth (that is $RW_t - B_t$) is projected, with net worth that is declining over the medium-term being taken as an indicator of unsustainable fiscal policy. It is concluded that there was a need for

fiscal adjustment in all six countries over the period 1982–92.

An alternative approach is to explicitly model the government's intertemporal budget constraint along with the path of resource exploitation. Chalk (1998) constructs a model with the government owning a known stock of nonrenewable resources (again it is oil), receiving flows from it, and making transfers to the private sector on the basis of these flows. He establishes that, for fiscal policy to be sustainable, the 'core deficit' (defined to exclude both revenues and spending that are related to the oil sector or strongly correlated with oil revenues) needs to be smaller than the deficit that stabilizes net worth. This is also similar in spirit to the Buiter approach, except that the model is dynamic. Thus, if the value of the stock of oil is appreciating over time (i.e., the country faces an improving terms of trade), a deficit in excess of the constant wealth deficit can still be regarded as sustainable (i.e., a deficit below the constant wealth deficit is a sufficient but not a necessary condition for sustainability). Applying this approach to Kuwait and Venezuela, it is concluded that fiscal policy was unsustainable in Kuwait during 1982–96 having been sustainable during 1973–81. Fiscal policy in Venezuela, however, was unsustainable over the entire period.

4 Fiscal and External Sustainability

Analysis of External Sustainability

Consistent with its principal mandate, the IMF pays considerable attention to external sustainability, and the approach to fiscal sustainability discussed above has an almost exact analogue in the measurement of external sustainability. However, the link between fiscal and external sustainability has not been systematically examined. What follows is a preliminary look at that link.

Let F_t be the net foreign liabilities of a country (external debt less foreign assets, including international reserves denominated in real foreign currency terms) and let TB_t represent the trade balance in real domestic currency terms. The evolution of net foreign liabilities is given by

$$e_t F_{t+1} = R_t^* e_t F_t - TB_t \tag{32}$$

where e_t is the inverse of the average real exchange rate and $R_t^* = 1 + r_t^*$ is the world interest factor. A positive trade balance leads to an improvement in a country's net indebtedness to the rest of the world, while a higher foreign interest rate increases a country's indebtedness.

Solving equation (32) forward gives

$$F_t = \sum_{j=0}^{\infty} R^*(t,t+j)^{-1} TB_{t+j} + \lim_{T\to\infty} R^*(t,t+j)^{-1} e_{t+T} F_{t+T+1} \tag{33}$$

where $R^*(t,t+j) = \left(\prod_{k=0}^{j} R_{t+k}^* \right) e_{t+j}$. This is a country's intertemporal external constraint. In the same way that a government cannot roll over its debt forever, a country cannot continually service its foreign debt with new borrowing from abroad. To do so would mean that foreign creditors have to hold a country's debt forever while they could improve their welfare by not doing so. A Ponzi game with external debt cannot therefore be an equilibrium outcome. This means that $\lim_{T\to\infty} R^*(t,t+T)^{-1} e_{t+T} F_{t+T+1} = 0$ is a necessary condition for external sustainability and that a country's net foreign liabilities cannot grow faster than the foreign interest rate. Imposing this sustainability condition implies that

$$F_t = \sum_{j=0}^{\infty} R^*(t,t+j)^{-1} TB_{t+j} \,. \tag{34}$$

Equation (34) say that a country's net foreign liabilities are sustainable only insofar as there are sufficiently large future trade surpluses (in present value terms) in prospect to service the net foreign liabilities.

The empirical tests for external sustainability also parallel those for fiscal sustainability discussed in Section II. Trehan and Walsh (1991) test for stationarity of the current account (i.e., whether $e_t F_{t+1} - e_t F_t = r_t^* e_t F_t - TB_t$ is stationary) while Husted (1992) and Hakkio and Rush (1991) examine whether exports and imports inclusive

of net interest payments are cointegrated. Ahmed and Rogers (1995) conduct a test on whether exports, imports, and interest payments are cointegrated.

In addition to statistical tests, it is also possible to derive measures of external sustainability which indicate whether the path of the trade balance is likely to lead to nonincreasing net foreign liabilities over time. Rewriting equation (32) in terms of ratios to output yields

$$(1+q_t)(1+n_t)f_{t+1} = R_t^* f_t - tb_t \tag{35}$$

where q_t is the real appreciation of the domestic currency. Net foreign liabilities as a ratio to output are reduced by a positive trade balance, an appreciating currency, or by faster economic growth. If

$$f_t = \frac{tb_t}{r_t^* - q_t - n_t} = \overline{f} \tag{36}$$

net foreign liabilities will be a constant share of output $\overline{f}$. When $f_t > \overline{f}$, net foreign liabilities will increase relative to output over time, which can be regarded as unsustainable. Adding the condition that trade surpluses cannot exceed a fraction of exports (i.e., $tb_t < \phi x_t$ with $0 < \phi < 1$) implies that if

$$\frac{F_t}{X_t} > \frac{\phi}{r_t^* - q_t - n_t} \tag{37}$$

net foreign liabilities are unsustainable.

Linking Fiscal and External Sustainability

What then is the relationship between the conditions for external sustainability described above and those for fiscal sustainability? In the same way as there is not necessarily a direct correspondence between the "twin deficits"—that is the fiscal deficit and the current account deficit—it is also the case that there is not a one-to-one relation

between fiscal and external sustainability. However, fiscal and external sustainability are not entirely independent.

Start with the national income identity

$$TB_t = -D_t + S_t - I_t \tag{38}$$

where S_t is private saving and I_t is private investment. Imposing covered interest rate parity and summing equation (38) over all future periods in net present value terms yields

$$e_t \sum_{j=0}^{\infty} R^*(t,t+j)^{-1} TB_{t+j} = -\sum_{j=0}^{\infty} R(t,t+j)^{-1} D_{t+j} + \sum_{j=0}^{\infty} R(t,t+j)^{-1} (S_{t+j} - I_{t+j}) \tag{39}$$

Equation (39) can be rewritten

$$e_t \left(F_t - \lim_{T\to\infty} R^*(t,t+T)^{-1} e_{t+T} F_{t+T+1} \right) = \left(B_t - \lim_{T\to\infty} R(t,t+T)^{-1} B_{t+T+1} \right) + \sum_{j=0}^{\infty} R(t,t+j)^{-1} (S_{t+j} - I_{t+j}) \tag{40}$$

by using the intertemporal budget constraint equation (2) and the intertemporal external constraint equation (33).

When there is both fiscal and external sustainability, equation (40) becomes

$$e_t F_t = B_t + \sum_{j=0}^{\infty} R(t,t+j)^{-1}(S_{t+j} - I_{t+j}) \tag{41}$$

so that if net foreign liabilities (in domestic currency terms) are greater than government debt, there has to be an excess of private saving over private investment (in present value terms) to cover the future external debt service.

If there is fiscal sustainability but the external position is unsustainable then

$$e_t F_t = B_t + \sum_{j=0}^{\infty} R(t,t+j)^{-1}(S_{t+j} - I_{t+j}) + \lim_{T\to\infty} R^*(t,t+T)^{-1} e_{t+T} F_{t+T+1} \tag{42}$$

and private saving is insufficient to cover external debt service. Consequently, private sector net external liabilities grow faster than the foreign interest rate (i.e., the private sector is rolling over its net external liabilities), and default on external debt service is likely in the absence of a change in macroeconomic policies.

Finally, if the external position is unsustainable but fiscal policy is unsustainable then

$$e_t F_t = B_t + \sum_{j=0}^{\infty} R(t,t+j)^{-1}(S_{t+j} - I_{t+j}) - \lim_{T\to\infty} R(t,t+T)^{-1} B_{t+T+1} \tag{43}$$

and the government is financing its excessive deficits by issuing domestic debt. In the absence of a change in fiscal policy, the government will inevitably default on domestic service.

Operationalizing Sustainability in the HIPC Initiative

Perhaps the most visible area where the IMF has been involved in assessing external sustainability has been in the context of the Highly Indebted Poor Countries (HIPC) Initiative. To qualify for exceptional assistance under HIPC, countries have to be IDA-only and PRGF-

eligible, and also face an unsustainable debt burden after the full application of traditional debt relief mechanisms such as Paris Club reschedulings[8]. The decision on whether debt is unsustainable is based upon a debt sustainability analysis (DSA). The key question a DSA attempts to answer is whether traditional debt relief mechanisms are sufficient to allow a country to service its debt under plausible assumptions about future export and output growth.

The DSA involves choosing a fixed time horizon, projecting forward key economic indicators such as output growth, export growth, exchange rates, and budget aggregates and looking at the behavior of the stock of public external debt and of debt service. The exercise is very similar to that described in Section III, but with a greater emphasis on external variables. To qualify for the HIPC (and for debt to be regarded as unsustainable), the net present value (NPV) of public external debt as a ratio to exports under the baseline scenario needs to be above 150 percent[9].

What the DSA looks primarily at external debt sustainability, the HIPC also includes a "fiscal window." This responds to the concern that, particularly for very open economies, ratios of debt or debt service to exports may belie the underlying fiscal sustainability of a country's debt profile. For countries with exports above 30 percent of output and revenues above 15 percent of output, a NPV of public external debt in excess of 250 percent of central government revenue is regarded as unsustainable[10].

The aim of this fiscal criterion is to ensure that debt sustainability is achieved both from an external and fiscal standpoint. In many HIPC countries, domestic financial markets are underdeveloped and most sovereign debt is external, in which case there will tend to be a

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[8] Typically, a stock of debt operation on Naples terms is assumed. See Andrews and others (1999) for further details.

[9] The NPV of external debt is used in order to best capture the concessionality of the debt structure.

[10] The criterion on revenues is included to prevent the moral hazard problem of having a country actually reducing its fiscal revenues (and increasing its debt-revenue ratio) in order to receive debt relief.

close relationship between fiscal and external sustainability. However, where domestic debt is significant, the focus on public external debt implies only a partial view of fiscal sustainability.

5 Concluding Comments

This paper is a hybrid, part a review of the literature on fiscal sustainability, part a description of how the IMF goes about assessing fiscal sustainability in different contexts, and part a catalogue of issues that arise in thinking about fiscal sustainability, including those relating to the link between fiscal and external sustainability.

The discussion in the paper suggests the following.

- There is something of disconnect between the theoretical work that has been done on fiscal sustainability and assessment of fiscal sustainability in practice. In particular, country work undertaken by the IMF and others generally pays less attention to the PVBC, focusing instead on indicators of sustainability that are not grounded in theory.

- That said, the PVBC approach has clear limitations, most notably some fiscal policies that in no obvious sense appear unsustainable can satisfy the PVBC while some other fiscal policies appear sustainable but do not satisfy the PVBC. In contrast, indicators of sustainability have considerable intuitive appeal.

- While the arbitrary nature of indicators of sustainability is a clear shortcoming, one advantage of the IMF approach to assessing fiscal sustainability in the context of a broader medium-term macroeconomic scenario is that debt targets that are not sufficiently ambitious will usually be revealed by weakness in one or more key macroeconomic indicators.

- Finally, the link between fiscal and external sustainability warrants further consideration, with a view to developing an integrated analytical framework that combines both aspects of sustainability and from which fully consistent indicators of fiscal and external sustainability can be derived.

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