IMF WORKING PAPER

© 1991 International Monetary Fund

WP/91/5   INTERNATIONAL MONETARY FUND

Fiscal Affairs Department

Indicators of Fiscal Sustainability

Prepared by Jocelyn Horne */

Authorized for Distribution by Sheetal K. Chand

January 1991

Abstract

This paper assesses the usefulness of summary measures of fiscal
sustainability for the purpose of multilateral surveillance. An
overview of the main conceptual issues is first presented. Next, an
assessment is made of the strengths and weaknesses of the summary
measures in the context of their recent application to industrial
countries by the OECD and the Fund. The measures are shown to highlight
the inadequacy of using trends in public debt ratios to assess
sustainability. However, the measures and their recent application are
subject to a number of caveats, in particular in relation to their
sensitivity to the discount rate, time paths of government expenditures
and private sector behavior.

JEL Classification Number:

320; 321

<div align="center">Contents</div> Page

Summary

"Indicators of Fiscal Sustainability" by Jocelyn Horne

Recent initiatives by the OECD and the Fund use summary measures to assess the sustainability of fiscal policies of industrial countries. This study assesses the usefulness of these measures.

The paper begins with an overview of the main conceptual issues. It draws a distinction between the concepts of government solvency and fiscal policy sustainability and then discusses their relationship to the measures. The summary indicators are closely related to the solvency constraint and measure the magnitude of the permanent fiscal adjustment needed to stabilize the base year public-debt-to-GDP ratio. (A sustainable level of public debt is defined in terms of its convergence toward a steady state debt-to-GDP ratio.) The paper argues that the solvency constraint, as presently defined, is inadequate for assessing fiscal sustainability for a number of reasons. These reasons include the fairly weak restrictions imposed on the behavior of the fiscal authorities, the assumed independence of real interest rates, economic growth, and fiscal balances, and interaction between private and public sector behavior.

The strengths and weaknesses of the measures are examined in the context of their recent application to industrial countries. While the measures represent a considerable improvement over the use of simple debt ratios as indicators of either government solvency or fiscal sustainability, they are subject to a number of limitations. The measures are sensitive to the discount rate used, as well as to assumptions regarding the time path of government expenditures and private sector behavior. Because of this sensitivity, their recent application to industrial countries should be treated with caution.

I. Introduction

In the face of a dramatic rise in public indebtedness of the main industrial countries in the past decade, the issue of the sustainability of fiscal policies has attracted considerable attention. While a large research effort has been directed toward developing short-term indicators of discretionary fiscal policy or of budgetary impact on aggregate demand, less progress has been made toward developing a set of indicators that are internationally comparable to assess the medium or long-term strength of fiscal policies. However, in a recent initiative, the OECD has begun preliminary work in this area. 1/

The purpose of this paper is to assess the usefulness of summary measures of fiscal sustainability for the purpose of multilateral surveillance. The analysis is intended to extend and complement recent OECD efforts, and to strengthen ongoing Fund work on fiscal indicators. 2/

A fundamental issue needs to be addressed at the outset: how do we identify a problem of fiscal unsustainability? Suppose the public debt-to-GDP ratio is observed to rise continuously over a prolonged period as was the case for many industrial countries in the 1980s. Does this imply fiscal policy unsustainability? Not necessarily, as will be demonstrated in the subsequent analysis. In the analysis, a distinction is drawn between the theoretical concepts of government solvency and fiscal policy sustainability and the relationship between the two concepts and the summary measures.

The government's solvency constraint is defined in the literature as the requirement that the government run future primary (non-interest) surpluses equal in present value terms to the outstanding public debt stock. In this sense, the constraint will always be met on an ex post basis, whether through debt repudiation or restructuring, monetization or revision of government expenditure and revenue plans. However, summary measures such as those developed in Buiter (1985) and Blanchard (1990) attempt to assess whether the present value budget constraint would be met in an ex ante sense over a specified planning period. 3/

Fiscal policy sustainability involves determining whether the government can continue to pursue indefinitely its set of budgetary policies. The present analysis follows Zee (1988) in defining a

---

1/ See Chouraqui and others (1990) and OECD (1990).
2/ See IMF (1990b).
3/ Recent work by Anand and van Wijnbergen (1989) in the context of developing countries bears a close relationship to the above approach. Building on the government financing constraint with explicit allowance for monetary and external financing, the conditions necessary for testing the ex post consistency between macroeconomic policies and targeted inflation and output growth are derived.

sustainable level of public debt in terms of a stable long-run equilibrium path. Government solvency is a necessary but not sufficient condition for fiscal policies to be sustainable. The reason is that the application of the solvency condition, in the absence of accompanying assumptions concerning private savings and investment behavior, assumes that the projected paths of the primary (non-interest) fiscal balance, interest rates and economic growth are independent. However, an assessment of whether present fiscal policies are sustainable necessarily involves relaxation of this assumption. The paths of the policies will depend upon assumptions concerning private sector savings and investment behavior which interact with the policies themselves to determine the long-run paths of interest rates and economic growth.

In relation to the above concepts, two further points should be emphasized at the outset. First, regardless of whether the intention is to assess government solvency or sustainability, observed trends in public debt ratios in terms of GDP may be misleading indicators. On conceptual grounds, a prolonged rise in the debt ratio need not imply government insolvency if, for example, output growth exceeds the real interest rate. Alternatively, even if interest rates are well above GDP growth and the government initially runs a primary budget deficit, the private sector may believe that the government will soon switch to running primary surpluses sufficient to meet its future debt service commitments. Application of the indicators to the main industrial countries in the 1980s clearly demonstrates the first point. Despite rising public debt ratios in most countries, the measures show a movement toward or strengthening of fiscal solvency.

The second point concerns the relationship between debt sustainability and debt optimality criteria. The achievement of fiscal sustainability need not imply optimality of fiscal balances or public debt. In this respect, a weakness of the summary measures lies in the implicit and arbitrary assumption that the stabilization of the outstanding public debt-to-GDP ratio is the objective of policymakers. This assumption may be unduly restrictive or possibly too relaxed (for example, if public debt exceeds the level of GDP, as in Italy, Ireland and Belgium).

The analysis discusses a number of strengths and weaknesses of the summary measures in the context of their recent application to industrial countries. The summary measures are derived from the government's solvency constraint and measure the permanent adjustment that would be needed to achieve stabilization of the outstanding stock of public debt in terms of GDP over a given planning horizon. The main strength of the measures relative to alternative methodologies based on country-specific medium-term scenario analysis is that they are relatively simple to construct, less information-intensive and internationally comparable.

The measures have been applied in both a forward- and backward-looking sense. For example, in OECD (1990) and IMF (1990b), the measures are used to assess the medium- and long-term sustainability of fiscal policies of industrial countries based on end-1989 public debt ratios. As a forward-looking concept, the indicators are useful in suggesting whether fiscal adjustment is needed to achieve debt stabilization in the base year and its likely magnitude. Alternatively, the measures may be used to assess budgetary performance under past policies. For example, the indicators have been used to evaluate fiscal consolidation programs undertaken by the main industrial countries in the 1980s (see Chouraqui and others (1990) and Horne (1990)). Such an analysis may be helpful in assessing the extent to which fiscal retrenchment effects were accompanied by any discernible shift toward government solvency and the factors behind such a movement.

The indicators are, however, subject to a number of limitations which include lack of behavioral content, inclusion of implicit normative criteria and absence of a global perspective. The degree to which these limitations act to weaken the usefulness of their recent application is discussed in the analysis.

The plan of the paper is as follows. The analytical framework and main conceptual issues are presented in Section II. This is followed in Section III by a discussion of the summary measures in the context of their recent application to assessing fiscal sustainability in industrial countries. Section IV draws together the main conclusions and identifies future areas of research.

II. Conceptual Issues

This section presents an overview of the main conceptual issues involved in assessing fiscal policy sustainability. The key message is that a clear distinction needs to be drawn between theoretical concepts of government solvency and sustainability, and operational measures of sustainability. The government's intertemporal budget constraint is first discussed and its usefulness for operational purposes is examined. A number of related questions are also examined: ex ante and ex post solvency, the role of private sector behavior, positive and normative criteria, the sustainability of the fiscal-monetary policy mix and linkages between fiscal and external sustainability.

1. Government intertemporal budget constraint

The central focus of the literature on government solvency and fiscal policy sustainability is the government's intertemporal or present value budget constraint. 1/ This is the requirement that the discounted present value of primary surpluses in terms of GDP must be equal to the initial stock of government debt in terms of GDP. The

---

1/ More extensive discussions are given in Buiter (1985) and Spaventa (1987).

operational significance of the constraint comes into play whenever the real interest rate lies above the real output growth rate. If the government pursues a primary (non-interest) fiscal deficit that is expected to continue, it will violate its ex ante intertemporal budget constraint. In order to satisfy ex post the constraint, the government must switch eventually to a policy of fiscal retrenchment, monetization or debt repudiation. 1/

Equation (1) gives the one-period government budget identity. For the purpose of simplifying the analysis, the government is assumed to finance the excess of expenditures over taxes by the creation of high-powered money and by the sale of domestic bonds. Deficit financing from external sources, the drawing down of foreign reserves and the sale of public assets are excluded. 2/ (Dots over variables signify rates of change while lower case variables are in terms of ratios to nominal GDP.)

$$\dot{b}_t + \dot{M}_t/Y_t \equiv g_t - \tau_t + ib_t - (n + p_t)b_t \qquad (1)$$
$$\equiv d_t + (r - n)b_t \qquad (1')$$

where b_t = ratio of government bonds to GDP (B_t/PY_t)
M_t = stock of high-powered money
d_t = ratio of primary (non-interest) deficit to GDP
g_t = ratio of public expenditures (excluding interest payments) to GDP
τ_t = ratio of taxes to GDP
i_t = nominal interest on government bonds
p_t = inflation rate
n_t = real growth rate of GDP
$r = i - p_t$ = real interest rate

Assume growth in high-powered money stock equals nominal GDP growth:

$$\dot{M}_t/M_t \equiv \lambda_t \equiv n + p_t$$

Then, $\dot{M}_t/Y_t \equiv \lambda_t m_t \qquad (m_t = M_t/Y_t)$

Rewriting (1') we obtain
$$\dot{b}_t \equiv d_t + (r - n)b_t - \lambda_t m_t \qquad (2)$$

From equation (2), the growth rate in the public debt-to-GDP ratio equals the primary (non-interest) deficit-to-GDP ratio plus the real interest rate net of output growth multiplied by the initial period debt ratio less the revenue from seigniorage.

1/ Assuming an upper limit exists on the amount of debt that can be issued, that is, a transversality condition exists.

2/ It is also implicitly assumed that the gross rate of return on public capital expenditures is zero in which case the definition of the primary surplus includes both recurrent expenditures and gross capital formation (see Buiter (1985)). The nominal interest rate on government bonds, the inflation rate and the output growth are assumed to be constant.

The intertemporal budget identity is derived by summing a succession of single period budget identities over an infinite planning horizon and is given by (3):

$$b_t = \int_t^\infty \tau_s e^{-(r-n)(s-t)} \, ds + \int_t^\infty \lambda_s m_s e^{-(r-n)(s-t)} ds \qquad (3)$$
$$- \int_t^\infty g_s e^{-(r-n)(s-t)} ds + \lim_{s \to \infty} b_s e^{-(r-n)(s-t)},$$

Government solvency is defined as the condition that public debt grows asymptotically at a rate less than the interest rate. Debt, in other words, should not be serviced indefinitely by borrowing. When this condition is fulfilled,

$$\lim_{s \to \infty} b_s e^{-(r-n)(s-t)} = 0, \qquad (4)$$

and the intertemporal budget constraint is expressed by:

$$b_t = \int_t^\infty \tau_s e^{-(r-n)(s-t)} ds - \int_t^\infty g_s e^{-(r-n)(s-t)} ds + \int_t^\infty \lambda_s m_s e^{-(r-n)(s-t)} ds \quad (5)$$

Equation (5) is the government's present value budget constraint-- the requirement that the initial public net debt stock ratio must be matched by the present value of expected future primary surpluses and expected future seigniorage (all expressed as ratios to GDP). 1/ Both the real interest rate and economic growth rate are assumed to be given.

For operational purposes, the requirement that the present value budget constraint be satisfied (ex ante) imposes quite weak restrictions on the behavior of the fiscal and monetary authorities for a number of reasons discussed below. First, if projected output growth exceeds the real interest rate, the debt ratio will eventually reach a steady-state level, albeit at a possibly high level. 2/ If this condition holds, no constraint would in principle be imposed on government borrowing since the government may continue to run indefinitely a constant primary deficit and service its debt by further borrowing. The choice between taxation and borrowing would be determined solely by efficiency and distributional criteria.

From a policy perspective, both the size of the (stabilized) debt ratio and the time it takes to reach this level are relevant concerns. 3/ The weakness of relying upon the budget constraint criterion

---

1/ The solvency condition may also be expressed in terms of the requirement that government net worth be non-negative by rearranging terms.

2/ In a global sense, it may be argued that the steady-state norm is a real interest rate above output growth although individual countries at different stages of economic development may experience prolonged periods when the reverse is true. See Abel and others (1986).

3/ For example, in a recent analysis of the sustainability of Indian public debt, it is shown that the public debt ratio would stabilize at 102 percent by the year 2000 (see Chealliah (1990)).

is that during the adjustment period, shocks to the economy, as well as endogenous changes in the level and composition of wealth, may induce movements in interest rates and output. For example, the government may initially be running a primary budget deficit that, under a situation with economic growth above the real interest rate, can be sustained without exploding debt. However, the underlying equilibrium may not be stable insofar as accumulated wealth in the hands of the private sector may lower private savings. By reducing the demand for bonds, the resulting rise in the interest rate could overshoot economic growth, moving the economy to a new equilibrium that under present fiscal policy would result in an exploding debt. 1/

Second, imposing an intertemporal budget constraint on government behavior does not in itself set limits on whether the ratio is stabilized or its ultimate size. A wide range of feasible fiscal rules whereby budget balances respond to public indebtedness may satisfy the condition of solvency but imply unbounded debt (see Spaventa (1987)). For example, the government may pursue a constant overall fiscal deficit under conditions of zero nominal growth or run a budgetary deficit that grows at a rate below the interest rate but higher than nominal GDP growth.

The size of the public debt ratio (as distinct from its growth rate) may be a critical factor influencing the private sector's perception of the government's commitment to meet the present value budget constraint as well as its ability to do so. Satisfaction of equation (5) requires only that at some future period, the government is expected by the private sector to generate future primary budget surpluses. However, as the debt ratio continues to grow, the government's credibility to meet its budget constraint is likely to be eroded. Furthermore, the larger the outstanding debt ratio and the longer policy action is postponed,, the greater the magnitude of the primary surplus needed to meet the budget constraint. The feasible tax constraint may then come into play with the result that a set of fiscal policies that initially meet the constraint may become unsustainable in the longer run. 2/

2. Ex ante and ex post solvency and debt stationarity

In translating the government's intertemporal budget constraint into an operational criterion, the distinction between ex ante and ex post satisfaction of the constraint is a fundamental one. As already noted, on an ex post basis, the constraint must be met, whether through fiscal retrenchment, monetization or debt repudiation and restructuring. However, any given set of fiscal and monetary plans may

---

1/ See the analysis in Masson (1985).

2/ Two conditions are needed to rule out the existence of a limit to the sustainable tax burden; a rising tax ratio has no disincentive effects on private sector behavior and has no adverse effects on income distribution. See the discussion in Spaventa (1987, p. 382).

violate the constraint on an ex ante basis. Summary measures attempt to assess the magnitude of this ex ante departure. 1/ As demonstrated in Section III, simple indicators of debt or tax burden such as a rising trend in the ratio of public debt to GDP or an increasing tax ratio may give a misleading picture of government solvency insofar as they fail to capture this ex ante measure.

The above distinction is also relevant to recent studies examining the empirical implications of the present value budget constraint for the conduct of fiscal policy (see, for example, Hamilton and Flavin (1986)) and the relationship between the concepts of sustainability and stationarity (see Engle and Granger (1987)). Recent tests of the stationarity of debt using cointegration analysis provide empirical information on the determinants of long-run equilibrium public debt, for example the role of external debt and demographic factors. 2/ The appropriate question is not whether the government will satisfy its budget constraint but rather to identify the various feedback mechanisms and fiscal rules whereby a long-run equilibrium debt level has been achieved in the past. For example, this methodology may be used to determine whether fiscal consolidation efforts by industrial countries in the 1980s acted in a stabilizing manner to ensure long-run debt equilibrium. 3/

3. Sustainability and private sector behavior

A fundamental issue is whether "model free" indicators of fiscal sustainability are meaningful for the purposes of country and multilateral surveillance. A distinction may usefully be drawn between the objectives of assessing government solvency and fiscal policy sustainability. By definition, a government is solvent if equation (5) is met; that is, if the present value of the government's spending program is equal to its net worth.

1/ It may be argued that if the private sector believed that the government would always behave in a way that would satisfy equation (5), no distinction need be made between ex ante and ex post satisfaction of the budget constraint. However, it is the lack of policy credibility and uncertainty about the future path of policies, particularly in the face of large and growing debt ratios, that makes sustainability a substantive policy issue.

2/ The small size of the post-World War II sample period may, in part, explain why cointegration tests generally fail to reject the hypothesis of non-stationarity. However, even where non-stationarity cannot be rejected for the main industrial countries using post-World War II data, the public debt-to-GDP ratio tends to move systematically with other non-stationary variables, including demographic factors. See Horne, Kremers and Masson (1989).

3/ See, for example, evidence based on cointegration analysis presented in Kremers (1989) which suggests that stabilizing feedback mechanisms broke down in the United States in the 1980s. See also the empirical evidence presented in Horne and Mansur (1991).

In assessing fiscal policy sustainability, it is necessary to determine whether the government can continue to pursue indefinitely its set of fiscal policies (for example, tax and expenditure ratios). For the purpose of this analysis, debt sustainability is identified with a stable long-run equilibrium path of the economy. 1/ The paths of these policies will depend upon assumptions concerning private sector savings and investment behavior which interact with the policies to determine the paths of interest rates and economic growth. The pursuit (or postponement) of fiscal consolidation programs may, itself, influence interest rates and economic growth through, for example, interactions between public debt stocks and risk premia, and between the composition of public expenditure, taxes, and economic growth. If these interdependencies are ignored, an assessment of policy sustainability based on the solvency constraint may either give misleading signals or worse, fail to provide an early warning signal of an impending speculative attack on public debt or foreign reserves.

Once allowance is made for forward-looking expectations on the part of private agents, further conceptual difficulties arise in deriving indicators based upon equation (5) to assess policy sustainability. 2/ The problem may be framed in the following way: if the economy is expected to move along an unsustainable path, some mechanism will occur to prevent this. Assuming private agents have forward-looking expectations, then current and dynamic paths of economic variables, and in particular, asset variables such as real interest rates and real exchange rates will alter to induce private agents to held government debt. Through induced movements in expenditures and revenues, the projected path of the primary balance will also incorporate private sector expectations. Furthermore, the timing of the policy reversal or possible debt default will be in part determined endogenously by private sector behavior in response to trigger mechanisms such as a large, unexpected disturbance that may result in a speculative attack on debt. 3/ In recent literature (see, for example, Alesina and others (1989)), it is argued that the probability of a self-fulfilling run on government debt may be positively related to the liquidity of public debt. As the average maturity of debt shortens, the probability of a confidence crisis increases, initiated by a reluctance by investors to roll over public debt. 4/

1/ "A sustainable level of public debt is therefore one that allows the economy, in the absence of unanticipated shocks, to converge to a steady state" (Zee (1988, p. 666)).

2/ A more detailed discussion is given in the context of assessing external sustainability in Horne (1991).

3/ See, for example, Calvo and Guidotti (1990) and Ize and Ortiz (1987).

4/ In the model by Alesina and others (1989), this result is due to the assumed non-linearity of tax collection costs. By holding a long and more evenly balanced maturity structure, the government can reduce the cost of responding to a crisis by raising taxes since the tax burden is distributed over several periods.

Simple measures of solvency fail to capture the essence of unsustainability--the probability of an impending policy switch. They need to be used interactively with market indicators of private sector response, for example the discount on secondary market debt or observation of movements in the real interest rate on domestic public debt relative to market substitutes. An index of fiscal sustainability is preferred since it would also provide some sense of the vulnerability of the economy to speculative runs as reflected, for example, through a rising probability of a policy switch. 1/

4. Sustainability and optimality

There is considerable confusion in recent policy debate in relation to external sustainability and domestic fiscal policy arising from the failure to distinguish clearly between normative and positive economic criteria. Some writers have argued that it is preferable to formulate sustainability criteria solely in terms of positive economic criteria (see, for example, Zee (1988)). The rationale is that, depending on shocks to the economy, parameter values and policymakers' preference functions, a sustainable path of fiscal policy is consistent with an infinite set of steady state debt levels.

Policymakers and others are, however, generally not indifferent to the long-term level at which public debt is stabilized. For example, in several of the main industrial countries, notably the United States, Italy and the United Kingdom, official medium-term targets for public debt or fiscal balance were set. 2/ On theoretical grounds, the appropriate medium-term objectives for fiscal balance and the level of sustainable and optimal debt may be determined endogenously by maximization of the government's intertemporal social welfare function under the solvency constraint. For example, these targets may be quantified using optimality criteria such as the neoclassical steady-state path along which per capita consumption is maximized. In more recent policy discussions, it has been argued that, in the face of recent marked declines in national savings ratios in many industrial countries, fiscal consolidation should be directed toward achieving targeted increases in national savings rates. The latter targets need not be consistent with optimality criteria.

1/ An index of external sustainability that measures the probability of a future switch in fiscal policy is also derived in Horne (1991). This index is systematically related to the targeted debt-to-GDP ratio as well as private sector behavioral coefficients.

2/ The existence of spillover effects of fiscal policies also means that national fiscal targets would need to be consistent in an ex ante global sense to avoid inconsistency in external balance objectives. In the context of recent literature on policy coordination (see, Horne and Masson (1988)), these spillover effects also imply that independent optimizing behavior by domestic residents and by governments may result in outcomes that, while sustainable and nationally optimal, are not globally optimal.

Policymakers generally appear to prefer a lower stabilized public debt ratio to a higher one for two main reasons; the desire for increased fiscal maneuver and for lower real interest rates. The existence of a high debt-servicing component in total public expenditure is the price paid for higher past levels of government expenditure and acts to reduce the scope for present and future spending plans. In the face of rigidities in other expenditure items (see Tanzi (1986)) and limits to raising taxes, there is limited flexibility for governments to adjust fiscal policy in the event of unexpected adverse shocks. 1/

The possible linkages between a rising public debt and high interest rates have been discussed extensively in the literature (see, for example, Chouraqui and others (1986), Masson (1985)). The two main channels of transmission whereby a rising stock of public debt may induce a rise in real interest rates are the macro-crowding-out effect and the portfolio effect or risk premium (country or issuer-specific) arising from imperfect asset substitutability. While cross-country empirical studies suggest the existence of fairly weak linkages, recent work on Italy suggests that the combined effect of the two channels may be quantitatively significant (see Cottarelli and Mecagni (1990)). 2/

5. Sustainability of monetary-fiscal policy mix and seigniorage

The discussion thus far has focused on the policy choice between borrowing and future fiscal retrenchment through, for example, higher taxes. 3/ Sargent and Wallace (1981) argue that an initial stabilization policy of disinflation and financing of the budget deficit through increased borrowing may eventually involve higher expected and actual inflation. As the debt stock grows, to hold future fiscal

---

1/ The problem of scope for fiscal maneuver has also been exacerbated by increased tax competition in the face of global integration of goods and assets markets as well as recent efforts toward tax harmonization by members of the European Community in the context of the 1992 single market initiative.

2/ For those countries in which similar empirical results are shown to hold, the case for fiscal consolidation through a permanent reduction in the budget deficit is strengthened since a more restrictive fiscal policy would thereby carry a "bonus" by driving down real interest rates relative to economic growth.

3/ The issue of choice between borrowing and running down foreign exchange rate reserves is ignored. Under a regime of fixed exchange rates (which requires long-run convergence of inflation rates), a related issue that has received considerable attention in the literature is the sustainability of the fiscal and exchange rate (monetary) regime policy mix. As emphasized in recent literature on exchange rate regime switching, under fixed exchange rate regimes, a speculative run on foreign reserves may also identify an unsustainable fiscal situation. See, for example, Krugman (1979).

deficits constant requires higher revenue from seigniorage and higher future inflation. 1/

From equation (2), the higher the revenue from seigniorage, the less the required fiscal adjustment to meet the budget constraint. However, seigniorage has been a negligible source of revenue for the main industrial countries with the exception of Italy, yielding on average about 0.2 percent of GDP in the past decade. 2/ The revenue from seigniorage that would be required to meet ex ante the budget constraint, given a constant targeted debt ratio and primary deficit is given by (6);

$$\lambda_t m_t = \bar{d}_t + (r-n)\bar{b}_t \qquad\qquad (6)$$

The higher the primary deficit as a proportion of GDP, the greater the seigniorage needed to satisfy the budget constraint. But there exists an upper limit on optimal revenue from seigniorage which limits the scope for the use of seigniorage by governments to finance permanently primary deficits. The policy implications of a positive gap between the seigniorage that would be consistent with a stabilized debt ratio and current seignorage revenue are therefore neither clearcut nor of particular relevance for the larger industrial countries. An assessment of the sustainability of the macro policy mix, however, may be derived from market perceptions of inflation as revealed, for example, by survey data and market indicators. For example, a sharp rise in long-term interest rates relative to short-term nominal interest rates would indicate rising inflationary expectations and, together with indicators of fiscal solvency, the perception of possible future monetization of the deficit.

6. Fiscal and external solvency

In the preceding analysis, it is assumed that budget deficits are financed solely from the issue of domestic bonds. However, in most of the industrial countries in the 1980s (with the exception of Italy), a considerable proportion of public debt was financed externally. Criteria of external solvency may be derived to assess whether the economy is likely to violate ex ante its consolidated present value budget constraint--the condition that the present value of trade surpluses must equal the stock of outstanding net external debt, all

---

1/ The terms, monetization and monetary financing of the deficit are used interchangeably in the discussion. See, however, Spaventa (1987, pp. 386-395) in which monetization is defined as a sharp and unexpected rise in the price level to reduce the real value of debt as compared to the choice between different degrees of monetary financing and steady-state inflation rates.

2/ See, for example, the analysis in Buiter (1985) and Dornbusch (1989).

expressed as ratios of GDP. The two key linkages between fiscal and external solvency are discussed below. 1/

First, government solvency is neither a necessary nor sufficient condition for external solvency. The behavior of the private sector is a crucial link in explaining any divergences between fiscal and external solvency. From the national income savings-investment identity in an open economy, any increase in government dissavings (the excess of government recurrent expenditures over revenue), given private savings and national investment behavior, will induce an increase in the current account deficit. However, government solvency need not be sufficient for external solvency (and sustainability) if private sector behavior is destabilizing while private sector behavior may be stabilizing when the fiscal position itself implies insolvency. Second, in a neoclassical theoretical framework in which current account imbalances are determined as the outcome of inter-country differences in productivity, time preference and government borrowing and lending policies, an external objective must be consistent with the chosen fiscal target, given private sector behavior. In a global setting that would allow for policy spillover effects, ex ante fiscal targets would also need to be consistent to avoid the possibility of conflict with other countries' implicit external targets.

III. Measures of sustainability

The relative and overall strengths and weaknesses of summary measures of fiscal sustainability are discussed in this section in the context of their recent application to industrial countries. 2/ The indicators attempt to assess the magnitude of any medium- or long-run inconsistencies in fiscal plans and measure the size of the permanent fiscal adjustment needed to achieve stabilization of the base year public debt-to-GDP ratio. Since a common methodological framework is used, the measures discussed below differ according to the assumed policy planning horizon and definition of government net worth. A critical assumption that underlies all the indicators is that the variables under consideration--the primary fiscal balance (and its components), real interest rates and output growth, are independent of each other. The longer the planning horizon, the less plausible is this assumption. Only the long-term indicator takes into account induced changes in expenditure arising from demographic (and other) factors.

1. Definition of measures

Measures of fiscal sustainability are proposed in Buiter (1985) that estimate the annuity value of the discrepancy in the government's ex ante balance sheet or the permanent adjustment needed to maintain a constant ex ante share of public sector net worth to trend output. The

---

1/ An algebraic presentation is given in Appendix 1.
2/ See OECD (1990), IMF (1990b) and Chouraqui and others (1990).

three OECD measures of fiscal sustainability--primary gap, medium and long-term tax gaps--are equivalent to simplified net worth measures. The various measures are defined and discussed below.

a. Constant net worth deficit

$$k_1 = g(r-n) - w \qquad (7)$$

where g = ratio of primary fiscal balance to GDP
       w = ratio of public sector net worth to GDP

The condition for government solvency may be expressed as the requirement that government net worth be non-negative, that is the present value of the primary fiscal balance equals government net worth. 1/ A measure of the required fiscal adjustment (in present value terms) to maintain positive net worth is given by k_1. A positive sign indicates unsustainability and a need for a reduction in current and projected government outlays or increase in taxes while a negative sign indicates the margin for increasing the primary fiscal deficit (the excess of government revenue over non-interest government expenditure) yet maintaining sustainability. 2/

There have been some attempts to construct public sector balance sheets (see, for example, Hills (1984), Eisner (1986)) in order to assess government net worth. However, a number of methodological and measurement problems limit their practical usefulness and these measures will not be discussed in the present paper. 3/

b. Primary gap (Blanchard (1990))

$$k_2 = s^* - s = (r-n)b_o - s \qquad (8)$$

where s^* = primary surplus $(= - d)$

The primary gap is conceptually equivalent to the constant net worth deficit (see Table 1), and measures the required adjustment in the primary deficit needed to stabilize the outstanding public debt-to-GDP ratio, given the current and projected paths of the primary balance, the

_____

1/ Government net worth may be defined narrowly, for example, as the difference between the present discounted value of the primary surplus less the initial ratio of public indebtedness or broadly to include items such as receipts from sales of public assets and contingent liabilities (see Buiter (1985)).

2/ The sustainability condition is defined asymmetrically to exclude only exploding (not imploding) debt.

3/ These problems include the treatment of valuation changes in government assets and liabilities, estimation of capital formation and depreciation and assessment of contingent liabilities. See Blejer and Cheasty (1990).

real interest rate and output growth. 1/ The primary gap equals the difference between the primary surplus that stabilizes the outstanding public debt-to-GDP ratio and the current primary fiscal surplus or deficit. The benchmark indicator is zero with a positive sign indicating the need for fiscal retrenchment. This measure is based on the assumption that present fiscal policy will be unchanged in the future. Its advantage, relative to the other measures, is that the derivation requires minimal information--the present primary balance, base year public debt-to-GDP ratio and trend real interest rates and output growth. The potential disadvantage is that by ignoring future official budgetary projections, for example, impending fiscal retrenchment plans, the indicator may give a misleading signal about the underlying fiscal situation. However, at least for fairly short planning horizons, use of the primary gap gives a broadly similar picture of sustainability to that of the three-year tax gap, as discussed below (see Chart 1). 2/

 c. Medium-term tax gap (Blanchard (1990))

$$k_3 = t^* - t = \sum_{i=1}^{n}(g + h)/n + (r-n)b_0 - t \tag{9}$$

where h = ratio of transfers to GDP.

 The medium-term tax gap measures the required adjustment in the tax ratio needed to stabilize the outstanding public debt ratio, given the projected path of non-interest expenditures and transfers, expressed as a ratio to GDP, real interest rate and economic growth. It equals the difference between the tax ratio, t^* , consistent with a stabilized initial public debt-to-GDP ratio approximated by the average of projected government spending and transfers as a ratio of GDP and the debt-dynamics term, and the current tax ratio. 3/ The benchmark case is zero with a positive sign suggesting the need for a rise in the tax ratio (or a reduction in the expenditure ratio) to achieve solvency (a negative sign indicates the margin for tax reduction). The main advantage of this measure is that it highlights the size and feasibility of the required transfer of resources that would be needed to ensure that a given set of public sector expenditure commitments meet the solvency constraint.

 d. Long-term tax gap

 The long-term tax gap is similar to the above measures but extends the planning horizon to 30-40 years and allows for induced changes in

---

 1/ The primary gap is derived from the budget identity given by equation (1), assuming no monetary financing and setting the change in debt stock equal to zero.
 2/ A similar finding is obtained in OECD (1990).
 3/ See Blanchard (1990) for the derivation of the sustainable tax ratio. The choice of fiscal instrument is arbitrary as long as all the variables are assumed independent of each other.

government expenditures through demographic and other factors. This measure is useful for assessing fiscal solvency in those countries, such as Japan, in which the rapid aging of the population is projected to have substantial adverse effects on government expenditures. Evidence that the medium-term budgetary gap measures switch sign in some countries when allowance is made for these long-term induced expenditure effects suggests that the indicators are quite sensitive to the long run time path of government expenditures as might be expected (see IMF (1989, 1990b)).

2. Application of measures

Table 1 provides some illustrative numerical examples that highlight the sensitivity of the indicators to changes in the three components; the initial public debt ratio, discount rate (r-n), and the projected path of the primary fiscal balance. In Case A, with a projected primary surplus of 1 percent of GDP and discount rate of 0.05 percent, the present value of the primary balance equals 20 percent of GDP. Compared to an assumed outstanding public debt stock of 30 percent of GDP, government net worth is -10 percent of GDP. The present and projected path of fiscal policy is clearly unsustainable and requires an increase in the discounted value of the primary surplus of 10 percent of GDP (k_1) or, equivalently an increase in the permanent surplus by 0.5 percent of GDP (k_2).

In case B, the projected primary surplus is assumed to be higher by 0.5 percentage points, resulting in zero government net worth and a switch to sustainability ($k_1 = k_2 = 0$). In case C, an assumed reduction in the discount rate of 0.02 percentage points raises the indicator in proportion to the size of the outstanding debt ratio, increasing the present discounted value of the projected primary surplus by 3 percentage points with the result that government net worth now becomes positive and the projected fiscal policy is sustainable. Case D shows that a reduction in the initial debt ratio of 10 percentage points is equivalent, in terms of its effect on the indicator, to a 0.5 percentage point rise in the projected primary surplus.

Table 1. Illustrative Examples of Indicators [1]/

(In percent of GDP)

	Discount Rate $(r-n)$	Primary Surplus	Present Discounted Value of Primary Surplus	Initial Public Debt Ratio	Net Worth	Sustainable Primary Surplus	k_1	k_2
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A	0.05	1.0	20	30	-10	1.5	-10	0.5
B	0.05	1.5	30	30	0	1.5	0	0
C	0.03	1.0	33	30	3	0.9	3	-0.1
D	0.05	1.0	20	20	0	1.0	0	0

[1]/ k_1 = constant net worth deficit { col. (7) = col. (3) - col. (4) }

k_2 = primary gap { col. (8) = col. (6) - col. (2) }

From the numerical results presented in Table 1, it is clear that the indicators are relatively more sensitive to changes in the domestic and global economic environment as captured by the discount rate term, particularly for countries with large outstanding public debt ratios. Since only direct impact effects of either a reduction in interest rates or rise in output growth are captured, the full impact effect on the indicator may be underestimated because of linkages between output growth, interest rates, and budgetary balances. [1]/

A change in the perception of domestic and global trends may have a quite significant effect on the indicator and consequently an assessment of whether fiscal solvency has acted as a particularly restrictive constraint for the setting of medium-term fiscal policies of industrial countries in the 1980s (and in the 1990s). For example, assuming an average real growth rate of 3 percent, real interest rate of 8 percent, and an initial net public debt ratio close to the weighted G-7 average of 32 percent in 1989, would require a sustainable primary fiscal surplus of about 1.7 percent of GDP to stabilize the 1989 debt ratio, somewhat, above the G-7 average primary surplus of 1.5 percent of GDP. However, a shift toward a more favorably perceived economic environment, for example, a fall in real interest rates to 6 percent, or an increase in economic growth to 5 percent, would require a sustainable primary surplus of only 1 percent of GDP, well below the G-7 average.

_____

1/ See, for example, the calculations presented in Chouraqui, and others (1986) and IMF (1990b).

3. Evaluation

    The main advantage of using summary measures of sustainability is
that they are relatively simple to construct, being model-free and based
on forecasts of a restricted information set. Provided the indicators
are constructed from data sets based on broadly similar definitions,
these properties make them a particularly attractive tool for cross-
country comparisons. However, like any simple empirical indexes, the
measures are subject to a number of limitations. There are three main
areas of weakness; lack of behavioral content, inclusion of implicit
normative criteria and the absence of a global or systemic perspective.

    a. Behavioral content

    The above measures exclude any explicit modeling of the economy.
However, any projections of the paths of expenditures and revenues
implicitly assume a given path of output and interest rates. In the
absence of a specific economic model and information about the source of
economic shocks as well as possible policy response, the linkages among
the variables--theoretical and empirical--are not clearcut. For
example, the effect of a rise in the real interest rate on output will
depend upon whether the interest rate change reflects a temporary
response to a tightening of monetary policy or a permanent response to
underlying resource pressures. 1/ The danger of ignoring these
interrelationships is that any policy adjustment undertaken to achieve
sustainability, for example, a reduction in public investment that acts
to lower future economic growth, may thereby enlarge the gap in future
periods. 2/ These interdependences also mean that the sustainability of
the monetary-fiscal policy mix as well as overall fiscal policy may
affect the medium-term paths of real interest rates and economic growth.

    Earlier estimates based on the OECD Interlink model (see Chouraqui
and others (1986)) suggest that the above effects are fairly small. In
contrast, recent simulations based on MULTIMOD (see IMF (1990b)) show
that for the G-7 countries, the initial impact effect on the medium-term
budget gap of a one percentage point rise in the interest rate tends to
be magnified by a factor of about two. 3/

    b. Normative criteria

    From an individual country perspective, the initial public debt
level is arbitrary and may differ significantly from official budgetary
targets. The larger the size of the (positive) gap between the initial
and targeted debt ratio, the more the measures will err on the side of

---

    1/ See the discussion in IMF (1990b).
    2/ For empirical evidence on the relationship between public
investment and economic growth, see, for example, Tullio (1987).
    3/ It should be emphasized that this simulation result is model-
specific and assumes the interest rate response is to a tightening of
monetary policy.

presenting an overly optimistic picture of government solvency. A
sensitivity analysis of the indicators applied to industrial countries
over the 1980s suggests that the broad inferences remain unchanged if
the weighted G-7 debt ratio is substituted for individual country
ratios. However, it should also be recognized that allowance for
official debt targets may have a significant bearing on the speed and
nature of the required macro adjustment effort to achieve debt
stabilization.

c. Perspective

The formulation and interpretation of indicators of sustainability
is necessarily influenced by the perspective that is adopted;
specifically, from a lender, borrower or global viewpoint. The above
measures reflect primarily the perspective of the borrower with the
burden of policy adjustment assumed to fall solely upon the borrowing
country.

From a lender's viewpoint, primary concern is with assessing the
ability of the borrower to meet debt service commitments to avoid
default as well as the borrower's willingness to repay. As long as
private and public debt (and domestic and foreign debt) are perfect
substitutes, no financing constraints on the part of the lender arise.
If, however, these assets are imperfect substitutes, a financing
constraint may arise from portfolio preferences as reflected in risk
premia on domestic government debt. Alternatively, if a global
perspective is adopted, then the focus would shift to the possibility of
shared macro policy adjustment arising from policy interdependences. If
the indicators are to be used for the purpose of an international
assessment of fiscal sustainability, the lack of a global perspective
limits the usefulness of the exercise, suggesting that a full analysis
of fiscal policy interactions is best handled by model simulations such
as MULTIMOD. 1/

d. Debt ratios and sustainability indicators

Public debt ratios and sustainability indicators are not
conceptually equivalent (the former measures the actual or ex post ratio
of the outstanding stock of public indebtedness to GDP while the latter
are ex ante measures of the required permanent fiscal adjustment needed
to stabilize the base year public debt ratio). Nevertheless, in view of
some of the limitations and additional information needed to construct
the sustainability indicators, it may be asked whether simple debt
ratios provide a good proxy of government solvency.

1/ The relative magnitude of the effects of domestic policies and the
global economic environment on fiscal sustainability may also be
obtained by examining the responsiveness of the differential between
domestic real interest rates and the global interest rate (as well as
the output differential) to domestic policy variables such as fiscal
balance and public debt stocks.

Table 2 and Chart 1 show the net public debt-to-GDP ratio of the general government of the Group of Seven (G-7) countries together with the primary and medium-term tax gaps in each country simulated over the period, 1980-89. 1/ The most striking finding is that despite rising public debt ratios in most countries that prime facie would indicate increasingly unsustainable fiscal policies, the indicators are shown to be improving over the period. 2/

Table 3 shows the correlation coefficient between public debt ratios and the three-year tax gap indicator for each country over the period, 1980-89. In three countries, the coefficient is negative while it lies below 0.5 in a further three countries. Only in the United Kingdom are the two measures positively and highly correlated. Thus, the observed rise in public debt ratios in most of the G-7 countries until the last few years of the decade gives a misleading picture of fiscal solvency by failing to capture the decline in the indicators.

Table 3.   Industrial Countries: Correlation Coefficient between Net Debt Ratios and Tax Gap Indicators,1980-89

Canada	0.3
United States	-0.5
Japan	-0.2
France	0.4
Germany	-0.5
Italy	0.2
United Kingdom	0.7

1/ The discount rate used to derive the primary gap is the trend (1987-87) real interest rate on long-term government bonds net of trend output growth while that for the three-year tax gap is derived from a three-year moving average. In deriving the tax gap, the projected path of government expenditures and transfers in terms of GDP is proxied by a three-year moving average.

2/ A similar result is obtained by Chouraqui and others (1990). Based on end-1989 debt ratios, and using five-year budget gaps, a similar picture of fiscal sustainability is also found in IMF (1990b). However, the longer-term (50-year gap) measures that take into account induced effects on government expenditures of demographic factors, show unsustainable fiscal positions for most of the G-7 countries.

Table 2. Major Industrial Countries : Public Debt and Indicators of Fiscal Sustainability, 1980-89

(Percent of nominal GNP/GDP)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Canada										
Net debt	13.1	10.1	16.6	22.7	26.4	33.0	37.4	37.9	37.1	37.5
Primary gap	-2.3	-4.5	-1.1	0.1	-0.7	-0.7	-2.1	-2.7	-0.1	-0.3
Tax gap	-2.0	-2.1	-1.3	0.6	0.2	0.0	-1.2	-3.1	0.7	0.0
United States										
Net debt	19.3	19.0	22.1	22.6	25.6	27.6	29.7	31.1	30.6	30.2
Primary gap	-1.5	-2.4	0.0	0.7	-0.7	-0.6	-0.3	-1.1	0.0	-0.4
Tax gap	-0.1	0.7	1.6	2.0	1.4	0.5	0.7	-0.2	-0.5	-0.9
Japan										
Net debt	17.3	20.7	23.2	26.2	26.9	26.7	26.5	22.0	19.3	16.4
Primary gap	1.4	0.4	-0.1	-0.5	-2.2	-3.5	-3.4	-4.9	-2.7	-3.0
Tax gap	0.5	-0.4	-0.5	-1.0	-2.3	-3.6	-3.8	-5.5	-2.9	-3.3
France										
Net debt	14.3	14.2	17.8	19.9	21.1	22.9	25.2	25.6	25.2	24.7
Primary gap	-1.2	0.2	1.0	0.9	0.5	0.4	0.5	0.1	-0.2	-0.2
Tax gap	-1.7	-0.5	0.3	0.7	0.2	0.1	0.7	-1.5	1.7	0.2
Germany										
Net debt	14.4	17.5	19.8	21.4	21.7	22.1	21.7	22.9	23.7	22.1
Primary gap	1.4	1.8	1.1	0.1	-0.4	-1.2	-1.0	-0.5	-0.2	-0.3
Tax gap	0.1	0.7	0.1	-0.3	-1.4	-2.3	-1.8	-2.0	0.2	-1.0
Italy										
Net debt	53.9	57.8	63.4	68.7	74.4	81.3	86.2	89.9	97.3	94.3
Primary gap	3.9	5.5	4.4	3.4	3.9	4.8	3.4	3.4	2.8	1.8
Tax gap	0.5	2.9	4.6	3.4	4.2	3.6	3.2	2.4	3.9	2.4
United Kingdom										
Net debt	47.6	46.7	45.9	46.2	47.7	46.7	45.9	43.4	33.7	28.7
Primary gap	-0.3	-0.2	-1.3	-0.4	-0.1	-1.2	-0.5	-1.9	-2.6	-3.0
Tax gap	-1.2	-1.3	-0.6	0.2	-0.1	-0.3	-1.3	-2.6	-1.8	-2.8

Sources : Net public debt of general governemnt : Organization for Economic Co-operation and Development.
Primary and tax gap indicators : Horne (1990b).

- 20 -

CHART 1

Major Industrial Countries
Public Debt and Indicators of Fiscal Sustainability, 1980-89

(In percent of GNP/GDP)
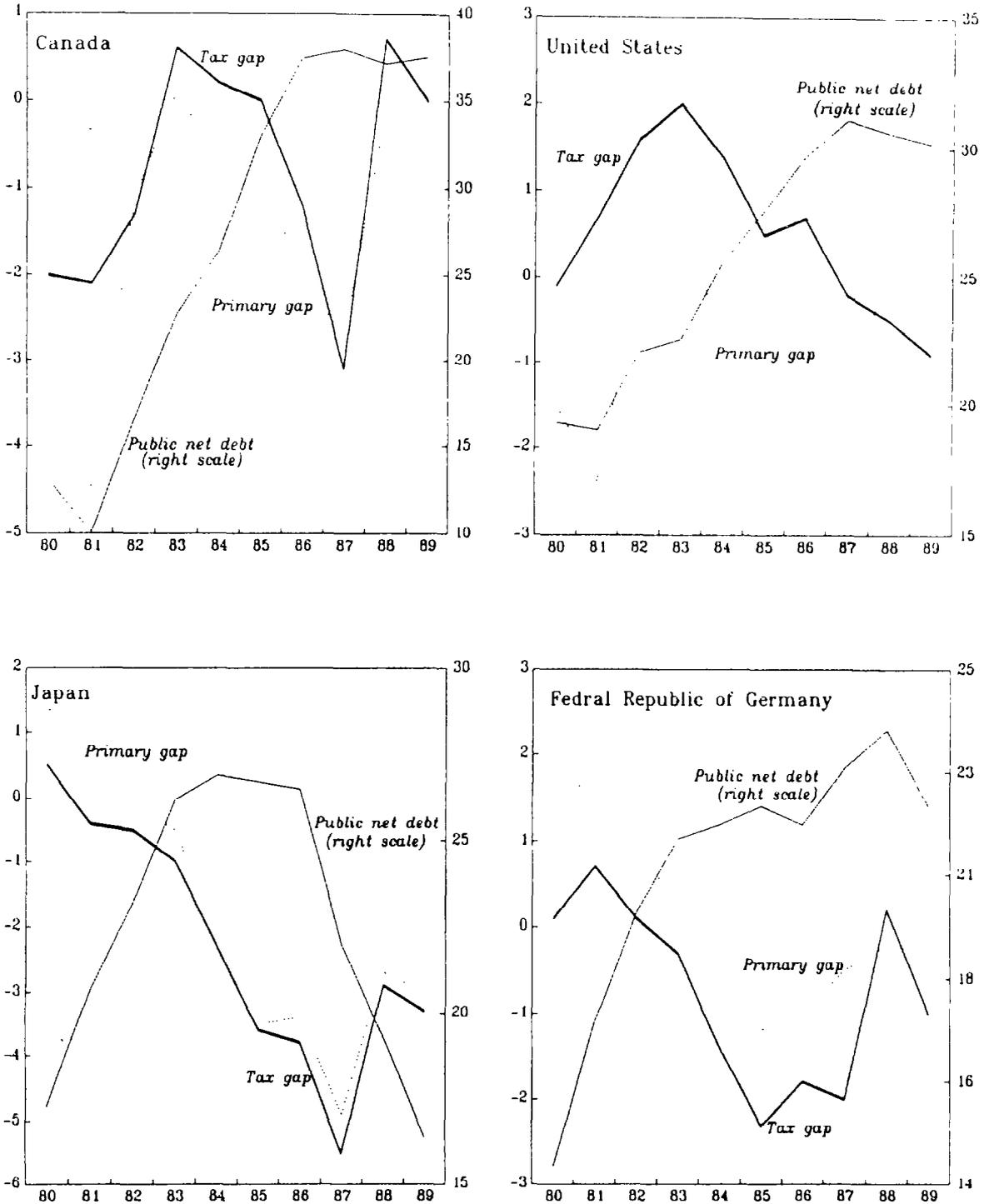
Sources : Organization for Economic Co-operation and Development; Horne(1990).

Chart 1 (Concluded)

Major Industrial Countries
Public Debt and Indicators of Fiscal Sustainability, 1980-89

(In percent of GNP/GDP)

France

Italy

United Kingdom
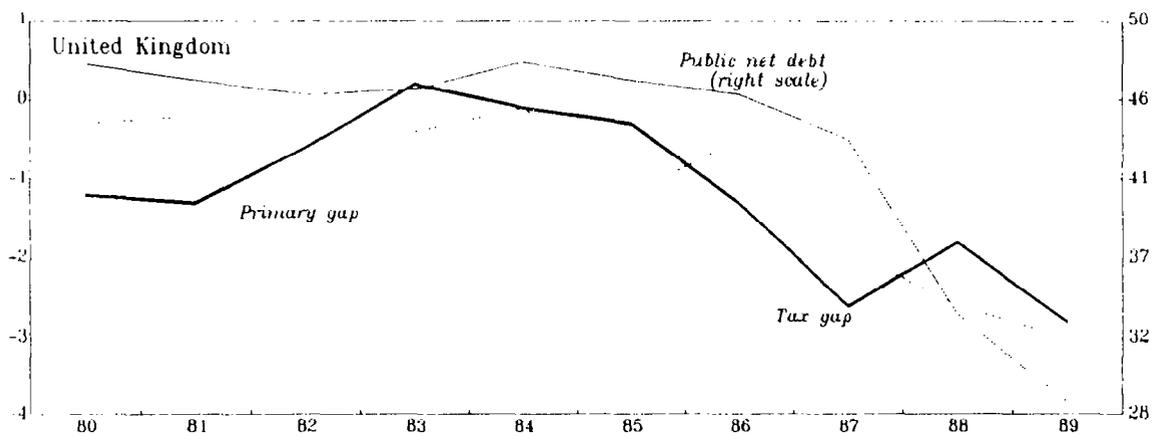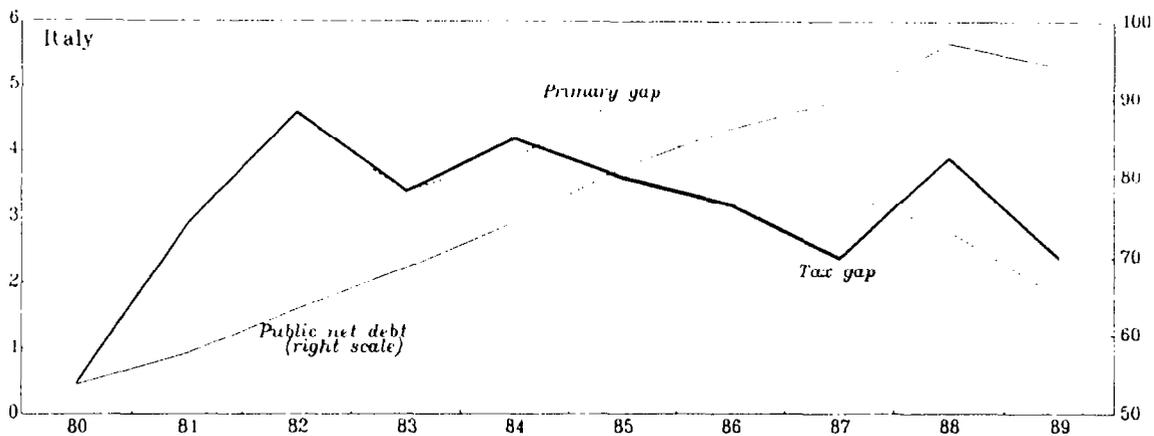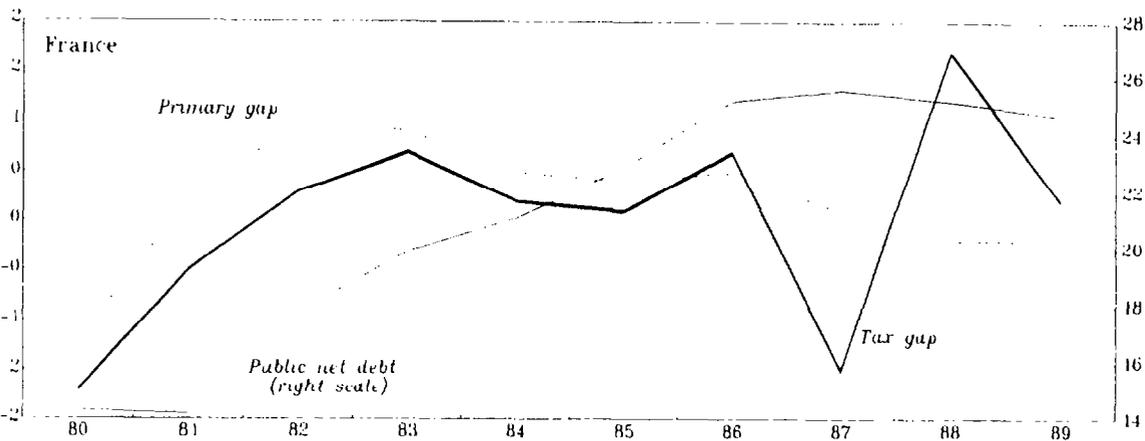
Sources : Organization for Economic Co-operation and Development; Horne(1990).

VI. Conclusions

An overall assessment of the usefulness of summary measures of fiscal sustainability needs to be made in the context of the specific purposes toward which these measures are to be directed. As an indicator of government solvency for a particular country, the measures serve a useful purpose although their relevance would be restricted to a fairly small set of countries with high debt leverage. As an indicator of fiscal policy sustainability for the purpose of multilateral surveillance, their usefulness is more problematic.

The main usefulness of the measures is to demonstrate that naive debt ratios are likely to be misleading indicators of either government solvency or fiscal sustainability. At the same time, the measures are subject to several limitations, related in particular to their sensitivity to the discount factor, time paths of government expenditures and private sector behavior. In this connection, their recent application to assessing fiscal policy sustainability in industrial countries needs to be treated with caution.

More recently, fiscal consolidation efforts in the industrial countries have shifted toward more ambitious goals of increasing national and global savings. Nevertheless, the setting of fiscal policies to achieve sustainability remains a relevant policy concern in most countries. In this regard, two priority areas of research may be identified; (i) application of the measures to other country groupings, especially smaller highly-indebted developing countries that face a largely exogenous global economic environment and which have sought to achieve fiscal consolidation under Fund supported programs; and (ii) the development and refinement of summary measures of fiscal sustainability to include behavioral content that would take into account endogenous private savings and investment behavior and thereby allow for extension to externally financed public deficits.

Fiscal and External Sustainability

The single period consolidated budget identity is given by (1A).

$$\dot{f}_t = tb + (r^* + e_t - n)f_t \tag{1A}$$

where $\dot{f} = EF^*/PY$ = ratio of net foreign assets
(in domestic currency) to GDP

E = number of units of domestic currency per unit of foreign currency

r^* = world real interest rate

$e_t = \dot{E}^*/E + \dot{P}^*/P$ = proportional real exchange rate depreciation

$tb = PTB/PY$ = ratio of primary trade balance to GDP

The solvency condition is given by equation (1B): growth in the net external debt-to-GDP ratio must be less than the foreign real interest rate adjusted for real exchange rate depreciation and output growth.

$$\lim_{s \to \infty} -f_s e^{-(r^*-e-n)(s-t)} = 0 \tag{1B}$$

Imposing the solvency condition on the intertemporal budget identity gives the economy-wide intertemporal budget constraint (equation (1C).

$$-f_t = \int_t^\infty (tb + a^*)e^{-(r^*-e-n)(s-t)}ds \tag{1C}$$

The present discounted value of future trade surpluses (the present value of domestic income less domestic absorption) must equal initial net external debt (private and public), all expressed as ratios of GDP.

References

Abel, A.B., N.G. Mankiw, L.H. Summers and R.J. Zeckhauser, "Assessing Dynamic Efficiency: Theory and Evidence," National Bureau of Economic Research Working Paper, No. 2097, 1986.

Alesina, Alberto, Alessandro Prati and Guido Tabellini, "Public Confidence and Debt Management: A Model and a Case Study of Italy," National Bureau of Economic Research Working Paper, No. 3135, October 1989.

Anand, Ritu and Sweder van Wijnbergen, "Inflation and the Financing of Government Expenditures: an Introductory Analysis with an Application to Turkey," The World Bank Economic Review, Vol. 3, 1989, pp. 17-38.

Bispham, J.A., "Rising Public-Sector Indebtedness: Some More Unpleasant Arithmetic" in M.J. Boskin, J.S. Flemming and S. Gorini, eds., Private Savings and Public Debt (New York: Basil Blackwell, 1987). pp. 40-71.

Blanchard, Olivier Jean, "Suggestions for a New Set of Fiscal Indicators," OECD Working Paper, April 1990.

Blejer, M.I. and A. Cheasty, "The Deficit as an Indicator of Government Solvency: Changes in Public Sector Net Worth," in M.I. Blejer and A. Cheasty, (eds.) The Measure of Fiscal Deficits: Analytical and Methodological Issues, International Monetary Fund, 1990, forthcoming.

Buiter, William, H., "A Guide to Public Sector Debt and Deficits," Economic Policy, Vol. 1 (November 1985), pp. 14-79.

Calvo, Guillermo and Pablo Guidotti, "Credibility and Nominal Debt: Exploring the Role of Maturity in Managing Inflation," Staff Papers, Vol. 37 (September 1990), pp.612-635.

Chealliah, Raja, "The Growth of Indian Debt. Dimensions of the Problem and Corrective Measures," Mimeo, 1990.

Chouraqui, Jean-Claude, Brian Jones and Robert Montador, "Public Debt in a Medium-Term Perspective," OECD Economic Studies, No. 7 (Autumn 1986), pp. 103-153.

_____, Robert Hageman and Nicola Sartor, "Indicators of Fiscal Policy: A Reassessment," OECD Economic Studies, No. 15 (Autumn 1990), pp. 7-36.

Cottarelli, Carlo and Mauro Mecagni, "The Risk Premium on Italian Government Debt, 1976-88, International Monetary Fund Working Paper, WP/90/38, April, 1990.

Engle, Robert F. and C.W. J. Granger, "Cointegration and Error Correction: Representation, Estimation, and Testing," Econometrica, Vol. 55 (March 1987), pp. 251-276.

Eisner, Robert, "Capital Gains and Income: Real Changes in the Value of Capital in the United States, 1946-77," in Dan Usher, ed., The Measurement of Capital (Chicago: University of Chicago Press, 1976).

Hamilton, James D., and Marjorie A. Flavin, "On the Limitations of Government Borrowing: A Framework for Empirical Testing," American Economic Review, Vol. 76 (1986), pp. 809-19.

Horne, Jocelyn, "Criteria of External Sustainability," International Monetary Fund Working Paper, European Economic Review, forthcoming, 1991.

_____, "Indicators of Fiscal Sustainability in Industrial Countries," mimeo, October 1990.

_____ and Paul Masson, "Scope and Limits of International Economic Cooperation and Policy Coordination," Staff Papers, Vol. 35 (June 1988), pp. 259-296.

_____ Jeroen Kremers and Paul Masson, "Net Foreign Assets and International Adjustment in the United States, Japan and the Federal Republic of Germany," International Monetary Fund Working Paper, WP/89/22, March 1989.

_____ and Assan Mansur, "Public Debt and Fiscal Rules," Mimeo, January, 1991.

International Monetary Fund, World Economic Outlook, (Washington April), 1989.

_____, (1990a) The Role of National Saving in the World Economy: Recent Trends and Prospects, Occasional Paper 67 (Washington March).

_____ (1990b) World Economic Outlook, (Washington October).

Ize, Alain and Guillermo Ortiz, "Fiscal Rigidities, Public Debt, and Capital Flight," Staff Papers, Vol. 34 (June 1987), pp. 311-332.

Kremers, Jeroen, "U.S. Federal Indebtedness and the Conduct of Fiscal Policy," Journal of Monetary Economics, Vol. 23 (March 1989).

_____, "Gaining Policy Credibility for a Disinflation: Ireland's Experience in the EMS," Staff Papers, Vol. 37 (March 1990), pp. 116-145.

Krugman, Paul, "A Model of Balance-of-Payments Crises,"
    Journal of Money, Credit and Banking, Vol. 11 (August 1979),
    pp. 311-25.

Masson, Paul R., "The Sustainability of Fiscal Deficits," Staff
    Papers, Vol. 32 (December 1985), pp. 577-605.

Organisation for Economic Co-operation and Development, OECD
    Economic Outlook, Vol. 47, June 1990.

Sargent, Thomas and Neil Wallace, "Some Unpleasant Monetarist
    Arithmetic," Quarterly Review, Federal Reserve Bank of Minneapolis,
    Vol. 5 (1981), pp. 1-17.

Spaventa, Luigi, The Growth of Public Debt: Sustainability, Fiscal
    Rules, and Monetary Rules," Staff Papers, Vol. 34 (June 1987),
    pp. 374-399.

Tanzi, Vito, "Public Expenditure and Public Debt: An International
    Perspective," in John Bristow and Declan McDonagh, eds., Public
    Expenditure--The Key Issues (Dublin: Institute of Public
    Administration, 1986), pp. 6-37.

_____ and Mark Lutz, "Interest Rates and Government Debt:
    Are the Linkages Global Rather than Global?," Paper presented to a
    Symposium on "The Political Economy of Public Debt," Netherlands,
    June 1990.

Tullio, Giuseppe, "Long Run Implications of the Increase in Taxation and
    Public Debt for Employment and Economic Growth in Europe," European
    Economic Review, Vol. 31 (1987), pp. 741-780.

Zee, Howell H., "The Sustainability and Optimality of Government
    Debt," Staff Papers, Vol. 35 (December 1988), pp. 658-685.