

WP/88/60

INTERNATIONAL MONETARY FUND

Research Department

Criteria of External Sustainability

Prepared by Jocelyn Horne*

Authorized for Distribution by Michael P. Dooley

July 11, 1988

Abstract

This paper analyzes the main conceptual issues that arise in assessing external sustainability with a view toward developing operational criteria for the purposes of multilateral surveillance. The main contribution of the analysis is to show how conditional forecasts of external imbalance may be generated in a consistent way that explicitly incorporates a mechanism for achieving sustainability. An index of external unsustainability is also derived that reflects the probability of future changes in policies expected by private agents over time.

JEL Classification Numbers:

431; 432

* I have benefited greatly from discussion on these issues and on earlier drafts of the paper with James Boughton, Max Corden, Michael Dooley, Robert Flood, Graham Hacche, Paul Masson, Kenichi Ohno, David Vines, and Howell Zee.

<u>Contents</u>	<u>Page</u>
I. Introduction	1
II. Analytical Framework	6
1. Intertemporal budget constraints	6
2. Policy sustainability	10
3. Unsustainability	12
III. Conditional Forecasts of Current Account Imbalance	14
1. Stochastic rational expectations model	16
2. Conditional and unconditional forecasts	11
3. Numerical example	13
IV. Operational Criteria of External Sustainability	14
1. Purchasing power parity criterion	14
2. Capacity to pay criteria (baseline projection of foreign debt to GNP ratios)	15
3. Krugman (consistent expectations) criterion	16
4. Global medium-term scenarios model	16
V. Conclusions	18
Table 1. Conditional Forecasts of Real Wealth and Index of External Unsustainability	13
Figure 1. Indices of External Unsustainability	14a
References	20

I. Introduction

The problem of defining and identifying external disequilibrium has always been a central focus of efforts directed toward multilateral surveillance of the international monetary system. In place of the earlier debate on the problem of identifying "fundamental disequilibrium" of countries operating under the Bretton Woods adjustable peg system, the issue of "external sustainability" has been the object of recent policy discussion. 1/ The resurgence of interest in this issue has arisen from two developments in the world economy in the 1980s; the widespread debt servicing problems of some large developing countries, and the large and persistent current account imbalances of the three main industrial countries.

The purpose of this paper is to examine the main conceptual and operational issues that arise in assessing external sustainability with a view toward developing operational criteria for the purposes of multilateral surveillance. At an operational level, the problem is one of assessing whether present paths of external imbalance can continue indefinitely, conditional on present policies being maintained. However, if the forecast path of current account imbalance is expected to be unsustainable, some mechanism will occur (for example, debt relief, policy switch or a change in private sector behavior) to prevent this, thereby altering future paths.

The main contribution of this paper is to show how such conditional forecasts of external imbalance may be derived in a consistent way that explicitly incorporates a mechanism for achieving sustainability. An index of external unsustainability is derived that reflects the probability of future changes in policies expected by private agents over time. This index is systematically related to chosen sustainability criteria such as the level at which the external debt to GNP ratio is stabilized and structural parameters of current account determination. It may thereby serve as a "warning signal" of the gravity of the external situation and the urgency of the need for policy response.

Many different definitions of external sustainability have been proposed in the literature and in recent policy discussions. 2/ For example, Marris (1985, p. 204) adopts a target of current account balance in 1990 for the United States. Salop and Spitaeller (1980, p. 102) define a sustainable current account as one that is consistent with continued financial solvency and economic viability. Krugman (1988) defines sustainability of the exchange rate in terms of the fulfillment of exchange rate

1/ See, for example, the discussion in IMF (1987a,c).

2/ Earlier policy views are discussed in Salop and Spitaeller (1980, pp. 123-128).

expectations or the absence of the need for these expectations to be revised. Crockett and Goldstein (1987, p. 38) adopt a broad definition of sustainability; in addition to the requirement that the country has the capacity to service debt out of current foreign exchange earnings, the resulting outcome needs to be "internationally appropriate". The latter position is interpreted as one that is also consistent with saving-investment preferences of other countries and full employment. These specific definitions of sustainability are, under certain conditions useful for characterizing outcomes for groups of countries or individual countries at different historical periods. Clearly, any criteria of external sustainability that is useful for policy purposes will need to be country and time-specific. However, unless these criteria are made explicit, different definitions of sustainability may cause confusion, even where a consensus may have emerged about unsustainability since these alternative concepts are likely to lead to different and possibly conflicting policy recommendations. ^{1/}

The focus of the analysis is on policy sustainability and is concerned with the following general question; can present policies be maintained indefinitely, i.e., can all key economic variables stay on the paths projected on the basis of current policies and assumed private sector behavior? An unsustainable present situation is defined as one in which variables cannot continue indefinitely on their historical paths as implied by current policies and private sector behavior. In this situation, the economy is not on a long-run equilibrium path and some variables must change in the future. The requirement that current domestic or foreign policies (or private sector behavior) must change in the future is the essence of unsustainability. It is important to emphasize that the above definition of sustainability is a broad one and based solely upon positive economic criteria. In order to make the definition country or time-specific, additional positive or normative criteria may be added but these need to be explicit. The failure to make the distinction between positive and normative criteria of sustainability, and clarify the relationship between sustainability and optimality criteria is the source of much of the confusion in recent policy debate.

The concepts of sustainability and optimality are frequently used to assess the appropriateness of policies to achieve external and internal adjustment. Other writers, for example, Salop and Spitaeller (1980) have emphasized that the terms are not equivalent. The reason is that, depending upon the initial shocks, model parameters and policy objectives, an infinite number of long-run equilibrium paths are possible. From a

^{1/} "By 1986, the current account deficit of the United States and the corresponding surpluses of Japan and the Federal Republic of Germany had reached levels that, by common consent, could not be considered indefinitely sustainable." (IMF, 1987c, p. 18)

policy perspective, a definition of external sustainability based solely upon positive criteria may be inadequate if it fails to offer guidance on the choice of alternative sustainable outcomes. For example, an outcome that stabilizes the net external debt to GNP ratio will be consistent with the above definition but leaves arbitrary the level at which debt is stabilized.

Even if allowance is made for flexible sustainability criteria, there remains the operational problem of identifying possible unsustainable paths. One method that is frequently used ^{1/} is to make conditional forecasts of current account imbalances based upon the assumption of unchanged policies over the projection period. However, these projections fail to take into account the fact that if the economy is expected to move along on an unsustainable path, something will happen to prevent this. Thus, the forecast path will be different from one that ignores the existence of a sustainability mechanism. This analysis shows how such conditional forecasts of external imbalance might be generated in a consistent way that incorporates a mechanism for achieving sustainability. In the particular theoretical example that is presented, it is assumed that one such mechanism is a policy switch from an expansionary fiscal policy (that if maintained is projected to generate an unsustainable current account path) to a balanced budget. A numerical example based upon the theoretical model is used to illustrate the way in which these conditional forecasts will differ from those that ignore such a mechanism. An index of external sustainability is also derived that reflects the probability of future changes in policies expected by private agents over time. This index is systematically related to key economic variables, including the chosen level at which the external debt to GNP ratio is stabilized and structural parameters of the assumed model of current account determination. Thus, it may serve as a "warning signal" of the urgency of the need for policy response.

The organization of the paper is as follows. Section II sets out the main issues within a general framework that emphasizes the linkages between saving-investment imbalances, current account imbalances and the economy-wide intertemporal budget constraint. Section III shows how forecasts of current account balance conditional on no policy change can be derived in a way that explicitly incorporates a mechanism for achieving sustainability. The theoretical example is a stochastic rational expectations model in which the source of external sustainability lies in an expansionary fiscal policy and the mechanism for achieving sustainability is a switch to a balanced budget once an upper bound on the net foreign asset to GNP ratio is reached. In Section IV, alternative operational criteria of external sustainability are compared and discussed. Section V brings together the main policy implications of the analysis and directions for future research.

^{1/} See for example the discussion in IMF (1988, p. 20).

II. Analytical Framework

In this section, the concept of external sustainability is discussed within a general framework of current account determination. The framework emphasizes current account imbalances as the outcome of intertemporal savings and investment decisions by the government and private sectors under classical assumptions of market-clearing and full employment. 1/

1. Intertemporal budget constraints

The current account imbalance measures the extent of an economy's net borrowing or lending abroad, and is the outcome of intertemporal savings and investment decisions by the government and private sectors. From the national income accounting identity, we have:
(all variables are expressed in real commodity units) .

$$\dot{B} = CA = Q + rB - C - G - H \quad (1)$$

$$\text{or} \quad CA = S_p + S_G - H \quad (2)$$

$$CA = - CA^* \quad (3)$$

In equations (1) and (2), B is the stock of net claims on the rest of the world, CA is the current account imbalance ($CA > 0$ implies surplus), Q is gross domestic product, r is a real yield on all financial claims (assumed to be fixed), C is private consumption, G is government expenditure, S_p is private savings, S_G is government savings, and H is gross domestic investment.

From equation (1), the change in net claims on the rest of the world (the current account imbalance) equals the difference between gross national product and domestic absorption. Equivalently, as given in equation (2), the current account surplus equals the difference between gross domestic savings and gross domestic investment. By definition, the home country's surplus is also offset by the rest-of-the-world's deficit, as given in (3). Goods market equilibrium implies that one country's planned deficit is matched by the rest-of-the-world's planned surplus. In the short run in which goods and asset markets clear for a given distribution of world outside asset stocks, the current account need not be in balance if there is capital mobility. 2/

1/ See, for example, Sachs (1982), Masson and Knight (1986), and Frenkel and Razin (1987). The intertemporal nature of current account determination is the key element emphasized here. The assumptions of market-clearing and full employment can easily be relaxed.

2/ In a non-stationary economy, the current account need not be in balance even in the long-run steady state.

Suppose a "persistent" current account deficit or surplus is observed over a period of time. The problem of sustainability is usually framed in terms of the question "how long can this go on?" i.e., can the present situation be maintained indefinitely? If it is assumed that outside assets denominated in domestic and foreign currency are perfect substitutes, no financing constraint arises from foreign portfolio preferences. There is, however a risk of default - the ability of domestic borrowers (private and public) to repay and/or service debt. 1/ The financial solvency condition is given by equation (4); real claims or debt vis-à-vis the rest of the world must grow more slowly than the real rate of interest. This condition rules out the possibility that a debtor country can keep borrowing indefinitely to make interest payments on debt.

$$\lim_{t \rightarrow \infty} e^{-rt} B(t) = 0 \quad (4)$$

Imposing condition (4) on equation (1) gives the economy-wide intertemporal budget constraint,

$$\int_0^{\infty} (C+G+H-Q)e^{-rt} dt = B(0) \quad (5)$$

From equation (5), the present value of domestic absorption less that of domestic output (the present value of trade deficits) equals the country's initial net claims on the rest-of-the-world. Given a finite value of $B(0)$, in present value terms trade deficits in earlier periods must be offset in later years by trade surpluses.

The economy-wide intertemporal budget constraint is consolidated from the constraints of the private and governments sectors. The intertemporal government budget constraint is given by equation (6) 2/

$$\int_0^{\infty} (T-G)e^{-rt} dt = -B_G(0) \quad (6)$$

From equation (6), the intertemporal government budget constraint implies that the discounted value of taxes less that of government expenditure

1/ It is assumed that the domestic country has unlimited access to international capital markets subject to its intertemporal budget constraint. For this reason, the analysis is less applicable to developing countries that face credit rationing in international capital markets (see Obstfeld (1986)).

2/ Equation (6) assumes the absence of Ponzi games.

(the present value of the primary fiscal surplus) equals initial net government debts vis-à-vis the private sector and the rest of the world. Equation (6) need not imply an upper bound on government debt if taxes have no distortionary effects on resource allocation, and in the absence of political constraints, taxes can at least equal domestic output. ^{2/} If, however, taxes are distortionary and there exists a political ceiling on taxes, primary fiscal surpluses in present value terms must be offset in later years by present value fiscal deficits. The requirement that equation (6) be met is a necessary but not sufficient condition for equation (5) since private sector behavior may be destabilizing. The intertemporal private sector budget constraint is given by equation (7).

$$\int_0^{\infty} C e^{-rt} dt = B(0) + \int_0^{\infty} (Q-G-H) e^{-rt} dt = W(0) \quad (7)$$

Equation (7) is satisfied if the discounted value of private sector consumption equals the initial stock of real wealth.

2. Policy sustainability

The economy-wide intertemporal budget constraint together with an economic model that specifies the behavior of the above variables will yield long-run equilibrium paths for the current account and other variables. In terms of the above framework, the initial question may now be reformulated to ask whether present policies can be maintained indefinitely i.e. can the current account remain on the path projected on the basis of current policies and assumed private sector behavior? A set of policies is defined as sustainable if, given an otherwise fully-specified model of the economy, it is consistent with a path of long-run equilibrium. Within this broad concept of sustainability, additional positive or normative criteria may be added to make the definition country or time-specific. For example, a definition of external sustainability expressed in terms of current account balance makes explicit the external policy target, and implicitly the particular level at which the net foreign asset to GNP ratio is stabilized. ^{2/} The rationale for adopting a particular current account target might be justified by various normative domestic criteria that include the need to reconcile internal and external balance, the particular stage of economic development of the country, or the desire to smooth consumption in the face of shocks. For example, in earlier stages of development, when domestic savings are inadequate, a country may

^{1/} See the discussion in Buiter (1986) and Spaventa (1986).

^{2/} The above discussion is not based upon any premise that an explicit external target is necessarily useful or desirable (see Corden (1986), Williamson (1978) and Boughton (1988)). Within the above framework, current account movements are the outcomes of inter-country differences in productivity, time preference, and government borrowing and lending policies.

prefer to be a long-term net capital borrower but in a later stage of growth may set a current account surplus target in order to promote the transfer of resources through long-term capital exports. 1/

Three potential problems may arise in setting country or time-specific external sustainability criteria. First, setting a zero (or x percent) flow current account target to be achieved in a certain period may not be consistent with a stabilized stock of net foreign assets to GNP ratio. The situation would not be sustainable as further adjustment of domestic absorption, wealth and exchange rates would occur. Second, if the specific sustainability criteria are based solely upon domestic welfare objectives, the possibility of conflict with other countries' external targets (and underlying policies) may arise. This issue is most relevant for larger countries whose policies have a greater effect on the exchange rate and external imbalance. Third, for larger countries whose policies exert significant externalities, independent optimizing behavior by domestic residents and the government may result in outcomes that while sustainable and nationally optimal are not globally optimal. 2/ In this situation, the concept of policy sustainability may be broadened to include consistency (and possible coordination) of domestic and foreign policies (see for example Crockett and Goldstein (1987)). Thus, for certain groups of countries such as the G-3, normative global criteria may be needed to make the definition of sustainability country-specific.

3. Unsustainability

An unsustainable external imbalance means that either a change in current policies or private sector behavior is needed in order not to violate the economy-wide intertemporal budget constraint. Suppose we conceive a situation in which a small, open economy faces contractual obligations, fixed productive capacity and no means of raising taxes (from either domestic or foreign residents) or monetizing debt. If the world real interest rate rises, the country cannot meet its floating-rate external debt obligations without default. The situation is clearly unsustainable. If one of the "fixed coefficients," for example, productive capacity is allowed to vary sufficiently, so that despite the external shock, equation (5) can be met without default or change in policies, the external situation is now sustainable. Suppose now that the shock is a

1/ For developing countries, the specific sustainability criterion is likely to include the requirement that additions to the stock of debt contribute (by adding to future productive capacity) the country's ability to repay debt. The actual level of the debt to export or GNP ratio will in turn vary according to the country's ability to profitably utilize foreign capital. (See the discussion in IMF (1987b, pp. 42-44).)

2/ Private optimizing behavior need not coincide with the social welfare function that the authorities wish to maximize.

domestic investment boom that, assuming independent optimizing behavior by private agents, results in a capital account surplus during the adjustment period. In terms of the general definition in which no explicit current account target is specified, the external situation is sustainable. However, from the criteria of income distribution and domestic absorption, the situation may not be optimal in terms of government objectives as the current account deficit is accompanied by a depreciating real exchange rate. For large countries faced with persistent current account surpluses, the potential losses to world welfare arising from protectionist sentiment may necessitate an adjustment of domestic (and foreign) policies in order to achieve an outcome that is both sustainable and globally optimal.

In the first example, the source of unsustainability was assumed to arise from external sources. For developing countries, the source of unsustainability is likely to arise less from domestic policies than from unexpected changes in the external environment (and indirectly from macroeconomic policies pursued in the main industrial countries). The concept of policy sustainability is less relevant here since the required adjustment of domestic policies may be politically and economically infeasible, increasing the likelihood of debt default. In this situation, multinational organizations such as the Fund play an important role by providing contingency mechanisms to help finance unsustainable current account deficits. Suppose, however, the source of external unsustainability arises from a myopic government that expands continually its primary fiscal deficit and there is no automatic tax mechanism for achieving sustainability.^{1/} This situation most closely matches the concept of policy unsustainability defined above. If private agents are assumed to have rational expectations, the current and dynamic paths of key variables will incorporate the expectation of the future policy switch needed to achieve sustainability. As shown in Section III, the timing of the policy reversal is in part endogenously determined by private sector behavior. This outcome could be judged a "problem" for policymakers insofar as resulting movements in real exchange rates and interest rates show sharp fluctuations (assuming "excess volatility" of these variables is judged to be undesirable), and the timing of the policy switch is considered to be politically undesirable. Multinational organizations also have an important role in advising national governments of the domestic and global consequences for key macroeconomic variables of a given path of macroeconomic policies in the absence of policy change over the medium term. Useful policy advice may be offered on policies that ought not to be followed to achieve sustainability, for example, debt monetization.

^{1/} The credibility and possible time-inconsistency of government policies is a critical factor in assessing whether unsustainability is a problem. For example, one hypothetical category of unsustainability may arise if policies are time-inconsistent, i.e., the government promises to reduce its fiscal deficit but reneges. If this behavior creates a moral hazard, the government may be forced to default. However, to the extent that private agents disbelieve governments, this source of unsustainability is less realistic.

III. Conditional Forecasts of Current Account Imbalance

In identifying possible unsustainable paths for the current account and the exchange rate, the question to be asked is whether present policies can be maintained indefinitely such that these variables can stay on their historical paths. For operational purposes, a conditional forecast or baseline projection, given historical paths and based upon the assumption of no policy change in the projection period is required. For example, simple baseline projections are often made to determine whether the net external debt to GNP ratio will be stabilized at a particular level in the medium term. These projections may be judgemental or model-based. However, these forecasts ignore a fundamental conceptual problem; if the economy are expected to go off on an unsustainable path, some mechanism will be activated to prevent this. The actual mechanism may include debt relief, a macroeconomic policy switch (or change in exchange rate regime) or change in private sector behavior. The point is that a forecast that explicitly incorporates a sustainability mechanism is likely to differ from one in which the mechanism is ignored.

This section shows how conditional forecasts of external imbalance may be derived when a mechanism for achieving sustainability is explicitly incorporated into the forecast. In the following analysis, it is assumed that the authorities decide to switch policies once a boundary for a critical variable is crossed. This mechanism is familiar from recent literature on collapsing exchange rate regimes (see for example Salant and Henderson (1978), Flood and Garber (1984)). ^{1/} In the following theoretical example a flexible exchange rate regime is assumed and the mechanism for achieving sustainability is a switch from an expansionary fiscal policy to a balanced budget. Rational expectations are assumed on the part of private agents although the existence of random current account shocks means that a probability distribution is attached to the timing of the policy switch. This probability distribution is endogenously determined by private sector response to the external situation (and assumed initial policies).

^{1/} In the open-economy macroeconomic literature, most of the attention has been focused upon the switch from a fixed exchange rate regime to a flexible regime or parity change with a foreign reserve constraint acting as the policy trigger. The assumption that the authorities initially choose the exchange rate as a stabilization instrument instead of altering underlying macroeconomic policy that is inconsistent with the existing exchange rate parity may be served as a first step in a two-stage process. (See for example, Drazen and Helpman (1986). Ultimately, if the new exchange rate regime is inconsistent with the underlying policy process, there will be a need for a new policy regime.

1. Stochastic rational expectations model

The domestic economy is assumed to be small, facing an exogenous real interest rate in long-run equilibrium, \bar{r} but during the adjustment process, the domestic real interest rate is driven by movements in the expected real exchange rate. There are two traded goods with the real exchange rate defined as the relative price of domestic traded goods in terms of foreign traded goods. The level and change in the real exchange rate are in turn driven by fiscal policy. Initially, the government is assumed to run a fiscal deficit; it is assumed that the government will eventually switch, at date T, to a balanced budget (the omission of the monetary sector excludes the possibility of debt monetization) once a given ceiling on the real wealth to GNP ratio is reached.

$$r(t) = \bar{r}(t) - [E(p(t+1)|I(t)) - p(t)] \quad p = \frac{eP_f}{P}, d(t) > 0 \quad (9)$$

$$\bar{y}(t) = \beta_0' - \beta_1 p(t) - \beta_2 \bar{r}(t) + d(t) \quad (10)$$

$$\bar{y}(t) = \beta_0 - \beta_1 p(t) + \beta_2 [E(p(t+1)|I(t)) - p(t)] + d(t) \quad \beta_0 = \beta_0' - \beta_2 \bar{r}(t) \quad (10')$$

$$w(t+1) - w(t) = \alpha [\delta_1 \bar{y}(t) + \delta_2 d(t) - w(t)] + \epsilon(t+1) \quad \alpha > 0 \quad (11)$$

The model is specified in discrete time (in logs) and described in equations (9) to (11). In equation (9), uncovered interest parity is assumed; the expected real depreciation of the exchange rate equals the difference between the domestic and foreign real interest rates. In equation (10), fixed domestic output equals real expenditure by domestic and foreign residents which is assumed to be a negative function of the real exchange rate, \bar{y} and the domestic real interest rate, and positively related to real fiscal expenditure. Substituting equation (9) into (10), real expenditure is a positive function of expected real appreciation. The evolution of the real stock of domestic wealth is given by (11). Real wealth adjusts by the parameter α to close the gap between the stock of desired long-run real wealth (assumed to be a fixed proportion of domestic output and real government expenditure) and actual real wealth. $E[\cdot|I(t)]$ is the mathematical expectations set operator conditional on

^{1/} Endogenous movements in foreign real interest rates may be introduced through shifts in savings and investment balances in the foreign economy.

^{2/} A rise in the real exchange rate signifies a real domestic appreciation (e = number of units of foreign currency per unit of domestic currency; P and P_f are domestic and foreign prices, respectively).

the information $I(t)$ that includes information about variables in t and earlier, and the model structure. A random current account disturbance term $\varepsilon(t)$ is given by (12).

$$\varepsilon(t) = -1/\lambda + v(t). \quad (12)$$

In equation (12), $v(t)$ is a random variable with assumed exponential distribution 1/ and assumed unconditional probability density function given by

$$g[v(t)] = \begin{cases} \lambda \exp[-\lambda v(t)] & v(t) > 0 \\ 0 & v(t) < 0 \end{cases} \quad (13)$$

The probability of a policy switch from an expansionary fiscal policy to a balanced budget at $t+1$ is the probability that $w(t+1) > \bar{w}(t)$ when $d(t) = 0$. Substituting $w(t+1)$ from equation (11) we have:

$$\begin{aligned} \pi(t) &= \Pr[(1-\alpha)w(t) + \alpha\delta_1 \bar{y}(t) + \varepsilon(t+1) - \bar{w}(t)] > 0 \\ &= \Pr[v(t+1) > K(t)] \end{aligned} \quad (14)$$

where $K(t) = \bar{w}(t) - (1-\alpha)w(t) - \alpha\delta_1 \bar{y}(t) + \frac{1}{\lambda}$.

2. Conditional and unconditional forecasts

The conditional expectation of $\tilde{w}(t+1)$ assuming no policy change in $t+1$ is given by (15):

$$\begin{aligned} E[\tilde{w}(t+1)|I(t)] &= (1-\alpha)w(t) + \alpha\delta_1 \bar{y}(t) + \alpha\delta_2 d(t) - \frac{1}{\lambda} \\ &\quad + E[v(t+1)|I(t)] \end{aligned} \quad (15)$$

The solution to $E[v(t+1)|I(t)]$ is given by: 2/

$$E[v(t+1)|I(t)] = - \frac{\frac{1}{\lambda} e^{-\lambda K(t)} [1 + \lambda K(t)] + \frac{1}{\lambda}}{1 - \pi(t)} \quad (16)$$

1/ While the explicit solutions to the model are distribution-specific, the basic results are unaffected if a uniform or normal distribution is assumed.

2/ Note the information set is no policy change. The solution is obtained by integrating the expression

$$\frac{\int_0^{K(t)} v(t)g(v(t))dv(t)}{[1-\pi(t)]}$$

$$\text{where } 1 - \pi(t) \frac{1}{\lambda} = \begin{cases} 1 - \exp[-\lambda K(t)] & K(t) > 0 \\ 0 & K(t) < 0 \end{cases}$$

Interpreting equations (15) and (16), the conditional forecast of real wealth assuming unchanged fiscal policy change can be viewed as made up of two components. The first component is a baseline projection based upon the historical paths of wealth, fixed output, government expenditure, and an estimate of $1/\lambda$ (the mean of the distribution of current account shocks). The second component is an adjustment factor that reflects private agents' expectations of the current account shock conditional on the assumption of no policy change. As the gap between the wealth ceiling and the accumulated wealth stock narrows, as reflected in a fall in $K(t)$, the probability that no policy switch converges toward zero, and $v(t+1)$, (the variance of the current account shock) converges toward $1/\lambda$. The adjustment factor reflects private agents' expectations of the current account disturbance term conditional on the assumption of no policy change in $t+1$; over time as the situation becomes increasingly unsustainable as reflected in a rise in $\pi(t)$, the expected magnitude of the shock becomes very small in order for there not to be a policy switch.

It is useful to distinguish between conditional and unconditional forecasts of the current account and their respective uses. The above discussion is in terms of conditional forecasts since these forecasts are relevant in assessing external sustainability and whether present policies can be maintained indefinitely. The unconditional forecast of the current account imbalance in $t+1$ is a probability-weighted average of the expected current account conditional on no policy change in $t+1$ (given by (15)), and the expected current account conditional on a policy switch occurring in $t+1$ (given by $\bar{w}(t)$). 2/ Unconditional forecasts are also useful indicators of external imbalance and are used for a broad range of functions. For example, forecasts of the current account may be needed to determine its response to a particular policy instrument such as import restrictions or to movements in other variables such as domestic absorption and the exchange rate.

The $\pi(t)$ function may be interpreted as an index of external unsustainability. For a given wealth ceiling and other parameters of the model, $K(t)$ falls over time as the gap between the wealth ceiling and the accumulated wealth stock rises, i.e. the probability of a policy switch

$$\frac{1}{\lambda} \quad 1 - \pi(t) = \int_0^{K(t)} \lambda \exp[-\lambda v(t+1)] dv(t+1)$$

2/ Similarly, the unconditional expected path of the real exchange rate is a probability-weighted average of the expected real exchange rate conditional that a policy switch occurs at $t+1$, and the expected real exchange rate assuming there is no policy switch at $t+1$, i.e.

$$E[p(t+1)|I(t)] = \pi(t)\bar{p}(t+1)|I(t) + [1 - \pi(t)] E[p(t+1)|I(t)]$$

increases over time as the external imbalance becomes increasingly unsustainable. A rise in the wealth ceiling or a fall in the wealth adjustment parameter lower the value of the index, and thereby delay the timing of the policy switch. The probability function is determined by both private sector behavior and, via the chosen wealth ceiling, by policymakers. Because the index reflects private sector response to the external situation and initial policies, it may serve as a useful warning signal of the gravity of the external situation and the urgency of the need for policy response.

3. Numerical example

In Table 1, a simple example based upon the theoretical model is used to illustrate how conditional forecasts and an index of unsustainability are derived. As seen in Table 1, the conditional forecast of real wealth derived from the model (the sum of columns (1) and (2)) lies above the baseline projection (column (1)). The divergence is greatest in earlier periods reflecting the fact that, in earlier periods agents adjust their forecasts upward by a large expected value of the current account shock consistent with the assumption of no policy change. In later periods, agents expect a lower magnitude of the current account shock in order to maintain their assumption of no policy change in the face of larger current account imbalances.

Table 1. Conditional Forecasts of Real Wealth and Index of External Unsustainability

Period	Conditional Forecast $\frac{1}{E[\tilde{w}(t+1) I(t)]}$		Index of unsustainability
	trend	adjustment factor	$\pi(t)$
	(1)	(2)	(3)
t+1	1.75	0.5	0.002
t+2	3.0	0.46	0.02
t+3	4.0	0.37	0.11
t+4	4.5	0.16	0.41
t+5	5.0	0	1.0

$\frac{1}{}$ Forecast conditional on no policy change in projection period. Predictions based upon following assumed values; $w(t) = 0$; $\bar{w}(t) = 5$; $\bar{y}(t) + d(t) = 7.5$; $1/\lambda = 0.5$; $\alpha = 0.3$; $\delta_1 = \delta_2 = 1$; $\pi(t) = \exp[-\lambda K(t)]$; $K(t) = \bar{w}(t) - (1-\alpha)w(t) - \alpha\delta\bar{y}(t)$.

In column (3) of Table 1, the index of unsustainability is shown to rise over time reflecting an increasing probability of a policy switch. The sensitivity of the index to different assumptions concerning the wealth ceiling and structural parameters is shown in Figure 1. A rise in the wealth ceiling delays the policy switch to period 8 and shifts the timing of the policy switch to period 3 (index 3); a rise in the wealth adjustment parameter accelerates the timing of the policy switch to period 3 (index 1). This example also reinforces the point made in earlier discussion concerning the role of the level of stabilized wealth (or debt). Since the dynamic paths of the current account, the domestic real interest rate and the real exchange rate are influenced by this ceiling, no unique sustainable path exists for these variables unless the stabilized level of the debt to GNP ratio is specified.

IV. Operational Criteria of External Sustainability

In this section, various operational criteria of external sustainability are compared and discussed. These methods include purchasing power parity, baseline projections, the Krugman expectations criterion, and global medium-term scenarios.

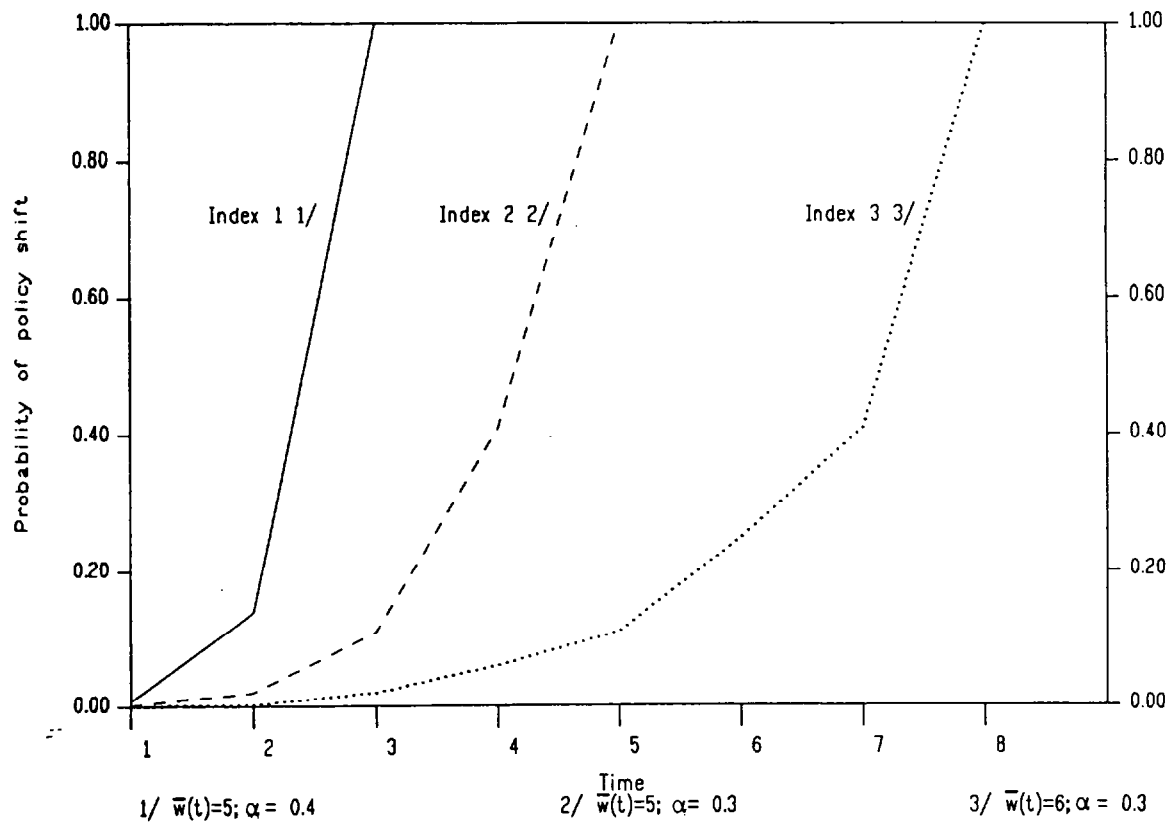
1. Purchasing power parity criterion

One of the earliest criteria used for assessing the sustainability of exchange rates (and current account imbalances) is the long-run equilibrium exchange rate value as determined by purchasing power parity (see, for example, IMF (1984)). The problems of using the purchasing power parity criterion are well known, and require only brief recounting. ^{1/} This criterion of sustainability is based upon a stationary-state value for the real exchange rate (and, by implication, a stabilized stock of net foreign assets to GNP ratio that corresponds to current account balance). In a very restricted class of models in which all shocks are of monetary origin and long-run neutrality holds, the long-run steady-state equilibrium is one in which the real value of the exchange rate is constant, the accompanying current account balance is zero, and the foreign debt to GNP ratio is stabilized at a given level. However, for most countries, these conditions have not been met in the past decade. More generally, change in resource endowment over time and in particular shifts in wealth stocks due in part to current account imbalances may require a steady-state change in relative price competitiveness to maintain a steady-state equilibrium. ^{2/} Definitions of sustainability based upon current account balance (see, for example Marris (1985)), suffer from the same weakness if they ignore long-run trends in an economy's factor

^{1/} See, for example, the discussion in IMF (1984).

^{2/} Only in steady-state equilibrium is there a one-to-one relationship between the exchange rate and the current account under flexible exchange rates. Thus, adjustment paths for the current account cannot be mapped from exchange rate paths (unless output is held fixed).

Figure 1
Indices of
External Unsustainability





endowments and time preferences. ^{1/} In a growing economy, the steady-state outcome need not correspond with current account balance, and thus the foreign debt to GNP ratio that corresponds to current account balance may not be stabilized. ^{2/}

2. Capacity to pay criteria (baseline projection of foreign debt to GNP ratios)

The operational criterion that is most consistent with the concept of sustainability discussed earlier is the capacity-to-pay external debt criterion used in both individual country programs and multilateral surveillance. One simple measure of capacity to pay external debt is to project whether the foreign debt to GNP ratio is likely to be stabilized in the medium term, assuming unchanged policies, exchange rates and interest rates. Assuming an exogenous long-run real interest rate (r) and long-run growth rate (n), a given initial stock of net foreign assets to GNP, $B(0)$, and an exogenously-determined trade account flow as a percent of GNP given by $X(t)$, the evolution of foreign debt to GNP is simulated over the medium term to determine whether it is likely to be stabilized.

$$\dot{B} = (1 + r - n) B(0) + X(t) \quad (17)$$

Comparing equation (17) and the conditional forecast generated from the rational expectations model, the key difference lies in the adjustment factor and the index of sustainability. Implicitly, baseline projections assign an unchanged value of unity to the probability of no policy change in each projection period. Thus, these projections ignore a key feature of unsustainability--the need for policy change--by failing to incorporate agents' expectations that the probability of a policy switch is likely to increase over time as the accumulated debt stock grows.

Both projection methods share the limitation of assuming a fixed world real interest rate and exchange rate. The assumption of a given interest rate, while plausible for a small, dependent economy with a fixed capital stock, is not realistic for large industrial countries in which capital accumulation and domestic macroeconomic policies may influence world interest rates. The interpretation of the results also depends crucially upon the assumed initial fiscal policy (and other policy measures adopted), and the method of financing fiscal policy.

^{1/} Sustainability criteria based upon historical trends are of limited usefulness because of the difficulty of isolating shifts in long-term structure from short-term shifts in savings-investment balances.

^{2/} See for example Buiter (1981) in which the country with a higher time preference is shown to run a current deficit in the steady state.

3. Krugman (consistent expectations) criterion

Krugman defines sustainability in terms of the exchange rate. "A currency is unsustainable, in other words, when the expectations that sustain its current level cannot be fulfilled and must be revised" (Krugman (1988, p. 86). The criterion for a sustainable current account adjustment path is one along which private sector exchange rate expectations are met (or any deviation between actual and expected exchange rate movements is a random variable). The Krugman criterion extends equation (17) to allow the trade imbalance to be endogenously determined as given by equation (18) where $p(t)$ is the (log) of the real exchange rate. The expected path of the exchange rate is assumed to be determined by the real interest rate differential as given by (19).

$$X(t) = \alpha_0 + \alpha_1 p(t) \quad (18)$$

$$p(t+1) = p(t) - [(r(t) - r_f(t))] \quad (19)$$

In interpreting equation (19), it is crucial to distinguish carefully between conditional and unconditional exchange rate expectations. If the sustainability criterion is expressed in terms of the exchange rate, 1/ the conditional exchange rate prediction assuming no policy change is needed in equation (19), and an accompanying index of sustainability can be computed. Two further points can be made. 2/ First, the coefficient (α_1) measuring the response of current account flows to exchange rate movements is assumed to be invariant to the underlying policy shock. However, both the sign and the magnitude of current account flows and exchange rates are sensitive to the underlying disturbance, whether it is of fiscal or monetary origin, and the accompanying fiscal-monetary mix. Second, as noted by Krugman, even if the projected foreign debt to GNP ratio is not explosive, there remains the problem of determining whether the stabilized foreign debt to GNP ratio is feasible or desirable. 3/

4. Global medium-term scenarios model

One recent approach to assessing external sustainability applies the capacity-to-pay criterion within estimated general equilibrium models of linked interdependent economies. 4/ For example, an arbitrary sustainable

1/ Note that a one-to-one mapping between current account imbalances and the exchange rate is valid only if output is fixed.

2/ The usefulness of the Krugman criterion may also be limited by the assumption of the absence of the risk premium. For empirical evidence to the contrary, see Hodrick (1988).

3/ An alternative to optimality criteria, is to use either a portfolio constraint or a comparison with large debtor countries (see Krugman (1988)).

4/ Earlier medium-term scenarios use the model MINIMOD (see IMF (1987c). In later analysis (see IMF(1988)), this model is extended to explicitly include the developing country region (see Masson et al. (1988)).

net foreign debt (in domestic currency) to nominal GNP ratio constraint is imposed at a specified terminal date and compared with that projected in the baseline period, assuming unchanged policies and given exchange rates. Rational expectations on the part of the private sector are assumed in the model so that any inconsistencies between the two sets of projections and the resulting domestic and global consequences of unsustainability may be examined.

The linked global general equilibrium model approach has two important advantages. First, in contrast to partial equilibrium criteria, this method makes explicit the assumptions that underline "unchanged policies" and models the linkages between these policies, saving-investment imbalances and current account imbalances. Second, by linking countries, the global inconsistencies of domestic policy projections are identified, and hence the exercise is very useful for multilateral surveillance.

This approach comes closest to the concept of policy sustainability discussed earlier, and, in the light of the preceding discussion, can be further refined in two ways. First, from the theoretical model of Section III, we know that adjustment paths for the exchange rate, domestic interest rate and the current account vary according to the magnitude of the imposed debt ceiling. Further, the timing of the terminal date is not exogenous if agents have rational expectations. Thus, since the steady-state solution for net foreign assets is assumed to be determined solely by saving-investment behavior (i.e. is independent of portfolio preferences), sensitivity analysis may be used to determine the nature and magnitude of market response to the size of the financial constraint and its terminal date. An index of sustainability may also be computed corresponding to the baseline projections.

There is, however, a major problem arising from the use of this sustainability criterion for the purposes of multilateral surveillance. The underlying concept of sustainability for the purpose of multilateral surveillance is a very broad one that includes both a positive and normative component. 1/ Fundamental policy issues concerning the choice of sustainable adjustment paths and the scope for coordinated policies to achieve outcomes that are both sustainable and globally optimal cannot be answered in any systematic way. Unless the policy objectives in each country are specified explicitly and optimising behavior is assumed on the part of

1/ "A sustainable balance of payments position can be defined as one in which the underlying current account surplus or deficit is matched by capital outflows or inflows that corresponds to a country's desire to accumulate foreign assets or debts, and its capacity to service its external debt out of current foreign exchange earnings. For such a position to be internationally appropriate, it must also be compatible with saving-investment preferences of the other countries, and reasonably full employment of factors of production". (Crockett and Goldstein (1987, p. 38))

both the private and the government sectors, no systematic means is available to choose between alternative macroeconomic policies and steady-state outcomes. 1/

V. Conclusions

The focus of the paper has been directed toward policy sustainability; whether present policies can be maintained indefinitely so that key variables including the current account imbalance and the exchange rate remain on their historical paths projected on the basis of current policies and assumed private sector behavior. This concept of external sustainability serves as a broad framework within which additional positive or normative economic criteria may be added to apply to particular groups of countries or specific time periods. It was suggested that the particular choice of additional criteria, for example the maximization of a domestic or global social welfare function depends upon several factors, including the relative size of the country, its stage of economic development and the nature of the shocks. The main message may be stated in an alternative way; unless specific optimality or positive criteria are added, there is no "unique" or "correct" sustainable current account imbalance or exchange rate. This point was also illustrated by the rational expectations theoretical model in which the dynamic paths for the current account imbalance and other variables were shown to be sensitive to the assumed debt ceiling. 2/

The main contribution of the analysis was to show how conditional forecasts of external imbalance may be derived in a consistent way that incorporate a mechanism for achieving external sustainability. This problem arises from the concept of unsustainability emphasized in the paper; the requirement that current policies (or private sector behavior) must change in the future. In the particular theoretical example presented in the paper, it was assumed that one such mechanism is a policy switch from an expansionary fiscal policy to a balanced budget once an upper bound on real wealth was reached. A numerical example based upon the model was used to illustrate how conditional forecasts assuming unchanged present policies may be derived and may differ from the baseline projections that ignore such a mechanism. In particular, baseline

1/ MULTIMOD does not make explicit the social welfare functions of countries.

2/ The same point is also illustrated by simulations of the Masson-Knight model reported in Masson and Knight (1986) of current account imbalances of the United States, Germany, Japan and the rest of the world. In these simulations, equation (5) is satisfied so that the resulting paths for the exchange rates and current account imbalances eventually converge toward sustainable outcomes. The choice of a unique adjustment path for current account imbalances (and the steady-state value of foreign debt) will depend upon the initial shocks, structural model parameters, and in the particular model simulations, the targeted steady-state level of domestic debt.

projections implicitly attach an unchanged value of unity to the probability of no policy change expected by private agents. As reflected in the index of unsustainability, if rational expectations is assumed on the part of private agents, the probability attached to a future policy switch rises over time and is systematically related to the variables and parameters of the assumed model. This index is in part endogenously determined by private sector response to the external situation (and assumed initial policy), and the country-specific sustainability criteria assumed to be adopted by the authorities. Thus, it may serve as a useful warning signal of unsustainability and the urgency of the need for policy response. Related operational criteria of sustainability were also discussed and, in particular attention was drawn to the usefulness for multilateral surveillance of medium-term scenarios based upon globally-linked macroeconomic models.

The analysis may be extended in several directions in order to be of more direct operational use. For example, alternative sustainability mechanisms may be assumed including debt monetization and coordinated adjustment of domestic and foreign macroeconomic policies. The theoretical and numerical example was intended for illustrative purposes and may be extended to apply to historical data for different groups of countries thereby allowing for country and time-specific sustainability criteria.

References

- Boughton, James M., "Policy Assignment Strategies with Somewhat Flexible Exchange Rates," International Monetary Fund Working Paper, WP/88/40, May 1988.
- Buiter, Willem H., "Time Preference and International Lending and Borrowing in an Overlapping-Generations Model," Journal of Political Economy, Vol. 89, (1981), pp. 767-97.
- _____, "Structural and Stabilization Aspects of Fiscal and Financial Policy in the Dependent Economy. Part 1," Centre for Economic Policy Research, Discussion Paper No. 128 (September 1986).
- Corden, W. Max, Inflation, Exchange Rates, and the World Economy, Lectures on International Monetary Economics, ch. 12 (Oxford: Clarendon Press, 1985).
- Crockett, Andrew and Morris Goldstein, Strengthening the International Monetary System: Exchange Rates, Surveillance, and Objective Indicators, Occasional Paper No. 50 (Washington: International Monetary Fund, February 1987).
- Drazen, Alan and Elhanan Helpman, "Stabilization with Exchange Rate Management Under Uncertainty," National Bureau of Economic Research Working Paper Series, No. 2268 (May 1986).
- Flood, Robert and Peter Garber, "Collapsing Exchange-Rate Regimes. Some Linear Examples," Journal of International Economics, Vol. 17 (August 1984), pp. 1-13.
- Frenkel, Jacob A. and Assaf Razin, Fiscal Policies and the World Economy (MIT Press, Cambridge, 1987).
- Hodrick, R., "U.S. International Capital Flows: Perspective From Rational Maximizing Models," Mimeo, March 1988.
- International Monetary Fund, Issues in the Assessment of the Exchange Rates of Industrial Countries, Occasional Paper No. 29 (Washington: International Monetary Fund, July 1984).
- _____, (1987a) World Economic Outlook (Washington: International Monetary Fund, April 1987)
- _____, (1987b), Theoretical Aspects of the Design of Fund-Supported Adjustment Programs, Occasional Paper No. 55 (Washington: International Monetary Fund, September 1987).

International Monetary Fund, (1987c) World Economic Outlook (Washington: International Monetary Fund, October 1987).

_____, World Economic Outlook (Washington: International Monetary Fund, April, 1988).

Krugman, Paul R., "Sustainability and the Decline of the Dollar," in R.C. Bryant, G. Holtham and P. Hooper, eds., External Deficits and the Dollar (Washington, D.C.: The Brookings Institution, 1988), pp. 82-99.

Marris, Stephen, Deficits and the Dollar: The World Economy at Risk, Institute for International Economics, Vol. 14 (December 1985).

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

_____, and Malcolm Knight, "International Transmission of Fiscal Policies in Major Industrial Countries," Staff Papers, International Monetary Fund (Washington), Vol. 33 (September 1986), pp. 387-438.

_____, Steven Symansky, Richard Haas, and Michael Dooley, "MULTIMOD: A Multi-Region Econometric Model," International Monetary Fund Working Paper, WP/88/23, March 1988.

Obstfeld, Maurice, "International Finance," NBER Working Paper Series, No. 2077, November 1986.

Sachs, Jeffrey, "The Current Account in the Macroeconomic Adjustment Process," Scandinavian Journal of Economics, Vol. 84 (1982), pp. 147-59.

Salant, Stephen W. and Dale Henderson, "Market Anticipations of Government Policies and the Price of Gold," Journal of Political Economy, Vol. 86 (August 1978), pp. 627-48.

Salop, Joanne and Eric Spitaeller, "Why Does the Current Account Matter?" Staff Papers, International Monetary Fund (Washington), Vol. 27 (March 1980), pp. 101-134.

Spaventa, Luigi, "The Growth of Public Debt Sustainability, Fiscal Rules and Monetary Rules," Staff Papers, International Monetary Fund (Washington), Vol. 34 (June 1987), pp. 374-99.

Williamson, John, "Payments Objectives and Economic Welfare," Staff Papers, International Monetary Fund (Washington), Vol. 20 (1973), pp. 573-90.

Zee, Howell H., "On the Sustainability and Optimality of Government Debt," Staff Papers, International Monetary Fund (Washington), 1988, forthcoming.

