Adjustment with Growth: Relating the Analytical Approaches of the World Bank and the IMF

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ADJUSTMENT WITH GROWTH:
RELATING THE ANALYTICAL APPROACHES
OF THE WORLD BANK AND THE IMF

by

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Abstract

The move towards closer cooperation between the World Bank and the International Monetary Fund naturally leads to questions of how the two institutions design adjustment programs that support their lending activities, and what the analytical underpinnings are of their respective approaches. This paper describes and examines the very simplest versions of the analytical approaches employed by the Bank and the Fund. In the case of the Bank this means essentially looking at variants of the two-gap growth model, and for the Fund a model derived from the monetary approach to the balance of payments. An attempt is also made to merge the Bank and Fund approaches within a consistent framework to demonstrate how they are related to each other. It should be noted that neither the individual approaches nor the combined approach proposed here capture the true flavor of actual programs, since they are unable to cover all the policies that are typically included in such programs. Nevertheless, as these simple approaches represent a starting point for the design of adjustment programs, a detailed exposition should assist in bringing about a better understanding of how the two institutions relate policies to objectives, and may serve as a basis for the development of a general framework that could be utilized by the Bank and the Fund to construct programs that combine growth with adjustment.
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I. Introduction

It is now widely acknowledged that closer cooperation between the World Bank and the International Monetary Fund will be essential in dealing with the serious economic problems faced by the developing world. Since the Fund is viewed as being primarily concerned with short-run adjustment and the Bank likewise with medium-term growth, it is only natural that the generalized call for adjustment with growth, reinforced recently by the Baker initiative (put forth by U.S. Treasury Secretary James Baker III in September 1985), should require the two institutions to combine forces and adopt a common strategy. The cooperation between the institutions is expected to occur at all levels, and perhaps most importantly from an operational standpoint, in the form of joint missions, reports, and policy advice to countries. The recent experience with the case of Mexico is a good example of enhanced collaboration between the Bank and the Fund. The IMF Structural Adjustment Facility (SAF), where the Fund and the Bank have undertaken to develop joint medium-term strategy papers for countries eligible for the Trust Fund reflows to the Fund, is another example.

While the principle of closer coordination between the Bank and Fund seems clear, this policy is bound to create difficulties at the operational level. There is, for example, a significant lack of understanding about how the two institutions formulate programs that support their lending, and in particular on the analytical underpinnings of the Bank and Fund approaches. In describing functions, statements such as the Fund is concerned with
stabilization and the Bank with growth, or that the Fund deals with the short run and the Bank with the long run, tend to be standard both within and outside the two organizations. The approaches of the institutions are also characterized in a similar vein -- the Fund uses a flow of funds methodology and concerns itself solely with nominal magnitudes, while the Bank focuses on the national accounts and real variables.

To a certain extent these various characterizations of functions and approaches contain an element of truth. However, they do tend to represent a fairly simplistic view, as the adjustment programs developed by both the Bank and the Fund are in fact complex packages of policy measures aimed at a number of objectives. Fund programs, for example, are designed to achieve a sustainable balance of payments position within the context of improved long-term growth performance and internal price stability. Clearly short-run demand restraint through control of domestic credit expansion, supplemented perhaps by exchange rate action, would not be sufficient to achieve the multiple objectives of a program. A typical Fund program would, therefore, also call for fiscal measures, such as reductions in government expenditures and increases in taxation, increases in domestic interest rates and producer prices to realistic levels, policies to raise investment and improve its efficiency, trade liberalization, and wage restraint.

The Bank in its pursuit of higher growth and improved living standards in developing countries also goes well beyond measures directed exclusively at raising the rate of domestic capital formation. Bank programs include trade liberalization and measures to promote exports, relaxation of interest rate and credit controls, deregulation of agricultural pricing, streamlining of industrial incentives, and policies to improve public sector management (including reforms in taxation and pricing of utilities, the
restructuring and privatization of parastatals, and improvements in investment planning and execution). Furthermore, recent programs of the Bank have contained policies aimed at stabilization, such as reductions in fiscal deficits and the elimination of distortions in the exchange system.

On the face of it, the policy packages of the Bank and Fund seem remarkably indistinguishable. The difference appears to really come down to a question of emphasis, with the Fund leaning more in the direction of improvement in the balance of payments and the Bank towards raising the growth rate of the economy. This difference becomes readily apparent when one moves beyond broad objectives and descriptions of the policy packages to the analytics of the Bank and Fund approaches to programs. The structure of all Fund programs is built on a framework that links the financial sector with the balance of payments. This approach, which has come to be termed the monetary approach to the balance of payments, 1/ ensures consistency between the monetary impact of policy changes and the desired balance of payments outcome. While the Bank's approach is not as well defined as that of the Fund, at the core of most Bank programs is a variant of the two-gap growth model or a Harrod-Domar model of an open economy, defined within the organization as the Revised Minimum Standard Model (RMSM). 2/ There are, of course, instances where more elaborate models are specified, but these tend to be special cases. 3/ Interestingly enough, the two-gap growth model also

1/ See, for instance, International Monetary Fund (1977).

2/ World Bank (1980).

3/ Bank programs, for example, have sometimes employed computable general equilibrium (CGE) and econometric models of varying complexity. In an internal report to a committee examining economy-wide modelling in the Bank, John Whalley confirms the view that the RMSM is by far the most frequently-used model at the operational level. See Whalley (1984).
appears in the Bank's policy analysis of external debt problems of developing countries. 4/

The purpose of this paper is to describe and examine the very simplest versions of the analytical approaches employed by the two institutions. In the case of the Bank this means essentially looking at the two-gap growth model, and for the Fund a model derived from the monetary approach to the balance of payments. While these approaches do not by any means represent the full analytical approaches of the Bank and Fund, they do represent a starting point for the design of adjustment programs. The exercise here is entirely expository in nature, and is aimed solely at bringing about a better understanding of the models underlying the approaches of the two institutions. Although the two approaches are merged in this paper to demonstrate how they are related to each other, no attempt is made to develop a general structural model that could be directly utilized to analyze short-run and medium-term macroeconomic adjustment. Such a step would require considerably more research, particularly as one moves away from simple models to more realistic representations. Even so, we feel that the simple exposition presented here will at least assist staff in both the Bank and the Fund to appreciate what their respective counterpart on joint missions is doing.

The remainder of this paper proceeds as follows: Section II describes a general macroeconomic framework within which the Fund and Bank approaches can be conveniently analyzed. The Fund approach is covered in Section III and the Bank approach in Section IV. The discussion in these sections covers both the theory as well as the operational procedures. A

model that combines the two approaches is described in Section V. The concluding section summarizes the main points of the paper and indicates the issues that will need to be considered in any attempt to develop a common analytical framework for medium-term adjustment and growth.

II. A General Macroeconomic Framework

In comparing the basic macroeconomic approaches used by the Fund and the Bank, it is convenient to employ the Meade-Tinbergen analysis of macroeconomic policy. The first step in this analysis is the specification of the macroeconomic accounting framework. The variables identified in this framework are then classified as exogenous, endogenous, and policy variables. Economic relationships are specified to supplement the accounting identities. This yields the economic model that underlies the policy decisions. To produce a policy program, forecasts of the exogenous variables are generated, values are specified for the target variables, and the model is solved for the policy variables.

To enhance the clarity of our presentation, we begin by adopting a single, consistent macroeconomic framework common to the approach of both the Bank and the Fund. 5/ In the simple framework considered here the economy in question can be divided into four sectors: the private sector, the public (government) sector, the foreign sector, and the domestic banking system, which is assumed for simplicity to consist solely of a central bank. In this particular framework, the private sector is assumed to own all factors of production. The sale of current output yields nominal income ($Y$) to the

---

5/ The framework here is basically a condensed version of that developed by Holsen (1985), and also utilized by Robichek (1985).
private sector, which it uses to pay taxes (T), purchase goods for consumption (C_p) and investment (ΔK_p), and accumulate financial assets. To keep matters simple, interest payments and receipts are ignored here, as is the distribution of central bank profits. All variables are measured in nominal domestic currency terms. The private sector's net accumulation of financial assets consists of money (ΔM) and foreign assets (ΔF_p), minus borrowing from the banking system (ΔD_p). The private sector's budget constraint is therefore:

\[ Y - T - C_p - ΔK_p = ΔM + ΔF_p - ΔD_p. \]

The public sector receives taxes and uses the proceeds for consumption (C_G) and investment (ΔK_G). Any surplus is devoted to the accumulation of financial assets in the form of foreign assets (ΔF_G), net of borrowing from the banking system (ΔD_G). This produces the public sector's budget constraint:

\[ T - C_G - ΔK_G = ΔF_G - ΔD_G. \]

The foreign sector receives revenues in the form of imports purchased by the domestic economy (Z), and it spends on domestic exports (X). To the extent that its revenues exceed expenditures, i.e., a current account deficit, it buys back its liabilities from the domestic private and public sectors and acquires reserves from the domestic banking system (ΔR), so that its actions obey the constraint: 6/

\[ Z - X = -(ΔF_p + ΔF_G + ΔR). \]

6/ Basically this is another way of writing the balance of payments identity: \( ΔR = X - Z - (ΔF_p + ΔF_G). \)
Finally, the central bank is simply a financial intermediary which acquires assets in the form of international reserves and claims on the domestic private and public sectors and supplies its own liabilities in the form of money to the private sector. These transactions must satisfy the balance-sheet constraint:

\[ \Delta M = \Delta R + \Delta D_p + \Delta D_G. \]

The variables contained in the identities described above can be interpreted as ex-ante, "desired" magnitudes or as ex-post, "realized" magnitudes. In either case these identities must obviously hold. The identities themselves can be combined in various ways to display several consistency relationships. For instance, summing (1) - (4) yields:

\[ Y - C_p - \Delta K_p - (C_G + \Delta K_G) - X + Z = 0, \]

which is the familiar national income accounting identity.

In the next two sections we will utilize these balance-sheet constraints to discuss the specific approaches of the Fund and the Bank, respectively.

III. The Fund Approach

A. The Simple Monetary Model

With this apparatus in hand, we can now describe the simplest Fund framework. The Fund's mandate is to finance temporary balance of payments.

\[ \text{Recall that for simplicity we assume that there are no banks other than the central bank.} \]
disequilibria. When balance of payments deficits are not inherently temporary they must be rendered so by corrective policy measures. The formulation of such measures requires the possession of an implicit or explicit model that links policy instruments controlled by the authorities to the balance of payments. The Fund's approach to balance of payments adjustment, which evolved out of staff work in the 1950s and 1960s on Latin American countries, has been formalized and articulated in a number of papers, principally by Polak (1957) and Robichek (1967). 8/ The more recent work on the subject has tended to stay within the Polak-Robichek tradition, 9/ and there is also evidence that would indicate that the basic Fund approach has not changed all that radically over the years (see Robichek, 1985). The simplest monetary model of an open economy with a fixed exchange rate can be described as follows:

(i) Nominal GDP is taken to be exogenously determined, i.e.:

(6) \( Y = \bar{Y} \).

(ii) The velocity of money is assumed to be constant: 10/

(7) \( \Delta M^D = v \Delta Y, \)

where \( v \) is a constant which represents the inverse of income velocity.

8/ See also the papers contained in International Monetary Fund (1977).

9/ This is especially true of the case studies prepared by the IMF Institute. See International Monetary Fund (1981) and (1984).

10/ The constant velocity relationship is only a simplifying assumption, and its replacement by a general function that related the demand for money to income, prices, interest rates, and expected inflation would not affect the analysis as long as this function was stable.
of money, and \( M^D \) is the demand for nominal money balances.

(iii) The money market is assumed to be in *flow* equilibrium. Therefore:

\[
\Delta M^S = \Delta M^D = \Delta M,
\]

where \( M^S \) is the supply of money. This equilibrium condition does not imply that the public holds the stock of money it desires at each instant, but rather that it will succeed in adding to its cash balances at the desired rate during the program period.

These three equations, together with identity (4), permit the balance of payments (\( \Delta R \)) to be expressed as a function of exogenous and policy variables. This can be shown by taking first differences in equation (6) and substituting successively into (7), (8), and (4), where \( \Delta M \) in (4) is now interpreted as the flow supply of money. The resulting expression can be written as:

\[
\Delta R = \nu \Delta Y - (\Delta D^*_p + \Delta D^*_c).
\]

The carets (^) over the credit flow variables identify these as policy variables controlled by the monetary authorities. Equation (9) is the fundamental equation of the monetary approach to the balance of payments, which was pioneered at the Fund. ¹¹/ The balance of payments is expressed as the difference between the private sector's flow demand for money and the flow of domestic credit. In this simple model increases in domestic credit will be offset by decreases in net foreign assets on a one-for-one basis.

To use this framework to formulate a policy program, choose a desired value for the endogenous variable $\Delta R$, say $\Delta R^*$, and then simply solve (9) for the required expansion of domestic credit:

$$\begin{align*}
(10) \quad (\hat{\Delta D}_p + \hat{\Delta D}_G) &= \nu \bar{\Delta Y} - \Delta R^*.
\end{align*}$$

Since policymakers' loss functions in countries experiencing persistent balance of payments deficits presumably attach little weight to positive deviations of $\Delta R$ from the desired value $\Delta R^*$, the targeted expansion of domestic credit is set as a ceiling. Equation (10) thus provides a justification for the use of credit ceilings as a key policy instrument and as performance criterion in Fund stabilization programs. By monitoring the expansion in domestic credit the Fund staff are able to determine if the program is on track in achieving the targeted increase in reserves.

Although the balance of payments is of necessity the focal point of Fund stabilization programs, a slight expansion of the "bare bones" framework described so far makes it possible to solve for other endogenous variables of interest. For example, treating exports and net foreign capital flows as exogenously determined, i.e., by adding the following identities:

$$\begin{align*}
(11) \quad X &= \bar{X} \\
(12) \quad \Delta F_p + \Delta F_G &= \bar{\Delta F}_p + \bar{\Delta F}_G,
\end{align*}$$

the balance of payments identity (3) can be used to solve for imports:

$$\begin{align*}
(13) \quad Z &= \bar{X} - (\bar{\Delta F}_p + \bar{\Delta F}_G + \Delta R^*).
\end{align*}$$
Thus, in the simple monetary framework, imports are simply the residual variable that adjusts to achieve the balance of payments target. 12/

This point can be clarified by using a variant of the "absorption approach", also developed at the Fund by Alexander (1952). Defining domestic absorption, $A$, as:

(14) $$A = C_p + C_G + \Delta K_p + \Delta K_G$$

and then summing the private and public sector budget constraints (1) and (2), and using equation (14) yields:

(15) $$(\bar{Y} - \Delta F) - A = \Delta M^D - \Delta D,$$

where $\Delta F = \Delta F_p + \Delta F_G$ is total purchases of foreign securities by the private and public sectors and $\Delta D = \Delta D_p + \Delta D_G$ is the total expansion of domestic credit. This equation states that domestic demand ($A$) will exceed available resources (consisting of GDP ($Y$) plus foreign savings ($-\Delta F$)) to the extent that credit expansion exceeds the flow demand for money. Notice that, since the flow demand for money is determined by assumptions (6) and (7), and since $\bar{Y}$ is exogenous, changes in the policy variable $\Delta D$ must be reflected in domestic absorption $A$. Thus in this framework a reduction in the availability of bank credit improves the balance of payments by reducing domestic absorption and therefore imports. 13/


13/ Substituting (14) in (5) and solving for $Z$ yields:

$$Z = \bar{X} + A - \bar{Y},$$

with $\bar{X}$ and $\bar{Y}$ exogenous it is clear that a reduction in absorption must come about through reduced imports.
In practice, the ceiling on expansion of total domestic credit is frequently accompanied by a subceiling on the expansion of credit to the nonfinancial public sector. This subceiling plays a dual role. On the one hand, it assists in monitoring the overall credit ceiling, since in the Fund's experience violations of overall credit ceilings frequently tend to originate with excessive expansion of credit to the public sector. More importantly, the public sector subceiling ensures that the availability of credit to the private sector is not curtailed excessively by the overall credit ceiling.

Formally, this implies that the expansion of credit to the private sector functions as a secondary target in Fund stabilization programs. 14/ Such a target, say $\Delta D_p^*$, can be achieved by using the expansion of credit to the public sector as an instrument, according to:

\[ (16) \quad \Delta D_G = \Delta D - \Delta D_p^*. \]

The target value of private credit expansion is typically related to the projection for nominal GDP. For example, it may be postulated that the expansion of credit to the private sector should keep pace with the increase in nominal GDP. Thus the targeted expansion of private credit would be derived from a "demand for a credit" relationship such as:

\[ (17) \quad \Delta D_p^* = (D_p / Y)_{-1} \Delta Y. \]

From the nonfinancial public sector's budget constraint, equation (16) effectively fixes the public sector deficit from "below the line" (i.e., from the financing side). Since from the budget constraint:

14/ See Kelly (1982).
The public sector must adjust to this programmed deficit by increasing revenue and/or reducing current or capital expenditures.

The model as it stands does not contain an import demand function, i.e., no stable relationship between imports and domestic output is postulated. If a relationship such as:

\[
Z = aY
\]

were added, the model would become overdetermined. In other words, there is no reason for the value of Z generated by equation (13) to be consistent with that which emerges from (18). If the validity of (18) is maintained, the overdeterminacy must be removed by treating one of the target or exogenous variables as endogenous -- i.e., by matching the additional equation with an additional unknown. After this adjustment the system is solved again and the test for consistency repeated. This process is iterated until the values of Z emerging from equations (13) and (18) converge to a single value. Formally, of course, this iterative process amounts to treating the target or exogenous variable being adjusted as endogenous. In the next subsection, nominal output Y plays this role.

B. The Polak Model

An important limitation of the simple monetary model is that nominal income is regarded as exogenous. In practice, Fund programs treat the price level as an endogenous variable. The endogeneity of the price level -- and

15/ The specification of equation (18) is chosen for simplicity. For present purposes all we need is that imports in domestic currency terms be an increasing function of domestic prices, given import prices and domestic real output. A more general specification is considered below.
therefore of nominal income -- requires a slight modification of the simple framework.

When nominal income is regarded as endogenous, equation (6) no longer holds and is replaced by:

\[ (6a) \quad Y = P\bar{y}, \]

where \( P \) denotes the domestic price level and \( \bar{y} \) is real GDP, regarded as exogenous. The change in nominal output can be approximated as:

\[ (19) \quad \Delta Y = \Delta P y_{-1} + P_{-1} \Delta \bar{y}. \]

In this equation, both last period's real GDP, \( y_{-1} \), and last period's price level, \( P_{-1} \), are predetermined. The change in real GDP, given by \( \Delta \bar{y} \), is exogenous, and \( \Delta P \) -- the change in the domestic price level -- is the endogenous variable.

To examine the implications of this change from the simple monetary model, substitute \( \Delta Y \) as given by (19) for \( \Delta \bar{y} \) in (9). The result is:

\[ (9a) \quad \Delta R = v \Delta P y_{-1} + P_{-1} \Delta \bar{y} - (\Delta D_p + \Delta D_G). \]

This equation now contains two endogenous variables -- \( \Delta R \) and \( \Delta P \) -- and it is not possible to find a unique solution for both conditional on a chosen expansion of domestic credit.

The situation is depicted in Figure 1. Equation (9a) is a straight line in \( \Delta R - \Delta P \) space, denoted MM, with intercept \( v P_{-1} \Delta \bar{y} - (\Delta D_p + \Delta D_G) \) and a positive slope \( v y_{-1} \). A reduction in the rate of expansion of domestic credit

\[ 16/ \text{We also assume that } \Delta \bar{y} \text{ and } \Delta P \text{ are small, so the second-order term } \Delta P \Delta \bar{y} \text{ can be neglected.}\]
FIGURE 1
THE POLAK MODEL
will shift this line upwards, so an improvement in the balance of payments will be associated with any given rate of inflation \( \Delta P \). But altering the rate of credit expansion \( \Delta D \) can only change the position of this line. It cannot determine where the economy will be found along this line at any moment of time, so that the domestic price level is indeterminate in this model.

This indeterminacy can be removed by taking into account the balance of payments identity (3) and import demand function (18). The latter can be written in the form:

\[
(18a) \quad Z = a (Y_{-1} + P_{-1} \Delta y) + ay_{-1} \Delta P,
\]

which is derived by substituting \((Y_{-1} + \Delta Y)\) for \(Y\) and using equation (19). When \((18a)\) is substituted into the balance of payments identity (4) we have, after solving for \(\Delta R\):

\[
(20) \quad \Delta R = (\bar{X} - \bar{F}) - a (Y_{-1} + P_{-1} \Delta y) - ay_{-1} \Delta P,
\]

which is the sought-after second relationship between \(\Delta R\) and \(\Delta P\). The result given by equation (20) is the well-known "Polak model" (see Polak, 1957).

The workings of the Polak model are illustrated in Figure 1. Equation (20) is the straight line BP with intercept \(\bar{X} + \bar{F} - a (Y_{-1} + P_{-1} \Delta y)\) and negative slope equal to \(-ay_{-1}\). Its intersection with the positively-sloped line MM yields the equilibrium levels of the balance of payments \((\Delta R_0)\) and inflation \((\Delta P_0)\), at point A. The economic intuition behind the model is the following: the price level adjusts to clear the (flow) money market in response to a change in the supply of money. After an increase in the rate of expansion of domestic credit, for example, price-level adjustments clear the money market in part by increasing the demand for money as nominal income rises \textit{pari passu} with the price level, and in part by reducing the endogenous component of the
money supply -- consisting of foreign exchange reserves -- as the demand for imports rises in response to the increase in the domestic price level.

Notice that a reduction in the rate of credit expansion shifts the locus MM vertically upwards, causing the equilibrium point to move to the northwest from A, in the direction of the arrow, along the locus BP. Credit contraction thus results in reduced domestic inflation and improved balance of payments performance. However, the targets for the balance of payments and domestic inflation cannot be chosen independently. Since changes in the rate of expansion of domestic credit can only move the equilibrium point along BP, only combinations of $\Delta R$ and $\Delta P$ that lie along this locus can be attained by altering $\Delta D$. Target values of $\Delta R$ and $\Delta P$ which lie off this locus, such as $(\Delta R^*, \Delta P^*)$ at point B, cannot be attained with the domestic credit instrument. In Meade-Tinbergen terms, two targets cannot be achieved with a single instrument. The authorities are one instrument short.

The use of the exchange rate as a policy tool provides a way out of this dilemma. One can modify the Polak model by introducing the equation:

\[(21) \quad \Delta P = (1-\theta) \Delta P_D + \theta \Delta e \bar{P}_Z,\]

where $P_D$ is an index of domestic prices, $P_Z$ is the price of importables measured in foreign currency, $\theta$ is the share of importables in the overall price index and $e$ is the exchange rate -- the domestic-currency price of a unit of foreign currency. \[17/\] This introduces an additional equation, an additional endogenous variable in the form of $\Delta P_D$, and more importantly, the additional policy instrument $\Delta e$. Furthermore, equation (18a) is modified to

\[17/\] It is assumed that initially $P = P_D = eP_Z = 1$, and that $\Delta P_Z = 0$. 

allow the volume of imports to depend on the relative price of importable goods in terms of domestic goods:

\[(18b) \quad Z = Z_{-1} + (Z_{-1} - b) \bar{P}_Z \Delta \hat{e} + b \Delta P_D + a \Delta y,\]

where \(b\) is a positive parameter that measures the responsiveness of the volume of imports to the relative price of importables. 18/ According to equation (18b), increases in domestic real GDP and in domestic prices raise spending on imports, while a devaluation will reduce imports if the volume of imports is sufficiently responsive to relative prices. Next, equation (4) is changed to reflect valuation effects of exchange rate changes on the central bank's balance sheet:

\[(4a) \quad \Delta M \equiv \Delta R + \Delta e \bar{R}_{-1} + \Delta D_p + \Delta D_G,\]

where \(\bar{R}_{-1}\) is the foreign currency value of the previously existing stock of foreign exchange reserves and \(\Delta R\) now refers to \(\Delta e \bar{R}\) -- the balance of payments in foreign currency valued at the current exchange rate. Finally, equations (11) and (12) are modified to make clear that the exogeneity assumption applies to the foreign currency value of exports and net foreign capital outflows:19/

18/ This expression is derived from the import volume equation:

\[QZ = QZ_0 + a \bar{y} - b(e \bar{P}_Z / P_D),\]

where \(QZ\) is the volume of imports.

19/ We assume for simplicity that the foreign currency value of exports does not respond to a change in the exchange rate. The incorporation of a positive export supply elasticity would, however, have no qualitative effects on the analysis that follows.
(11a) \[ X = \bar{X}_{e-1} + \bar{X} \Delta e \]

(12a) \[ \Delta F = \bar{\Delta F}_{e-1} + \bar{\Delta F} \Delta e . \]

Substituting the price identity (21) into (9a) as well as (11a), (12a), and (18b) into the monetary identity (4a) allows the expanded Polak model to be written as:

(9b) \[ \Delta R = \nu y_{-1} (1 - \theta) \Delta P_D + (\nu y_{-1} \phi P_Z - \bar{\bar{K}}_{-1}) \Delta e + \nu P_{-1} \Delta y - \Delta D \]

(20a) \[ \Delta R = (\bar{X} - \bar{\Delta F}) e_{-1} - Z_{-1} + [\bar{X} - \bar{\Delta F} - (Z_{-1} - b)] \Delta e - a \Delta y - b \Delta P_D . \]

The behavior of the expanded Polak model can be analyzed in exactly the same fashion as the basic model, except that the variable on the horizontal axis in Figure 1 now becomes \( \Delta P_D \), the change in domestic prices. More importantly, control over \( \Delta e \) now allows the authorities to shift the locus traced out by equation (20a) so that, say, a better balance of payments outcome can be attained for a given rate of inflation. Points such as B can now be attained by adjusting \( \Delta e \) so that the locus BP passes through B, and then moving MM to intersect BP at that point through adjustments in the rate of expansion of bank credit. With two instruments at their disposal, the authorities can now attain the targeted values for both the balance of payments and the rate of inflation.

The structure of the basic Fund framework can be summarized in Meade-Tinbergen terms as follows:

20/ To verify the neutrality of this model, set \( \Delta R = \Delta \bar{y} = 0 \), \( \Delta P_D = \Delta \bar{e} \), and \( \Delta D = D_{-1} \Delta \bar{e} P_Z \). The resulting equations are satisfied for any value of \( \Delta e \).
**Table 1: Structure of the Fund Framework**

<table>
<thead>
<tr>
<th>Targets</th>
<th>Endogenous Variables</th>
<th>Exogenous Variables</th>
<th>Instruments</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔR</td>
<td>ΔY</td>
<td>Δy</td>
<td>ΔD</td>
<td>u</td>
</tr>
<tr>
<td>ΔP_D</td>
<td>ΔM</td>
<td>P_Z</td>
<td>ΔD_G</td>
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<td>ΔD_p</td>
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<tr>
<td>T-C_G-ΔK_G</td>
<td>ΔF_G</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

C. Financial Programming

The Fund uses the term "financial programming" to describe the process of determining the values of the policy instruments that are required to achieve desired values of the target variables. The formulation of a financial program in practice involves the following steps:

(i) Specify the desired values of the target variables, such as ΔR* and ΔP_D*.

(ii) Generate projections for the values of the exogenous variables during the program period. These include real output (Δy), exports (X), net capital flows (ΔF_p + ΔF_G), and the international price of imports (P_Z).
(iii) Formulate a judgment on the adequacy of the existing exchange rate by ascertaining whether, given the projections of the exogenous variables in step (ii), the balance of payments target in step (i) can be attained. If it cannot be, then either the required exchange rate change must be calculated from equation (20a) or the balance of payments and/or domestic inflation targets must be adjusted downwards.

(iv) Given the programmed exchange rate change $\Delta e$, the domestic inflation target $\Delta P^*_D$ and the projection of import prices $\bar{P}_Z$, the aggregate price level is projected using equation (21). A projection for nominal income can then be derived using equation (19).

(v) Next, the nominal income projection is used together with the assumption for the velocity of income and the balance of payments target to derive the credit ceiling $\hat{D}$ from equation (10).

(vi) Using the projected value of nominal income, the secondary target for the expansion of credit to the private sector, $\Delta D^*_P$, is derived from equation (17), and the subceiling on expansion of credit to the public sector is determined from (16).

(vii) Finally, from the public sector's budget constraint (2a), the expenditure and revenue items in the budget are reconciled with the programmed expansion of credit to the public sector.
IV. The Bank Approach

A. The Simple Growth Model

In contrast with the Fund's concern with temporary balance of payments disequilibria, the Bank has been charged with the financing of growth and development over the medium term. The basic approach that the Bank uses for its macroeconomic projections and policy work, therefore, emphasizes the relationships between savings, foreign capital inflows, investment, and growth. This approach is reflected in the Revised Minimum Standard Model (RMSM) that "has been the basis of country economic projections in the Bank for several years". 21/ This model was developed to establish a consistent approach to projections over all countries and to facilitate comparisons across countries. A recent study of country-wide modelling activity in the Bank concludes that the RMSM remains the most widely-used tool for making macroeconomic projections and analyzing macroeconomic policies (see Whalley 1984). Other modelling approaches have been used to study particular problems in particular countries (i.e. Egypt, Dominican Republic, Nepal). However, Whalley (1984) notes that since these models remain country specific, no clear and widely accepted alternative to the RMSM has emerged as yet.

The RMSM is essentially an accounting framework that links the national accounts and the balance of payments, with particular attention being paid to the foreign financing gap and projections of foreign borrowing. The concern is with medium-term growth and its financing, and as such interest is focused on real variables only. Inflation is therefore not determined within the model, and if required is projected in some exogenous manner.

For the purposes of this paper, like the Fund model, the RMSM can also be reduced to a small number of key relationships for a closer examination of its internal structure. For simplicity and comparability of notation between the Fund and Bank approaches, prices are assumed constant in the remainder of this discussion ($AP = AP_D = AP_Z = 0$). In the context of the general macroeconomic accounting framework in Section I above, the RMSM basically posits the following four additional relationships.

(i) It is assumed that an incremental capital-output ratio (ICOR) is either historically or technologically given. Thus output as a function of the level of investment may now be written as:

\[
\Delta y^* = \rho^{-1} \Delta K,
\]

where $\Delta K = \Delta K_p + \Delta K_G$ is total domestic investment and $\rho$ is the incremental capital-output ratio. This relationship (22) allows one to obtain either the growth of real GDP based on the available level of investment, or the required level of investment consistent with a desired rate of growth. \(^{22/}\)

(ii) Similar to the Fund model, exports are assumed to be determined exogenously:

\[
X = \bar{X}.
\]

\(^{22/}\) In the latter case equation (22) becomes $\Delta K = \rho \Delta y^*$.  

(iii) The approach assumes a stable relationship between imports and GDP. This generally takes the form of the import demand equation (18), and is reproduced below:

\[ Z = ay^* \]

(iv) The final relationship required in RMSM is the private sector savings function. This is essentially reduced to a stable, historically given savings rate. Given such a savings rate the implied consumption function may be specified as:

\[ C_p = (1-s) (y^* - \hat{T}), \]

where \( s \) is the ratio of private saving to disposable income. 23/

Thus in their modelling of the external trade sector, both the Fund and the Bank approaches are similar. The main differences between the two, therefore, are the monetary approach of the Fund model to study balance of payments disequilibria, and the emphasis on the real sector in the Bank model to allow medium-term growth to be determined. Furthermore, the Bank approach does not provide an explicit relationship between policy variables and growth. For the purpose of the determination of growth, the Bank model relies on the assumed behavioral relationships for saving and investment. It is perhaps worth recognizing that the very simple forms for these relationships -- essentially ratios to GDP -- do imply certain restrictions on the underlying economic structure of the concerned country. For example, the assumption of a constant ICOR rests on fairly restrictive assumptions

23/ Strictly speaking, RMSM does not make savings a function of disposable income, but of GDP.
regarding the aggregate production function as well as for the returns to the factors of production. In general, a constant ICOR is associated with a fixed factor proportions production function where factor substitution is not possible. Allowing for factor substitution and assuming a constant return to scale production function as well as exogenously determined returns to factors of production, the ICOR is determined to be a function of the ratio of the wage rate and the return to capital. If the ICOR is assumed to remain constant in this case, then it necessarily implies that the ratio of wages to the return to capital also remains constant. The assumption of a more general production function would result in the ICOR being a function of both the ratio of wage to the return on capital and the level of factor utilization.

Before proceeding to discuss output determination in the Bank model, it would perhaps be useful to see how this model relates to the growth literature. The simple investment-output relationship (22), perhaps for reasons of convenience of calculation in countries with limited data, is reminiscent of earlier growth models of the Harrod-Domar variety. Similar to the RMSM, these models rely on a specified saving rate and a given capital-output ratio to determine feasible levels of growth. The relatively simple fixed factor production function assumed in these models, however, leads to knife-edge solutions for growth. Only if the required amount of saving was available would the economy continue to grow. If domestic saving was inadequate to meet the required investment needs of the economy for a target growth rate, and if foreign saving was available to make up the difference, the target for growth would be achieved. As later models show, dropping the assumption of fixed factor proportions for a smoother neoclassical production function allows knife-edge solutions to be less likely. In the RMSM the
availability of foreign savings to supplement domestic savings avoids the knife-edge problem.

Moving to output determination in the model, the national income accounting identity (5) may be rewritten as:

\[(24) \Delta K = (y^* - T - C_p) + (T - C_G) + (Z - X),\]

which yields the condition that domestic investment is the sum of private saving, public saving, and the inflow of foreign savings. Substituting the import demand equation (18) and the consumption function (23) in the identity (24) we obtain:

\[(25) \Delta K = s(y^* - T) + (T - C_G) + (ay^* - X).\]

Collecting the \(y^*\) terms together, we have an alternative formulation of the national income accounting identity (5):

\[(5a) \Delta K = (s + a) y^* + (1 - s) T - C_G - \bar{X}.\]

This expression now gives us a positive relationship between income and investment via the aggregate demand curve and with the price variables exogenously determined. An increase in output increases both domestic savings according to the given saving rate, \(s\), and the inflow of foreign savings according to \(a\), the marginal propensity to invest. This increased saving is reflected in increased investment on a one-for-one basis.

A "supply" or a technological relationship for output determination can be obtained via the ICOR relationship (22) and can be written as:

\[(22a) \Delta K = \rho y^* - \rho y_{-1},\]

which gives us another positive relationship between investment and output.
The simultaneous determination of output and investment in the Bank model is depicted in Figure 2. Equations (22a) and (5a) trace out positively-sloped loci in \( \Delta K - y \) space. The slope of the aggregate supply curve (AS), generated by equation (22a) is \( \rho \), whereas that of the aggregate demand curve (AD), which describes equation (5a), is \( (s + a) \). Since reasonable values of ICOR are in the range (4-7) while \( s \) and \( a \) are positive fractions, the slope of AS obviously exceeds that of AD. The authorities can shift locus AD vertically through policy measures that change the amount of domestic saving that will be forthcoming at a given level of output. The policy tools available to this end are public consumption and tax receipts. A reduction in public consumption increases public sector saving while leaving private savings unchanged. This increase in domestic saving shifts the locus AD upwards as investment increases. The intersection of the two loci moves from A to B, resulting in higher output and investment. Similarly, an increase in tax revenues raises public sector saving while reducing private saving. 24/ The reduction in private saving is smaller than the increase in public saving, however, because the private sector responds to the decline in its disposable income partly by reducing consumption. Thus in this case domestic saving also increases and AD shifts upward, with results similar to those described above.

The output targets \( \Delta y^* \) can be reconciled with a balance of payments target, say \( \Delta R^* \) only if the authorities exert some control over net capital inflows or if foreign capital is available perfectly elastically. In this

24/ In the RMSM private consumption is not assumed to be a function of disposable income. If this were the case since savings by definition equals disposable income minus consumption, tax policy would prove to be more effective in the RMSM than in this model, i.e., tax policy would move the curve (5a) by more than suggested here.
FIGURE 2
INVESTMENT AND OUTPUT DETERMINATION
IN THE BANK FRAMEWORK

\[ \Delta K \]
\[ \Delta K_0 \]
\[ \Delta K_1 \]

\[ y^*_0 \]
\[ y^*_1 \]
case ΔF can be considered a policy variable which is chosen according to

\[ \Delta F = a^* y + \Delta R^* - X. \]

B. Constraints on Foreign Inflows -- The Two-Gap Growth Model

If there are limits to foreign borrowing then (26) will operate as a constraint on the output determination equations (5a) and (22a). Such a model with foreign exchange constraints is immediately recognizable as one version of the familiar two-gap growth models. If the foreign exchange constraint was binding, the investment and growth potentials would not be realized.

The basic notion underlying the two-gap growth model is that two independent resource constraints inhibit the growth potential of a developing economy. First, the required level of investment to enable the growth potential of the economy to be realized is not available because of the inability of the economy to generate internally the needed savings. Second, domestic growth is restrained by the limited availability of foreign exchange, or the inability of a developing economy to run current account surpluses. Since foreign inflows can both add to domestic saving and provide the foreign exchange for imported inputs for which there are no close domestic substitutes, the latter constraint can be hypothesized to be the dominant constraint.

As in the RMSM, these two-gap growth models generally assume an aggregate saving function and an aggregate import demand function along with some output or growth determination equation. In a two-gap situation, depending on which constraint is binding, observed domestic saving may be different from desired domestic saving as may observed imports from desired or

25/ See Chenery and Strout (1966), Weisskopf (1972a and 1972b), and Blomqvist (1976).
required imports. In order to estimate saving and/or import functions from historical data, a judgment must be made about which constraint may have been binding over the relevant time period. A similar judgment on the binding constraint is also required for the determination of a feasible growth path. 26/ Following the two-gap approach, the principal use of the RMSM is to determine the financing requirements for alternative rates of growth, hence determining the feasibility of a particular rate of growth given reasonable foreign financing scenarios.

A classification of the variables in Meade-Tinbergen terms and according to their uses is presented in Table 2, clarifying further the role of foreign inflows in the RMSM. Given an exogenously derived export projection the levels of the policy variables, $C_G$, $T$, and $\Delta F$ can be used to

Table 2: Structure of the Bank Framework

<table>
<thead>
<tr>
<th>Targets</th>
<th>Endogenous Variables</th>
<th>Exogenous Variables</th>
<th>Instruments</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta Y^*$</td>
<td>$Z$</td>
<td>$X$</td>
<td>$C_G$</td>
<td>$s$ (savings rate)</td>
</tr>
<tr>
<td>$\Delta R^*$</td>
<td>$\Delta K$</td>
<td>$T$</td>
<td>$a$ (marginal propensity to import)</td>
<td></td>
</tr>
<tr>
<td>$S$</td>
<td>$\Delta F$</td>
<td>$\rho$ (ICOR)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

26/ Weisskopf (1972a and 1972b) and Blomqvist (1976) test whether the foreign exchange constraint dominated the domestic saving constraint or not for a set of developing countries. The results generally rejected this hypothesis for most countries.
achieve the targeted values of $\Delta Y^*$ and $\Delta R^*$. The levels of the variables, $Z$, $\Delta K$, and $S_p$ are endogenously determined. If, however, the level of foreign inflows, i.e., $\Delta F$, is not a policy variable but given as a binding constraint, then the model operates in a manner that is similar to the two-gap approach. As equation (26) shows, the income target has to be adjusted to reflect the constrained supply of foreign savings. Given the historically determined saving rate, the reduced income growth results in a decline in domestic saving. Furthermore, given the endogenously determined domestic import requirements, domestic saving cannot pick up the slack in the supply of foreign savings. Assumptions about the level of foreign financing are therefore quite critical in determining the way in which the model operates and one of the reasons why the RMSM iterations tend to focus on this variable.

Essentially, as the ICOR relationship suggests, growth in the RMSM model is determined according to the Harrod-Domar framework. The broadening of the definition of savings to include both government and foreign saving allows certain policy content to be built into the simple Harrod-Domar framework. In this open economy version of the Harrod-Domar model, for a given growth rate the ICOR determines the required level of investment. If foreign financing is not available perfectly elastically, then for a given level of foreign financing and a planned level of saving by the government, private saving is determined residually. As a consistency check the private saving level that is determined can be compared to the level obtained from the behavioral (historical) relationship such as (23). If the two savings estimates do not reconcile, then through a series of iterations a feasible change in the parameters of the model, such as the savings rate, $s$, the ICOR, $\rho$, and the marginal propensity to import, $a$, and/or the targeted growth rate have to be determined. This iterative approach is essentially used to overcome
the problem of overdetermination in the model that results from two different estimates of domestic saving. 27/

Similar to the Fund model, the overdeterminacy could be removed by introducing more economic behavior into the model. As mentioned earlier, Bank policy programs include possible action in the exchange rate area. In recognition of this, if the import function is generalized beyond the simple form presented in (18) to include the effect of the exchange rate on imports we have: 28/

\[ Z = ay^\ast - be. \]  

(27)

The net inflow of foreign capital equation (26) is now changed to

\[ \Delta F = ay^\ast - be + \Delta R^\ast - \bar{X}. \]  

(28)

With the introduction of the exchange rate the model is fully determined even with a constraint on foreign inflows. In this case, an exchange rate action can reconcile an income target to the available level of foreign inflows. More precisely, without the inclusion of an exchange rate variable and with a foreign exchange constraint we had only two endogenous variables with three independent equations. The inclusion of an exchange rate allows three independent equations to determine three variables even when foreign exchange is constrained in supply.

---

27/ This iterative approach is similar to that employed in dealing with the overdetermination of imports in the Fund model.

28/ This is a simplified version of the general import equation (18b) that was specified in the Fund approach. Since prices are assumed constant e can be interpreted here as the real exchange rate.
When there are no constraints on the supply of foreign exchange, exchange rate policy can be used to allow a level of foreign inflows that is consistent with the domestic savings rate, given the rate of domestic investment consistent with the assumed ICOR and the growth target.

C. The Bank Programming Procedure

In practice, the process of determining the values of policy instruments to achieve desired values of the targeted variables would involve the following steps.

(i) Specify the desired levels of the target variables -- $\Delta y^*$ and $\Delta R^*$.

(ii) Given the exogenously determined ICOR ($\rho$) and the marginal propensity to import ($a$), and a constant exchange rate, the values for investment, $\Delta K$, and imports, $Z$, are derived from equations (22a) and (27), respectively.

(iii) Exports, $\bar{X}$, are projected exogenously.

(iv) Given the required level of imports ($\bar{Z}$), the export projection ($\bar{X}$) and the targeted level of balance of payments ($\Delta R^*$), the required inflow of foreign savings ($\Delta F$) is determined from equation (26).

(v) With the investment projection and the projection for the trade balance, government savings ($T-C_G$) may be used in equation (24) to determine a feasible level of private savings.

(vi) The saving level derived from the historical relationship (23) can be used as a consistency check on the feasibility of the derived projections. If the two levels are markedly different, then the
targets and the instruments have to be adjusted to achieve a consistent level of savings.

These steps assume that foreign financing is not constrained in any manner. If foreign financing is constrained then the import requirements that are consistent with the available level of foreign financing, would constrain the feasible set of income growth targets. The growth target would therefore have to be adjusted to a level which is consistent with the availability of foreign finance. The above steps could still be followed to enable a set of projections that are consistent with the amount of foreign financing that is available to be determined through a series of iterations. Alternatively, for given foreign inflows and an export projection, a growth projection to match a realistic change in reserves is obtained from equation (26), and via the ICOR, $\Delta K$ is obtained while steps (v) and (vi) remain the same as before.

V. Merging the Fund and Bank Approaches

Given the Bank's concern with real variables and the Fund's emphasis on financial variables, it is not surprising that the two institutions' general macroeconomic approaches can be merged quite readily. The resulting "hybrid" model, while internally consistent, is nevertheless too simple to serve as a general framework for the design of growth-oriented adjustment programs. It is presented here purely for expository purposes and to lay the groundwork for future research. The merged approach is divided into a price-output sector, a monetary sector, and an external sector. All equations are drawn from previous sections and are repeated here for convenience.
A. The Price-Output Sector

The growth of real output is derived from the ICOR relationship (22):

\[ \Delta y^* = \rho^{-1} \left( \frac{\Delta K_p + \Delta K_G}{P_{-1} + \Delta P} \right), \]

where total investment \( \Delta K \) is divided into private and public investment and nominal investment spending is deflated by the aggregate price level \( P_{-1} \) to express investment in real terms. Notice that real GDP growth is a target variable in the merged approach. The budget constraints for the private and public sectors can be used to derive expressions for private and public investment:

\[ \Delta K_p = s(Y_{-1} + \Delta Y - \hat{T}) - \Delta M^D - \Delta F_p + \Delta D_p \]

\[ \Delta K_G = (T - C) - \Delta F_G + \Delta D_G, \]

where the consumption function (23) has been used in (1a) to express private saving as a function of disposable income.

The change in nominal GDP continues to be given by equation (19):

\[ \Delta Y = P_{-1} \Delta y^* + y_{-1} \Delta P, \]

while the change in the aggregate price level \( \Delta P \) is given by (21):

\[ \Delta P = (1 - \theta) \Delta P^*_D + \theta P^*_Z \Delta e. \]

B. The Monetary Sector

The Fund's assumption of exogenous income velocity is retained in the form of equation (7):
The supply of money, on the other hand, comes from the banking system's balance sheet as in (4):

\[ \Delta M^s = \Delta R^* + \Delta D_p + \Delta D_G. \]

Flow equilibrium holds continuously in the money market, so we still have:

\[ \Delta M^s = \Delta M^D = \Delta M. \]

C. The External Sector

The external sector's budget constraint defines the balance of payments:

\[ \Delta R^* \equiv X - Z - (\Delta F_p + \Delta F_G). \]

Exports and flows of foreign financing are exogenous in foreign currency terms, so that:

\[ X = \bar{X}e_{-1} + \bar{X}e \]

\[ \Delta F_p = \bar{F}_p e_{-1} + \bar{F}_p e \]

\[ \Delta F_G = \bar{F}_G e_{-1} + \bar{F}_G e. \]

Finally, imports depend on income and relative prices:

\[ Z = Z_{-1} + (Z_{-1} - b) \bar{P} \hat{e} + b\Delta P_D^* + a\Delta y^*. \]
D. Structure of the Merged Approach

The framework just described contains 13 equations. Its structure is summarized in Table 3.

Table 3: Structure of the Merged Framework

<table>
<thead>
<tr>
<th>Targets</th>
<th>Endogenous Variables</th>
<th>Exogenous Variables</th>
<th>Instruments</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δy*</td>
<td>ΔY</td>
<td>P_z</td>
<td>T</td>
<td>ρ</td>
</tr>
<tr>
<td>ΔP_D</td>
<td>ΔP</td>
<td>X</td>
<td>C_G</td>
<td>θ</td>
</tr>
<tr>
<td>ΔR*</td>
<td>ΔM^D</td>
<td>ΔF_P</td>
<td>ΔD_p</td>
<td>v</td>
</tr>
<tr>
<td></td>
<td>ΔM^S</td>
<td>ΔF_G</td>
<td>ΔD_G</td>
<td>b</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Δe</td>
<td>a</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td></td>
<td>s</td>
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<tr>
<td>ΔF_P</td>
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<tr>
<td>ΔK_P</td>
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<td>ΔK_G</td>
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Given the values of the six behavioral parameters, the thirteen equations of the model determine values for the ten endogeneous variables and three target variables conditional on the exogenous variables and policy instruments. We refer to this as the model's "positive" mode. Conversely, given chosen values for the target variables, two of the policy instruments can be chosen arbitrarily and the model will then determine values for the endogenous variables and the three remaining policy instruments. This is the model's "programming" mode.
The model can be solved in the positive mode by condensing it into two
two relationships between \( \Delta y \) and \( \Delta P \). These relationships can be regarded as a
"Bank" component and a "Fund" component. The heart of the Bank component is
the ICOR relationship (22a). Substituting (7) in (1a) and then both (1a) and
(2a) in (22a) yields an equation for the growth of output:

\[
(29) \quad \rho \Delta y^* = \frac{s(Y_{-1} + \Delta Y) + (1 - s) \hat{T} - \hat{C}_G - \upsilon \Delta Y - \Delta F + \Delta D}{P_{-1} + \Delta P}
\]

\[
= \frac{(s - \upsilon) \Delta Y + (1 - s) \hat{T} - \hat{C}_G + sY_{-1} - \Delta F + \Delta D}{P_{-1} + \Delta P}
\]

where for notational brevity we have used \( \Delta F = \Delta F_p + \Delta F_G \) and \( \Delta D = \Delta D_p + \Delta D_G \).
The numerator of the expression on the right-hand side is nominal aggregate
investment, which consists of an "autonomous" portion \( I_0 \), given by:

\[
I_0 = (1 - s) \hat{T} - \hat{C}_G + sY_{-1} - \Delta F + \Delta D,
\]

and a portion which is induced by changes in nominal GDP -- i.e., \( (s - \upsilon) \Delta Y \).
The latter is an increasing function of \( \Delta Y \) if the "marginal propensity to save"
\( (s) \) exceeds the "marginal propensity to hoard" \( (\upsilon) \), since in this case an
increase in saving induced by an increase in GDP will not be completely
absorbed by the accumulation of cash balances, leaving some resources to be
devoted to investment.

The change in nominal GDP, which appears in (29), is given by:

\[
(19a) \quad \Delta Y = P_{-1} \Delta y^* + y_{-1} \Delta P + \Delta y^* \Delta P,
\]

to which (19), which will be recalled, is an approximation which holds
when \( \Delta y^* \) and \( \Delta P \) are small, since the second-order term \( \Delta y^* \Delta P \) can be dropped in
this case. Substituting (19a) in (2a) and multiplying both sides by \((P_{-1} + \Delta P)\) produces:

\[ P_{-1} \rho \Delta y^* + \rho \Delta y^* \Delta P = (s - u) (P_{-1} \Delta y^* + y_{-1} \Delta P + \Delta y^* \Delta P) + I_0. \]

The relationship between \(\Delta y^*\) and \(\Delta P\) in the Bank component depends on the extent to which the approximation (19) is valid. If the second-order terms can be ignored in the above expression, as we have implicitly been doing up to now, we have:

\[ (30) \quad \Delta y^* = \frac{I_0 + (s - u) y_{-1} \Delta P}{\rho - (s - u)}. \]

Substituting for \(\Delta P\) from (19) yields:

\[ (31) \quad \Delta y^* = \frac{I_1 + (s - u) (1 - \theta) y_{-1} \Delta P^*}{\rho - (s - u)}, \]

where:

\[ I_1 = I_0 + (s - u) y_{-1} \theta \Delta \hat{w}. \]

Equation (31) depicted in Figure 3 as the positively-sloped locus BB in \(\Delta P_D - \Delta y\) space as long as \(s > u\). The positive slope of this locus holds only for small \(\Delta y^*\) and \(\Delta P_D^*\). Intuitively, this is because an increase in \(\Delta P_D\) has two effects on real aggregate investment. On the one hand, when \(s > u\), it increases nominal investment expenditures, as explained above. On the other hand, the increase in the current price level reduces the real value of initial nominal investment spending. When initial \(\Delta y^*\) is small,
initial investment $I_0$, must also be small, so the positive effect on investment spending must dominate the negative "valuation" effect. 29/

A second expression $\Delta y$ relating to $\Delta P_D$ can be derived from the money-market equilibrium condition (8). By substituting the equation for $\Delta y$ into the flow demand for money (7), $\Delta M_D$ in equation (8) is expressed as a function of $\Delta y$ and $\Delta P_D$. The same can be done for the flow supply by substituting (11a), (12b), (12c), and (18b) into the balance of payments identity (3) and using the result in the money supply identity (4). Setting the money supply and demand equations derived in this way equal to each other in accordance with (8) yields the second relationship between $\Delta y$ and $\Delta P_D$. Since this solution procedure is in effect the same as that employed in solving the expanded Polak model, a simpler way to describe it is to notice that it is equivalent to substituting equation (20a) into (9b) and solving for $\Delta y$. The resulting Fund component is:

$$
(32) \quad \Delta y = \frac{E_1 - [u_y - 1(1-\theta)+b] \Delta P_D}{u + a}
$$

29/ If $\Delta y^*$ is not small, (30) becomes:

$$
\Delta y^* = \frac{I_0 + (s - u) y_{-1} \Delta P}{(\rho - s + u) (P_{-1} + \Delta P)}
$$

with slope at $\Delta P = 0$:

$$
\frac{d\Delta y^*}{d\Delta P} = \frac{(s - u) y_{-1}}{(\rho - s + u)} - \frac{I_0}{(\rho - s + u)}
$$

(recall that $P_{-1} = 1$). The first term is the effect on nominal investment spending, which is positive if $s > u$, while the second term is the "valuation" effect. For a small initial $\Delta y^*$ (and therefore small $I_0$), the former must dominate. It follows, of course, that $d\Delta y^*/d\Delta P$ must be negative for sufficiently large $I_0$, and the locus $BB$ would have a negative slope in this case.
where:

\[ E_1 = [(\bar{X} - \Delta F) e_{-1} - Z_{-1} + \hat{D}] + [(\bar{X} - \Delta F - (Z_{-1} - b)) - v y_{-1} \theta P Z + \bar{R}_{-1}] \Delta e. \]

This equation traces out a negatively-sloped locus in \( \Delta P_D - \Delta y \) space, denoted FF in Figure 3. These two expressions can be solved simultaneously for \( \Delta y \) and \( \Delta P_D \) as functions of the exogenous and policy variables.

Figure 3 also lends itself to standard comparative-static exercises. For example, a reduction in ICOR shifts BB to the right, increasing \( \Delta y \) and reducing \( \Delta P_D \). On the other hand, a reduction in \( \hat{D} \) shifts both BB and FF to the left, thereby reducing \( \Delta y \). The effect on \( \Delta P_D \) is, however, ambiguous, because the relative magnitude of the shifts of the two curves in Figure 3 depends on the values of the parameters.

The solution of the model in the programming mode proceeds as follows: Substituting (11a), (12b), (12c), and (18b) into (3) yields:

\[ \Delta R^* = [(\bar{X} + \Delta F_P + \Delta F_G) e_{-1} - Z_{-1} + b \Delta P_D^* - a \Delta y^*] \]

\[ + [(\bar{X} + \Delta F_P + \Delta F_G - (Z_{-1} - b) \bar{P}_Z] \Delta e. \]

Similarly, substituting (21) into (19), (19) into (7), and both (7) and (4) into (8) produces:

\[ \Delta R^* = v y_{-1} (1 - \theta) \Delta P_D^* + u P_{-1} \Delta y^* + v y_{-1} \theta P Z \Delta e - (\Delta D_p + \Delta D_G). \]

The interaction of these two equations in determining values for \( \hat{D} \) and \( \Delta e \) conditional on the targets \( \Delta y^* \), \( \Delta R^* \), \( \Delta P_D^* \) was already described in the analysis.
FIGURE 3
PRICE AND OUTPUT DETERMINATION IN THE “MERGED” MODEL
of the expanded Polak model in Section III. The only difference here is
that \( \Delta y^* \) is now a target variable rather than exogenous. 30/

Notice that with \((\hat{\Delta}D_p + \hat{\Delta}D_G)\) and \(\hat{\Delta}\) given by (20a) and (9b) we now
have solutions for \(\Delta P, \Delta Y, \Delta M^D, \Delta F_p,\) and \(\Delta F_G\). Using a tilde (~) to denote the
solution to each of these variables so that, for example, \(\hat{\Delta}P\) is the solution
for \(\Delta P\), and letting:

\[
\hat{\Delta}D = \hat{\Delta}D_p + \hat{\Delta}D_G,
\]

we can now rewrite (22a), (1a), and (2a) as:

\[
(22a) \quad \Delta y^* = \rho^{-1} (\Delta K_p + \Delta K_G) / p_{-1}
\]

\[
(1a) \quad \Delta K_p = s (Y_{-1} + \hat{\Delta}Y - \hat{T}) - \Delta M^D - \hat{\Delta}F_p + \hat{\Delta}D_p
\]

\[
(2a) \quad \Delta K_G = (\hat{T} - \hat{C}_G) - \hat{\Delta}F_G - (\hat{\Delta}D - \hat{\Delta}D_p).
\]

These equations contain the unknowns \(\hat{T}, \hat{C}_G, \Delta K_G, \Delta K_p,\) and \(\hat{\Delta}D_p\). Given choices
for two of the three policy variables \(\hat{T}, \hat{C}_G,\) and \(\hat{\Delta}D_p\), the three equations can
be used to determine values for the endogenous variables \(\Delta K_G, \Delta K_p,\) and the
remaining policy variable. For example, if \(\hat{T}\) and \(\hat{\Delta}D_p\) are fixed, \(\Delta K_p\) is given
by (1a). Substituting this value in (22a) gives \(\Delta K_G\), and with \(\hat{T}, \hat{\Delta}D_p,\) and
\(\Delta K_G\) now determined, equation (2a) can be solved for \(\hat{C}_G\).

VI. Conclusions

The increasing collaboration between the Bank and the Fund in the form
of joint missions and reports raises three important questions. First, how do

30/ A trivial difference is that \(\hat{\Delta}D\) is expressed here as the sum
of \(\hat{\Delta}D_p\) and \(\hat{\Delta}D_G\).
the two institutions design their programs? Second, how can the approaches be combined? Third, is there a generalized framework which can be utilized to analyze issues of adjustment relevant to the two institutions? The focus of this paper was on the first two of these questions, and the objective was to describe and analyze the basic models that lie behind the policy packages developed by the Bank and the Fund. It should be stressed that by concentrating on the formal models we consciously glossed over many of the more detailed aspects of programs. Our defense is that the combination of widespread interest in Bank-Fund programs and the scarce existing literature on the methodology employed suggests that even a rudimentary analytical exposition of the approaches of the two institutions would be helpful. The exercise here can perhaps form the basis for an eventual examination of the third question.

As this paper shows, the approaches of both the Bank and the Fund turn out to have fairly simple analytical underpinnings. The Bank's approach involves some variant of the two-gap growth model, and Fund programs generally bear a close resemblance to the models associated with the monetary approach to the balance of payments. This paper described these approaches, demonstrated how they are utilized in the formulation of programs, and then combined them in a relatively straightforward manner. Of course, there is much more contained in programs but this does not detract from the fact that the simple models play an important role as well.

An interesting question to ask is why the existing models, despite their restrictive assumptions, have survived for so long. There are several good reasons for this. The models used by the Bank and Fund are very transparent and thus easily understood. They also require very little information on behavior and are easy to apply. Furthermore, by stressing the importance of balance sheet and budget constraints, they are helpful as an
organizing device. On the negative side, however, the simple Bank and Fund approaches do not convey much information on the relationship between policy variables and the objectives of programs. In this respect, the Fund approach does go further than that of the Bank in specifying the links between policies such as domestic credit expansion and exchange rate action and the objective of an improved balance of payments. The formal Bank approach, as represented by the two-gap model, does not contain any such linkage. Policy changes have to be handled arbitrarily by changing the values of key parameters, particularly the ICOR, or the exogenous variables, such as the availability of domestic and foreign savings. While this may appear to give Bank economists a greater degree of flexibility in designing policy packages to raise growth in the economy, the underlying economic relationships are left unclear.

The simple Bank and Fund approaches considered here also do not capture the true flavor of programs because they are unable to cover all the policies that are typically included in programs. In fact, there is a large gap between the formal models and the actual policy packages that are implemented by the Bank and the Fund. While it is possible to merge the existing simple models of the Bank and the Fund into one larger "hybrid" model, as was done here, this gap nonetheless remains. What is needed is the development of a general analytical framework that relates the various policy measures contained in Bank and Fund programs and their ultimate objectives. Within such a framework the respective Bank and Fund approaches could possibly emerge as special cases.

While the principle of having such a general framework is hardly disputable, the actual task of designing one is no easy matter and will undoubtedly occupy researchers for the foreseeable future. It may also be that these efforts do not yield a unique framework. The very diversity of
developing countries in terms of, inter alia, production structures, degrees of financial development, trade and exchange regimes, and the type of the existing disequilibria, argues for a flexible approach in the design of programs. Of course, this is not to deny that certain theoretical and empirical relationships may well be common across programs and countries, but the search for a unique model that will simultaneously achieve the objectives of the two institutions, or even of each institution, may well turn out to be an elusive one. Obviously, Bank and Fund operational work in this area cannot come to a standstill while awaiting the development of an appropriate framework. Staff in the two institutions, therefore, must utilize whatever tools and models are available. The approaches described in this paper, and in particular the combined Bank-Fund approach, can serve a useful purpose in the interim, but they are not a substitute for a general analytical framework for macroeconomic adjustment that can be adapted by the Bank and Fund to the individual country for which a program is being designed.
References

(1) Alexander, Sidney S., "Effects of Devaluation on a Trade Balance", International Monetary Fund Staff Papers, April 1952, pp. 263-78.


(11) Robichek, E. Walter, "Financial Programming Exercises of the International Monetary Fund in Latin America", address to a seminar of Brazilian professors of economics, Rio de Janeiro, September 1967.


(13) Selowsky, Marcelo and Herman van der Tak, "The Debt Problem and Growth", World Bank, mimeo, 1986.


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