ELSEVIER

Journal of Development Economics
Vol. 45 (1994) 17–34

JOURNAL OF
Development
ECONOMICS

Gap models

Lance Taylor *

New School for Social Research, 65 Fifth Avenue, New York, NY 10003, USA

Received November 1990; final version received April 1993

Abstract

'Gap' models put together the national income and product, fiscal, monetary, and balance of payments accounts that inform macroeconomic debate in the developing world. This paper sets out saving, foreign exchange, investment, and inflation gap restrictions on potential output growth and capacity utilization, along with a discussion of IMF-style financial programming. Subject to demand-driven and foreign exchange-constrained closures, the model is used to illustrate the effects of devaluation and a heterodox shock anti-inflation package, and to analyze policy problems posed by adverse shocks and incoming resource transfers.

Keywords: Gap models

JEL classification: E19, O11

1. Introduction

Applied macroeconomic models in developing economies take compact form. Often, policy analysis is set up "... essentially in terms of four sets of accounts – the balance of payments accounts, the fiscal accounts, the consolidated accounts of the banking system, and the national income and product accounts which usually

* Research support from the Swedish International Development Authority, a helping hand from Anne Maasland and Desmond McCarthy, and comments by referees are gratefully acknowledged.

SSDI 0304-3878(94)00024-7

offer only a pale reflection of what is going on in the real economy, out there. Now fairly simple models can be constructed using the type of accounting identities represented by the four sets of accounts just mentioned... '' (Sobhan, 1990).

In fact, two 'fairly simple' formulations almost always frame the debate. One feeds the fiscal, monetary, and balance of payments numbers into the International Monetary Fund's 'financial programming' exercises which have scarcely changed since they were designed by Polak (1957). The other fits all the accounts into various 'gap' models that follow a pioneering paper by Chenery and Bruno (1962). What these models can tell us about specific policy issues is a question of vital interest to residents of developing countries, and the topic of this paper. The general conclusion is that gap models inform, in diverse sets of circumstances.

2. The evolution of the gaps

The written gap record starts with Chenery and Bruno, but the ur-history goes a bit further back. In the 1950s, the Harrod–Domar linkage between the growth rate of actual output (assumed equal to potential output or capacity) and saving supply was extended to include 'foreign saving' or the external deficit on current account. Rosenstein-Rodan (1961) presented typical computations in which the saving gap was used to estimate foreign resource inflows required to support target rates of growth.

A few years later, Chenery was visiting the United Nations Economic Commission for Latin America in Santiago, where the concept of 'external strangulation' was in vogue. He was inspired to extend the Harrod–Domar formulation to incorporate the external accounts explicitly, with emphasis on the unavoidability of capital goods imports to support investment in developing economies. Using the activity analysis methodology popular at the time, he built separate saving and foreign inequality gaps or constraints into his models, adding an external restriction to Rosenstein-Rodan's savings gap.

This linear programming focused attention on the external restrictions that poor countries confront. But its macroeconomics was confused, since model solutions often included one binding and one slack inequality, or a 'gap between the gaps'. Such results contradicted the ex post equality between the saving–investment and foreign balances. How this apparent disequilibrium was to be resolved caused a lot of head–scratching over the years. To this day, for example, when World Bank country economists solve the RMSM or 'Revised Minimum Standard Model' that Chenery helped implant in that institution, they almost always assume that the trade gap is binding (Addison, 1989). In most Bank assessments of an economy's growth prospects, therefore, private consumption and saving are treated as slack variables adjusting to make the national income and product accounts tally out.

Bacha (1984) finally pointed out that the two gaps restate internal and external balance relationships, with a tropical accent. Just as in industrial economies, one has to introduce adjustment mechanisms such as short-run output changes (dropping the older gap models' maintained hypothesis that output is predetermined by capital accumulation), forced saving/inflation tax responses, interest rate movements, etc. via which the gaps can be resolved consistently with the institutional structure at hand. The fact that inflation took off while output was below capacity throughout Latin America and Africa during the 1980s makes Bacha's observation especially apt.

Indeed, inflation had been brought into the gap picture some years after Chenery–Bruno. Cauas (1973) pointed out that there is an ex ante discrepancy between the inflation rate coming from the side of costs and the rate that assures internal balance via the inflation tax and forced saving. This third gap made applied financial programming in Chile (where Cauas was vice-president of the Central Bank) less harmonious than the typical Polak exercises. Unsurprisingly, the inflation gap has been rediscovered elsewhere in Latin America, e.g. Fanelli et al. (1987).

Finally, fiscal limitations can open a gap between desired and feasible growth rates through the public sector accounts. On the one hand, there is much recent discussion about how private investment is strongly crowded in by public capital formation through complementarities between the sorts of projects that the two sectors undertake. But on the other hand, public investment has been drastically cut back after the terms-of-trade and debt shocks that hit many developing countries in the 1980s, because public revenue from export taxes has declined while foreign debt with its associated payments burdens has effectively been nationalized. Growth prospects are restricted by this fiscal gap, as set out in various forms by Fanelli and Frenkel (1989), Bacha (1990), Ros (1992), and Taylor (1993).

3. Accounting formulations

Table 1 gives a simplified statement of Sobhan's macro balances, based on the assumption that actual output (or X) can fall below productive capacity or potential output Q. The variable $u = X/Q \leqslant 1$ stands for the level of capacity utilization. If I is current gross investment and ΔQ means the change in Q from one period to the next, then the potential output growth rate $g = \Delta Q/Q$ can be tied to capital accumulation as in equation (G). The coefficient c is the incremental capacity/capital ratio (typically taking a value between 0.2 and 0.4), and d is an intercept term which might be negative because of depreciation or positive if there is a growth trend in potential output. The investment/capacity ratio i can be limited by available saving, a foreign exchange restriction, and the economy's own investment demand function.

3.1. The saving constraint

The first constraint comes from the national income and product accounts, reduced to their simplest version as a balance between investment and saving. If standard behavioral functions are stated in linear form, we arrive at equation (S) in Table 1. The first two positive terms represent national demand injections measured relative to the value of potential output, PQ, where P is the current price level. They are i or investment, and δ or the current public sector deficit (current expenditure less tax and other revenues). Private saving relative to PQ is a leakage that comes next: s_0 and su relate savings flows to the level of economic activity (s_0 is an intercept term, s is the marginal saving rate). The term $\sigma\hat{P}$ represents effects such as the inflation tax and forced saving via which a faster inflation rate $\hat{P} = \Delta P/P$ increases potential saving or reduces aggregate demand. Again scaled by potential output, net incoming external transfers t (capital inflows plus other transfers less interest payments, profit remittances, and amortization) less the increase in international reserves ρ equals the trade deficit, another leakage.

The saving-constrained potential output growth rate follows from substitution of (S) into (G) to get (S′) in Table 1. The signs of the partial derivatives are likely to be as shown. To elaborate a bit on the algebra in (S), relevant stories go as follows:

Inflation. Following Polak (1957) and ultimately Wicksell's (1935) cumulative process inflation model, we treat the banking system as the *only* financial intermediary – a plausible first approximation in many developing economies. The $\sigma\hat{P}$ term in (S) embodies the structuralist interpretation of the inflation tax: a higher inflation rate reduces aggregate demand by shifting the aggregate saving function upward.

Table 1
Model equations

(G)	$g = d + c(I/Q) = d + ci,$
(S)	$i + \delta - s_0 - su - \sigma\hat{P} - (t - \rho) = 0$
(S′)	$g^s = s(\underset{+}{u}, \underset{+}{t}, \underset{+}{\hat{P}}, \underset{-}{\delta}, \underset{-}{\rho})$
(Q)	$\hat{H} = \hat{P} + \hat{g}$
(B)	$\pi u = \delta + k - jt$
(Z)	$\hat{\eta} = (PQ/\eta)\{\pi u + \rho + [i - k - (1 - j)t] - (s_0 + su)\}$ $= (PQ/\eta)[\delta + i + (\rho - t) - (s_0 + su)]$
(F)	$(t - \rho) + \epsilon - au - bi - z = 0$
(F′)	$g^f = f(\underset{-}{u}, \underset{+}{t}, \underset{-}{\rho}, \underset{-}{z})$
(I)	$-i + i_0 + \alpha u + \beta k + \psi(t - \delta) = 0$
(I′)	$g^i = i(\underset{+}{k}, \underset{+}{u}, \underset{+}{t}, \underset{-}{\delta})$
(P)	$\hat{P} = C(u, w, e, \ldots)$
(FP)	$\delta = (1/V)(\hat{P} + g) - (\rho + i) + jt$

This linkage can be derived in stylized fashion from the flows of funds of the fiscal, monetary, and external sectors under the Wicksell/Polak assumption that all financial transactions are intermediated via a consolidated banking system with three assets (loans to the government and private sector, and foreign reserves). Its liabilities comprise deposits D which are the destination of normal savings flows, and currency supply η which is used for transactions. The equation of exchange $HV = PQ$ describes currency demand H. 'Velocity' V is a scaling factor that might take a value between 2 and 10. In four steps, the derivation of (S) goes as follows:

(1) In flow terms, $HV = PQ$ is restated as Eq. (Q) in Table 1. The variable $\hat{H} = \Delta H/H$ is the growth rate of currency demand and V is assumed constant. Economic actors perceive the current inflation rate without error, in a simple version of rational expectations. [1] Their demand for the means of payment rises when either the inflation rate or the rate of growth of potential output is higher. Since they have no other source, higher currency holdings ultimately must come from increased private saving.

(2) Relative to potential output, new bank deposits come from desired savings apart from flows induced by inflation: $\Delta D/PQ = s_0 + s(X/Q) = s_0 + su$. A simple Keynesian saving function is assumed to apply.

(3) Sources of bank assets less deposit growth (a use) are summarized in the second line of equation (Z) for $\hat{\eta} = \Delta\eta/\eta$. To see the accounting, let k be the level of government investment relative to potential output and j the share of foreign transfers t directed through the public accounts. Local public borrowing is given on the right-hand side of equation (B); the coefficient π on the left stands for the famous public sector borrowing requirement (or PSBR), relative to current output. Public borrowing πu appears as the first term in brackets in the first line of (Z), i.e. the government's only source of finance is bank loans. Next, reserve increases ρ add to money growth. In the last positive term, firms are assumed to finance investment both at home and abroad, with $i - k - (1 - j)t$ standing for the part of private capital formation $(i - k)$ paid for by bank credits after new foreign loans $(1 - j)t$. Consolidating terms gives the equation's second line.

(4) Setting currency demand and supply levels and growth rates equal (so that $PQ/\eta = V$ and $\hat{\eta} = \hat{H}$) and straightforward substitution give an aggregate

[1] If velocity is treated as a positive linear function of the inflation rate (say $V = V_0 + \varphi\hat{P}$) in accepted monetarist fashion, then a term $(\varphi/V)\Delta\hat{P}$ for $\hat{V}$ should be added to the left-hand side of (Q). With model-consistent expectations about $\hat{P}$ and $\Delta\hat{P}$, this extended equation's positive linkage between the inflation rate and its own rate of change would produce typical rational expectations saddlepath dynamics. For details (in continuous time) when there is backward-looking money wage indexation see Taylor (1991, Appendix 4.A). In applied work, one could write the equation of exchange in terms of actual as opposed to potential output without changing the results of the model.

saving–investment balance like (S) via the banking system's flows of funds, including the $\sigma\hat{P}$ term with $\sigma = 1/V$. [2]

In old-fashioned monetarist language, an excess of demand injections over leakages leads to 'inorganic emission' and thereby inflation. Consumers may acquiesce for several reasons. One is that households may be forced below their desired zero-inflation consumption value $[(1-s)u - s_0]PQ$ by supply preemption by the government and investors. With access to bank loans, they can use credit to get commodities, leading to emission which drives up prices as part of the process of crowding out consumption demand. A second is that $(H/P)\Delta P$ is the instantaneous loss in real balances caused by a price increase ΔP. The public may raise its saving by this amount to reconstitute wealth – rationally reducing demand to available supply. Thirdly, faster inflation means that people need a bigger money stock for transactions purposes. With no easily liquefiable assets at hand, the only way they can build currency holdings up is to save more. Finally, investment itself may fall due to greater uncertainty as inflation accelerates. On all counts, effective demand declines with more inflation.

Other salient factors affecting the saving–investment balance can be described as follows:

Forced saving. Real wage reductions due to faster inflation can reduce aggregate demand. If nominal wage increases are not fully indexed to rising prices, then when $\hat{P}$ rises, the real wage will fall. The resulting increase in the profit share is likely to boost the national saving rate. This linkage was at least as important as the inflation tax in many developing economies in the 1980s, when real wage losses as high as 75 percent were observed in Latin American and African economies subject to massive external and supply shocks (Taylor, 1988).

Capital inflow. In principle, extra foreign saving permits higher national capital formation. But the increment may well be less than one-for-one due to capital flight and consumption leakages as stressed by gap model critics such as Griffin (1970) and Weisskopf (1972): In (S), s_0 is likely to shift downward as t moves up. By rediverting hard currency inflows abroad, reserve increases ρ also reduce saving available to finance local capital formation.

Fiscal dissaving. Fiscal behavior can also matter. As public dissaving δ rises in (S), then so must the inflation rate $\hat{P}$ if overall saving is to be held constant. This traditional monetarist linkage may be supplemented or offset by at least three additional 'effects,' viz.:

[2] A small term $-(1/V)g$ has been dropped from (S) in Table 1 for simplicity. It represents the real money creation absorbed by capacity growth in the equation of exchange. Seigniorage models usually fix $u = 1$, so that the inflation tax is only a wealth transfer from savers to recipients of bank credit, without effects on economic activity. The present formulation lets inflation act like any other tax, and reduce effective demand.

The Olivera–Tanzi effect. This may stimulate demand. As inflation speeds up, real fiscal receipts in a developing economy are likely to decline, due to collection lags for indirect taxes. In effect, δ in (S) becomes an increasing function of $\hat{P}$, reducing potential saving economy-wide.

Fiscal adventurism. The same result may occur if the government seeks to offset the ill effects of forced saving on workers' incomes by higher spending or transfer programs. Again, δ rises with $\hat{P}$, but from the expenditure as opposed to the taxation side. Examples include Chile in the early 1970s, and Peru 10 or 12 years later.

Variable velocity. As noted in footnote 1, a central monetarist stylized fact is that money velocity tends to rise along with inflation, generating an inflation tax Laffer curve. We assume that the economy stays on this curve's 'right' (that is, rising) side, which turns out to be empirically relevant in Section 5.2.

Clearly, inflation has numerous effects on aggregate demand. In what follows, we stick with the assumption of an overall negative response in (S′). One empirical justification is that when inflation is rapidly cut back in 'heterodox shock' packages relying on price freezes, consumption demand is observed to rise. Reducing forced saving and the inflation tax outweighs the Olivera–Tanzi effect and fiscal expansionism, in these examples at least.

3.2. The foreign exchange constraint

The next accounting relationship is the foreign balance. Stated relative to the value of potential output, it appears as equation (F) in Table 1. The new terms are ϵ or exports; au or imports of intermediate goods in proportion to the rate of capacity utilization u; bi or imports of investment goods as a share of national capital formation i; and z stands for other foreign exchange outflows to be described more fully.

Plugging (F) into (G), the foreign exchange limit on potential output growth can be stated as (F′).

Output effect. All economies apart those of large, industrialized nations require imported capital goods. At the same time, intermediate imports are an essential input into current production, as a consequence of the pursuit of industrialization via import substitution. Increasing capacity utilization thus uses foreign exchange and crowds out capital formation. In the 1980s, developing economies responded to this constraint in diverse fashion, e.g. Tanzania maintained three percent potential output growth while cutting capacity utilization by about 20 percent while its neighbor Zimbabwe had negligible capacity growth but kept the level of activity high by directed import controls (Taylor, 1993).

Capital flows. A bigger trade deficit permits higher imports of capital goods, if u is held constant. This is *the* traditional two-gap argument à la Chenery and Bruno

(1962). Contrariwise, reserve increases soak up forex which otherwise could be used to support intermediate or capital goods imports.

3.3. The investment function

To construct a complete model, we have to add an investment function to the accounting already discussed. A version which makes empirical sense in a developing country context appears as equation (I) in Table 1, where i_0 is a constant term; αu stands for accelerator and profit-related effects via which higher capacity use stimulates capital formation; βk represents possible 'crowding-in' effects of public capital formation k on overall investment demand (for $\beta < 0$, there is 'crowding-out'); and the term $\psi(t - \delta)$ indicates that when foreign transfers increase or the public sector current deficit falls there is likely to be more credit available nationally to finance extra investment demand.

Substitution of (I) into (G) gives (I′). The signs of the responses can be explained as follows:

Public investment. As recounted by Bacha (1990) and Shapiro and Taylor (1990), recent evidence suggests that public investment has a net crowding-in effect on private capital formation; indeed, in 16 out of 18 developing country cases summarized by Taylor (1993), the linkage was found to be positive, with crowding-in coefficients like β ranging from -0.4 to 1.6.

Output effect. Both accelerator- and profitability-based investment theories suggest a positive response of investment demand to u.

4. Model representation and financial programming

Fig. 1 illustrates the model as stated so far in the (u, g) plane. The three growth restrictions (S′), (F′), and (I′) must cross in an equilibrium point with $g = g^s = g^f = g^i$. The inverse relationship between capacity utilization and potential output growth imposed by the external restriction (F′) shows up clearly, while investment is assumed to respond less strongly than saving to an increase in u (a standard stability condition). Potential saving in (S′) rises with the inflation rate, implying that only one value of $\hat{P}$ will be consistent with I-F equilibrium, as shown by the solid S-schedule. If $\hat{P}$ is varied parametrically, then a family of inflation contour lines (or iso-inflation loci) relating capacity utilization with the potential output growth rate can be mapped out – the dashed lines illustrate two examples. Since faster inflation increases saving for a given u, contours further to the northwest correspond to higher values of $\hat{P}$.

The next question to ask is how does $\hat{P}$ get determined? As discussed by Kindleberger (1985) and Taylor (1988, 1991), two inflation theories have come down through more than two centuries of economic thought. One, conventionally

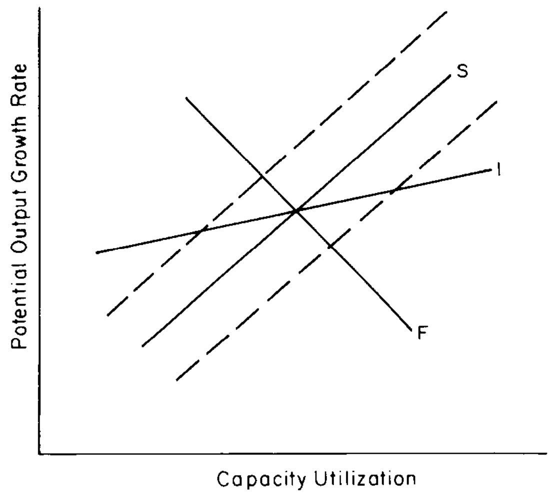

Fig. 1. Saving, investment, and foreign exchange restrictions on potential output growth.

called monetarist, postulates that inflation follows from the equation of exchange (Q), with growth rates of capacity and the money supply determined elsewhere in the macroeconomic system. The alternative, or structuralist, view is based on the input–output decomposition of the value of output into its component costs. Structuralists think that observed inflation $\hat{P}$ adjusts to a rate C determined from the side of costs, as in (P) in Table 1.

In this equation, w is the wage rate, e is the exchange rate, and the ellipses represent other factors such as cost-push from increased charges for financing working capital when the interest rate rises or else changes in flexible prices due to (for example) the evolution of food supply. If causality runs from right to left in (P), then structural forces determine the inflation rate; reverse causality means that some component(s) of cost adjust to ratify the quantity theory inflation rate $\hat{P}$ coming from (Q).

In its financial programming exercises, the IMF employs cost-based inflation theories, basing a forecast of $\hat{P}$ on an equation like (P) supplemented by the notion that in an open economy, many domestic prices will be determined by trade arbitrage from abroad. The economy has fixed capacity use (say, $u = 1$), and the investment function (I) is replaced by a target rate of capacity growth g. Finally, a balance of payments target in terms of reserve increases ρ is specified. In other words, the Fund asks how fiscal and monetary policy should adjust to predetermined values of $\hat{P}$, u, g, and ρ.

Without stating the means by which money market equilibrium is attained, financial programmers set money demand growth $\hat{H}$ equal to supply growth $\hat{\eta}$. They usually do not consider the possibility that saving may mop up new money supply, and drop the term $s_0 + su$ from (Z). Then (Z) and (Q) determine the public sector borrowing requirement: $\pi u = (1/V)(\hat{P} + g) - (\rho + i) + k$. After substitution from (B), this relationship can be rewritten as equation (FP) in Table 1. It says that improvement in external balance (a higher ρ) or a reduced inflation rate (a lower $\hat{P}$) must be ratified by a lower current fiscal deficit δ. A higher δ would crowd out investment i for given values of the other variables, slowing growth.

Equation (FP) helps explain the Fund's obsession with cutting the fiscal deficit. However, financial programming does not consider competing capital goods and intermediate imports under the external constraint, excess capacity and aggregate demand, and a behavioral investment function. It is not a complete model, and cannot explain how equations (F′), (S′), and (I′) all cross through one point in Fig. 1.

5. Policy responses under different model closures

In contrast to financial programming, 'three-gap' models which include fiscal and monetary relationships can incorporate all macroeconomic balances. Our three growth restrictions and two inflation theories can interact in schemes of macroeconomic causality or 'closure' besides the one preferred by the IMF. Different economies demonstrate diverse macroeconomic behavior at different times, making choice of closure assumptions an empirical question. [3]

The variants listed in Table 2 provide a sample selection. Older gap formulations congregate in the column for cost-based inflation. Both Chenery's and successor World Bank RMSM specifications do not allow u to vary in the short run in response to changes in the availability of foreign exchange or aggregate demand. Growth in output is fixed by lagged capital formation which in turn follows from a predetermined trade deficit through a 'binding gap' (typically external balance in RMSM, another Bretton Woods simplification).

Cases A and B – representing demand-determined and foreign exchange-constrained macro equilibria with respective adjustments in the trade deficit and the inflation rate – are the closures most relevant to policy. [4] To illustrate how these two modes of adjustment work, we can consider model responses under Cases A and B to two policy maneuvers: currency devaluation and a heterodox shock anti-inflationary program.

[3] See Dewatripont and Michel (1987) for an alternative point of view.

[4] In practice, of course, both inflation and external deterioration are likely to follow an adverse macro shock, but for analytical purposes it helps to work through the implications of each adjustment mode separately.

5.1. Devaluation

The implications of exchange rate depreciation are illustrated in Fig. 2. If devaluation leads immediately to increased export volume (a j-curve does not apply), then in Case B the F-schedule will shift upward. A new (u, g) equilibrium is determined as in step (i) of Fig. 2B. Excess aggregate supply is increased, so the saving rate can decline by a reduction in the rate of inflation (step ii). We have a deflationary, expansionary devaluation of the sort observed in Tanzania in the late 1980s (abetted, it might be added, by a substantial increase in capital transfers t, which also shifted the F-schedule up). This sort of response to depreciation hinges on endogenous jumps in the inflation rate to bring aggregate demand in line with the constrained level of supply, via the inflation tax and/or forced saving. Gibson (1985) and Rattso (1990) present more detailed gap model discussions.

Fig. 2A shows an inflationary, contractionary devaluation when macro equilibrium is determined by domestic saving and investment, with price increases coming from the side of costs. Devaluation drives up cost inflation C in (P). Due to the inflation tax, forced saving, and the fact that depreciation cuts real spending power if there is an initial trade deficit (Hirschman, 1949), a resulting potential

Table 2
Alternative model closures

Growth and output determination	Inflation determination	
	Cost-based or structuralist	Quantity theory or monetarist
Joint solution of (S′), (I′), and (F′); g, u, and t are all endogenous	Demand-determined output with cost-based inflation (Case A)	Probably unstable; an increase in g reduces $\hat{P}$, in (Q) which in turn increases u and g via aggregate demand
Joint solution of (F′) and (I′) with predetermined t: (S′) adjusts	Quantity rationing required to force saving (and consumption) to an equilibrium value, i.e. there is 're-pressed inflation'	Foreign exchange-constrained output with inflationary adjustment to excess aggregate demand (Case B)
Joint solution of (S′) and (F′) with predetermined t; (I′) adjusts to the limiting restriction (or 'binding gap')	Gives traditional two-gap model when u is 'technically' determined; either (S′) or (F′) becomes the binding gap	Underdetermined

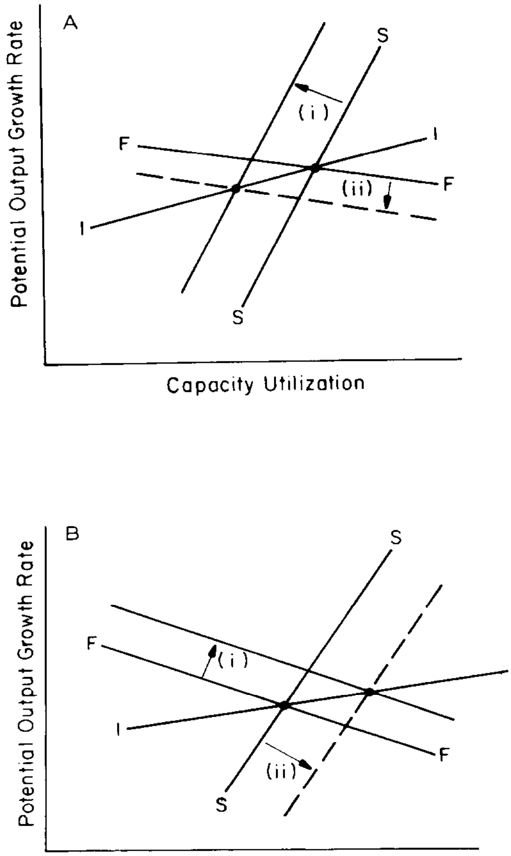

Fig. 2. (A) Inflationary, contractionary devaluation; (B) Deflationary, expansionary devaluation.

excess of saving over investment makes output decline in step (i) if the export response is not strong. In step (ii), the trade deficit t falls, permitting the F-schedule to shift to ratify the new equilibrium. Recent econometric work suggests that Case A applies 'on average' in developing economies (Edwards, 1989; Morley, 1990), although alternative outcomes such as Tanzania's can always happen.

5.2. *A heterodox shock*

Heterodox shock packages aim to reduce the cost-based inflation rate C by price freezes and deindexation of contracts. They were applied in the 1980s unsuccessfully in Argentina and Brazil and with better luck in Israel and Mexico. Fig. 3 illustrates how a heterodox shock fits into the various gaps.

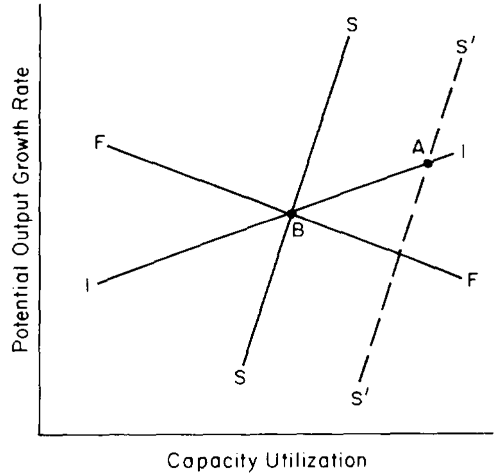

Fig. 3. Effects of a heterodox shock anti-inflation program.

To reach saving–investment equilibrium after $\hat{P}$ is cut and aggregate saving declines, u and g have to lie along the dashed curve S′S′. Meanwhile, enough money is still being created to be consistent with the inflation rate corresponding to SS. Demand-determined equilibrium at A is infeasible, since supply will be limited by foreign exchange. Greater capital inflows or payments arrears, reserve losses, or increased exports will be required.

Unfortunately, foreign exchange generation by exports or capital inflows may not be on the cards. Domestic producers are not likely to expend effort on foreign sales when domestic consumption is booming. At the same time, capital flight – a higher z in equation (F) – becomes tempting. If the economy is on the 'right' side of its inflation tax Laffer curve, velocity will fall less than in proportion to the reduction in the inflation rate, i.e. excess money supply growth will rise (Taylor, 1991). This monetary overhang can spill over into demand for foreign assets, shifting the F-schedule in Fig. 3 downward, worsening the disequilibrium. At the same time, the black market exchange rate is likely to go up, increasing cost pressures and perhaps triggering a devaluation and faster inflation from (P).

The moral is that cost-oriented anti-inflation programs have to be accompanied by increased transfers from abroad to move the F-schedule up, cuts in fiscal dissaving to shift S′S′ to the left, or public investment restraint to shift the I-schedule down. The price-freeze packages which succeeded in Israel and Mexico were accompanied by big capital inflows and reserve losses respectively. They also featured wage restraint by 'social pacts' which helped hold down renewed cost pressures even though aggregate demand went up.

6. An adverse external shock

Fig. 4 shows the impacts of an external shock, e.g. the large reduction in t for many countries in the wake of the debt crisis of 1982. The F-schedule shifts downward. With reduced external inflows, the rate of inflation has to rise to generate forced saving and a higher inflation tax to offset lower saving from abroad. That is, the whole family of S-curves shifts to the right. Finally, credit conditions tighten, reducing investment demand. With a binding forex limit, demand-driven equilibrium at A cannot be attained. Hence, real output tends toward B with slower potential output growth, reduced output, and faster demand inflation which in turn can stimulate further price pressure from the side of costs.

An adequate policy response to an external shock is hard to orchestrate (Bacha, 1990). The shifting curves in Fig. 4 suggest the following:

Fiscal restraint (a lower δ) will move the S-curves back to the left, permitting faster capacity growth and reduced inflation, but with lower capacity utilization. Although it brings partial relief, austerity often is politically difficult to pursue.
Increased public investment (a higher k) shifts the I-schedule up, speeding capacity growth when $\beta > 0$ in (I) and there is investment crowding-in, at the cost of higher inflation and reduced current output. Early in the 1980s, Brazil, South Korea, and Tanzania had some degree of success with this sort of policy.
Higher exports (an increase in ϵ) can help release the forex limit. However,

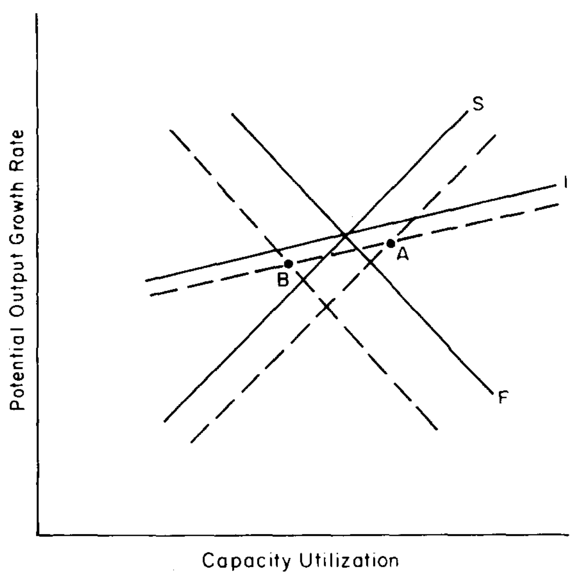

Fig. 4. Effects of an adverse external shock.

raising sales abroad in the short run can be difficult, especially for a raw material exporter. An export push is easier for semi-industrialized economies in which domestic recession creates spare manufacturing capacity which can be diverted to foreign markets, e.g. Turkey, Korea, or Brazil.

Import quotas and controls can be used to change the slope of the F-schedule, permitting u or g to rise in conjunction with other policies. Tanzania, Zimbabwe, Kenya, and Colombia utilized variants of this option successfully in the 1980s.

Expansionary policy or increased public investment and fiscal dissaving will stimulate g and u, but at the cost of spiraling inflation. Peru's expansionism of the mid-1980s can be interpreted as a failed attempt to offset external restrictions by increased spending on the part of the state.

Policy coordination is never easy. Few developing (or developed!) country governments are agile enough to deploy simultaneous fiscal restraint in current transactions, increased state capital formation, intelligent manipulation of quotas, and export incentives to offset all the ill effects of an external shock.

7. Import support and other inflows

In the early 1990s, foreign inflows to developing countries rose. There was renewed direct foreign investment in Latin America. African countries got aid for 'import support' via which local governments gain the local currency 'counterpart' from sales of the foreign goods internally. Typical payment flows are traced by Roemer (1989), and fit naturally into a gap framework.

Fig. 5 illustrates responses to an increased foreign transfer. The S-curves shift to the left, leading to lower output and slower capacity growth at an A-type equilibrium with the original rate of inflation, and the F-curve shifts upward. Investment may also rise (as shown), but does not have to. In the early 1990s many Latin economies grew slowly even though they began to run trade deficits. In a gap set-up, Ros (1992) shows how stagnant capital formation exacerbated by fiscal tightness were major parts of the problem.

Other changes are also needed to move the economy toward faster growth at point B. Slower inflation can shift the S-curves back to the right, reducing forced saving and the inflation tax. How rapidly such a transition can occur depends on the strength of cost pressures, including a potentially destabilizing Phillips-type positive response of $\hat{P}$ to u in (P). Experience suggests that inflation may be difficult to control when extra spending power suddenly appears in the system from abroad, especially if the supply of key non-traded goods is relatively price-inelastic.

More government dissaving (a higher δ) also shifts the S-schedules to the right, as counterpart funds underwrite a boom led by public consumption. More sensible in the long run, perhaps, would be an increase in public investment (a higher k) which would move the I-schedule upward, raising potential output growth but with faster inflation and lower capacity use.

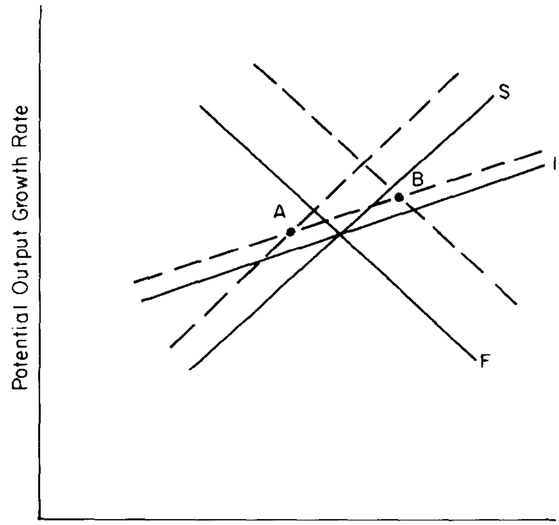

Fig. 5. Effects of an incoming resource transfer.

In sum, absorption has to adjust to meet a higher t, regardless of how external balance is reestablished in equation (F). Part of that change would take the form of higher values of g and u, but exports ϵ may decline or additional imports z come in. For these newly available goods to be absorbed in the market, either public or private consumption has to rise. If δ and k are held in check by fiscal policy, then more 'incentive' imports financed from a higher t must be taken up through higher private consumption stimulated by a higher u, a lower $\hat{P}$, or else a decline in s_0, the intercept term in (S). We are back to Griffin (1970) and Weisskopf (1972).

A more ominous possibility is capital flight, or an increase in z mediated by sending forex abroad to finance increased external asset holdings by the private sector. When the higher foreign inflow t initially goes to the government, then there has to be a public-to-private transfer to permit capital flight (the perhaps illegal obverse of the private-to-public transfer that debtor economies have to engineer). Imports have to be overinvoiced and exports underinvoiced or simply smuggled to permit realization of the higher z which will be reflected in the national accounts by a decline in estimated national saving. Increased foreign inflows open channels for corruption both between the state and private sector and in external trade.

Finally, foreign reserves can be increased to absorb the transfer in both the saving and external balances (S) and (F). With counterpart funds on hand, the public sector can rely less on new credit from the banking system and more on foreign sources to finance its total PSBR. Bank loans to the government are cut back but reserves build up, leaving money supply growth as well as capacity utilization, inflation, and growth rates unchanged.

As with adverse external shocks, access to extra inflows of foreign exchange raises policy coordination problems which developing country governments can find extremely difficult to handle. By providing a simple but complete macro framework, gap models can help sort such questions out.

References

Addison, Doug, 1989, The World Bank revised minimum standard model, PPR working papers (The World Bank, Washington, DC).

Bacha, Edmar L., 1984, Growth with limited supplies of foreign exchange: A reappraisal of the two-gap model, in: Moshe Syrquin, Lance Taylor and Larry Westphal, eds., Economic structure and performance: Essays in honor of Hollis B. Chenery (Academic Press, New York).

Bacha, Edmar L., 1990, A three-gap model of foreign transfers and the GDP growth rate in developing countries, Journal of Development Economics 32, 279–296.

Cauas, Jorge, 1973, Short-term economic policy, in: Jagdish N. Bhagwati and Richard S. Eckaus, eds., Development and planning: Essays in honor of Paul Rosenstein-Rodan (MIT Press, Cambridge, MA).

Chenery, Hollis B. and Michael Bruno, 1962, Development alternatives in an open economy: The case of Israel, Economic Journal 72, 79–103.

Dewatripont, Mathias and Gilles Michel, 1987, On closure rules, homogeneity, and dynamics in applied general equilibrium models, Journal of Development Economics 26, 65–76.

Edwards, Sebastian, 1989, Real exchange rates, devaluation, and adjustment (MIT Press, Cambridge, MA).

Fanelli, Jose Maria and Roberto Frenkel, 1990, Growth exercises for Argentina (CEDES, Buenos Aires).

Fanelli, Jose Maria, Roberto Frenkel and Carlos Winograd, 1987, Argentina: Stabilization and adjustment policies and programmes, Country study no. 12 (WIDER, Helsinki).

Gibson, Bill, 1985, A structuralist macromodel for post-revolutionary Nicaragua, Cambridge Journal of Economics 9, 347–369.

Griffin, Keith, 1970, Foreign capital, domestic savings, and economic development, Bulletin of the Oxford University Institute of Statistics 32, 99–112.

Hirschman, Albert O., 1949, Devaluation and the trade balance: A note, Review of Economics and Statistics 31, 50–53.

Kindleberger, Charles P., 1985, Keynesianism vs. Monetarism and other essays in financial history (Allen and Unwin, London).

Morley, Samuel A., 1990, On the effect of devaluation in LDCs (Department of Economics, Vanderbilt University, Nashville, TN).

Olivera, Julio H.G., 1967, Money, prices, and fiscal lags: A note on the dynamics of inflation, Banco Nazionale del Lavoro Quarterly Review 20, 258–267.

Polak, J.J., 1957, Monetary analysis of income formation and payments problems, International Monetary Fund Staff Papers 6, 1–50.

Rattso, Jorn, 1990, Medium term adjustment under import compression: Macroeconomic analysis relevant for Sub-Saharan Africa (Department of Economics, University of Trondheim, Trondheim).

Roemer, Michael, 1989, The macroeconomics of counterpart funds revisited, World Development 17, 795–807.

Ros, Jaime, 1992, Foreign exchange and fiscal constraints on growth (Department of Economics, University of Notre Dame, Notre Dame, IN).

Rosenstein-Rodan, Paul N., 1961, International aid for underdeveloped countries, Review of Economics and Statistics 43, 107–138.

Shapiro, Helen and Lance Taylor, 1990, The state and industrial strategy, World Development 18, 861–878.

Sobhan, Rehman, 1990, Introduction, in: R. Sobhan et al., Structural adjustment in Third World countries (Bangladesh Institute of Development Studies, Dhaka).

Tanzi, Vito, 1977, Inflation, lags in collection, and the real value of tax revenue, International Monetary Fund Staff Papers 24, 154–167.

Taylor, Lance, 1988, Varieties of stabilization experience (Clarendon Press, Oxford).

Taylor, Lance, 1991, Income distribution, inflation, and growth (MIT Press, Cambridge, MA).

Taylor, Lance, 1993, The rocky road to reform (MIT Press, Cambridge, MA).

Weisskopf, Thomas E., 1972, The impact of foreign capital inflow on domestic savings in underdeveloped countries, Journal of International Economics 2, 25–38.

Wicksell, Knut, 1935, Lectures on political economy, Vol. II (Routledge and Kegan Paul, London).