

WIDER WORKING PAPERS

*Gap Disequilibria: Inflation,
Investment, Saving, and Foreign
Exchange*

Lance Taylor

WP 76

October 1989

*World Institute for Development Economics Research
of the United Nations University*

Massachusetts Institute of Technology

July 1989

Gap Disequilibria: Inflation, Investment, Saving, and Foreign Exchange

by Lance Taylor*

* Comments on previous drafts by Edmar Bacha and Hollis Chenery and research support from the World Institute for Development Economics Research are gratefully acknowledged.

Abstract

Four "gaps" or restrictions on capacity growth -- from available saving and foreign exchange, investment demand (with crowding-in of private by public capital formation), and ex ante discrepancies between inflation rates needed on the one hand to achieve macroeconomic balance via the inflation tax and forced saving and on the other hand to meet increases in costs -- are analyzed in a simple, unified framework. Several policy issues are addressed, in particular how a developing economy can sustain growth when faced with reduced net foreign resource transfers and capital flight, and macroeconomic difficulties implicit in "heterodox shock" anti-inflation programs.

When Chenery and Bruno (1962) unveiled the two-gap model based on internal and external balance, or saving and foreign resource constraints, they emphasized how potential growth of an economy can be limited by either its saving or trade performance -- one gap may be more binding than the other. A few years later, Cauas (1973) showed how the ex ante gap between monetary and cost-based inflation rates made applied financial programming in Chile less harmonious than the typical IMF exercises; his scheme has subsequently been reinvented elsewhere in Latin American, e.g. Fanelli, Frenkel, and Winograd (1987). Finally, there is much recent discussion about how the contradiction between fiscal limits and crowding-in of private investment by public capital formation can hold down economic expansion, e.g. Taylor (1988) and Bacha (1990).

Ex post, in the macro data that economists use, "gaps between the gaps" are eliminated by a variety of adjustment mechanisms and (occasionally) the ingenuity of statisticians. But ex ante, all four gaps -- saving, foreign exchange, inflation, and investment -- call attention to the disequilibria that developing economies face. These notes put the gaps into one framework to discuss modes of macroeconomic response to external shocks and the forces affecting medium run growth. We begin in section 1 by deriving the saving and foreign gaps from representative flows of funds; how capital flight, the inflation tax, forced saving, and other factors affect adjustment is the question addressed. Section 2 adds an investment function permitting both crowding-in and crowding-out of private by public capital formation. Section 3 shows how these three relationships interact pairwise: the emphasis is on the multiplicity of policy actions a developing economy may take, each with its good and bad features. Section 4 gives a graphical resolution of the three gaps under one well-defined set of adjustment rules, and section 5 introduces financial disequilibrium. Section 6 closes with a discussion of medium term

projection techniques, and an analysis of the trade-offs between faster inflation and cutting public investment as devices for holding down growth to satisfy limits on inflows of foreign exchange.

1. Saving and Foreign Exchange Gaps as Flows of Funds

Apart from foreign exchange restrictions, we assume for the most part that output X (measured gross of intermediate imports) can vary freely in the short run; capacity limitations are introduced briefly in section 5. The level of activity is indicated by the output-capital ratio, $u = X/K$. Labor and intermediate imports are the variable production inputs, with fixed input-output coefficients b and a respectively. Variable cost per unit output is therefore $wb + ea$, where w and e stand for the nominal wage and exchange rates, and the import price is normalized at unity. The output price is set by a mark-up factor $1/(1 - \pi)$ over variable cost,

$$(1) \quad P = (wb + ea)/(1 - \pi),$$

where π turns out to be the share of profits in the total value of output, $PX = wbX + eaX + \pi PX$. The capital stock is made up in proportions θ and $1 - \theta$ of nationally produced and imported goods respectively; the cost of a unit of investment is therefore $P_k = \theta P + (1 - \theta)e$. In what follows, we do not explicitly consider devaluation, so it is simplest to set $e = P_k = P$.

Saving and foreign exchange gap equations can be derived from flows of funds augmented by hypotheses about uses and sources of national saving. We work with four flows -- for private savers and investors, the financial system, the government, and the foreign sector -- and assume that private saving is channeled to higher bank deposits, increases in the stock of narrowly defined money, or asset-holdings abroad through capital flight. The level of nominal saving is assumed to depend on income and the rate of inflation, in line with recent emphasis in the literature on the inflation tax and other wealth effects.

Since money and quasi-money are the main assets in most developing country financial markets, we omit other stores of wealth from the algebra for simplicity. The financial side of the economy is treated as a pure credit banking system of the sort described by Wicksell (1935) and in effect used by the IMF in its monetary programming. Let A_p be bank assets (credits, loans) advanced to the private sector, A_g be advances to the government, and eR be the value of foreign reserves. Bank liabilities are deposits D and narrow money M . The banking system balance sheet is

$$A_p + A_g + eR = D + M \quad ,$$

which we will analyze in flow terms,

$$(2) \quad \dot{A}_p + \dot{A}_g + e\dot{R} = \dot{D} + \dot{M} \quad ,$$

where a "dot" over a variable denotes its time derivative, $\dot{x} = dx/dt$.

If there is no depreciation, then $g = I/K$ is the growth rate of capital stock. Real investment I in turn is the sum $I_p + I_g$ of private and public capital formation. Let $I_g = \kappa K$ be the government's investment decision -- its own capital formation is set as a share κ of the total capital stock. The value of private investment is $(g - \kappa)PK$, and we assume that banks issue new loans \dot{A}_p to finance the increase in private capital,

$$(3) \quad \dot{A}_p/PK = g - \kappa \quad .$$

The overall investment function determining g is presented as a reduced form (depending on credit availability among other factors) in section 2. For the moment, (3) is best interpreted as an accounting "identity."¹

Let real government current spending $G = \gamma K$; we will use γ as a proxy for the non-investment fiscal deficit or government dissaving to avoid carrying along symbols representing taxes. The government also borrows abroad. Its outstanding stock of loans is F upon which it pays an interest rate r . Let $\xi = eF/PK$ be the debt-capital ratio and T be the net transfer of new money from abroad relative to capital stock: $T = (e\dot{F} - reF)/PK = (\hat{F} - r)\xi$ where a "hat"

over a variable signifies its growth rate ($\dot{x} = \dot{x}/x$). There is a net inflow of foreign resources if the debt growth rate \dot{F} exceeds the interest rate r , a condition violated in most corners of the Third World in the late 1980's. The government turns to the banks to finance the part of its spending it cannot cover with foreign loans,

$$(4) \quad \dot{A}_g/PK = \kappa + \gamma - T \quad .$$

Domestic borrowing can be a substantial share of GDP when T is less than zero. Debtor country governments owe large foreign obligations (typically having taken over private loans in internal financial "reforms" in the early 1980's) but do not own the resources to generate foreign exchange to pay; the outcome is a severe fiscal crunch.

Finally on the bank asset side, the increase in reserves is

$$(5) \quad \dot{eR}/PK = T + \epsilon - au - (1 - \theta)g - Q \quad ,$$

where $\epsilon = E/K$ is the ratio of exports (net of competitive imports) to capital stock, imports go only for intermediates au and capital goods $(1 - \theta)g$, and Q stands for net acquisition of foreign assets (relative to the capital stock) by the private sector.

To describe the saving gap, we have to add hypotheses about sources of deposits and narrow money. Following Ros (1989), we assume that saving desired by nationals in the absence of price inflation is directed either to foreign asset accumulation or else to increased bank deposits:

$$Q + \dot{D}/PK = [\pi s_\pi + (1 - \pi)(1 - \phi)s_w]u - s(\pi, \phi)u \quad ,$$

where s_π and s_w are the saving rates from profit and wage income flows respectively. The new symbol $\phi = ea/(ea + wb)$ is the share of intermediate imports in variable cost, so that $(1 - \pi)(1 - \phi)u$ is the ratio of the wage bill to the capital stock. If a share λ of saving flows abroad, the equation above becomes²

$$(6) \quad \dot{D}/PK = (1 - \lambda)su \quad .$$

Putting (2) through (6) together shows that the increase in the supply (or "emission") of narrow money is

$$(7) \quad \begin{aligned} \dot{M}/PK &= g + \gamma - (1 - \lambda)su + [\epsilon - au - (1 - \theta)g] \\ &= g + \gamma - (1 - \lambda)su + [e\dot{R}/PK - T] \quad , \end{aligned}$$

where the terms in brackets represent the balance of payments (net of capital flight) on current and capital account in the first and second lines respectively.

What can be said about the growth rate of money demand, say $\hat{\mu}$? Although it gives the analysis a monetarist cast, it is instructive to follow Wicksell and set up a cumulative process inflation by postulating that the quantity theory applies to the two stocks in the system, $\mu V = PK$, and that V is constant. Hence, $\hat{\mu} = \hat{P} + g$, or

$$(8) \quad \dot{\mu}/PK = (1/V)(\hat{P} + g) \quad .$$

Money demand rises in proportion to the inflation rate \hat{P} and the growth rate of the capital stock (or capacity) g . The first component is often called the "inflation tax" -- we will observe its tax-like effects on aggregate demand shortly. Higher money demand due to capacity growth is "seigniorage," so to speak it is the money that the banking system gets to create without inflationary complications.

Our first macro equilibrium condition is that excess supply growth of money (or excess demand for goods) should be zero. Setting $(\dot{M} - \dot{\mu})/PK = 0$ gives a slightly modified version of the usual investment-saving balance:

$$(S) \quad [1 - (1/V)]g + \gamma + e\dot{R}/PK - T - (1 - \lambda)su - (1/V)\hat{P} = 0 \quad .$$

This equation says that the difference between demand injections and leakages must be zero. Injections include investment net of seigniorage, government spending (or dissaving), and the increase in reserves representing a reduction in the trade deficit. Leakages include net foreign resource inflows (or "foreign saving"), the share of zero-inflation private saving directed toward

bank deposits, and the inflation tax.

The final term shows that effective demand declines as inflation runs faster -- this is the tax-like aspect of $(1/V)\hat{P}$. As discussed more fully by Taylor (1989), the demand reduction can be interpreted in various ways. One is that the public is forced below its desired consumption schedule by preemption of output by the government and investors; they have a prior claim on output, financed by money emission. A second is that $(M/P)\overset{\cdot}{P}$ represents the instantaneous loss in the value of real money balances caused by a price increase $\overset{\cdot}{P}$. The public is supposed to raise its saving in this amount to reconstitute its wealth -- a rational act. Finally, faster inflation means that people need a bigger money stock for transactions purposes. With no easily liquifiable assets at hand, the only way they can build it up is to save more.³ On all three counts, consumption declines from its zero-inflation level $[1 - s - (e/P)a]u$.

The other restriction that comes from the flows of funds is a restatement of (5):

$$(F) \quad \epsilon + T - (1 - \theta)g - (a + \lambda s)u - eR/PK = 0 \quad ,$$

stating that sources less uses of foreign exchange must equal zero. The capital flight term λsu increases the foreign exchange loss associated with higher capacity utilization beyond the leakage au implicit in dependence on imported intermediates to support the production process.

Equations (S) and (F) are the saving and foreign resource gaps respectively. We will see how they interact in section 3, but before that it is useful to list other macro responses that one might want to build into the model:

Olivera-Tanzi effect Especially when the tax system is not indexed to inflation, its efficiency drops as \hat{P} goes up. The usual explanation is that due to lags in tax collection, real receipts progressively decline as

inflation runs faster; for the algebra see Olivera (1967) or Tanzi (1977). In our framework, this linkage could be captured by making γ an increasing function of \hat{P} .

Forced saving is relevant when output is foreign resource (or supply) constrained. Any demand increase will make all prices rise, but some may not be fully responsive. If, for example, money wage rates lag general inflation, the real wage will fall and the mark-up factor $1/(1 - \pi)$ and profit share π will increase. With $s_{\pi} > s_w$ in (6), the overall saving rate $s(\pi, \phi)$ will rise along with \hat{P} , reducing aggregate demand back toward the constrained level of supply. The effect is practically important -- real wages have fallen by 50 to 90 percent in Africa and Latin America under inflation with severe supply limitations during the 1980's. Taylor (1989) reviews the similarities and differences between forced saving and the inflation tax. They often work in the same direction, but are not the same thing: the inflation tax ("induced lacking" in Dennis Robertson's terms) is a wealth effect while forced saving ("automatic lacking") is the outcome of regressive changes in real income flows.

Fiscal populism When inflation accelerates, the government may seek to offset the ill effects of forced saving on workers's real incomes by higher spending or transfer programs such as food subsidies. With output bounded by available foreign exchange, the attempt will not work -- the paradox of thrift applies.⁴ Nonetheless, we may observe that γ is an increasing function of \hat{P} from the expenditure as opposed to the Olivera-Tanzi taxation side.

Variable velocity The stylized fact is that V is an increasing function of \hat{P} . The rationale is that the public economizes on its use of money, the more rapidly its value is being eroded by inflation. From equation (S), the demand-reducing effect of an increase in \hat{P} weakens as V rises when inflation runs faster. Ultimately, $d(\hat{P}/V)/d\hat{P}$ can become negative, as the elasticity of V

with respect to \hat{P} exceeds unity and the economy crosses to the "wrong" side of the inflation tax's Laffer curve. In what follows, we assume that this eventuality does not arise.

Export responsiveness Especially in semi-industrialized economies, an inverse relationship between capacity utilization and exports is often observed (Taylor, 1988). The usual explanation is that as domestic demand declines, potential exporters in the manufacturing sector become more aggressive in seeking markets abroad. Such a response is less likely in a primary-product exporting country. Reduced internal demand will not release large quantities of copper or bananas for potential buyers overseas.

2. Investment Crowding-Out and Crowding-In

Relative to capital stock, we assume that private investment demand is given by the function

$$(9) \quad I_p/K = g_0 + \alpha u + \beta(I_g/K) + \psi[(\dot{D}/PK) - (\dot{A}_g/PK)] \quad .$$

The term αu is an instantaneous accelerator -- an output-investment linkage is common in developing country econometrics. Including lags would complicate the algebra but not add much economics.

The term in I_g/K shows that public investment crowds in private capital formation because of complementarities and other external effects. Demonstrating the importance of crowding-in has become a thriving cottage industry in the late 1980's, and it makes sense to incorporate the possibility in any growth model.⁵

The last term in (9) introduces financial crowding-out as a potential counterpoise to direct crowding-in. We assume along conventional lines that investment is cut back when the government puts pressure on financial markets. Specifically, I_p falls when new government borrowing \dot{A}_g/PK grows with respect to the deposit increase \dot{D}/PK . The rationale could be that banks raise interest rates and tighten credit limits when more of their deposit base is absorbed by

the government. This simple flow specification is dimensionally equivalent to the quantity theory of money demand (8) and saves the use of asset stock or state variables.

Plugging (4) and (6) into (9) and simplifying gives

$$(I) \quad -g + g_0 + [\alpha + \psi(1 - \lambda)s]u + (1 + \beta - \psi)\kappa - \psi\gamma + \psi T = 0 \quad .$$

This relationship shows that the capital stock growth rate g increases endogenously in response to greater capacity utilization u due to the accelerator and also because higher private saving creates deposits which banks use to finance investments. Government investment κ has an overall crowding-in effect if $1 + \beta > \psi$. This condition will be satisfied if $\beta \geq 1$ and $\psi \leq 1$, as is likely. Finally, an increase in foreign transfers T or a reduction in government dissaving γ cuts back on public borrowing from the banks, again permitting private investment to rise.

3. Interactions between the Gaps by Pairs

The gap equations (S), (F), and (I) are easy to solve simultaneously under plausible assumptions about endogenous and exogenous variables, but the reduced form obscures the complexity of macroeconomic adjustment in the Third World. Indeed, illustrating the manifold constraints that developing economies face was the goal of the original Chenery-Bruno article. They switched axes in a number of two-dimensional constraint diagrams to hammer home the point. We will do a bit of the same in this section, as we follow Bacha (1990) in discussing possible channels via which disequilibrium "gaps between the gaps" are removed pair-by-pair, before giving a full solution based on specific adjustment rules.

Saving and foreign exchange Figure 1 is the traditional two-gap diagram, with foreign transfers on the horizontal axis and the capital stock growth rate that they permit measured vertically. The foreign exchange constraint FF has a slope exceeding 45 degrees because the import content of investment is

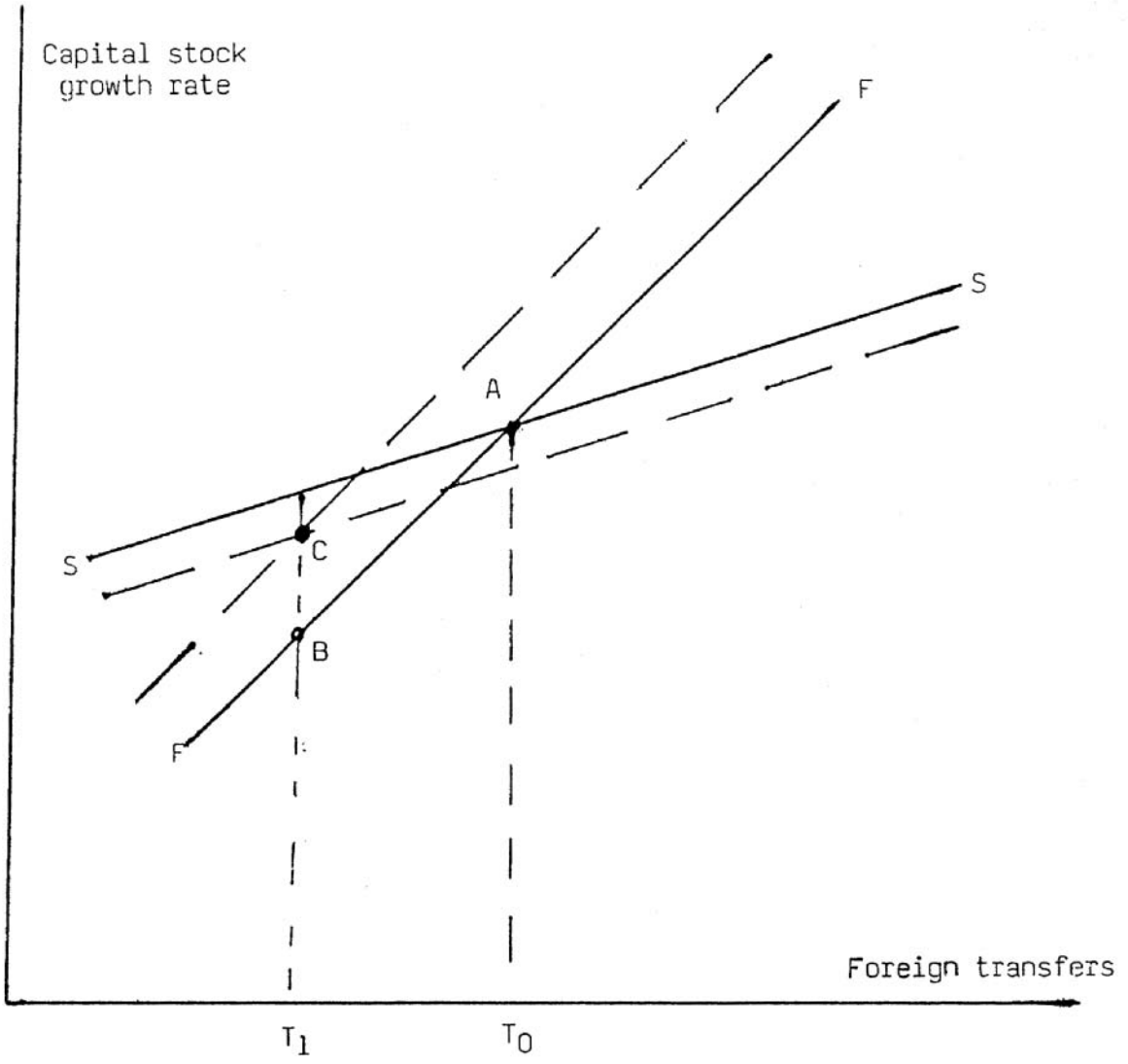


Figure 1: The saving and foreign exchange gaps.

less than 100 percent: a one-unit increase in the trade deficit lets investment rise by an amount $1/(1 - \theta) > 1$. The slope of the saving gap SS also is greater than 45 degrees because of seigniorage, but less than the slope of FF with plausible parameters.

Suppose that transfers are cut from T_0 to T_1 ; alternatively, there could be an increase in the rate of capital flight λ . After either shock, investment is limited to a lower value by its import content than by potential saving. How does the economy adjust?

Several responses can occur. First, capacity use u is likely to fall, as scarce foreign exchange is shared among intermediate and capital goods importers by market and non-market devices. The intermediate import flow au will decline. As we have noted, in the medium run in semi-industrialized economies at least, low domestic demand means that exports ϵ tend to rise. Finally, saving from both transfers T and income su will fall, creating excess commodity demand at the initial investment level. The natural response is for inflation \hat{P} to speed up, to generate extra saving via the inflation tax and forced saving.

A likely transition path is from A toward B then C. The upward shift of FF comes from reduced intermediate imports and (with a lag) higher exports. The saving constraint shifts downward as u declines, partly offset by a higher \hat{P} . There will be greater output loss and faster inflation, the less responsive are exporters to opportunities abroad. Countries like South Korea and Brazil represent favorable cases in which FF shifts strongly upward as exports rise. Alternatively, foreign exchange may be saved by effective import quotas as in Kenya and Colombia in the early 1980's -- Ocampo (1987) sets up an instructive model. The medium run problem with quotas is that it is often easier to raise exports ϵ from a low level than to force the import coefficient a down toward zero.

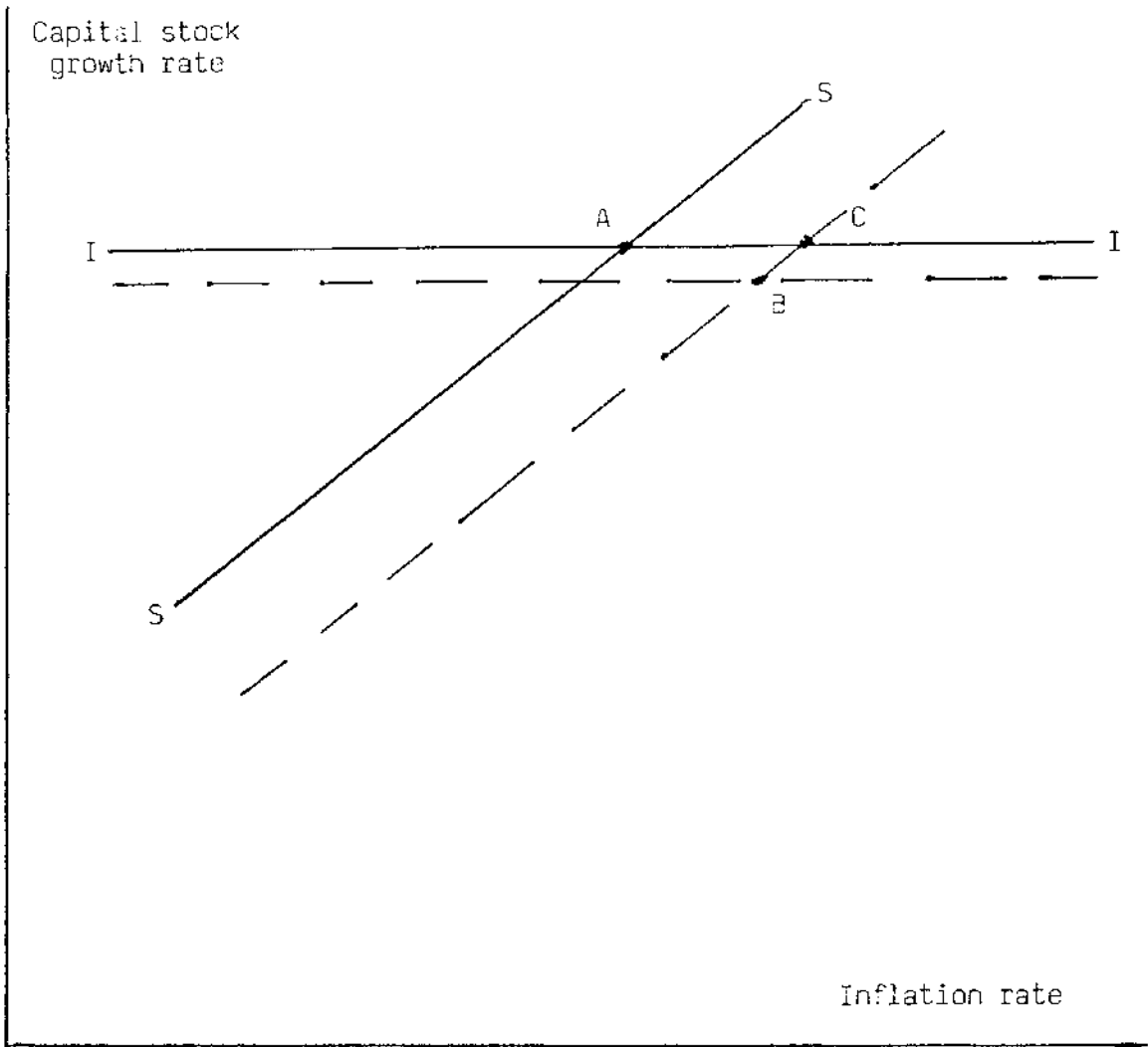


Figure 2: Saving and investment constraints.

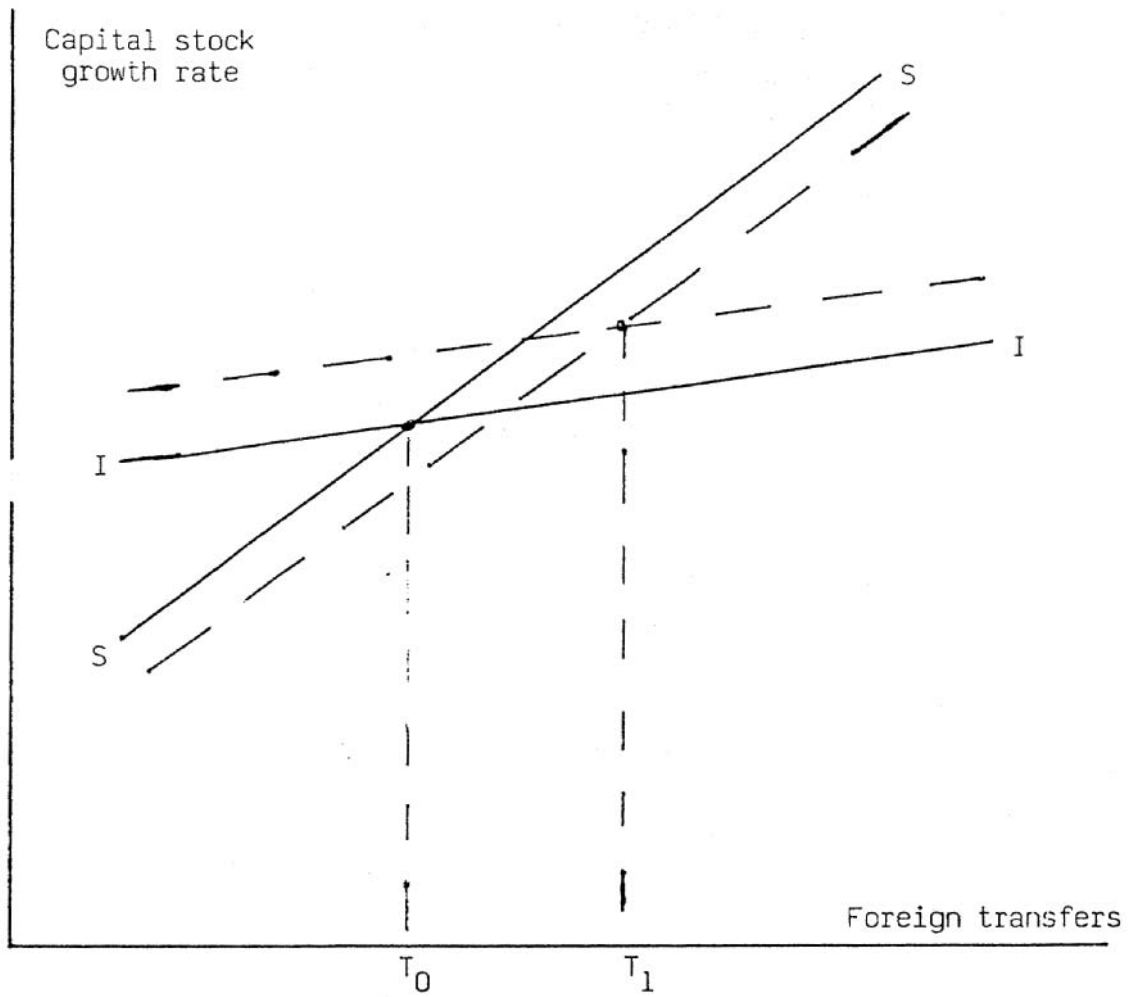


Figure 3: Saving and investment constraints.

Saving and investment Figure 2 shows that the saving limit on growth SS is an increasing function of the inflation rate, while investment demand II does not depend on \hat{P} .⁶ A smaller foreign transfer means that both curves shift downward, due to reduced saving for SS, and restricted bank finance for private investment along II as the government replaces foreign by domestic loans. If financial crowding-out of domestic investment is relatively weak ($\psi \leq 1$), inflation will rise from A to B as illustrated in the diagram.

Various responses can occur. The healthiest, perhaps, is a reduction in γ due to government spending cuts and higher taxes. Both schedules return toward their original positions, alleviating tendencies toward inflation. But there is still a foreign exchange disequilibrium to be resolved by the mechanisms discussed above. Fiscally-based adjustment of this sort seems more politically feasible in Asia than elsewhere in the world.

A second option is to increase public investment κ , shifting the II locus back to its initial position. Inflation rises from B to C. This move represents adjustment a la Brazil, at least through the mid-1980's.

The poorest choice is to increase γ to support employment and try to offset real wage losses via transfer programs. This shift will be exaggerated if Olivera-Tanzi effects are strong. In addition, public investment may be maintained, on long-term planning grounds. SS shifts further downward and II moves up, pushing inflation higher. Chile and Peru more or less followed this path in the early 1970's and late 1980's respectively.

Finally, quantitative restrictions can drive intermediate imports down, reducing capacity use and employment but perhaps allowing public investment targets to be met -- an African scenario.

Figure 3, with the foreign transfer replacing inflation on the abscissa, illustrates adjustment when foreign resources go up or capital flight diminishes. There is an excess of nationally usable saving over investment ex

ante, creating tendencies for both u and P to decline. The obvious offsetting maneuvers are to increase public investment κ (shifting II upward) and to pursue price and incomes policies leading inflation to fall more than output as SS shifts downward.

Investment and foreign exchange The foreign exchange (FF) and investment (II) schedules appear in Figure 4. FF has the steeper slope because the import share of investment is well less than one. A transfer decrease from T_0 to T_1 means that growth is constrained by FF. An immediate response might be to run down foreign reserves, shifting FF temporarily upward. But in a longer run, public investment is likely to be cut, quotas imposed on capital goods imports, etc., to make II move down to a new equilibrium at B.

What happens if extra resources become available at T_2 ? Now investment is held down along II by insufficient financial crowding-in. Again, various adjustments are possible. The authorities may opt to cut net exports and shift FF down by liberalization of import quotas and tariff reduction -- a policy line often recommended by the World Bank and IMF. Domestic producers of traded goods will object, and depending on the balance of political forces, liberalization may be curtailed. If not, deindustrialization is a likely outcome, e.g. Chile and Sri Lanka in the late 1970's.

The central bank may "sterilize" part of the extra transfer by wiping up arrears, buying back external debt, etc. Such policies also often provoke domestic resistance -- why not use the dollars at home? The part of the inflow that does not go to extra imports or sterilization will have to be accumulated as reserves. The resulting money supply expansion can lead to faster inflation, increased capacity utilization, or both. Policies have to be designed to enhance output as opposed to price increases.

Finally, public investment κ can be raised to shift the II locus upward, absorbing part of the extra foreign exchange in capacity growth.

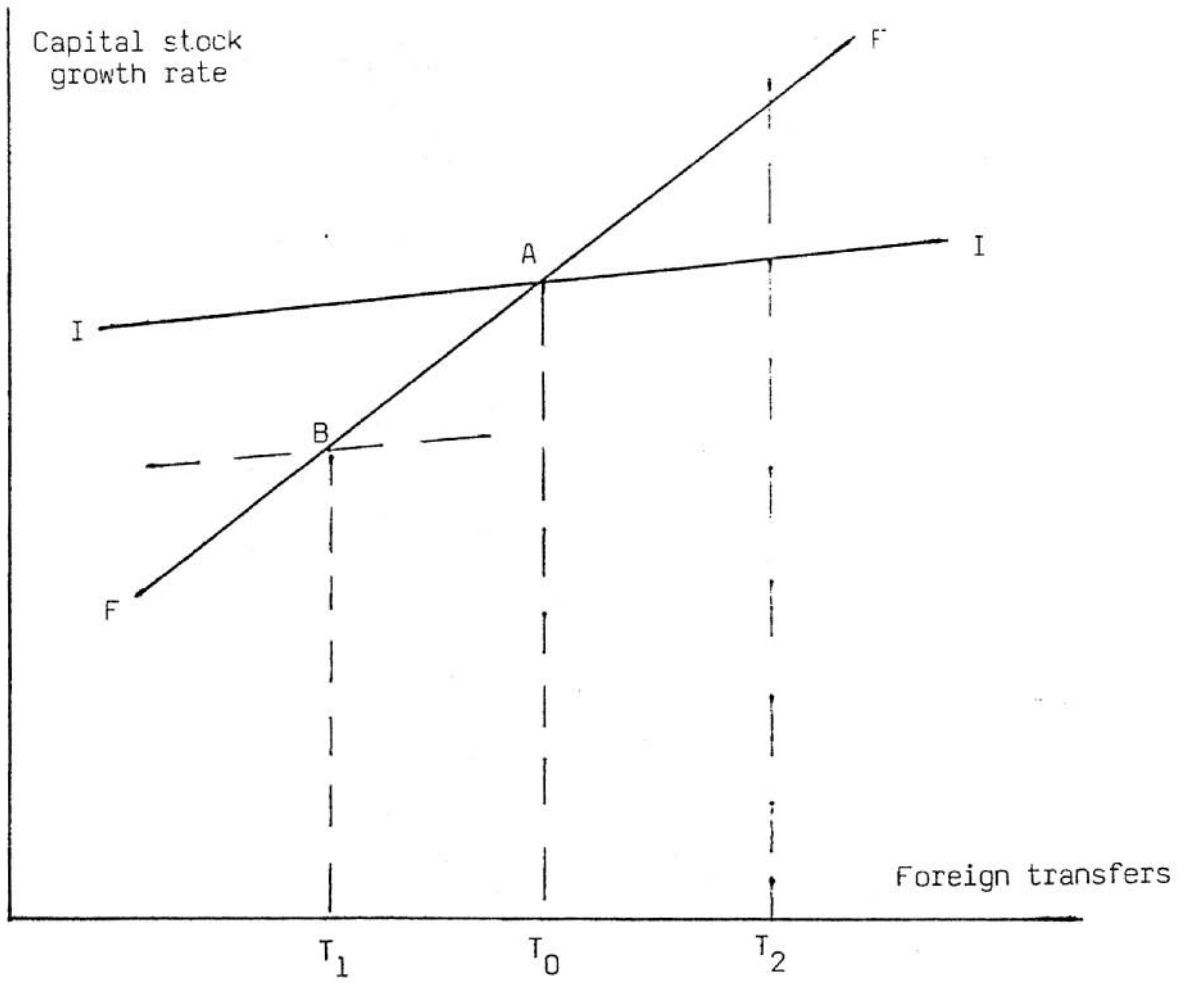


Figure 4: Investment and foreign exchange constraints.

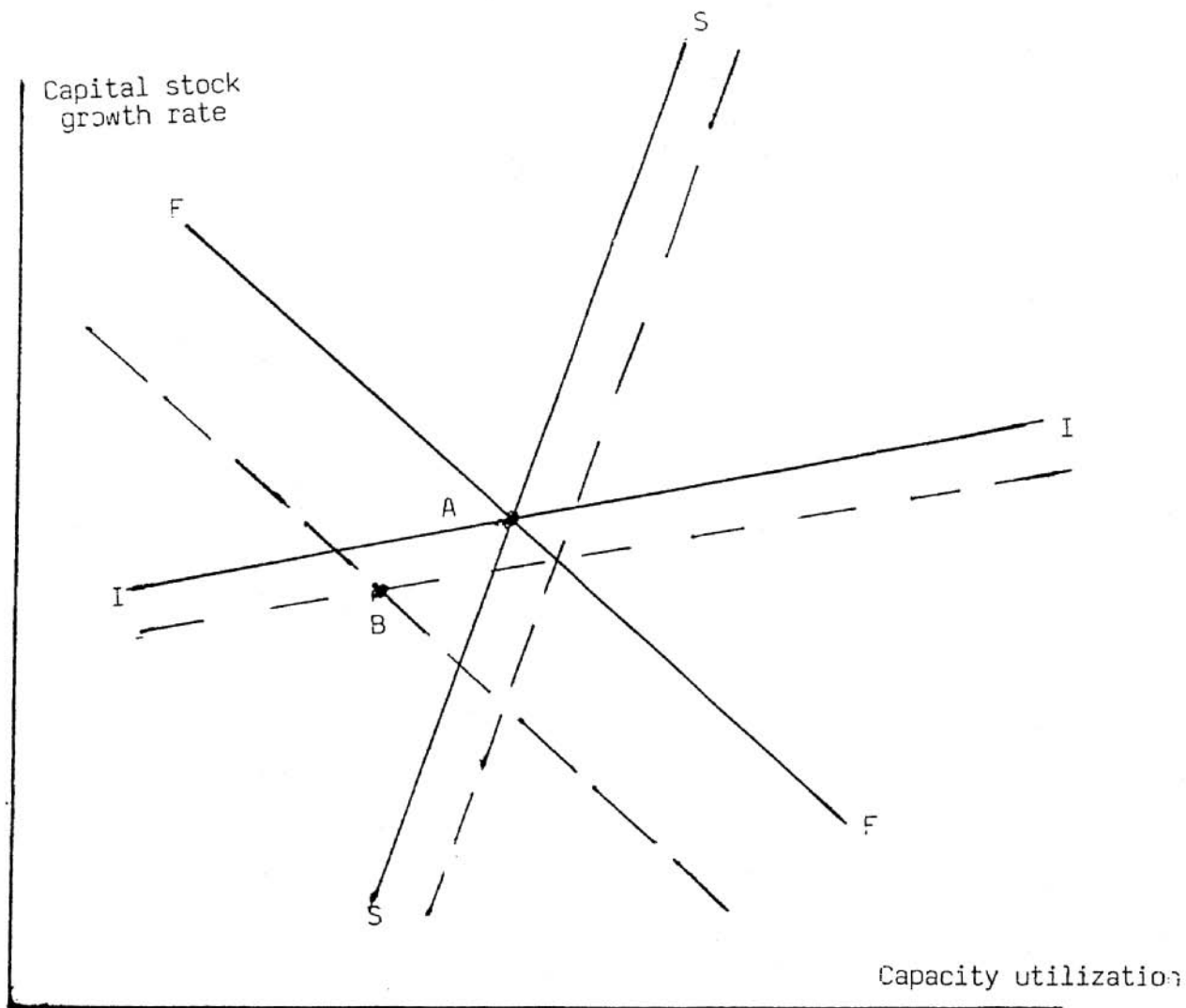


Figure 5: Joint solution of investment, saving, and foreign exchange constraints.

4. A Three-Gap Resolution

The foregoing discussion suggests that there is no dearth of mechanisms via which the gaps can be resolved. The policy challenge is to select a relatively comfortable adjustment path. For analytical purposes, a related question is how to set up one plausible set of adjustment rules to close the model fully.

In this section, we present an example, based upon the recursive structure of equations (S), (F), and (I). Suppose that the growth rate g is the adjusting variable in (I). Capacity use u varies in (F), with intermediate imports (and capital flight) absorbing the foreign exchange left over after investment needs are met. In effect, output is constrained by available yen or dollars. To attain overall macro balance in (S), saving has to be brought into line with fiscal and investment demand. A changing inflation rate \hat{P} is the vehicle, acting through forced saving and the inflation tax. Routh-Hurwitz criteria applied to the three-equation model easily show that this adjustment process is locally stable.

Figure 5 in the (u, g) plane illustrates how the macro response to a reduced foreign transfer takes place. The solid lines refer to an initial equilibrium position. The foreign exchange locus FF has a negative slope, reflecting the competition between investment and current economic activity for scarce foreign exchange that is frequently brought out in economic analyses for Africa, e.g. Green and Kadhani (1986). The investment schedule II has a shallow positive slope, depending on the strength of accelerator and financial crowding-in effects.

The SS schedule is one of a family of inflation contour lines (or iso- \hat{P} loci). It shows combinations of capacity utilization u and the capital stock growth rate g that hold the inflation rate constant in equation (S). Since an increase in g or a reduction in u signals incipient excess commodity demand,

curves in the family to the left of SS correspond to faster inflation rates.

A reduced transfer means that the investment locus must shift downward and the foreign exchange constraint to the left. Capital stock growth unambiguously falls. Capacity utilization will also decline unless financial crowding-out of investment demand is very strong, releasing enough foreign exchange to permit production \hat{A} to be maintained. Since for given u and g , a reduced transfer means that P rises in (S) to replace lost saving, the whole family of iso-inflation curves shifts to the right. The new real equilibrium at B lies to the left and the shifted inflation contour to the right of the initial point A, so that inflation accelerates.

What are possible policy responses? Stepping up public investment moves the II curve back toward its original position, restoring capital stock growth at the cost of greater stagflation. An export increase (or effective import substitution) shifts FF to the right, raising u and g while decelerating P . Cutting government dissaving makes the investment curve move upward by reducing crowding-out, and slides the inflation contour lines back toward the left. The net result of a lower γ is that output is still held down by scarce foreign resources, but growth recovers and inflation slows down. Blending these policies could bring the economy from point B back toward A, but designing and managing such a comprehensive program would not be an easy task.

5. The Inflation Gap

Although it is beloved by monetarists, the inflation theory that we have been using so far is a bit farfetched. To maintain financial equilibrium, inflation is supposed to adjust instantly to drive excess commodity demand (or excess money supply in flow terms) to zero via the inflation tax as supplemented by forced saving. The problem is that any time, observed inflation \hat{P}_c will be determined from the side of costs, e.g. from a growth rate version of the mark-up equation (1):

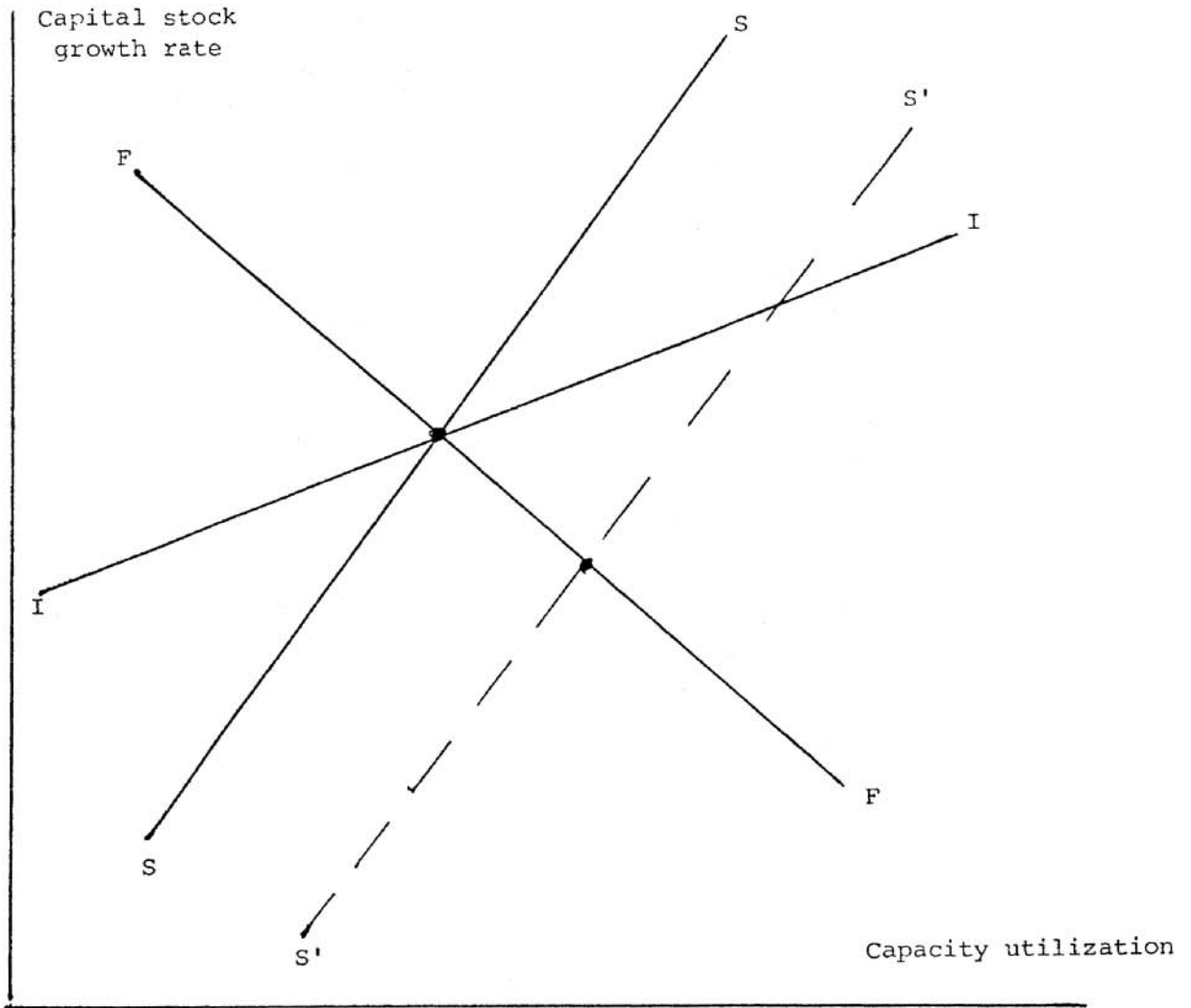


Figure 6: The inflation gap superimposed on investment, saving, and foreign exchange constraints.

$$(10) \quad -\hat{P}_c + (1 - \phi)\hat{w} + \phi\hat{e} + \pi/(1 - \pi) = 0$$

Unless wage inflation, exchange rate inflation, or movement in the profit share quickly adjusts to changes in excess commodity demand, the inflation equilibrium condition

$$(P) \quad \hat{P} - \hat{P}_c = 0$$

will be violated. Monetarists implicitly assume that \hat{w} , \hat{e} and/or π jumps to allow (P) to be satisfied, but they rarely explore the implications for income distribution and effective demand. The contrasting structuralist view is that class conflict and propagation mechanisms such as contract indexation often make \hat{P}_c the driving force behind inflation, and that \hat{P} (through endogenous fiscal and monetary policy) has to adjust.⁷

Figure 6 shows what happens when the observed inflation rate \hat{P}_c is suddenly reduced from a pre-existing equilibrium, say by price controls and deindexation in a "heterodox shock" anti-inflation program. To reach saving-investment equilibrium after \hat{P}_c is cut, u and g have to lie along the dashed $S'S'$ line whereas enough money is still being created to be consistent with an inflation rate corresponding to SS . Experience suggests that consumption demand will rise in response to the reduced inflation tax, so that investment will be limited by scarce foreign exchange. With II lying above FF along $S'S'$, there is incipient excess commodity demand unless the investment curve shifts downward or there are greater capital inflows, increased exports, or reserve losses and/or a run-up in arrears to move FF up. Demand pressure will be more severe insofar as the increase in u lifts output close to installed capacity.

Unfortunately, foreign exchange generation by exports or capital inflows may not be on the cards. Foreign sales are not likely to rise when consumer demand is booming, especially in a semi-industrialized economy. To analyze changes in net capital flows, we have to ask how private sector demand for

foreign assets will change under the heterodox anti-inflationary shock.

We can begin by noting that when \hat{P}_c falls, V will decline as money becomes less costly to hold. If the economy is on the "right" side of the Laffer curve, there will be an inelastic response of velocity to inflation. In equation (8), V falls less than \hat{P} so that money demand growth will decrease: $\dot{M}/PK > \dot{\mu}/PK$ after the shock. Initially, wealth-holders have to accept the excess money that is being created. But a natural response on their part is to search for alternative assets, so that λ will rise. There will be pressure on the black market exchange rate, perhaps forcing devaluation and renewed cost pressure. At the same time, all the sold curves in Figure 6 will shift unfavorably, as in Figure 5. In the medium term, there will be loss in reserves, but the consequent reduction in money supply growth may come too late to offset macroeconomic deterioration.

The moral seems to be that cost-oriented anti-inflation programs are best accompanied by increased transfers from abroad to move FF up, cuts in fiscal dissaving to shift the S'S' locus toward the left, or public investment restraint to shift II down. It is noteworthy that the price-freeze packages that have succeeded at least for a time -- in Mexico, Israel, and Argentina -- have been characterized by high T's and low γ 's and κ 's in terms of the notation adopted here.

The opposite case of $\hat{P}_c > \hat{P}$ occurs when cost pressure increases, say from devaluation. The economy tends toward the intersection of a leftward-shifted SS schedule with II. There is an excess supply of foreign exchange as both g and u decline. It can be absorbed by the policies discussed above, but initially we observe the familiar stagflationary effects of devaluation.

In closing, it bears emphasis that our discussion of Figure 6 hinges on the narrow, quantity theory view of financial adjustment built into equations (7) and (8). As illustrated in Taylor (1985), a more realistic approach is to

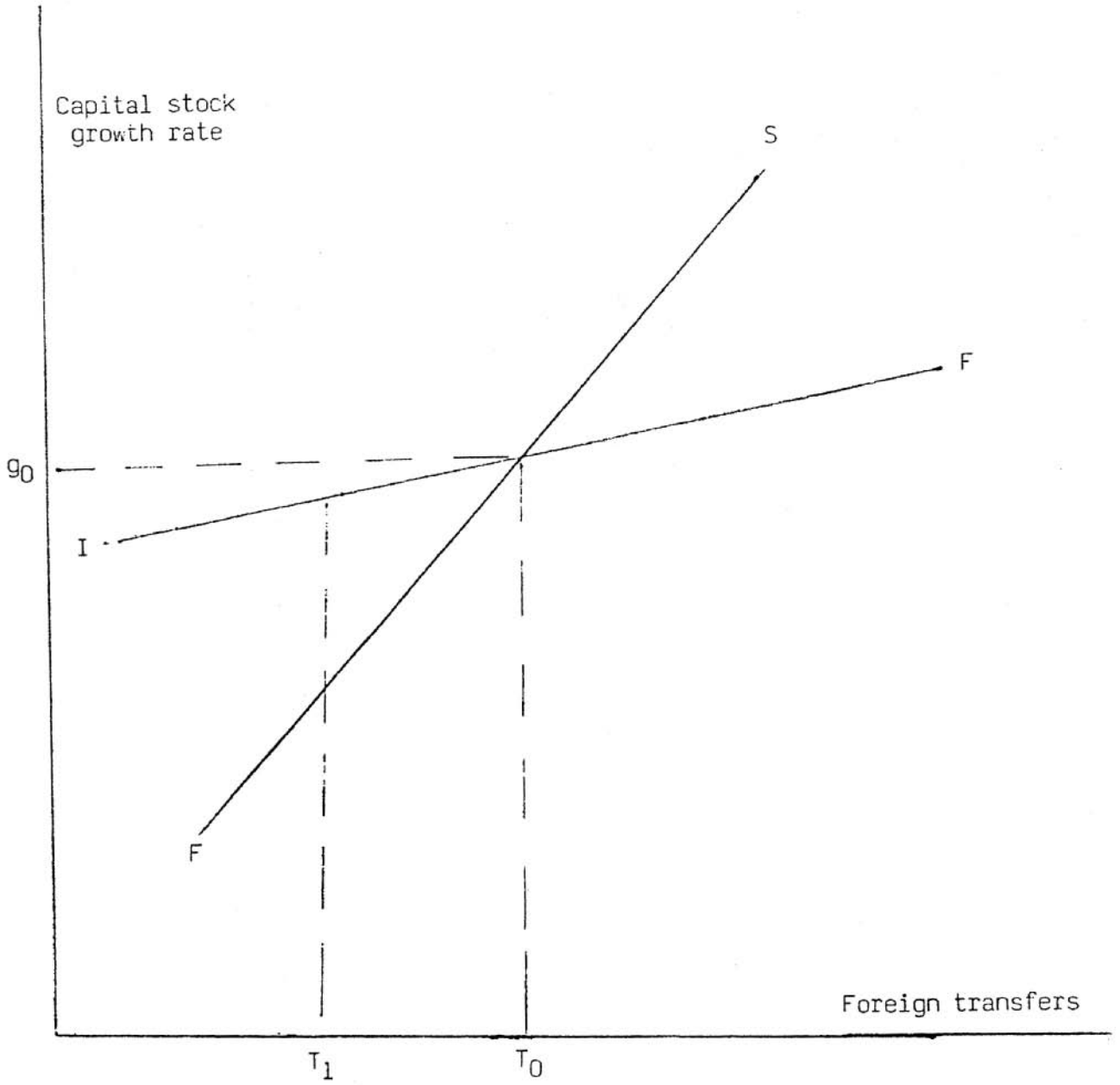


Figure 7: Relationships between the foreign exchange/saving and investment/foreign exchange constraints.

treat $V = PK/M$ as a (usually) stable state variable, evolving according to the laws that govern \hat{P} (responding to class conflict or demand pressures, as befits the economy at hand), g , and \dot{M} . When one works with such a model, it is clear that there will be economic forces (such as interest rate increases and better tax collection) shifting SS and S'S' toward one another after a heterodox shock. Political factors can offset (or exacerbate) tendencies toward capital flight. In applied anti-inflation programs, policy formation has to take such possibilities into account.

6. Growth Projections

Although Chenery and Bruno concentrated on adjustment problems, subsequently the two-gap model has mostly been used to make conditional forecasts of medium-term growth. In early applications, equations (S) and (F) were used separately, with a constant "technically given" output-capital ratio u and omitting inflation taxes and reserve changes. One or the other equation would give a lower g for a given T , and the corresponding constraint was said to be binding. Although they were recognized, macro adjustment issues of the type discussed here were usually not incorporated into growth projections.

Bacha (1984) suggested a more sophisticated procedure based on solving (S) and (F) simultaneously for g and u (given \hat{P}) and also setting T equal to $(F - r)\xi$ so that both new money inflows and interest payments could be taken into account. The discussion here would suggest using (S), (F), (I), and (P) together to make projections, with a mix of quantity theory and cost-based inflation processes appropriate to the economy at hand. Figure 7 illustrates potential policy issues, in a diagram based on semi-reduced forms from the model on the familiar foreign transfer vs. growth rate plane.⁸

The schedule labeled FS results from eliminating capacity utilization u between the saving and foreign exchange constraints (F) and (S), for a given rate of inflation. Its slope exceeds unity, because the import content of

investment is less than 100 percent. Faster inflation (a bigger inflation tax) means that less foreign saving is required to support a given rate of growth, so that FS shifts leftward as \hat{P} rises.

The IF curve comes from eliminating u between (I) and (F). Overall macro stability requires that it be less steep than FS, and a reduction in public capital formation κ shifts IF downward. The intersection of the curves defines a growth/capital inflow equilibrium at (T_0, g_0) . How will the economy adjust if the required inflow is not forthcoming?

The possibilities easy to analyze in the diagram are faster inflation and cuts in public investment (both can be complemented by reduced fiscal dissaving). Inflation permits T_0 to fall to T_1 with the growth rate determined along IF as FS moves to the left, while cutting public capital formation means that IF shifts downward along the steeper FS. There is a lower cost in terms of growth from the inflationary as opposed to the investment-cutting solution (which shows that Brazil's strategy discussed in section 3 may not have been pure folly after all). However, at the same time, higher demand inflation feeds back into more and faster contract indexation, etc., which can make trending prices much more difficult to tackle from the \hat{P}_c side. The policy question is multifaceted: how much fiscal restraint in terms of current spending or taxation is required to support a healthy level of public investment (with private investment crowding-in) and a politically acceptable inflation rate under likely prospects for capital inflows and success in promoting exports and holding imports down?

This question is not fundamentally different from the one Chenery and Bruno were asking in 1962, but the fiscal/foreign exchange crisis in much of the Third World makes it even more urgent now than it was when they first began to analyze disequilibrium growth adjustment and gaps.

Footnotes

¹ We omit new credit advanced to households or for working capital. Both uses would presumably depend on the change in output, or (after the application of stock-flow conversions in a planning context) the rate of capacity growth g . This extension is left out for simplicity, although non-investment credit flows are important in practice.

² Equation (6) shows that private asset accumulation abroad reduces resources available for the banking system to intermediate toward productive investment. In practice, capital flight is often transmitted by underinvoiced exports, overinvoiced imports, etc., which bleed enterprise cash flows and directly reduce investment through that channel.

³ We assume that running down foreign balances is difficult (and unlikely with rapid domestic inflation). Deposits could also be converted to transactions balances, but this possibility will be limited if (as is often the case in developing economies) the ratio of quasi-money to money is low. The authorities may also sustain deposits by raising nominal interest rates along with inflation.

⁴ For example, suppose capital income is taxed to finance a transfer to workers. If output cannot increase, prices will rise to reduce purchasing power from wage-plus-transfer income and restore macro equilibrium. If an existing tax/transfer program is expanded, it is easy to show that in the final outcome, total per worker real income will fall.

⁵ In developing economies, the importance of crowding-in effects was emphasized in 18 country studies of recent stabilization programs sponsored by the World Institute for Development Economics Research (WIDER) and summarized in Taylor (1988). A neoclassical rationale is that public and private capital enter in complementary fashion in the aggregate production function (Arrow and Kurz, 1970). The relevance of the phenomenon has been supported by recent

econometrics. Chakravarty's (1987) regressions give a coefficient β between one and two for Indian agriculture; Ortiz and Noriega (1988) estimate that it takes a value of unity economy-wide for Mexico; Barro (1989) comes up with a β of one based on cross-country data; and Aschauer (1989) argues that for the United States, public investment raises the profitability of private capital formation enough to offset direct crowding-out so that the overall level of national investment is lifted.

⁶ We omit a possible increase in investment demand as faster inflation reduces real interest rates (along Mundell-Tobin lines). A possible reduction in g as the variance of price changes rises with inflation is ignored as well.

⁷ Taylor (1988) goes into the political economy of divergent monetarist and structuralist inflation theories.

⁸ Ros (1989) uses a similar trick in presenting his gap model for Mexico.

References

- Arrow, Kenneth J., and Mordecai Kurz (1970) Public Investment, the Rate of Return, and Optimal Fiscal Policy, Baltimore: The Johns Hopkins Press
- Aschauer, David (1989) "Does Public Capital Crowd Out Private Capital?" Journal of Monetary Economics, to appear
- 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, New York: Academic Press
- (1990) "A Three-Gap Model of Foreign Transfers and the GDP Growth Rate in Developing Countries," Journal of Development Economics, to appear
- Barro, Robert (1989) "A Cross-Country Study of Growth, Saving, and Government," Working Paper No. 2885, Cambridge MA: National Bureau of Economic Research
- 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, Cambridge MA: MIT Press
- Chakravarty, Sukhamoy (1987) Development Planning: The Indian Experience, Oxford: Clarendon Press
- Chenery, Hollis B., and Michael Bruno (1962) "Development Alternatives in an Open Economy: The Case of Israel," Economic Journal, 72: 79-103
- Fanelli, Jose Maria, Roberto Frenkel, and Carolos Winograd (1987) "Argentina," Stabilization and Adjustment Policies and Programmes Country Study No. 12, Helsinki: World Institute for Development Economics Research
- Green, Reginald, and Xavier Kadhani (1986) "Zimbabwe: Transition to Economic Crisis, 1981-83: Retrospect and Prospect," World Development, 14: 1059-1083
- Ocampo, Jose Antonio (1987) "The Macroeconomic Effect of Import Controls: A

Keynesian Analysis," Journal of Development Economics, 27: 285-306

Ortiz, Guillermo, and Carlos Noriega (1988) "Investment and Growth in Latin America," Washington DC: International Monetary Fund

Ros, Jaime (1989) "Medium Term Perspectives on the Mexican Economy," Helsinki World Institute for Development Economics Research

Taylor, Lance (1985) "A Stagnationist Model of Economic Growth," Cambridge Journal of Economics, 9: 383-403

_____ (1988) Varieties of Stabilization Experience, Oxford: Clarendon Press

_____ (1989) "Real and Money Wages, Output and Inflation in the Semi-Industrialized World," Cambridge MA: Department of Economics, MIT

Wicksell, Knut (1935) Lectures on Political Economy (Vol. II), London: Routledge and Kegan Paul