DM/86/45

INTERNATIONAL MONETARY FUND

Research Department

Reducing High Inflation in Developing Countries Without Output Losses: Monetary Contraction, Currency Depreciation, and the Current Account Balance

Prepared by Omotunde Johnson*

Approved by Anthony Lanyi

July 7, 1986

Summary

The paper analyzes a high-inflation economy, characterized by both rapid monetary expansion and continuous depreciation of the domestic currency, in which imports are important in production. The chief question addressed is under what conditions it is possible to reduce inflation without output losses, in the absence of explicit supply-side measures. In the model of the paper, the authorities have an output target and an external target, the latter consisting of either a net savings rate or the maintenance of a purchasing-power-parity rule; the net savings rate is the current account balance (or the change in the country's net foreign asset position) as a percentage of GDP. It is hypothesized that monetary policy is relatively important in achieving the output target and the exchange rate relatively important for the external target. It is argued that when the external target is a net savings rate, inflation can be reduced without output losses only by utilizing additional (fiscal and interest rate) measures that raise the net saving schedule. When the external target is the maintenance of purchasing power parity, inflation can be lowered without output losses only by modifying the purchasing-power-parity rule. In particular, if the elasticity of output is greater with respect to the rate of monetary expansion than with respect to the rate of change in the exchange rate, then the rate of currency depreciation must be smaller than that required to maintain purchasing power parity.

* Without implicating them for any errors, the author would like to thank Peter Montiel and C.L. Ramirez-Rojas for comments on an earlier draft.

I. Introduction

It is generally agreed that high inflation is costly in terms of welfare and growth 1/ and that structural inflation cannot explain more than a modest rate of inflation over and above world inflation rates. 2/ Furthermore, it is accepted that high inflation, even when aggravated by cost-push pressures from the private sector, persists because of passive monetary policy by the authorities and that if inflation is to be reduced, the rate of monetary expansion must be made to decline. In many cases, of course, the inflationary pressure arises principally from government budgetary deficits financed by borrowing from the central bank (monetary authority), and such financing must then be curtailed if inflation is to be reduced.

In high-inflation countries, rapid monetary expansion is generally accompanied by continuous depreciation of the domestic currencies. This adaptation to inflation is a necessary condition for a sustained and reasonable rate of economic growth in such countries. For these countries, the issue is not whether to depreciate or not but rather at what rate to do so.

The setting for the analysis in this paper is a high-inflation country characterized by both rapid monetary expansion and continuous depreciation of the domestic currency. The chief question addressed is under what conditions it is possible to reduce inflation without output losses in the absence of explicit supply-side measures, when demand management and the exchange rate are the chief policy instruments.

To the extent that supply-side policies can be put in place quickly, inflation can be reduced somewhat without output losses, mainly because such policies lower the reduction in money stock expansion required to attain any given rate of price deceleration. Policies, such as tariff reductions, that increase the efficiency of resource use and lower the costs of imports can, in certain circumstances, greatly help in this regard. 3/ But in general, supply-side policies take some time to yield substantial benefits in real output. For simplicity, the absence of explicit supply-side policies is assumed in this paper.

1/ See, for example Fischer and Modigliani (1978), and O.E.G. Johnson (1984), and references in those papers. For the argument that inflation may be part of the growth process in economies with structural features similar to those possessed by the high-inflation economies of Latin America see e.g., Canavese (1982), Cardoso (1981) in the references.

2/ See Harberger (1964) and H.G. Johnson (1966).

3/ See Edwards (1985).

Demand management policies, however, may entail output costs, because factor rentals and prices may be based on expectations of certain rates of monetary expansion realized in the recent past. 1/ The credibility of policies may help, of course, to counteract the implied inertia and rigidities as well as alter expectations, as emphasized, for instance, by Barro (1978), Lucas (1973), Sargent and Wallace (1976). In the development literature, "structuralist models" have been formalized in which deceleration in monetary expansion, aimed at slowing down inflation, has adverse repercussions on real output. 2/

The development literature has also had some discussion of the role of currency appreciation (or reducing the rate of currency depreciation) in slowing down inflation, particularly since certain countries have tried to use such an approach. 3/ Models have also been formalized to demonstrate that devaluation in developing countries can have contractionary effects on output. 4/ Such models, to the extent that they are empirically relevant, may have importance for the appropriate exchange rate policy that must be followed during attempts to decelerate the rate of inflation if adverse effects on output are to be avoided. These models are not, however, inconsistent with the view that real effective exchange rate depreciation has an expansionary effect on output in the medium-term 5/.

The argument of the paper is that in a high-inflation country in which the exchange rate policy is aimed either at achieving a certain net export rate (current account balance as a ratio to gross domestic product) or at following a purchasing-power-parity rule in fixing its exchange rate, anti-inflation policy must consist in reduction of both the rate of monetary expansion and the rate of depreciation of the domestic currency if inflation is to be lowered without output losses. In the particular case in which the country has been following a purchasing-power-parity rule, it is argued that the rate of currency depreciation should be less than that required for exact adjustment for the differential between domestic and foreign inflation rates. It is also argued that if such policies are carried out, there will be a decline in the net export ratio unless fiscal and interest rate policies are employed to raise the net savings ratio and money demand relative to income. (In this paper the term "net savings ratio" will be used instead of "net export ratio" to reflect the fact that this ratio represents the difference between domestic savings and investment expressed as a proportion to output.)

1/ See, e.g., Chopra, Gordon, for further discussion and references.
2/ Lopes and Bacha (1983), Taylor (1983) and van Wijnbergen (1983).
3/ See Diaz-Alejandro (1982), Blejer and Mathieson (1981) and Edwards (1985).
4/ See, for example, Diaz-Alejandro (1963), Krugman and Taylor (1978).
5/ See e.g. Kincaid (1984).

The paper does not tackle the important question of how fast to reduce inflation. The paper also implicitly assumes throughout that the output level (or, in general, the rate of output growth) is at least sustainable; it is not, for instance, being maintained by an unusually high rate of foreign borrowing with implications for future debt service that make output losses inevitable over some medium-term period.

The paper is organized as follows. Section II sets out a simple framework depicting the macroeconomic variables behind the inflationary process in what is called the inflation-prone economy. Section III is a discussion of how the authorities control changes in the money stock and in the exchange rate to achieve the required domestic target (output) and external target (savings ratio or realization of purchasing-power-parity rule). The analysis and results of this section are then used in section IV to derive the basic propositions of the paper with regard to reducing high inflation. The final section contains some concluding remarks.

II. The Inflation-Prone Economy: Some Relevant Aspects of the Inflationary Process

The model focuses on a small developing economy that is a price-taker in world markets. The aggregate output of this economy is denoted by X. The economy imports only one good (M) from abroad, which is used as an input in the production of X. Apart from M, labor (N) and capital (K) are also used in the production of X. The labor suppliers are contractual income earners being paid wages (W) by the owners of K, who are the residual income earners.

Suppliers of labor are treated, for expository reasons, as if they act in concert to determine their asking wage. The capitalists are then free to determine how much labor they will employ. In deciding how much they will request as their wage, labor suppliers take into account at least three factors: (1) the anticipated effect of the wage rate on their employment, (2) past and expected inflation rates, and (3) an assessment of the fairness of their share in total output.

The exchange rate (e), defined as the number of units of some numeraire foreign currency per unit of the domestic currency, is fixed by the monetary authority, but this authority is quite willing to alter the rate frequently. The exchange arrangement might therefore be described as a type of managed floating. Because the foreign price of the import M is determined exogenously, changes in the exchange rate alter the price of the import in domestic-currency terms.

Apart from workers and capitalists, there is a third set of decision-makers in the economy, "the authorities", including the monetary authority. It is assumed that the authorities ideally aim at "full employment" of productive capacity. At their disposal are four basic policy "instruments" --the nominal exchange rate, the money stock, the fiscal balance, and the

regulated nominal interest rate (which, in turn, influences the real rate of interest). This paper will be concerned mainly with the first two of these instruments, i.e., the exchange rate (e) and the stock of money (MO). The latter variable is targeted by the authorities in relation to the capacity output level of X: this ratio will be denoted MO/X.

The basic model will be analyzed in terms of the rates of change of the supply price and demand price for X, the capacity output of X, and the rate of change of capacity output. A hat (^) over a variable indicates the percentage rate of change of the variable in question; for convenience, the "percentage rate of change of" will be sometimes abbreviated to "change of" or "change in". Equation (1) gives the change in the supply price of X--$\hat{P}^S$--as a function of the change in the wage rate ($\hat{W}$), the change in the exchange rate ($\hat{e}$), the change in the price of the import in the foreign numeraire currency ($\hat{P}^*_m$), and the change in the quantity of X ($\hat{X}$). That is,

$$\hat{P}^S = S(\hat{W}, \hat{P}^*_m - \hat{e}, \hat{X}) \qquad (1)$$

Increases in $\hat{W}$, $\hat{P}^*_m$, and $\hat{X}$ all raise the rate of change of the supply price of X, i.e., $\hat{P}^S$. An increase in the rate of appreciation of the domestic currency, i.e.--an increase in $\hat{e}$--reduces the rate of increase in the domestic-currency cost of the import and so tends to lower the acceleration in the supply price of X.

The commodity X is a composite good. Part of it is tradable and part nontradable. This means that the domestic price of X is not simply a price determined in international markets and translated via the exchange rate. In particular, the demand price of X depends on MO/X, the foreign price level (P*), the exchange rate (e), the fiscal balance (FB/X) and the interest rate (r). In short, for the demand price of X we have

$$\hat{P}^D = D\,(\widehat{MO/X}, \hat{P}^* - \hat{e}, \Delta(FB/X), \hat{r}) \qquad (2)$$

where increases in $\hat{P}^*$ and $\widehat{MO/X}$ tend to raise $\hat{P}^D$; Δ is the difference operator. The assumed effect of the money stock expansion on demand price follows (1) from a real balance effect in private consumption and (2) from credit extended to the private sector (workers and capitalists) for the purchase of X. Currency appreciation (depreciation) lowers (raises) the domestic-currency price of X and is tantamount to a fall (rise) in the demand price of X.

The fiscal balance (FB) is the difference between government revenue, G_R, and government expenditure G_E. Government revenue is simply a given fraction, t, of output--t being the average effective tax rate. An increase in FB/X, then, results from an increase in t or a decrease in G_E/X.

Capacity output (X_c) is a function of the available capital stock (K), fully-employed labor (N_f) and the level of efficiency in the utilization of resources (symbolized here by θ).

That is,

$$X_c = X\ (K,\ N_f,\ \theta) \qquad (3)$$

where increases in K, N_f, θ, ceteris paribus, will, of course, raise X_c. The rate of change in capacity output is made a function of investment (I), the marginal efficiency of investment (MEI) 1/, and fully-employed labor force growth. That is,

$$\hat{X}_c = X\ \ [(I/K).MEI,\ \hat{N}_f] \qquad (4)$$

Some of the domestic output of X is purchased by foreigners in return for commodity M or for foreign assets. The net saving of the inflation-prone (home) economy under consideration is the difference between the quantity of X purchased by foreigners and the M that the home economy purchases; in short, the net saving (NS) is the home economy's net addition to its foreign assets. The ratio of this net saving to actual output, to be denoted here by NS/X, is assumed to be a decreasing function of MO/X; increases in MO/X lead to increases in demand for X by home-country residents, thereby (1) inducing more M (to produce more X) and (2) leaving a smaller fraction of X available for purchase by foreigners. NS/X is also assumed to decrease with appreciation of the domestic currency, which lowers the domestic price, and therefore raises domestic consumption, of X. Finally, NS/X is assumed to increase as the real fiscal balance to output (FB/X) increases or as the interest rate (r) rises. An increase in FB/X implies that government saving ratio is increasing, through an increase in government revenue, or through a reduction in government expenditure, relative to output, or both. Even where the private saving ratio falls somewhat, as a consequence of any additional taxation that lowers disposable income, relative to total income, it is not expected to fully counteract the increase in government saving. An increase in r induces the private sector, ex ante, to save more and invest less relative to income. In short, it is hypothesized that:

1/ The marginal efficiency of investment (MEI) is the product of the marginal productivity of investment and the marginal productivity of capital. That is, $\frac{\partial X}{\partial I} = \frac{\partial K}{\partial I} \cdot \frac{\partial X}{\partial K}$.

$$NS/X = F\ (\widehat{MO/X},\ \hat{e},\ FB/X,\ r) \qquad (5)$$

where $F_1 < o$, $F_2 < o$, $F_3 > o$ and $F_4 > o$.

In the inflation-prone economy under consideration the authorities are interested in attaining a given quantity of real output X; for ease of exposition it will be assumed throughout that the real output level sought is the full capacity output X_c. Apart from this, the authorities also have one of two objectives in the external sector; hence two cases will be distinguished. In the first--Case I--the authorities are assumed to be interested in attaining a given NS/X, say $\overline{NS/X}$. In the second--Case II--the authorities determine their exchange rate change according to some purchasing-power-parity (PPP) rule; that is, the exchange rate will be depreciated at a rate determined by the difference between domestic and foreign inflation. It is assumed that initially an exact PPP rule is followed so that, in Case II, $\hat{e} = \hat{P}^* - \hat{P}$. In Case II, then, NS/X is endogenous.

To achieve their desired quantities--say X_c^o and $\overline{NS/X}$ in the Case I situation--the authorities will be assumed, in the short term, to vary MO/X and e. For example, a reduction of e and an increase of MO/X both raise demand; but the reduction of e raises NS/X, while the increase of MO/X lowers NS/X. Hence raising MO/X to achieve a required increase in demand, may have to be accompanied by a reduction in e to maintain the desired level of NS/X.

Assume now that capacity output is growing at a constant rate ($\hat{\overline{X}}c$). Let $\hat{X}$ represent the rate at which actual output is growing, such that

$\hat{X} = \hat{\gamma} + (1 + \hat{\gamma})\hat{\overline{X}}_c$ where γ is the rate of capacity utilization and is in the interval (0,1). As γ increases, $\hat{P}^s$ increases given $\hat{W}$, $\hat{P}_m^*$ and $\hat{e}$. The assumption is made henceforth that $\hat{P}_m^*$ bears a fixed relation with $\hat{P}^*$ so that it will suffice to speak only of $\hat{P}^*$. In figure 1, the P^D curves are the demand-price schedules and the P^S curves are the supply-price schedules. Given $\hat{W}$, $\hat{e}$ and $\hat{P}^*$, the supply curves are drawn to begin where they become increasing functions of $\hat{X}$, to represent the fact of diminishing marginal productivity of labor and hence increasing marginal cost. Increases in $\hat{W}$ and $\hat{P}^*$ will shift the P^S schedules upward, while increases in $\hat{e}$ shift the P^S schedules downward. The P^D curves are drawn for given $\widehat{MO/X}$, $\hat{P}^*$, ΔG_E, $\hat{e}$, t, and r. Increases in the levels of the first three of these variables, and decreases in the last three, tend to shift the demand schedules upwards.

Initially, the demand schedule is P_o^D and the supply schedule P_o^S. Given capacity output growth of $\hat{\bar{X}}_c$ the initial equilibrium is at point A in Figure 1. The equilibrium condition is

$$\hat{P}(\hat{\bar{X}}_c) = \hat{P}^D(\hat{\bar{X}}_c)$$

where $\hat{P}(\hat{X}_c)$ is the supply price rate of change at $\hat{\bar{X}}_c$.

1. Private enterprise activity

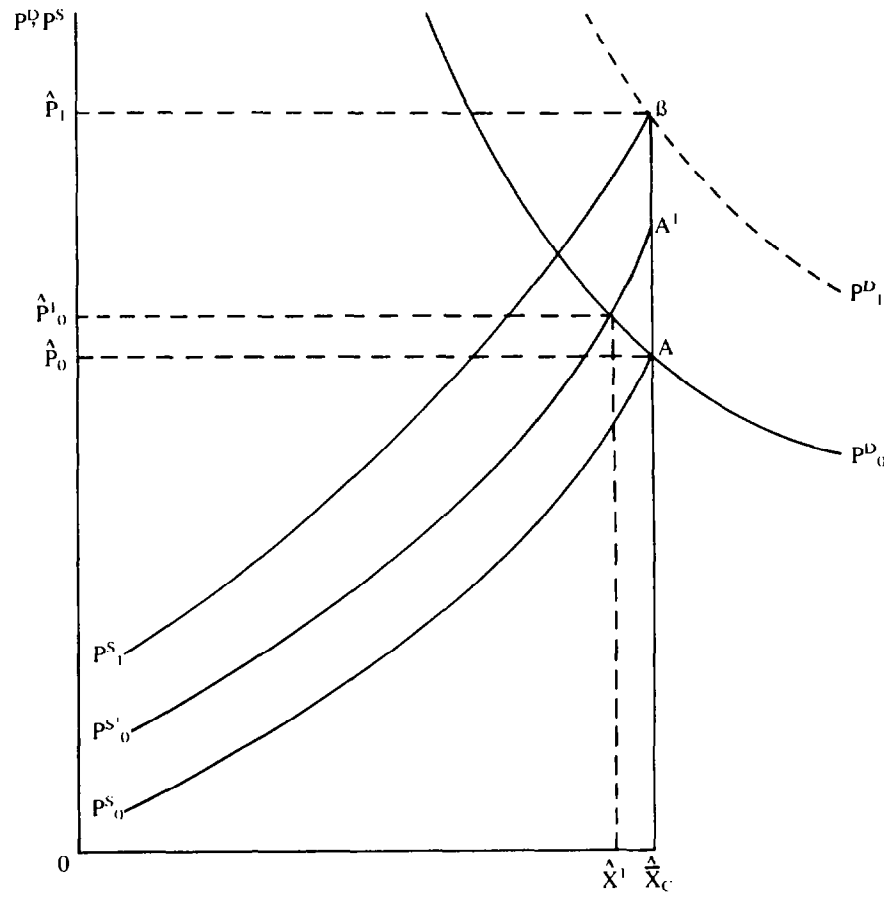
Suppose now that starting from the equilibrium point A, the increase in wages accelerates, i.e., $\hat{W}$ rises, leading to an upward shift in the supply-price curve to $P_o^{S'}$. Given P_o^D, output tends to $\hat{X}'$. As the authorities are assumed to take measures to ensure that the rate of capacity utilization does not fall below unity, in this case they would raise the rate of money stock expansion and/or increase the rate of depreciation of the currency, while keeping in view their external objectives. The raising of $\widehat{MO/X}$ and/or accelerating the depreciation of the currency will shift the demand price curve upward to P_1^D. But the reduction of $\hat{e}$ shifts the supply-price curve upward until a new equilibrium is established; in figure 1 this occurs at point B with new schedules P_1^D and P_1^S. Instead of inflation rate $\hat{P}_o$ and output growth rate $\hat{X}'$, the monetary and exchange rate intervention of the authorities engenders a higher inflation rate--$\hat{P}_1$--but ensures that the output growth rate $\hat{\bar{X}}_c$ is maintained. In such an inflation-prone economy, therefore, labor suppliers do not experience a reduction in employment from demanding additional wages.

While inflationary pressures coming from foreign inflation, P^*, are exogenous to the economy, it can be argued that those emanating from W will cease when workers no longer expect to improve their real wages from wage increases. Thus, when no inflationary pressures are coming from outside the economy or from the public sector, the equilibrium rate of inflation at capacity output growth can be attained when workers do not expect to improve their share of real incomes by changing their asking wages.

2. Public enterprise activity and government purchases

So far the assumption has been that the authorities increase $\widehat{MO/X}$ only in response to wage and price increases of the private sector that tend to lower $\hat{X}$ below the capacity output growth. Assume now that the authorities comprise not only a monetary authority, ensuring full employment through raising $\widehat{MO/X}$ and changing $\hat{e}$ but also public enterprises producing X and government departments consuming X. Inflationary pressures could now come from the authorities if they try to increase the share of output produced by public enterprises or consumed by government

FIGURE 1


P^D, P^S
$\hat{P}_1$
$\hat{P}^1_0$
$\hat{P}_0$
B
A^1
A
P^D_1
P^D_0
P^S_1
$P^{S'}_0$
P^S_0
0
$\hat{X}^1$
$\hat{X}_C$

departments. Again, the assumption will be throughout the analysis of this subsection that the authorities are varying $\hat{MO/X}$ and $\hat{e}$ to attain not only full capacity utilization but also their desired NS/X, or their PPP.

Hence suppose the public enterprises, backed by money from the monetary authority, try to bid away labor and capital from the private sector. This activity will set in motion the same forces as before. In this case the supply price of X will increase as $\hat{W}$ increases, while the increase in $\hat{MO/X}$ will raise the demand price of X. Hence $\hat{P}$ tends to increase, disrupting external equilibrium. By lowering $\hat{e}$ to restore external equilibrium, the monetary authority would of course further raise the demand price for X as well as the supply price of X. The resulting combination of higher MO/X and lower e can be used to keep output growth (with its associated employment growth) at $\overline{X}_c$ in Figure 1 while attaining the external objectives of the authorities. The policy would, inter alia, have resulted in a redistribution of productive activity from private firms to public enterprises.

Analogously, let the government departments try to increase the share of X they consume backed by money obtained from the monetary authority. The effect is to raise the demand price of X; i.e., the P^D. schedule is shifted upward. Again currency depreciation (reduction of e) to foster external equilibrium would further raise the demand-price schedule and would also cause the supply-price schedule to shift upward. Also, in the new equilibrium, the share of output consumed by the government departments would have increased relative to the share of output consumed by the private sector--forced saving would have occurred.

III. The Equilibrium Policy of the Authorities

In equilibrium in the inflation-prone economy, let it be assumed that real output growth is at the capacity growth rate. As explained earlier, two types of external targets are considered. In Case I, the authorities have a target for the net savings rate (NS/X) and in equilibrium this rate, NS/X, is being attained. In Case II, the authorities set the exchange rate change according to a purchasing-power-parity (PPP) rule and in the initial equilibrium, $\hat{P} = \hat{P}^* - \hat{e}$. We assume a money demand function such that, given $\hat{W}$, $\hat{P}^*$, $\hat{e}$, FB/X, and r, it will be the case that in equilibrium, i.e. when adjustment of NS/X is also completed, $\hat{P} = \lambda(\hat{MO/X})$, where $0 < \lambda \leq 1$ is an indicator of the speed with which excess real money stock is wiped out by price increases. We shall consider only the equilibrium case in which $\lambda = 1$, so that $\hat{P} = \hat{MO/X}$. This assumption that $\hat{P} = \hat{MO/X}$ means that in Case II, in equilibrium, $\hat{P}^* - \hat{e} = \hat{MO/X}$.

For Case I, then, writing a linear approximation of equation (5) and abstracting from FB/X and r, gives

$$NS/X = f_1 \hat{MO/X} + f_2 \hat{e} \qquad (6)$$

For given $\hat{P}^*$ and $\hat{W}$, and once again abstracting from FB/X and r, equations (1) and (2) can be used to write a linear approximation of changes in $\hat{X}$ as a function of alternative combinations of MO/X and $\hat{e}$. That is,

$$\hat{X} = x_1 \, \widehat{MO/X} + x_2 \, \hat{e} \qquad (7)$$

Note again that in equation (6) f_1, f_2 <0 and that x_1, x_2, >0 in equation (7).

In Figure 2 the XX schedule shows all combinations of $\hat{e}$ and $\widehat{MO/X}$ that leave the X markets cleared; along the XX Schedule, $\hat{X} = \hat{\bar{X}}_c$. All points above XX are excess demand situations for X, so that a contraction of $\widehat{MO/X}$ and reduction of $\hat{e}$ (currency "depreciation") are required to return to equilibrium. The $\widehat{MO/X}$ reduction will tend to reduce demand for X but will tend to contract supply of X as well. The currency "depreciation" (i.e. reduction of $\hat{e}$) will tend to raise demand for, and reduce supply of, X. The obverse is the case for all points below the XX schedule.

The XX schedule, therefore, incorporates the assumptions that, ceteris paribus, currency appreciation raises the capacity utilization rate and currency depreciation lowers it. Domestic monetary expansion on the other hand raises the capacity utilization rate while domestic monetary contraction lowers it.

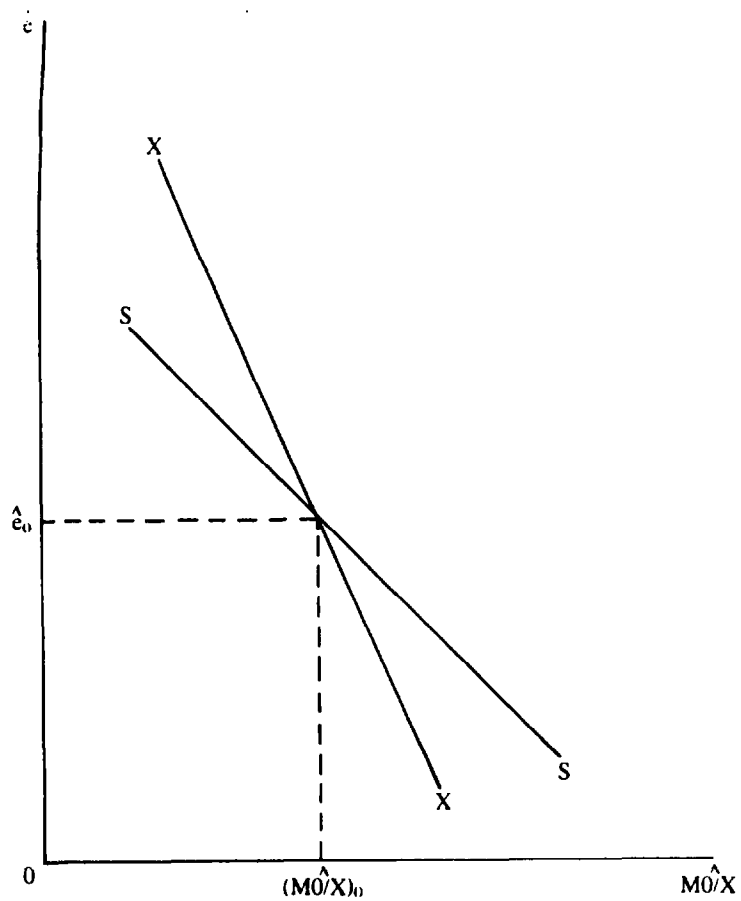
The SS schedule gives the combinations of $\hat{e}$ and $\widehat{MO/X}$ that leave the actual NS/X equal to the desired level ($\overline{NS/X}$). All points above the SS schedule are ones at which the NS/X are less than the desired $\overline{NS/X}$; both $\hat{e}$ and $\widehat{MO/X}$ must be reduced. The obverse is the case for points below the SS schedule. In terms of a simple target-instrument approach it is assumed here that money is relatively important in achieving the real output target and the exchange rate is relatively important in achieving the net saving (current account) target; in other words, $f_1/f_2 < x_1/x_2$. The slopes of the curves can be obtained by using equations (6) and (7) as follows:

$$\left.\frac{d\hat{e}}{d\widehat{MO/X}}\right|_{SS} = \frac{-f_1}{f_2} \qquad (8a)$$

and

$$\left.\frac{d\hat{e}}{d\widehat{MO/X}}\right|_{XX} = \frac{-x_1}{x_2} \qquad (8b)$$

FIGURE 2



The assumption of $f_1/f_2 < x_1/x_2$ implies that the XX schedule is steeper than the SS schedule. The equilibrium levels of $\hat{e}$ and $\widehat{MO/X}$ shown in equations (9) and (10) (of footnote 1 below) with $\hat{X} = \hat{X}_c$ are $\hat{e}_o$, $(\widehat{MO/X})_o$ in Figure 2. 1/

For Case II a similar approach can be developed. But, instead of equation (6), equation (11) below gives the PPP rule. For Case II, the situation is represented as follows:

$$\hat{X} = x_1 \widehat{MO/X} + x_2 \hat{e} \tag{7}$$

$$\hat{P}^* = \widehat{MO/X} + \hat{e} \tag{11}$$

In Figure 3 is shown the Case II analogue of Case I. The XX schedule again shows all combinations of $\hat{e}$ and $\widehat{MO/X}$ that leave the X markets cleared; again along the XX schedule $\hat{X} = \hat{\overline{X}}_c$. The PP schedule, here replacing the SS schedule of figure 2, reflects the PPP rule and shows all combinations of $\hat{e}$ and $\widehat{MO/X}$ which leave PPP satisfied: e.g., at all points above PP the domestic currency is becoming increasingly overvalued. As required by the purchasing-power parity rule (note again that $\hat{P}^*$ is constant) the slope of PP is one; that is,

$$\left.\frac{d\hat{e}}{d\widehat{MO/X}}\right|_{PP} = -1 \tag{12}$$

1/ From (6) and (7) the equilibrium solution for given X and NS/X, is as follows:

$$\widehat{MO/X} = \frac{x_2 \overline{NS/X} - f_2 \hat{X}}{\Delta} \tag{9}$$

$$\hat{e} = \frac{f_1 \hat{X} - s_1 \overline{NS/X}}{\Delta} \tag{10}$$

where $\Delta = f_1 x_2 - f_2 x_1$. Since it is assumed in this paper that $f_1/f_2 < x_1/x_2$ then $|f_1 x_2| < |f_2 x_1|$ and $\Delta > o$.

The assumption that money is relatively important in achieving the real output target and the exchange rate is relatively important in achieving the net savings (current account) target implies that $|x_1/x_2| > 1$; hence XX is steeper than PP in Figure 3. 1/

IV. Reducing High Inflation: Money, Exchange Rate and the Current Account

Inflation is presumed to entail costs that make its reduction desirable. More specifically, in terms of the model presented here, inflation adversely affects the efficiency with which resources are used (i.e., Θ), the level of investment (I), and the marginal efficiency of investment (MEI), the last due to inefficiencies in the investment process. In short, the assumption is that, for the high-inflation country,

$$\frac{\partial I}{\partial \hat{P}} < 0, \quad \frac{\partial \Theta}{\partial \hat{P}} < 0 \text{ and } \quad \frac{\partial MEI}{\partial \hat{P}} < 0.$$

This assumption is consistent with other studies of the cost of inflation (see, e.g., Fischer and Modigliani, 1978, and the references in that paper). Now, over time, as the rate of investment changes in the economy the rate of growth of capacity output will be changing as well; i.e., the vertical line representing capacity output growth will be moving to the right or left of $\bar{X}_c$. The important cost of inflation for the analysis in this paper is that, after a certain level of inflation, the rate at which capacity output is increasing is adversely affected by increases in the rate of inflation.

Suppose the rate of inflation is initially $\hat{P}_o$ and is to be reduced to $\hat{P}_1$. The authorities will tend to push down the rate at which the money stock is increasing to $\widehat{MO/X} = \hat{P}_1$. But the authorities also want to ensure that actual output grows at the full-employment capacity output. Consider now the Case I situation. In that case, for both capacity output and the net savings target to continue to be maintained while $\widehat{MO/X}$

1/ In equilibrium the solution is

$$\widehat{MO/X} = \frac{\hat{X} - x_2\hat{P}^*}{x_1 - x_2} \tag{13}$$

and

$$\hat{e} = \frac{x_1\hat{P}^* - \hat{X}}{x_1 - x_2} \tag{14}$$

FIGURE 3

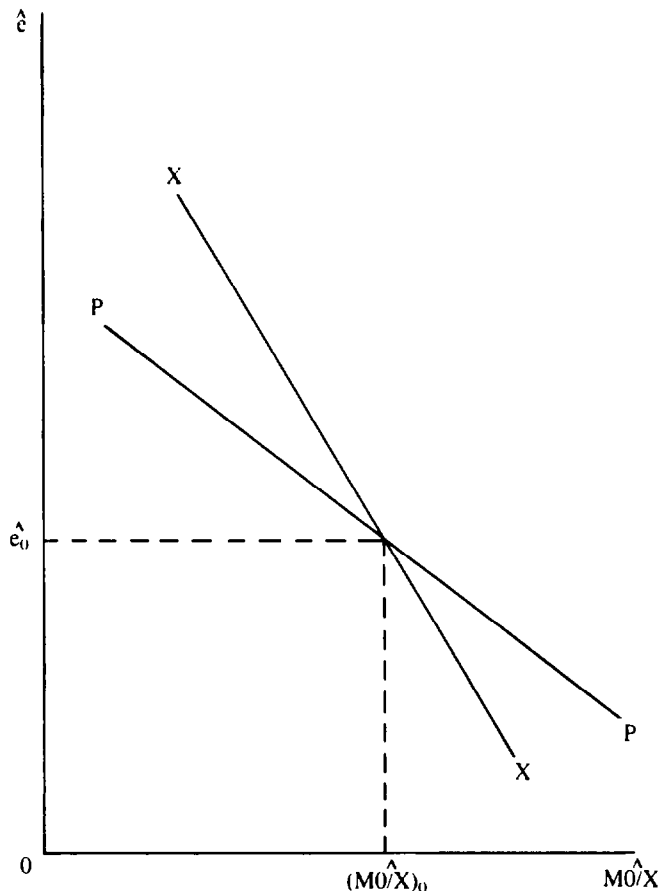
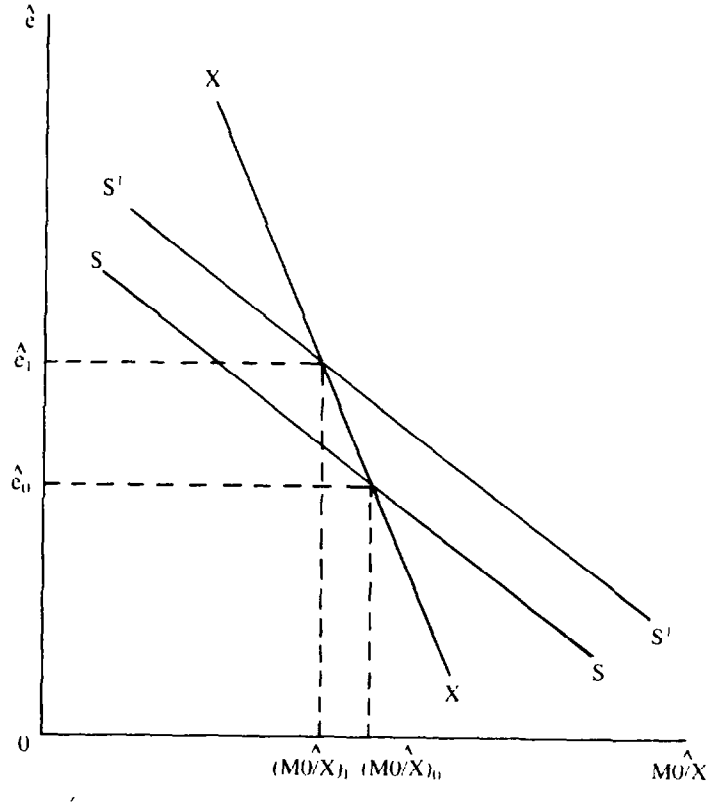


FIGURE 4



is being reduced, the SS schedule must be made to shift upward. This situation is shown in Figure 4, where the schedules SS and XX are the initial schedules and the initial equilibrium is $[\hat{e}_o, (\widehat{MO/X})_o]$. When the rate of expansion of the money stock is reduced, to $(\widehat{MO/X})_1$ (Figure 4), the exchange rate change must be e_1 if output growth is to be maintained at full capacity growth. But at the exchange rate $\hat{e}_1$, savings will be below targeted NS/X. The authorities could alter their targeted NS/X, thereby incurring a deterioration in their external position. Alternatively, policies could be instituted to raise the savings ratio NS/X for given $\widehat{MO/X}$ and given $\hat{e}$: in other words, such policies would change the functional relation $NS/X = F(\widehat{MO/X}, \hat{e})$, so that, in equation 6 ,the absolute value of f_1 falls and/or the absolute value of f_2 falls such as to shift SS to S'S'. This could be done, for example, by fiscal and interest rate policies that induce an increase in the real demand for assets, including money, relative to output.

Consider now the Case II situation. So far the assumption has been that, for this case, the authorities maintain a strict purchasing-power-parity rule. Suppose that when $\widehat{MO/X}$ is reduced, the new exchange rate change is set at $\hat{e}_1 = \hat{P}^* - (\widehat{MO/X})$, as dictated by the strict PPP rule. Then the new rate, i.e., $\hat{e}_1$, will not, in our analysis, be consistent with maintaining full-capacity output. This situation is shown in Figure 5, where PP and XX are the original schedules with equilibrium at $[e_o, (\widehat{MO/X})_o]$. If now, after the money growth rate is reduced, the strict purchasing-power-parity (PPP) rule continues to be followed, output growth will be lower than full-capacity output growth. For full capacity output growth the PPP rule must be modified. This will be tantamount to an upward shift of the PP schedule, with the new equilibrium at $[\hat{e}_1, (\widehat{MO/X})_1]$.

Alternatively, the situation can be depicted as follows. Now, in general, for continuous full utilization of capacity,

$$\hat{e} = \hat{P}^* - \frac{d\hat{e}}{d(\widehat{MO/X})} \widehat{MO/X}$$

where

$$\frac{d\hat{e}}{d(\widehat{MO/X})} = x_1/x_2$$

(The strict PPP rule, of course, assumes that $x_1/x_2 = 1$.)

Define $\beta \equiv -1 + x_1/x_2$. Then

$$\hat{e} = \hat{P}^* - (1 + \beta)\, \widehat{MO/X} \qquad (15)$$

is the general PPP rule. For the typical high-inflation country, rule (15) says that the rate of currency depreciation should be more or less than the rate required by the strict PPP rule, to the extent that x_1 is smaller or greater than x_2.

The variables x_1 and x_2 represent the elasticities of output with respect to the money-output ratio and the exchange rate, respectively. If, as is hypothesized in this paper, it is the case that $x_1 > x_2$, then the rate of depreciation must be smaller than what would be required to maintain purchasing power parity. In essence, the domestic currency appreciates in terms of PPP. But if in fact $x_1 < x_2$ is the case, then the currency depreciation must be greater than what is required to simply maintain PPP constant.

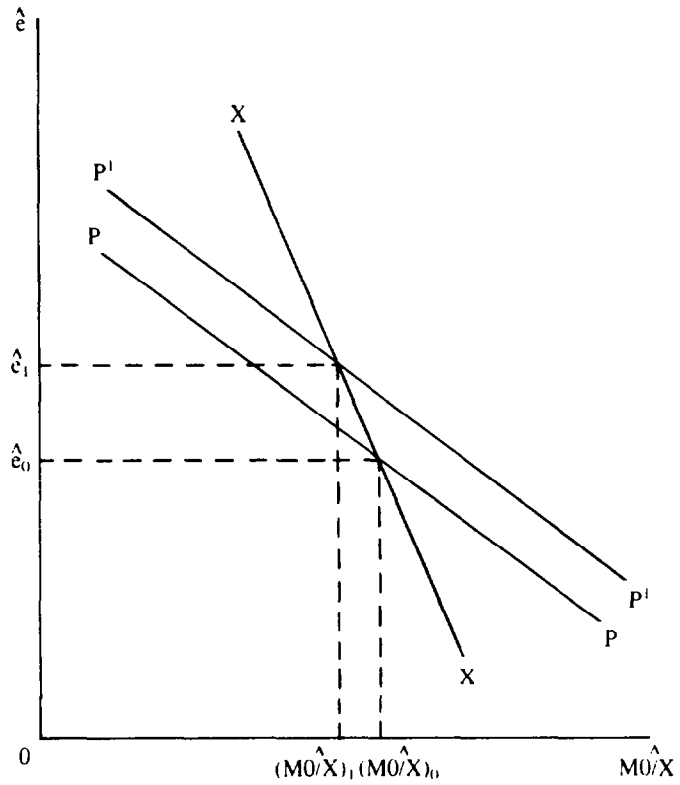
Insofar as in the Case II situation NS/X, the net saving ratio, is endogenous, the above policy of reducing inflation while maintaining capacity output can mean declining equilibrium NS/X. On other grounds (e.g., objectives with regard to external debt and foreign exchange reserves) this may be undesirable. Again one is led to the conclusion that fiscal and interest rate policies, to increase the savings rate and raise money (and productive asset) demand, must come to the rescue if the level of NS/X is of importance in the policy design.

V. Concluding Remarks

This paper has been concerned with a high-inflation economy in which imports are important in production, and where the authorities use monetary policy and the exchange rate in pursuit of full capacity utilization in production and an external target consisting of either a net savings rate or the maintenance of a purchasing power parity rule. It is hypothesized that monetary policy is relatively important in achieving the real output target and the exchange rate is relatively important in achieving the net saving/external target. It is argued, in this framework, that reducing the rate of expansion of the money stock in order to reduce the inflation rate, accompanied by a compensating reduction in the rate of currency depreciation, in order to help maintain output, will tend to reduce the net savings rate. The implied currency appreciation has an adverse effect on net saving. To realize any given net savings target, fiscal and interest rate policies must be instituted to help raise the net saving schedule.

As a practical matter, it may be very difficult to raise the net saving (NS/X) schedule in the short- to medium-term. The particular high-inflation country may already have a negative NS/X ratio. Yet it is possible that there is some scope for lowering this ratio further. For instance, it may be possible to obtain additional external finance by borrowing from nonresidents. A country with a relatively low stock of external debt or low debt service burden may be able to do this. The NS/X ratio may be lowered also if the country has a large stock of external assets available to the authorities to draw down.

FIGURE 5



When there is no scope for reducing the NS/X ratio, some hard choices would then confront the authorities. The anti-inflation policy may be abandoned altogether and postponed until some future date when the external environment and prices are more favorable, or when various supply measures--e.g., import tariff changes, liberalization of the exchange control regime, reform of the public enterprises, and investment policies in manufacturing and agriculture--may begin to bear fruits. Alternatively, the authorities may accept some reduction in output growth as a small price to pay because over the medium-term to long-term the gains from reducing inflation more than compensate, in a discounted (present) value sense, for the temporary output "losses." A third option would be for the authorities to embark first on major tax and interest rate reforms in order to raise the NS/X schedule, before proceeding on a significant anti-inflation policy. In the meanwhile, the exchange rate policy would be kept or made appropriate in light of the high inflation rate that is to continue.

When the external target consists in a purchasing-power-parity rule, the manner in which the exchange rate is depreciated would depend on the elasticities of output with respect to monetary expansion (i.e., x_1) and with respect to exchange rate depreciation (i.e., x_2). It was shown that if $x_1 > x_2$, as hypothesized in the paper, the rate of depreciation must be smaller than what would be required to maintain purchasing power parity. But if $x_1 < x_2$, then the rate of depreciation must be greater than the rate required for maintenance of purchasing power parity. The usual PPP formulation of depreciating by the difference between domestic and foreign prices implicitly assumes that $x_1 = x_2$.

References

Barro, R.J., "Unanticipated Money, Output, and the Price Level In the United States," Journal of Political Economy, Vol. 86 (August, 1978),pp. 549-80.

Blejer, M.I., and D.J. Mathieson, "The Preannouncement of Exchange Rate Changes as a Stabilization Instrument," Staff Papers, International Monetary Fund, Vol. 28 (December 1981), pp. 760-92.

Canavese, Alfredo J., "The Structuralist Explanation in the Theory of Inflation", World Development, Vol.10 (July 1982) pp. 523-29.

Cardoso, Eliana A., "Food Supply and Inflation", Journal of Development Economics, Vol.8 (June 1981), pp. 269-84.

Chopra, Ajai, "The Speed of Adjustment of the Inflation Rate: A Cross-Country Study of the Role of Inertia," unpublished, International Monetary Fund, August, 1985).

Diaz-Alejandro, Carlos F., "A Note on the Impact of Devaluation and Distributive Effect", Journal of Political Economy, Vol.71 (December 1963), pp. 577-80.

_____, "The Argentine Stabilization Plan of December 20th," World Development, Vol. 10 (September 1982), pp. 801-11.

Edwards, Sebastian, "Stabilization with Liberaliization: An Evaluation of Ten Years of Chile's Experiment with Free-Market Policies, 1973-1983," Economic Development and Cultural Change, Vol. 33 (January 1985), pp. 223-54.

Fischer, Stanley and Franco Modigliani, "Towards an Understanding of the Real Effects and Costs of Inflation", Weltwirtschaftliches Archiv, Vol. 114 (No.4, 1978), pp. 810-33.

Gordon, R.J., "Output Fluctuations and Gradual Price Adjustment, Journal of Economic Literature, Vol. 19 (June 1981), pp. 493-530.

_____, "Why Stopping Inflation May be Costly: Evidence from Fourteen Historical Episodes," in Inflation: Causes and Effects, ed. by R.E. Hall (Chicago: University of Chicago Press, 1982), pp. 11-40.

Harberger, A.C. "Some Notes on Inflation" in Inflation and Growth in Latin America, ed. by Werner Baer and Isaac Kerstenetzky (Homewood, Illinois: R.D. Irwin, 1964), pp. 319-51.

Johnson, Harry G., "Is Inflation the Inevitable Price of Rapid Development or a Retarding Factor in Economic Growth?", Malayan Economic Review, Vol. 11 (April 1966), pp. 21-28.

Johnson, Omotunde E.G., "On Growth and Inflation in Developing Countries", Staff Papers, International Monetary Fund (Washington) Vol. 31 (December 1984), pp. 636-60.

Kincaid, G.R., "A Test of the Efficacy of Exchange Rate Adjustments in Indonesia," Staff Papers, International Monetary Fund, Vol. 31 (March 1984), pp. 62-92.

Krugman, Paul and Lance Taylor, "Contractionary Effects of Devaluation", Journal of International Economics, Vol. 8 (August 1978), pp. 445-56.

Lopes, Francisco L. and Edmar L. Bacha, "Inflation, Growth, and Wage Policy: A Brazilian Perspective", Journal of Development Economics, Vol. 13 (August-October 1983), pp. 1-20.

Lucas, R.E., "Some International Evidence on Output-Inflation Tradeoffs," American Economic Review, Vol. 63 (June 1973), pp. 326-34.

Sargent, Thomas J. and Neil Wallace, "Rational Expectations and the Theory of Economic Policy," Journal of Monetary Economics, Vol. 2 (April 1976), pp. 169-83.

Taylor, Lance, Structuralist Macroeconomics, (New York: Basic Books, 1983).

Van Wijnbergen, Sweder "Credit Policy, Inflation, and Growth in a Financially Repressed Economy", Journal of Development Economics, Vol. 13 (August-October 1983), pp. 45-65.