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Financial Operations

The World Bank
September 1988
WPS 84

Black Markets for Foreign Exchange, Real Exchange Rates, and Inflation

Overnight versus Gradual Reform in Sub-Saharan Africa

Brian Pinto

Inflation could rise permanently and substantially as a result of unifying official and black market exchange rates, even if real government spending remains constant.

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The black market foreign exchange premium is an important implicit tax on exports, creating a conflict between the fiscal goal of financing government spending with a limited menu of tax instruments and the allocative goal of stimulating exports. The premium is solved for in a model that includes the portfolio balance approach to exchange rates, dual exchange markets, and seignorage for financing the fiscal deficit.

The steady-state and dynamic implications for inflation of floats as a vehicle for unifying official and black market rates are then analyzed. Inflation could rise substantially in the new steady state as the lost revenue from exports is replaced with a higher tax on money. Further, the conditions under which undershooting or overshooting occur are parameterized. The paper is motivated by and illustrated with recent examples from Sub-Saharan Africa.

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I. EXCHANGE RATE UNIFICATION AND INFLATION

This paper, which focuses on exchange rate reform and inflation in the presence of black markets for foreign exchange, is motivated by the recent experience of certain Sub-Saharan African countries, although many Latin American countries would qualify. Attempts to unify official and black market exchange rates by officially floating the domestic currency has in two recent instances, Sierra Leone and Zambia, led to large increases in inflation, with an acceleration in the rate of currency depreciation relative to that historically observed in the black market. Such increases in inflation have damaged the credibility of the economic reform and weakened official commitment to it.

What causes these surges in inflation? Take Sierra Leone. Sierra Leone experimented briefly with a foreign exchange auction in 1982, abandoning it in favor of a fixed peg to the dollar till it floated its currency, the leone, in July, 1986. The black market exchange rate (leone per dollar) was roughly four times the official rate prior to floating. Inflation, which had averaged 70 percent per year over the previous three years, jumped almost immediately to an annual rate in excess of 200 percent, at which it stabilized.

Likewise, Zambia started a foreign exchange auction in October, 1985, after unsuccessfully trying to lower the black market premium and improve external balance through managed exchange rate rules from July, 1983. Its currency had been linked to a foreign currency basket and was depreciated every month at a predetermined rate with the rationing of commercial and capital transactions retained. The black market premium was in excess of one hundred percent when the auction started. Annual inflation rose from about 20 percent in 1983 and 1984 to 37 percent in 1985 (auction started in October), attaining an estimated level of 70 percent in 1986.

Two basic motives have spurred the adoption of market exchange rates: first, to minimize black market premia (unify official and black market exchange rates) thereby increasing exports and eliminating allocative inefficiency and inequity through import license rents; and second, absorbing black markets into the official mainstream through economic incentives rather than unenforceable legislation, so as to raise the credibility of economic policy. Initial conditions have included a rationed official market with a managed (fixed) rate, and a black market, where the currency floats freely and foreign exchange is at a premium. In contrast to the usual specification of dual exchange rates, e.g., Lizondo (1984), Dornbusch (1986), domestic currency in the dual regimes of Sub-Saharan Africa is not convertible either commercial (trade) or capital (financial) transactions at the official exchange rate. The black market rate applies explicitly or implicitly to both sets of transactions, serving as the marginal cost, or implicit resale value, of foreign exchange. 1/

One might reason as follows: if, in fact, the official exchange rate is inframarginal, then floating the currency officially should result in a unified rate that is pretty close to the black market rate. Further, post-float inflation -- rate of currency depreciation -- should be no different from that which prevailed in the black market pre-float. In seeking to allay policy-makers' fears that a float will result in a "free fall of the exchange rate" irrespective of fundamentals, Quirk et al. (1987) point out that the inflationary effects of floating have "depended crucially on the monetary and fiscal economic policies that have influenced the subsequent direction of the exchange rate changes". They proceed to cite the example of Uganda, where domestic prices had already adjusted to the black market rate prior to floating (which is typically the case): "The subsequent surge of inflation ----- when the exchange markets were unified was in response to a relaxation of fiscal policy ----".

It will be argued here that, under plausible conditions, post-unification inflation could rise permanently and substantially even if the level of real government spending remains constant. The surge in inflation is explained instead by developing the link between fiscal and exchange rate reform with high black market premia. This link is direct: there is a conflict between the allocative goal of stimulating exports by lowering the black market premium and the fiscal goal of financing government spending with a limited menu of available tax instruments. The black market premium functions as an implicit tax on exports, serving at once as a disincentive to export production and a source of hidden fiscal revenues. The fiscal deficit is financed by a combination of seignorage (the tax on domestic money) and the implicit tax on exports. With unification, the hidden export tax vanishes. As a result, there is a compensating rise in the tax on domestic money, inflation.

The first part of the analytical model focuses on production and real exchange rates, formally interpreting the premium as a tax on exports. In contrast to other tax rates, e.g., a 30 percent import tariff, the premium is an endogenous tax rate, being determined by the general equilibrium of all the asset prices in the economy. Consequently, the second part of the model focuses on the determinants of the premium as a precursor to discussing the tradeoff between the premium and rate of inflation. These determinants include fiscal, monetary and exchange rate policy, asset preferences and the terms of trade. Unification through floats and the implications for inflation are then discussed both dynamically and in the steady state. The impact of accelerated crawls and maxi-devaluations is also examined. Lastly, policy formulation and some concluding remarks are presented.

II. MODEL

Exchange rate reform in non Franc Zone Sub-Saharan Africa, and in LDCs generally, is motivated by the linked goals of making external balance sustainable and increasing exports. This requires consideration of export incentives, or the real exchange rate defined as the relative price of exports to nontradables. There are thus two goods: exports and home goods.

There is currency substitution (Calvo and Rodriguez (1977)) with residents holding two non-interest bearing assets, domestic money (cedis) and foreign money (dollars). The dynamics of cedis are influenced by the financing of the fiscal deficit, and of dollars, by the current account.

Government Spending and Foreign Exchange Rationing

For simplicity, the government spends only on imported goods including, importantly, interest payments on historically contracted foreign debt: no new foreign borrowing is incurred. The government buys dollars from the private sector at the arbitrary rate, e, exchanging cedis for dollars. These dollars are paid for partly from conventional tax receipts, which the private sector pays in cedis, and partly by printing cedis, which covers the deficit. The existence of a fiscal deficit thus permits a simultaneous examination of the inflation tax on cedis and the implicit tax on exports via a choice of e (cedis per dollar).

The government sets e arbitrarily, does not have the reserves to deplete and so rations the official foreign exchange market by capital controls and restrictions on commercial transactions. The analytical implication is that, with some leeway, official reserves in dollars, R, can be arbitrarily chosen. We assume that they are held constant, i.e., $\dot{R} = 0$. Thus, a fraction of private sector exports is surrendered to the government at rate e for cedis. The government uses this to finance its own spending, which is exclusively on imports, giving the remainder back to the private sector also at rate e. There is consequently no net official accumulation of dollars.

The rationing scheme of the previous paragraph amounts to a redistribution within the private sector coupled with an implicit net tax transfer to the government, the source of this tax being the premium on dollars in a black market, where the exchange rate is $b \geq e$. The black market, or free market, arises precisely because the official market is rationed. Domestic currency is freely convertible in the floating black market at rate b, which is the marginal cost of foreign exchange. Dollars obtained officially can be re-sold, or at any rate, imports purchased with official dollars are priced in domestic currency at their opportunity cost, the black market rate. This is precisely what gives rise to "rents" in the presence of rationing through import licenses.

Exporters either ship their exports through official channels, earning the rate e, or smuggle them, at rate b. There are no real resource costs of smuggling, but there are private costs of smuggling. 2/ These consist of bribes paid to various officials. The marginal cost of these bribes increases with the volume of exports smuggled. Exporters equate the marginal returns between the official and black markets in equilibrium. Consequently, the marginal return on exports is the official rate e. This creates an asymmetry between importers and exporters. For importers, e is infra-marginal and irrelevant; for exporters, e is the marginal return. It is precisely this difference that leads simultaneously to import license rents and to the black market premium being interpreted as a tax on exports.

In the above regime, e has an exogenously chosen rate of depreciation, $\dot{e}/e \equiv \hat{e} \geq 0$. This, in conjunction with a given real fiscal deficit and the assumption that $\dot{R} = 0$, is equivalent to a money supply rule, as we shall see later.

Production and Real Exchange Rate

The approach here follows Kharas and Pinto (1987). There is no capital, and the given endowment of labor, $\bar{L}$, is fully employed, being allocated between two goods: an export good, and a home good, which also requires intermediate imports. The private sector spends only on home goods, domestic consumption of the export good being negligible.

Home goods, H, with price p_H, are produced by a Cobb-Douglas technology using imported inputs (oil), I, and labor, L_1. 3/ Imports are valued at their marginal cost, b. Exports are produced using a constant-returns-to-scale technology, X = L. Of total exports, X, X_2 is smuggled out and X_3 surrendered to the government at rate e. $C(X_2)$ is a strictly convex function representing private costs of smuggling (bribes) in terms of exports with $C(0)=0$ and C', $C''>0$. The private sector solves the following problem, where w is the domestic currency wage and p_x the dollar price of exports. The dollar price of imports is unity:

$$(1) \quad \max_{\{I, L_i\}} \quad p_H H + bp_x X_2 + ep_x X_3 - bp_x C(X_2) - w(L_1 + L_2 + L_3) - bI$$

$$\text{s.t.} \quad H \leq L_1^{a} \, I^{1-a}, \; a \in [0,1)$$

$$X_i \leq L_i \qquad (i=2,3)$$

$$\sum_{i=1}^{3} L_i \leq \bar{L}$$

$$I, L_i \geq 0 \qquad (i=1,2,3).$$

The solution to (1) based on the FOC may be described as follows: total exports are distributed between the official market (X_3) and the black market (X_2) by equating marginal returns, i.e., by setting $bp_x(1 - C'(X_2)) = ep_x = w$. Let $c \equiv (C')^{-1}$. We obtain the export smuggling function

$$(2) \quad X_2 = c\,(1 - 1/\phi),$$

where $\phi \equiv b/e$ is the black market premium. Since $c' > 0$, $dX_2/d\phi > 0$, so that the incentive to smuggle increases as the premium rises.

With regard to home goods, it must be the case that in equilibrium, $p_H = k(\alpha)\, w^{\alpha} b^{1-\alpha}$, where k is a constant depending on α. Using the FOC that $ep_x = w$, it follows that $p_H = k(\alpha)\, e\, \phi^{1-\alpha}\, p_x^{\alpha}$.

The current account in dollars is given by $p_x(X_2 + X_3) - I - g$, where I is intermediate imports and g is government spending on imports, fixed in dollars. Consequently, $p_x(X_2 + X_3) - I - g = \dot{F} + \dot{R}$, the RHS of the equality denoting foreign asset accumulation. F is the stock of dollars held in private portfolios. Recalling that $\dot{R} = 0$, it follows that

(3) $p_x(X_2 + X_3) = I + g + \dot{F}$.

Consequently, in steady state with $\dot{F} = 0$, $I = p_xX-g$, where $X = X_2 + X_3$ is total exports. Substituting into $H = L_1^{\alpha}\, I^{1-\alpha}$ (see (1)) gives the steady state technological relationship between H and X,

(4) $H = (\bar{L} - X)^{\alpha}\, (p_xX-g)^{1-\alpha}$,

since $X = \bar{L} - L_1$. It is easy to verify that $H_{xx} < 0$ so that H is a strictly concave function of X. Further, $H = 0$ when $X = g/p_x$ or when $X = \bar{L}$. We require that $p_x\bar{L} > g$, i.e., that the maximum feasible supply of dollars exceed the government's requirements.

The PPF is shown graphically in Fig. 1. At $X = X^* = (1-\alpha)\bar{L} + \alpha(g/p_x)$, $H_x = 0$. Since domestic residents consume only home goods, it follows that the optimal point to produce at is X^*, where H is maximized.

Fig. 1 near here

Where does production actually take place? From (1), we know that $(1 - \alpha)\, p_H H = bI$ and that $\alpha p_H H = wL_1$. Using these FOC and $X_2 = L_2$, $X_3 = L_3$ with (3) yields:

$$(5)\quad L_1 = \frac{\alpha\phi(p_x \bar{L} - \dot{F} - g)}{p_x(1 - \alpha + \alpha\phi)}, \quad I = \frac{(1 - \alpha)\,(p_x\bar{L} - \dot{F} - g)}{1 - \alpha + \alpha\phi}.$$

Let X^{opt} denote the steady state solution to (1). Since $X^{opt} = \bar{L} - L_1$, using (5) with $\dot{F} = 0$, we get $X^{opt} = [(1 - \alpha)\bar{L} + \alpha\phi(g/p_x)](1 - \alpha + \alpha\phi)$. Since $\phi \geq 1$, it follows that $X^{opt} \leq X^*$, with $X^{opt} = X^*$ when $\phi = 1$, i.e., the export tax via ϕ is eliminated. When $X = X^{opt}$, $H_x = bp_x(1 - 1/\phi)/p_H$, which is zero when $\phi = 1$. This expression is merely the ratio of the marginal costs of smuggling to price of home goods.[4/] So long as $\phi > 1$, $X^{opt} < X^*$ and consumption of home goods is less than its maximum feasible level corresponding to X^*. Not only does this capture the production distortion as a result of the export tax via ϕ, it also captures the notion of import compression and its effect on lower GDP growth as a result of stunted exports, a major preoccupation in many LDCs today. The bottomline is that in order to stimulate exports, ϕ must be reduced. This is the allocative goal that is pursued.

In the circumstances, a natural candidate for the real exchange rate is ep_x/p_H, the relative marginal returns of exports and home goods. This works out to be $k^{-1}(p_x/\phi)^{1-\alpha}$, since $p_H = k(\alpha)(ep_x)^{\alpha}b^{1-\alpha}$. In order to raise the relative return of exports and thereby the incentives to produce them, ϕ must clearly be reduced, which is consistent with our earlier observations.

<u>Proposition 1:</u> In order to depreciate the real exchange rate and improve production incentives for exports, the black market premium must be lowered.

<u>Proof:</u> Obvious from above discussion and Fig. 1.

<u>Inflation Tax, Portfolio Balance and the Premium</u>

Since reducing ϕ stimulates exports, we now focus on the determinants of ϕ. This brings us to the monetary part of the model. The main ideas from the real part of the model are that ϕ must be reduced if exports and real income are to be raised, which is obvious from Fig. 1. We simplify the rest of the presentation by setting $\alpha = 0$, i.e., home goods are produced with intermediate imports only. This makes the algebra more elegant, but does not <u>in any way</u> change the results we now present on the trade-off between the tax on exports and the inflation t x (see Kharas and Pinto (1987)). This is because these results are driven by the financing of the fiscal deficit and the asset demand for dollars.

Setting $\delta = 0$ means that the private sector, like the government, spends only on imported goods, which is the assumption in Lizondo (1984) and Pinto (1986). All production, $p_x\bar{L}$, is now exported and consumption, imported. Eq. (3) can therefore be rewritten as $\dot{F} = p_x\bar{L} - g - I$, where I is now private consumption.

Private residents spend a fixed fraction, a, of their nominal financial wealth, $W = M + bF$, where M is the stock of cedis in private portfolios and F is converted from dollars into cedis at the (relevant) black market rate, b. Thus, $bI = a(M + bF)$. This, in conjunction with $\dot{F} = p_x\bar{L} - g - I$ yields the dynamic equation:

(6) $\dot{F} = p_x \bar{L} - g - a(m/\phi + F)$,

where $m \equiv M/e$, recalling that $\phi \equiv b/e$.

The dynamic equation for M is provided by the financing of the deficit. We assume that government spending, g, and taxes, t, are fixed in dollars. The deficit is financed by domestic credit, D. Since $\dot{R} = 0$ it follows that:

(7) $\dot{M} = \dot{D} = e(g-t)$,

with the deficit being converted into cedis at the official exchange rate, e. Since $m \equiv M/e$, we get:

(8) $\dot{m} = (g-t) - m\hat{e}$,

where $\hat{e} \equiv \dot{e}/e > 0$ is the official rate of depreciation.

The system is completed by a portfolio balance equation. Let λ be the fraction of wealth $W \equiv M + bF$ held as domestic money. Since interest rates are abstracted from, the relevant differential rate of return between M and F is the rate of depreciation of the cedi in the black market, $\hat{b} \equiv \dot{b}/b$. Continuous asset-market clearing and perfect foresight yield

$$(9) \qquad M = \frac{\lambda(\hat{b})}{1-\lambda(\hat{b})} \,.\, bF \,, \quad \lambda'(\cdot) < 0.$$

An obvious problem with multi-asset perfect foresight models is that there is no apparent motive for a diversified portfolio. Eq.(9) is rationalized as capturing an aggregation over many consumers with dispersed expectations. Using $m \equiv M/e$ and $\phi \equiv b/e$, (9) can be rewritten:

$$(10) \qquad m = \frac{\lambda(\hat{\phi}+\hat{e})}{1 - \lambda(\hat{\phi}+\hat{e})} \,.\, \phi F.$$

Equations (6), (8) and (10) are the dynamic equations of the system. From (8), it is evident that a choice of (g-t) and $\hat{e}$ is equivalent to the choice of a money supply rule. The steady-state solution $(\dot{\phi}, \dot{F}, \dot{m}) = (0, 0, 0)$ is: 5/

$$(11) \qquad \phi^* = \frac{a}{\lambda(\hat{e}).\hat{e}} \,.\, \frac{g-t}{p_x\bar{L}-g}$$

$$(12) \qquad F^* = (1-\lambda(\hat{e})) \,.\, \frac{p_x\bar{L}-g}{a}$$

$$(13) \qquad m^* = (g-t)/\hat{e}.$$

By definition, in the steady state, b and e depreciate at the same rate, $\hat{e}$, which is also the steady-state rate of inflation. Further, the deficit (g-t) is financed by the inflation tax, $m^*.\hat{e}$.

Trade-off between Tax on Exports and Inflation Tax

An interesting result is that the steady state solution (11) - (13) is unique and saddle-point stable for $\hat{e} > 0$ and belonging to some interval of the positive real line. 6/ The bounds on this continuum are set by the resultant values of ϕ^*, since from (11), ϕ^* depends upon $\hat{e}$. Thus, ϕ^* should not exceed

$\tilde{\phi}$, where $\tilde{\phi}$ has that property that $p_xX_3 = g$, ensuring consistency between the rationing scheme and money supply rule (otherwise, the government would not get enough dollars to meets its requirements). $\tilde{\phi}$ can be derived from eq. (2), noting that $X_3 = \bar{L} - X_2$. There is also an implied lower-bound for ϕ^*, $\underline{\phi}$. In order to define it precisely, we need to discuss the inflation tax.

By definition, the inflation tax can be levied only on domestic money, and not on dollars. The proceeds from seignorage, $m^*.\dot{e}$, depend upon the rate of the tax, $\dot{e}$, the share of domestic money in wealth, λ, and total financial wealth. We shall refer to the expression $\lambda(\dot{e}).\dot{e} \equiv \theta(\dot{e})$ on the R.H.S. of eq. (11) as the unit inflation tax. Define η as as the inflation elasticity of domestic money demand, $\eta \equiv -\lambda'(\dot{e}).\dot{e}/\lambda(\dot{e})$. Assume that η rises with $\dot{e}$ so that $\theta(\dot{e})$ has the shape of a Laffer curve with a global maximum when $\eta = 1$. This in turn implies, from eq. (11), that ϕ^* is u-shaped function of $\dot{e}$ with a global minimum when $\eta = 1$. More formally, we obtain the following comparative static result from (11) (see also Lizondo (1984), who first obtained this result):

(14) $$\frac{d\phi^*}{d\dot{e}} = a \bullet \frac{(g-t)}{p_x\bar{L}-g} \bullet \frac{(\eta-1)}{\theta(\dot{e}).\dot{e}} \qquad \begin{matrix} > 0 \text{ if } \eta > 1 \\ < 0 \text{ if } \eta < 1. \end{matrix}$$

Assuming η rises with $\dot{e}$ yields a u-shaped curve, shown as $\phi^*(\dot{e})$ in Fig. 2.

Fig. 2 near here

Eq. (14) has an interesting interpretation: if domestic money demand is inflation-inelastic, a rise in the rate of crawl will lower the steady-state premium (between 0 and B in Fig. 2). On the other hand, if $\eta > 1$, i.e., $\dot{e}$ exceeds the seignorage maximizing rate, increasing $\dot{e}$ actually raises ϕ^* (to the right of B in Fig. 2). The intuition is that a rise in $\dot{e}$ will, in the new steady state, raise the differential rate of return between M and F, increasing the desirability of F. This by itself would raise ϕ; but $\dot{e}$ also affects the unit inflation tax, leading to the ambiguity.

Notice that in Fig. 2, the minimum-point on the $\phi^*(\hat{e})$ curve (corresponding to B on the x-axis) is less than 1. This is equivalent to assuming that it would be feasible for the government to finance its deficit entirely by the inflation tax, should it choose to. Further, in the dual regime, it is analytically desirable that $\phi \geq 1$, owing to rationing. These considerations together imply that $\phi = 1$. Thus, the relevant trade-off between $\hat{e}$ and ϕ is between A and π_1 on the x-axis, and the segment CD on the $\phi^*(\hat{e})$ curve in Fig. 2. This trade-off exists iff $\eta < 1$. Further, the model and steady-state equilibrium solution do not apply between π_1 and π_h, since for an $\hat{e}$ in this interval, seignorage exceeds the deficit and foreign exchange is bought at an official premium, rather than discount, relative to the black market.

We shall assume the following conditions are satisfied:

$$\phi^* \in (1, \bar{\phi})$$

(15)

$$\eta < 1 \quad (\Rightarrow \hat{e} \in (A, \pi_1) \text{ in Fig. 2}).$$

<u>Proposition 2:</u> Given conditions (15), there is a trade-off between ϕ and $\hat{e}$ in financing the fiscal deficit, (g-t).

<u>Proof:</u> Equation (11) can be rewritten:

(16) $$\phi^* . \theta(\hat{e}) = a . \frac{g-t}{p_x L - g} .$$

since the R.H.S of (16) is exogenous and assumed held constant, it follows that a fall in ϕ^* must be compensated by a rise in $\theta(\hat{e})$, therefore a rise in $\hat{e}$ since $\eta < 1$. In other words, a decline in the tax on exports requires an increase in the rate of inflation.

The scope of this trade-off is affected by changes in g and p_x: a rise in g with $\hat{e}$ fixed raises the required base for the inflation tax and hence the stock of cedis that must be held. As a result, the premium on dollars rises. A fall in p_x (TOT deterioration) affects $\dot{F}$ negatively, hence raises ϕ^*. In terms of Fig. 2, a rise in g or fall in p_x shifts $\phi^*(\hat{e})$ upwards, lowers $\bar{\phi}$ and raises π_1, reducing the scope for a trade-off. Both comparative static results, $d\phi^*/dg > 0$ and $d\phi^*/dp_x < 0$, can be formally derived from eq.(11).

A precise expression is now derived for the implicit tax on exports in steady state via the premium. First, for the private sector, the real stock of cedis is M/b, and not $m \equiv M/e$. Accordingly, the relevant capital loss from the inflation tax in steady state is $(M/b).\hat{e} = m^*.\hat{e}/\phi$. Second, from eq. (7), cedi taxes = et, so that the real tax burden is $et/b = t/\phi^*$ in steady state. Since the private sector's net loss is the government's gain, it follows that the residue is the implicit tax on exporters, given by $g-(m^*.\hat{e}/\phi^* + t/\phi^*) = g(1 - 1/\phi^*)$. More mechanically, reorganizing eq. (13) yields:

$$(17) \qquad g = m^*\hat{e} + t = g(1- \frac{1}{\phi^*}) + \frac{t}{\phi^*} + \frac{m^*\hat{e}}{\phi^*} \quad .$$

If $\phi \geq 2$, i.e., there is a 100 percent premium on foreign exchange in the conventional sense--a common situation in Sub-Saharan Africa--this revenue finances upwards of 50 percent of government spending on imports and interest payments on foreign debt!

Unification Through Overnight Floats and Inflation

Assume, to start with, that there is a genuine trade-off between ϕ and $\hat{e}$ as discussed earlier in the context of Fig. 2. The "real deficit" continues to refer to (g-t), i.e, the number we would get by looking at the fiscal accounts available at any Ministry of Finance. Thus, revenues from both the inflation tax and implicit tax on exporters via ϕ are excluded in computing the real deficit. The reason for this reminder will become apparent.

Proposition 3: Assume conditions (15) hold and that (g-t) and p_x are given. Then if the currency is floated overnight (rationing is eliminated and the official rate of depreciation endogenized), post- unification inflation will rise in the new steady state, i.e., there will be a permanent increase in inflation.

Proof: Let u=b=e denote the unified floating exchange rate, and $\hat{u}$ denote its now endogenous rate of depreciation. The new dynamic system consists of eqs. (6), (8) and (10), with e = u and ϕ = 1. In particular, m is redefined as M/u, and in the new steady state, ϕ^* = 1. Consider eq. (16), noting that $\hat{e}$ is the rate of inflation just before floating. Since the R.H.S. of (16) is constant, and $\phi^* > 1$ prior to the float, it must be the case that $\theta(\hat{u}) > \theta(\hat{e})$ if the inflation tax is to finance the deficit in the new steady state. But, from (15), $\eta < 1$. Therefore, $\hat{u} > \hat{e}$. In fact, $\hat{u} = \pi_l > \hat{e}$, where π_l is shown in Fig. 2.

The intuition is simple: by unifying, the government loses the tax revenues implicit in the premium, $g(1-1/\phi)$ (eq. (17)). In the absence of changes in fiscal policy, it must replace this tax on exports with a higher tax on money. Obviously, the larger the tax on exports (the larger ϕ^* is, equivalently, the smaller $\hat{e}$ is) to begin with, the bigger the jump in inflation upon floating.

Fig. 3 near here

Fig. 3 summarizes the outcome. Since, upon unification,

$$(18) \qquad \theta(\hat{u}) \equiv \lambda(\hat{u}).\hat{u} = \varepsilon \; . \; \frac{g-t}{p_x L-g} \quad ,$$

and the R.H.S. of (18) is a constant, it follows that there are two possible steady-state equilibria, π_l and π_h as shown in Fig. 3. These are the same as the π_l and π_h in Fig. 1 for given (g-t) and p_x. 7/ In accordance with standard results (e.g., Dornbusch and Fischer (1985)), π_l is saddle point stable, and π_h completely locally stable, given rational expectations. 8/

Proposition 4: Assume, with given (g-t) and p_x, that the currency is floated overnight, unifying the official and black market exchange rates. Of the two possible steady-state equilibria, π_l and π_h (Fig. 3), π_l ($\eta < 1$) is saddle-point stable, and π_h ($\eta > 1$) completely locally stable, under rational expectations.

Proof: Set $\phi = 1$ in eq. (6), (8) and (10) and replace e with u. This is the new dynamic system. Redefine m as M/u, noting that it is now a jump variable. Invert (10) to yield $\Omega = \phi(m/F)$, where $\phi \equiv [\lambda/(1-\lambda)]^{-1}$, $\phi' < 0$. This yields the (2 x 2) system:

(19) $\dot{F} = p_x\bar{L} - g - a\,(m + F)$

(20) $\dot{m} = (g - t) - m\phi(m/F), \quad \phi' < 0.$

When the system, ($\dot{F}$, $\dot{m}$), is linearized around the steady-state solution, the relevant determinant $\Delta = a\Omega(1 - 1/\eta)$, noting that $\phi' = (1-\lambda)^2/\lambda'$ and recalling recalling that $\eta \equiv -\lambda'\Omega/\lambda$. Since we have one pre-determined variable, F, and one jump variable, $m \equiv M/u$, saddle-point stability requires that $\Delta < 0$. Since $\Omega > 0$, the saddle-point stability of π_l follows. π_h can be shown to be completely locally stable by showing that $\Delta > 0$ and the trace, given by $[-a + \Omega\,((1-\lambda)/\eta-1)]$, negative when $\eta>1$.

What are the dynamics of inflation upon floating? We assume that upon floating, the economy gravitates to the low-inflation equilibrium, π_l, for the same reason as in the closed-economy literature: this equilibrium is saddle-point stable (Proposition 4) and therefore implies a unique dynamic path for the price level and inflation.

Given conditions (15), inflation will be higher in the new steady state, so that the desired steady state ratio and level of F will rise, implying a dynamic path for inflation. Fig. 4 presents the phase diagram in m-F space for the system (19)-(20). The curve $\dot{F}=0$ is shown as the downward sloping line, FF, with slope -1. MM is the $\dot{m}=0$ curve. Its slope is derived in the appendix.

D is the dual regime equilibrium: the ratio of domestic to foreign assets ($\lambda/(1-\lambda)$) is higher and inflation, lower. E is the saddle-point stable low inflation equilibrium (π_1, m*, F*), with higher inflation and therefore a lower domestic-to-foreign asset ratio, $\lambda(\pi_1)/(1-\lambda(\pi_1)) = m^*/F^*$.

Fig. 4 near here

VV is the positively sloped saddle path leading to E. Since F is higher in the new steady state, current account surpluses need to be generated. By (19), this requires a reduction in (m+F). With F sticky, $m \equiv M/u$ jumps to the point ' on VV. The economy then converges to E along VV. From Fig. 4, we see that whether inflation overshoots or undershoots its new steady state level, π_1, depends upon whether VV is flatter or steeper then the line OE with slope m*/F*. If the slope of VV equals m*/F*, then inflation will jump immediately to π_1. The precise condition is derived in the Appendix as eq. (25) and graphed in Fig. 5.

Fig. 5 near here

It turns out thac if $a/\pi_1 > [1-\lambda(\pi_1)]$, the inflation rate will overshoot π_1. Otherwise, it will undershoot π_1. Assume $\lambda(\Omega)$ is a Cagan-type portfolio equation, $\lambda(\Omega) = \lambda_0 e^{-\gamma\Omega}$, $\lambda_0 \in (0,1)$. At Ω^* in Fig. 5, which plots condition (25) (see Appendix), $a/\Omega = [1 - \lambda(\Omega)]$. Therefore, if $\pi_1 <$ (>) Ω^*, we observe overshooting (undershooting). The determinants of Ω^* are portfolio preferences (as parameterized by λ_0 and γ) and the speed at which dollars can be accumulated (as determined by the propensity to spend out of wealth, a). The determinants of π_1 include these as well as the fiscal deficit (recall from Fig. 3 that $\lambda(\pi_1).\pi_1 = a(g - t)/(p_x\bar{L} - g)$). Suppose γ goes down (desired ratio of dollars in wealth goes down at each level of inflation) and a goes up (larger current account surpluses will be generated for a given reduction in wealth). Then from Fig. 5, Ω^* goes up and from Fig. 3, π_1 goes down (unit inflation tax curve rises) increasing the chances of overshooting.

Table 1 computes approximate values of Ω^* for different parameter levels.

Table 1: Illustrative Computation of Values for $\hat{u}^*$

(1) Case	(2) a	(3) λ_0	(4) γ	(5) π^*	(6) $\hat{u}^*$
				(% per year)	
A	0.05	0.85	0.50	200	21
B	0.10	0.85	0.20	500	45
C	0.10	0.90	0.20	500	53
D	0.10	0.90	0.10	1000	64

Case A assumes reasonably that 5 percent of wealth is consumed per year. At zero inflation, 85 percent of wealth is held as cedis ($\lambda_0 = 0.85$). γ is 0.50, implying a seignorage-maximizing rate of inflation (π^*, col. (5)) of 200 percent/year. $\hat{u}^*$ is roughly 21 percent/year. In case B, a is raised to 10 percent and π^* to 500 percent/year, with $\hat{u}^*$ rising to 45 percent/year. Case C raises λ_0 to 0.90. Case D is the most conservative, with a = 0.10, $\lambda_0 = 0.90$ and $\pi^* = 1000$ percent/year. Yet, $\hat{u}^*$ rises modestly to 64 percent/year.

Since prevailing inflation rates prior to floating are lower-bounds for π_1 under conditions (15), undershooting of inflation is empirically a distinct possibility for many of the empirical cases from Sub-Saharan Africa.

The bottomline of this section has two parts: first, in any event, inflation will rise in the new steady state; second, to know whether inflation is going to overshoot or undershoot, we must know π_1 and $\hat{u}^*$. Otherwise, we cannot offer the comfort that the rise in inflation is transitory and that inflation will eventually decline.

Exchange Rate Rules

We now consider official exchange rate rules that attempt to lower the premium. From eq. (11), we see that the steady-state solution for ϕ is independent of the level of the official rate, e. One-shot devaluations will therefore reduce the premium only temporarily. 9/ The reason is that growth rates and monetary dynamics do not change fundamentally. Some intuition is provided for this result in Fig. 6. The downward sloping line plots eq. (8), $\dot{m} = (g-t) - m\hat{e}$. To simplify, assume we are in steady state to start with, and that the devaluation is unanticipated. As a result of the devaluation, m, which is usually sticky, jumps from m^* to m_1 in Fig. 6, so that $\dot{m}$ jumps to $A > 0$. Since F is sticky, ϕ must decline to ensure portfolio balance. However, as m returns from m_1 to m^*, ϕ returns to its original value (see Pinto (1986) for explicit dynamics). A devaluation which accompanies a reduction in g will, however, speed up adjustment to a new steady state where ϕ is permanently lower.

Fig. 6 near here

In contrast, if $\hat{e}$ is increased, ϕ will go up or down depending on whether $\hat{e}$ is beyond π_h, or between A and π_1, to start with, in Fig. 2. This result has already been discussed above: accelerating $\hat{e}$ will work only if $\eta<1$. If $\hat{e}>\pi_h$ to start with, a reduction in $\hat{e}$ will be unambiguously beneficial, since both the premium and rate of inflation decline. 10/ It is important to note however, that for such high inflation situations, attempts to halt inflation in its tracks through exchange rate freezes ($\hat{e}=0$) will not work <u>unless</u> g and (g-t) are drastically reduced. Otherwise, there is no steady-state solution for m or ϕ, and $\hat{\phi}$ equals $\hat{b}$, which approximates the growth rate of base money. 11/ A policy switch will be forced when $\bar{\phi}$ is hit. In such cases, inflation will rise rapidly and by a large amount if the policy change includes an overnight float (see Proposition 3).

Another possibility is motivated by the erroneous argument that the equilibrium exchange rate, e^*, is some weighted average of b and e, rather than being determined on the margin. Thus, $e^* = \beta b + (1-\beta)e$, $\beta \epsilon (0,1)$, and advice is to move towards e^*. This unwittingly links official depreciation to the premium: $\dot{e} = e^*-e = \beta(b-e)$, or, $\hat{e} = \beta(\phi-1)$. Such a policy could set up a destabilizing spiral of higher premia and rising depreciation, raising inflation (see Kharas and Pinto (1987) for an example).

III. EXAMPLES FROM SUB-SAHARAN AFRICA

Why does the government trade off the premium with the rate of inflation? Typically, exports originate in agriculture, with the bulk of import licenses going to urban manufacturing. The gainers and losers in the event of unification, are shown below:

	Gainers	Losers
Dual Regime	- Government - Import license recipients	- Farmers - Domestic currency holders
Unified Regime	- Government - Farmers	- Former import license holders - Domestic currency holders

The trade-off thus potentially has strong urban-rural redistribution connotations. The distributive effects of the higher inflation tax upon unification depend upon who holds domestic currency. One could argue that the urban, rent-seeking sector is able to hedge itself by acquiring dollars, so that the inflation tax is regressive, affecting the urban and rural poor.

Examples of relevant countries are Ghana, Sierra Leone, Somalia and Uganda. [12/] Stereotypically, there is a single export, cocoa. Part of the cocoa is surrendered through a commodity board to the government, which sets prices with reference to the official exchange rate. The rest is smuggled out for hard currency. Equivalently, cocoa is exported directly by the producers, with some fraction surrendered to the government at the official exchange rate.

For countries like Nigeria, which is a net seller of foreign exchange to the private sector, rationing implies a real transfer from the government to the private sector which is proportional to the dollar value of import licenses issued. Tax receipts and the real deficit therefore are not independent of the premium. In terms of Fig. 3, the horizontal line with intercept $a.(g-t)/(p_x\bar{L}-g)$ will move downwards upon unification, lowering π_1. The incentive effects of exchange rate reform, however, apply to non-oil exports. Hereafter, we concentrate on the more common "net buyer" case: extension to the "net seller" case is straightforward. 13/

In terms of mechanics, exchange rate rules have not worked well. Devaluations are not generally accompanied by a relaxation of rationing. The theoretical result that the premium in steady state is independent of the level of the official rate and therefore will decline only temporarily with one-step devaluations has received considerable empirical support: Somalia in 1985, when the goal of unifying the official and free rates by December was thwarted by almost immediate equivalent upward movements in the free rate; Sudan in recent times; Zaire and Zambia in the two or three years before they adopted floating rates. Such temporary depreciations of the real exchange rate are not likely to stimulate new, permanent commitments to the export sector.

Accelerating the official rate of depreciation above prevailing rates of inflation will work only if conditions (15) are satisfied. Thus, if prevailing inflation exceeds π_h in Fig. 2, ϕ will rise. A pre-emptive shift into dollars to escape the higher inflation tax will accelerate this process and raise inflation today via unpleasant monetarist arguments (Sargent and Wallace (1984)).

Overnight vs. Gradual Reform

Policymakers in countries with high black market premia face a dilemma: either they live with misallocated resources, inequitable transfers, stunted exports and lower real income; or they float, raising inflation substantially with high political and social costs. 14/

A middle ground is provided by the recent experience of Ghana. It initiated a recovery program in April, 1983, when the black market exchange rate was over 60 cedis per dollar, and the official rate, a mere 2.75 cedis per dollar! Inflation was over 100 percent per year. 15/ In a nutshell, Ghana's strategy has been one of a gradual reduction of the fiscal deficit, accompanied by an equally gradual relaxation of rationing, and supported by large, discrete devaluations to speed up adjustment to a lower premium. Rationing has been relaxed imaginatively, through the gradual transfer of commercial transactions from the official to the black market. This was formalized by the introduction in October, 1985, of a broad-based special import license scheme for imports through the black market. Such recognition of the black market is an important psychological step in eventual unification.

This was followed in September, 1986 by an auction. Through a series of maxi-devaluations, the official rate had been moved from 2.75 to 90 cedis per dollar, but still represented a substantial discount relative to the black market, where the rate was roughly 180 cedis per dollar (ϕ was reduced from over 20 in April, 1983 to 2 by September 1986). It was therefore decided to split the official market into a fixed rate tier and a freely determined rate through an auction with restricted access. This step represented essentially the continued taxation of cocoa and subsidization of petroleum.

These markets were unified at the auction rate in March, 1987. Future steps involve merging the auction, which has restricted access, with the black market.

In contrast to the more-or-less overnight measures in Sierra Leone, Ghana's program appears painfully slow, having lasted for over four years, with unification still in process. There is an important argument in favor of such gradualism: fiscal reform is much more time-consuming than exchange rate reform, which can be introduced instantly. The reasons are the weakness of institutional mechanisms, credibility issues and political will. 16/

Ironically, in Sierra Leone, the tax/GDP ratio declined monotonically from 16.5 percent in 1978/79 to 5.6 percent in 1985/86, and fiscal discipline was at its weakest when the currency was floated. Credibility was low, with the arrears position so extreme that Sierra Leone was paying upto 20 percent above spot international prices for rice and petroleum, an almost unheard-of situation. To float the currency under such circumstances, when ϕ was between 3 and 4, implying a substantial exports tax, is at least questionable (recall that the export tax is $(1-(1/\phi))$.

IV. CONCLUDING REMARKS

Paradoxically the first step in exchange rate reform for "high ϕ" countries must be a fiscal one: recasting the budget to fix the size of the implicit tax revenues from exports via ϕ. The tax-subsidy redistribution within the private sector as a result of foreign exchange rationing is also important. This involves identifying the potential gainers (e.g., agriculture) and losers (e.g., commerce, protected manufacturing using imported inputs) in the event of unification. Such identification will make plain the political pressure points likely to emerge upon unification.

Three key issues arise: (1) To what extent and how quickly can government spending be reduced? (2) Are existing tax instruments apart from the premium and rate of inflation being used to the hilt, or are the latter being used as the easy way out (see Aizenman (1986) for a welfare analysis of a related issue)? [17/] (3) Is there an equitable distribution of the tax burden based on Ramsey-type considerations?

The main policy conclusion is that if policy credibility is low and the initial level of the premium high, with significant revenue and redistributive implications, the pace of reform should be set by the feasible speed of fiscal reform. Accelerating rates of depreciation above prevailing inflation in the absence of credible fiscal reform could result in perverse black market premium response, jeopardizing the survival of both fiscal and exchange rate reform. Moreover, such policy will not succeed in real depreciation unless the premium falls. Likewise, overnight adoption of floats is likely to meet with considerable political and social opposition as inflation rises, creating the possibility of policy reversals. The "best" route, consequently, might be to gradually relax rationing, accompanying this with discrete devaluations, with the pace of reform being set by the speed of fiscal reform: there are no quick fixes. Lastly, it would be incorrect to conclude from this study that an LDC should never float its currency. This decision should depend upon the credibility and speed of accompanying fiscal reform and the initial size of the premium.

Footnotes

1. The recent experience of Bolivia, Ghana, Nigeria, Somalia and Zaire suggest a wide coverage of the ideas expressed here. Quirk et al. (1987) document the recent experience of several developing countries with floating exchange rates.

2. The first reason for ignoring resource costs of smuggling is that the issue has already been researched. The second is that for many LDCs, they do not seem to be a major issue: a cocoa smuggler uses the same means as the cocoa board, only he has to grease several palms.

3. Home goods include all goods and economic activity that do not contribute to the supply of tradables. This would include commerce, e.g., the distribution and marketing of imported consumer goods, and highly protected manufacturing that thrives on cheap imports via licenses at the official rate. See also Krueger (1974).

4. Intuitively, the private sector maximizes the value of home goods minus smuggling costs.

5. This is the same as the steady-state solution in Kharas and Pinto (1987), eqs. (18)-(20), with $a=0$.

6. For a proof, see Pinto (1986), Appendix I. There are two predetermined variables, m and F, and one jump variable, ϕ.

7. This explains why the minimum point of $\phi^*(\hat{e})$ in Fig. 1 is less than unity. It enables a consistent comparison of inflation between the dual and unified regimes.

8. Lizondo (1987) studies unification in a similar set-up, but with two major differences: absence of rationing, and an exogenously given growth rate for domestic money. Therefore, upon unification, there is a unique equilibrium and the issue of post-unification inflation does not arise. Lizondo focuses instead on the exchange rate and balance of payments following unification.

9. Only in the unrealistic case of a zero fiscal deficit will a one-shot devaluation permanently lower the premium. Nominal domestic money, M, is fixed so that m permanently declines ($\hat{e}=0$ since there is no inflation tax).

10. This will raise the unit inflation tax; but total revenue from inflation will continue to be (g-t) in the new steady state.

11. In Ghana (Pinto (1986)), e was fixed at 2.75 cedis per dollar between 1978 and October, 1983. With foreign exchange rationing and the monetization of deficits, b continued to depreciate, reaching about 90 cedis per dollar by October, 1983, resulting probably in the highest recorded premium in history!

12. For other examples, see Quirk et al. (1987). In Latin America, Bolivia is a classic recent case. (see Kharas and Pinto (1987)).

13. Nigeria's experience is instructive for another reason, demonstrating conclusively that the equilibrium exchange rate is not a weighted average of the official and black market rates. Immediately before its float in September, 1986, the official rate was 1.50 and the black market rate between 4 and 5 naira/dollar. Since official oil exports accounted for more than 95% of total exports; it was believed that upon floating, a rate close to 1.5 naira/dollar would emerge. However, a rate very close to 5 naira/dollar emerged. This development was consistent with rationing and the implicit re-sale of officially allocated dollars in the dual regime.

14. With the exception of the Gambia, the floats in Africa have been "current account" based, with capital controls having been retained. In such cases, black market premia have declined from their substantial initial levels of several hindered percent to 10-15 percent, an example being provided by Zaire. This suggests seepage between current and capital account transactions.

15. Johnson et al. (1985) suggest that, for countries with a history of high inflation, people are accustomed to living with depreciation that "will at

least offset inflation, and there is little problem in accelerating the rate slightly to produce a real depreciation". The arguments advanced here suggest that such a policy could be costly.

16. For an imaginative treatment of credibility issues, see Calvo (1986) and van Wijnbergen (1985).

17. Suppose $\phi=3$ to start with, implying a tax rate of 67 percent, and that the export is bought by a commodity board. Upon unification, the government might find it difficult to justify an explicit tax of 67 percent. It may, however, decide upon a lower tax of say, 15 percent. This has the advantage of eliminating the misallocation costs associated with cheap imports in the erstwhile dual regime, since importers must now pay the unified rate.

Appendix

Linearizing (19)-(20) around the saddle-point stable, low-inflation equilibrium (π_1, m*, F*) gives:

$$(21)\quad \begin{vmatrix} \dot{m} \\ \\ \dot{F} \end{vmatrix} = \begin{vmatrix} -\pi_1 - \frac{m}{F}\frac{(1-\lambda)^2}{\lambda'} & (\frac{m}{F})^2 \frac{(1-\lambda)^2}{\lambda'} \\ \\ -a & -a \end{vmatrix} \cdot \begin{vmatrix} m-m^* \\ \\ F-F^* \end{vmatrix}$$

or x = D.y, where x' = ($\dot{m}$, $\dot{F}$), etc., and the partial derivatives in D are evaluated at (π_1, m*,F*). Recall that m is now defined as M/u and is therefore equivalent to m/ϕ = M/b in the dual regime.

Shape of $\dot{m}$ = 0 Curve (MM) in Fig. 4

When $\dot{m}$ = 0, it follows from (20) that (g-t) = m$\hat{u}$. From portfolio balance, we know that m/(m + F) = $\lambda(\hat{u})$, $\lambda' < 0$. Hence, we can write:

$$(22)\quad \frac{(g - t)}{\lambda(\hat{u}).\hat{u}} = m + F$$

$$(23)\quad \lambda(\hat{u}) = \frac{m}{m + F},$$

which are parametric in $\hat{u}$. Let π^* denote the unit inflation tax maximizing rate (level of $\hat{u}$ which maximizes $\lambda(\hat{u}).\hat{u}$). From (22), when $\hat{u} = \pi^*$, (m + F) is at its minimum value. When $\hat{u} > \pi^*$, $\lambda(\hat{u}).\hat{u}$ is lower and (m + F) is higher. Further, m/(m + F) falls (see (23)), so that m/F declines. Hence, this part of the $\dot{m}$ = 0 is negatively sloped and becomes asymptotic to the horizontal axis in Fig. 4 as $\hat{u} \to \infty$.

When $\hat{u} < \pi^*$, (m + F) grows, but so does m/(m + F), so that m/F increases. Consequently, the $\dot{m}$ = 0 curve cuts the $\dot{F}$ = 0 curve from below and asymptotically aproaches the line with slope $\lambda_0/(1 - \lambda_0)$ as $\hat{u} \to 0$, $\lambda_0 \equiv \lambda(0) \in$ (0, 1).

<u>Slope of Saddle Path in Fig. 4</u>

From the phase plane in Fig. 4, we know that the saddle path is positively sloped. Let v^* denote the slope of the saddle path, VV. Then v^* is the positive root of the quadratic (see (21)):

$$(24) \quad P(v) = av^2 + \left(a - \pi_1 - \frac{m^*}{F^*}\,\frac{(1-\lambda)^2}{\lambda'}\right) v + \left(\frac{m^*}{F^*}\right)^2 \cdot \frac{(1-\lambda)^2}{\lambda'} = 0.$$

We want to know if $v^* \gtreqless \lambda/(1-\lambda)$, where λ is evaluated at π_1. Directly from

from (24), $P(\lambda/(1-\lambda)) = \frac{\lambda}{1-\lambda}\left(\frac{a}{1-\lambda} - \pi_1\right)$.

Consequently,

$$(25) \quad P\left(\frac{\lambda}{1-\lambda}\right) \begin{array}{l} > 0 \\ = 0 \\ < 0 \end{array} \quad \Leftrightarrow \quad \frac{a}{\pi_1} \begin{array}{c} > \\ = \\ < \end{array} (1-\lambda) \quad \Leftrightarrow \quad v^* \begin{array}{c} > \\ = \\ < \end{array} \frac{\lambda}{1-\lambda}.$$

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Figures 1 - 3

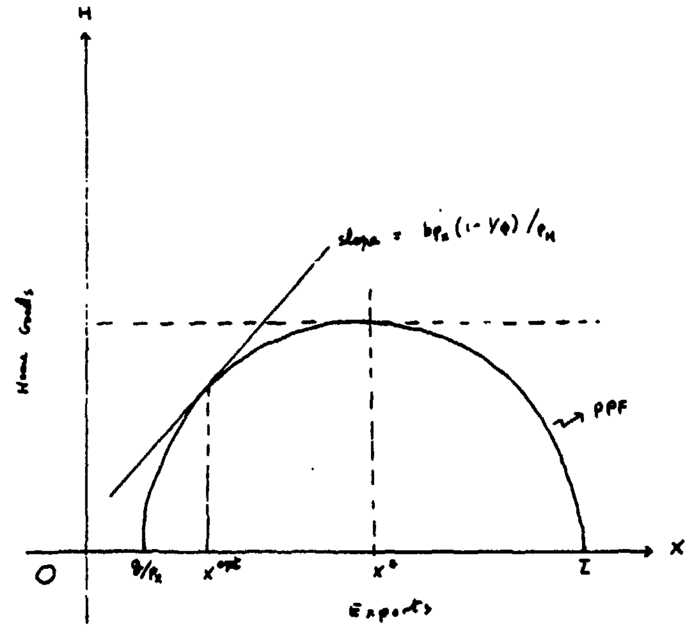

Fig. 1: Steady-state PPF between home goods and exports

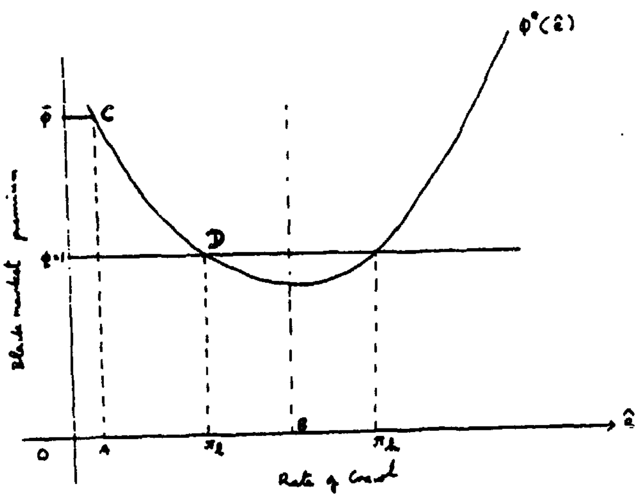

Fig. 2. Steady-state relationships between Black market Premium and Rate of Crawl

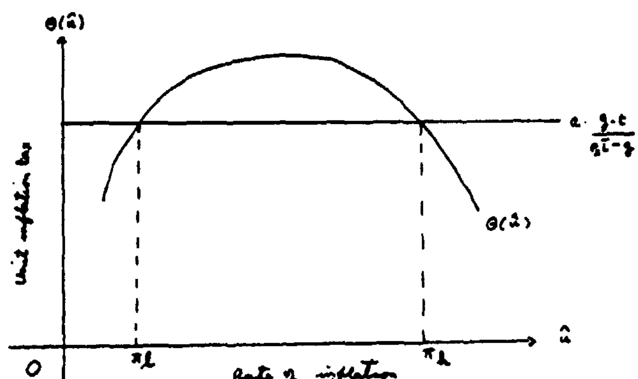

Fig. 3 Overnight Float with Dual Equilibria

Figures 4 - 6

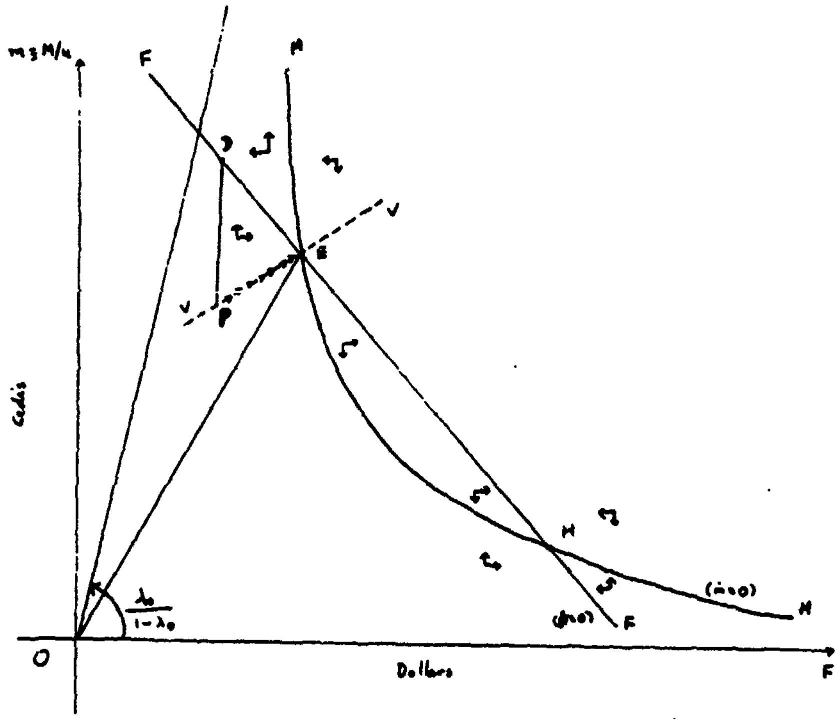

Fig. 4: Dynamics of Inflation upon Floating

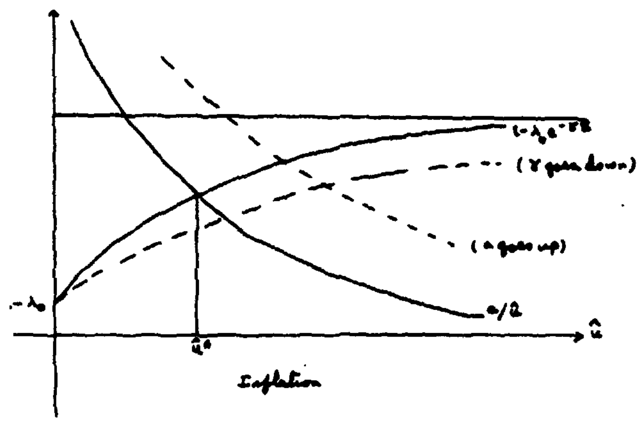

Fig. 5. Condition for Inflation to Under/Overshoot

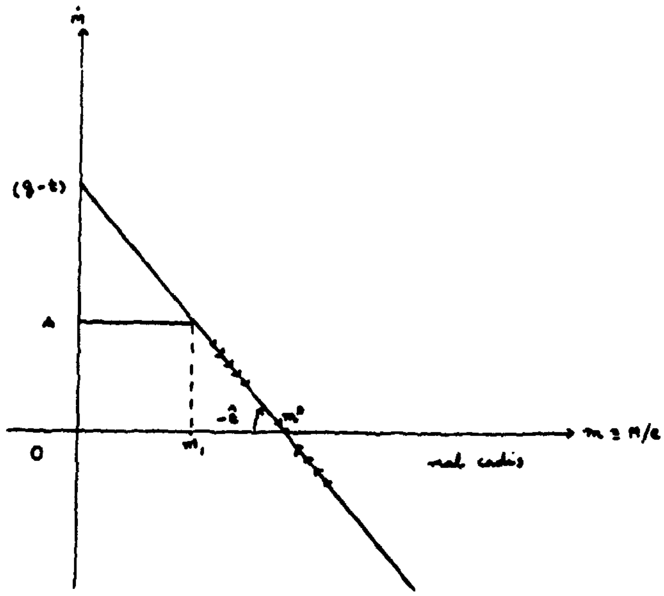

Fig 6: Impact of One-Shot Devaluation on Monetary Dynamics

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