Journal of International Economics 30 (1991) 121–135. North-Holland

Black markets for foreign exchange, real exchange rates and inflation

Brian Pinto*

The World Bank, Washington, D.C. 20433, USA

Received March 1989, revised version received May 1990

The black market foreign exchange premium is a tax on exports, creating a conflict between the financing of government spending and the allocative goal of stimulating exports. The premium is solved for in a model that includes private portfolio choice, dual exchange markets and money-financing of the fiscal deficit. The inflationary implications of switching to floats as a means of unifying official and black market rates are then analyzed. Inflation could rise substantially if the lost revenues from exports are replaced with a higher tax on money. The paper is motivated with examples from Sub-Saharan Africa.

1. 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.

*I have benefited from comments by Joshua Aizenman, Guillermo Calvo, Bob Flood, Homi Kharas, Saul Lizondo, Alan Walters and seminar participants at Princeton and Yale. Christophe Chamley was especially helpful. Errors and omissions are solely mine. The views herein are the author's and not necessarily shared by the World Bank or affiliated institutions.

0022-1996/91/$03.50

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 100 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, minimizing 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 (1987a) and Dornbusch (1986), domestic currency in the dual regimes of Sub-Saharan Africa is not convertible for 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. Furthermore, 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 premanently and substantially even if the level of real

[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.

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.

2. The model

2.1. Government spending and foreign exchange rationing

The government spends only on imported goods including 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 domestic currency, 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 government sets e (cedis per dollar) arbitrarily, does not have the reserves to deplete and so rations the official foreign exchange market by capital controls and import licenses. Consequently, 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.

The above rationing scheme is a combination of a redistribution from exporters to importers 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 $b \geqq e$. The black market, or free market, arises 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 resold, or imports purchased with official dollars are priced in domestic currency at their opportunity cost, the black market rate.

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. 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. For importers, e is infra-marginal and irrelevant; for exporters, e is the marginal return. This difference 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, $\dot{e}/e \equiv \hat{e} \geqq 0$. Given a real fiscal deficit and the assumption that $\dot{R}=0$, this is equivalent to a money supply rule, as we shall see later.

2.2. Production and real exchange rate

The approach here is similar to Kharas and Pinto (1989). 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, such that $H = L_1^{\alpha} I^{1-\alpha}$, $\alpha \in [0,1)$. 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', $C''>0$. Let w denote the domestic currency wage and p_x the dollar price of exports, with the dollar price of imports normalized to unity. The private sector maximizes expression (1) subject to the production function constraints for H and X, labor constraint and non-negativity:

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

In (1), L_2 is labor devoted to X_2 and L_3 is labor devoted to X_3. The solution 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:

$$X_2 = c(1 - 1/\phi), \tag{2}$$

where $\phi \equiv b/e$ is the black market premium. Since $c' > 0, \mathrm{d}X_2/\mathrm{d}\phi > 0$, so that the incentive to smuggle increases as the premium rises.

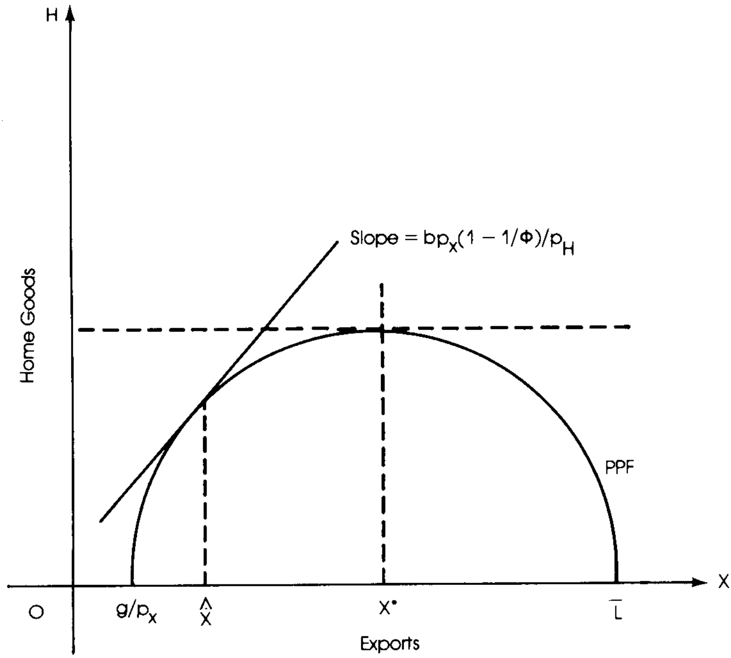

Fig. 1. Steady-state PPF between home goods and exports.

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

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

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

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

since $X=\bar{L}-L_1$. 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 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. Production actually takes place at $\hat{X}=[(1-\alpha)\bar{L}+\alpha\phi(g/p_x)]/(1-\alpha+\alpha\phi)$. Comparing the expressions for $\hat{X}$ and X^* and noting that $\mathrm{d}\hat{X}/\mathrm{d}\phi<0$, it follows that $\hat{X}\leqq X^*$ and $\hat{X}=X^*$ when $\phi=1$, i.e. the export tax has been eliminated. This captures not only the production distortion as a result of the export tax through the premium but also the notion of import compression and resulting lower GDP growth because of stunted exports, an important problem in many LDCs today.

Proposition 1. To depreciate the real exchange rate and improve production incentives for exports, the black market premium must be lowered.

Proof. Obvious from the above discussion and fig. 1.

2.3. Inflation tax, portfolio balance and the premium

Since reducing ϕ stimulates exports, we now focus on the determinants of ϕ. We simplify the rest of the presentation by setting $\alpha=0$, i.e. home goods are produced with intermediate imports only. This simplification does not change the basic results we now present on the trade-off between the tax on exports and the inflation tax because these results are driven by the financing of the fiscal deficit and the asset demand for dollars.

Setting $\alpha=0$ means that the private sector, like the government, spends only on imported goods. All production, $p_x\bar{L}$, is exported and consumption, imported. Eq. (3) can therefore be rewritten as $\dot{F}=p_x\bar{L}-g-I$, where I denotes 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 yields the dynamic equation:

$$\dot{F}=p_x\bar{L}-g-a(m/\phi+F), \tag{5}$$

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

The money supply process is governed 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 there is no net accumulation of reserves, it follows that

$$\dot{M}=\dot{D}=e(g-t), \tag{6}$$

with the deficit being converted into cedis at the official exchange rate, e, or

$$\dot{m}=(g-t)-m\hat{e}, \tag{7}$$

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

The system is completed by a currency-substitution type portfolio balance equation [Calvo and Rodriguez (1977)]. Let λ be the fraction of wealth $W \equiv M + bF$ held as domestic money. Since interest rates are abstracted from, the 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:

$$M = \frac{\lambda(\hat{b})}{1-\lambda(\hat{b})} bF, \quad \lambda'(\cdot) < 0. \tag{8}$$

An obvious problem with multi-asset perfect foresight models is that there is no apparent motive for a diversified portfolio. Eq. (8) is rationalized as capturing an aggregation over many consumers with dispersed expectations. Using $m \equiv M/e$ and $\phi \equiv b/e$, (8) can be rewritten:

$$m = \frac{\lambda(\hat{\phi}+\hat{e})}{1-\lambda(\hat{\phi}+\hat{e})} \phi F. \tag{9}$$

Eqs. (5), (7) and (9) are the dynamic equations of the system. From (7), 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

$$\phi^* = \frac{a}{\lambda(\hat{e}) \cdot \hat{e}} \frac{g-t}{p_x \bar{L} - g}, \tag{10}$$

$$F^* = (1-\lambda(\hat{e})) \frac{p_x \bar{L} - g}{a}, \tag{11}$$

$$m^* = (g-t)/\hat{e}. \tag{12}$$

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. Furthermore, the deficit $(g-t)$ is financed by the inflation tax, $m^* \cdot \hat{e}$.

2.4. Dual regime trade-off between export and inflation taxes

The steady-state solution (10)–(12) is unique and saddle-point stable for $\hat{e} > 0$ and belonging to some interval of the positive real line.[2] The bounds

[2]A proof is contained in Pinto (1986). There are two predetermined variables, m and F, and one jump variable, ϕ.

on this continuum are set by the resultant values of ϕ^*, since from (10), ϕ^* depends upon $\hat{e}$. Thus, ϕ^* should not exceed $\bar{\phi}$, where $\bar{\phi}$ has that property that $p_x X_3 = g$, ensuring consistency between the rationing scheme and the money supply rule (otherwise, the government would not get enough dollars to meet its requirements). $\bar{\phi}$ can be derived from eq. (2), noting that $X_3 = \bar{L} - X_2$. There is also an implied lower bound for ϕ^*, $\underline{\phi}$. To define it, we need to discuss the inflation tax.

By definition, the inflation tax can be levied only on domestic money. We shall refer to the expression $\lambda(\hat{e}) \cdot \hat{e} \equiv \theta(\hat{e})$ on the RHS of eq. (10) as the unit inflation tax. Define η as the inflation elasticity of domestic money demand, $\eta \equiv -\lambda'(\hat{e}) \cdot \hat{e}/\lambda(\hat{e})$. Assume that η rises with $\hat{e}$ so that $\theta(\hat{e})$ has the shape of a Laffer curve with a global maximum when $\eta = 1$. This in turn implies, from eq. (10), that ϕ^* is a U-shaped function of $\hat{e}$ with a global minimum when $\eta = 1$. More formally, from (10) [see also Lizondo (1987a), who first obtained this result]:

$$\frac{\mathrm{d}\phi^*}{\mathrm{d}\hat{e}} = a \frac{(g-t)}{p_x \bar{L} - g} \frac{(\eta - 1)}{\theta(\hat{e}) \cdot \hat{e}} \begin{cases} >0, & \text{if} \quad \eta > 1, \\ <0, & \text{if} \quad \eta < 1. \end{cases} \tag{13}$$

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

According to eq. (13), if domestic money demand is inflation-inelastic, a rise in the rate of crawl will lower the steady-state premium (between O and B in fig. 2). But if $\hat{e}$ exceeds the seignorage maximizing rate, increasing $\hat{e}$ actually raises ϕ^* (to the right of B in fig. 2). The intuition is that a rise in $\hat{e}$ 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 $\hat{e}$ also affects the unit inflation tax, leading to the ambiguity.

Notice that in fig. 2 the minimum point on the $\phi^*(\hat{e})$ curve 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. Furthermore, owing to rationing in the dual regime, it is analytically desirable that $\phi \geqq 1$. These considerations together imply that $\underline{\phi} = 1$. Thus, the relevant trade-off between $\hat{e}$ and ϕ is between A and π_ℓ on the x-axis, and the segment CD on the $\phi^*(\hat{e})$ curve in fig. 2. This trade-off exists iff $\eta < 1$. Furthermore, the model and steady-state equilibrium solution do not apply between π_ℓ 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 at a discount, relative to the black market.

We shall assume the following conditions are satisfied:

$$\begin{aligned} &\phi^* \in (1, \bar{\phi}), \\ &\eta < 1 (\Rightarrow \hat{e} \in (A, \pi_\ell) \text{ in fig. 2}). \end{aligned} \tag{14}$$

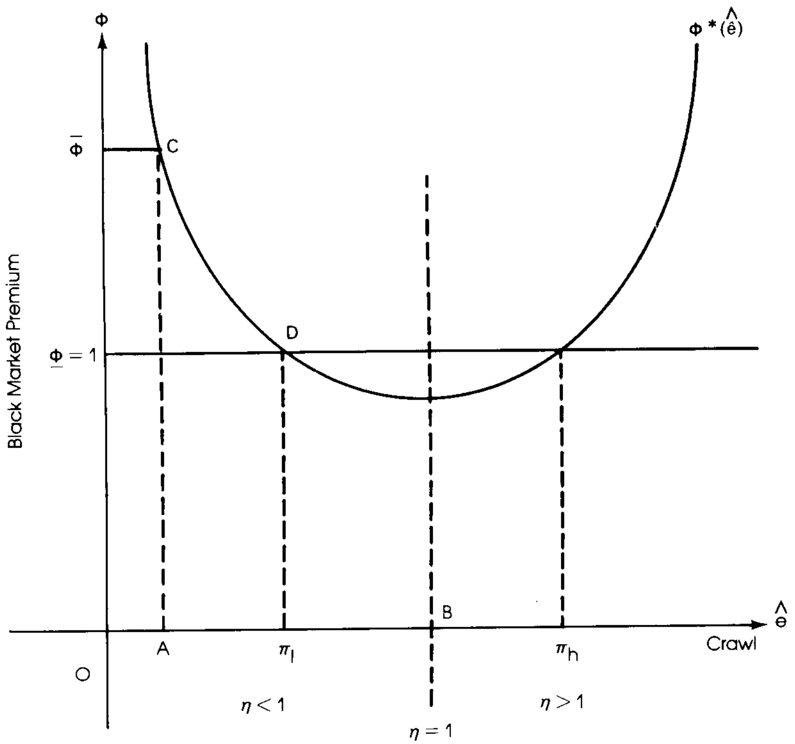

Fig. 2. Steady-state relationship between premium and rate of crawl.

Proposition 2. *Given conditions* (14), *there is a trade-off between* ϕ *and* $\hat{e}$ *in financing the fiscal deficit*, $(g-t)$.

Proof. Eq. (11) can be rewritten:

$$\phi^* \cdot \theta(\hat{e}) = a \frac{g-t}{p_x \bar{L} - g}. \tag{15}$$

Since the RHS of (15) 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 must be balanced by an increase in the rate of inflation.

An expression is now derived for the steady-state revenues from an implicit tax on exports. First, for the private sector, the relevant capital loss from the inflation tax in the steady state is $(M/b)\cdot\hat{e}=m^*\cdot\hat{e}/\phi$. Second, from eq. (6), cedi taxes$=et$, so that the real tax burden is $et/b=t/\phi^*$ in the 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 $g-(m^*\cdot\hat{e}/\phi^*+t/\phi^*)=g(1-1/\phi^*)$. More mechanically, reorganizing eq. (12) yields:

$$g=m^*\hat{e}+t=g\left(1-\frac{1}{\phi^*}\right)+\frac{t}{\phi^*}+\frac{m^*\hat{e}}{\phi^*}. \tag{16}$$

If $\phi\geqq 2$, 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!

2.5. *Unification through overnight floats and inflation*

Assume that there is a trade-off between ϕ and $\hat{e}$ as discussed 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 which excludes revenues from the inflation tax and implicit tax on exporters.

Proposition 3. Assume conditions (14) *hold and that* $(g-t)$ *and* p_x *are given. Then if there is a switch to a clean float* (*rationing is eliminated and the official rate of depreciation endogenized*), *inflation will rise in the new steady state.*

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. (5), (7) and (9), with $e=u$ and $\phi=1$. In particular, m is redefined as M/u, and in the new steady state, $\phi^*=1$. Consider eq. (15), noting that $\hat{e}$ is the rate of inflation just before floating. Since the RHS of (15) 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 (14), $\eta<1$. Therefore, $\hat{u}>\hat{e}$. In fact, $\hat{u}=\pi_\ell>\hat{e}$, where π_ℓ is shown in fig. 2.

By unifying, the government loses the tax revenues implicit in the premium, $g(1-1/\phi)$ [eq. (16)]. In the absence of fiscal retrenchment it must replace this tax on exports with a higher tax on money. Obviously, the larger the tax on exports, the bigger the jump in inflation upon floating. Since, upon unification,

$$\theta(\hat{u})\equiv\lambda(\hat{u})\cdot\hat{u}=a\,\frac{g-t}{p_x\bar{L}-g}, \tag{17}$$

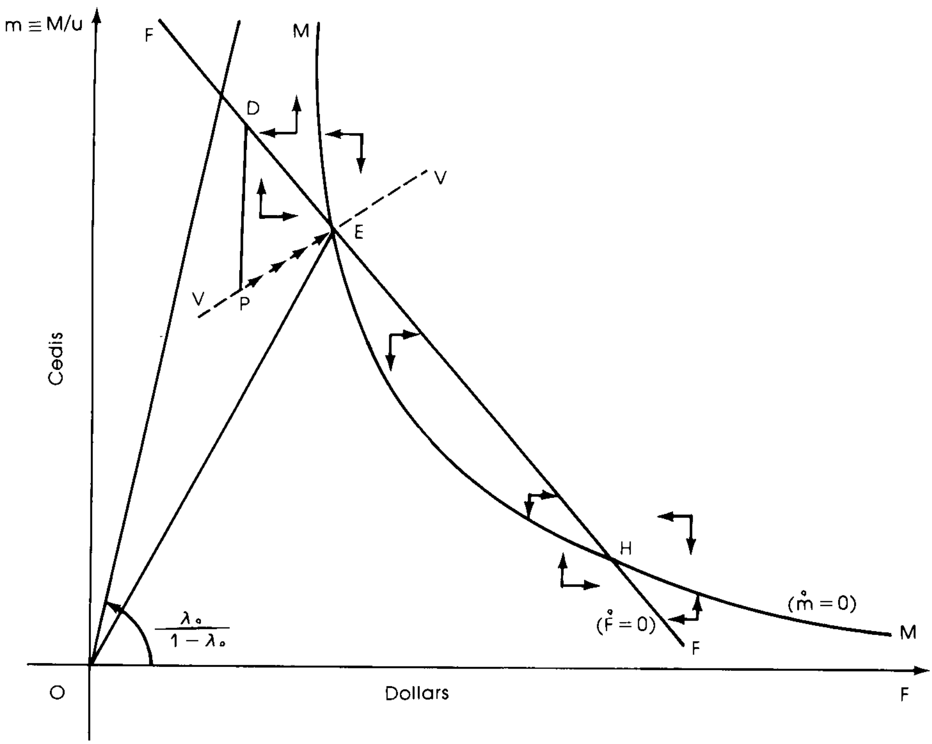

Fig. 3. Dynamics of inflation upon floating.

and the RHS of (17) is a constant, it follows that there are two possible steady-state equilibria, π_ℓ and π_h, as shown in fig. 2. In accordance with standard results π_ℓ $(\eta<1)$ is saddle-point stable, and π_h $(\eta>1)$ completely locally stable, given rational expectations.[3]

We now discuss inflation dynamics upon floating. Set $\phi=1$ in eqs. (5), (7) and (9) 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 (9) to yield $\hat{u}=\psi(m/F)$, where $\psi\equiv[\lambda/(1-\lambda)]^{-1}$, $\psi'<0$. This yields the (2×2) system:

$$\dot{F}=p_x\bar{L}-g-a(m+F), \tag{18}$$

$$\dot{m}=(g-t)-m\psi(m/F), \quad \psi'<0. \tag{19}$$

Fig. 3 presents the phase diagram in m–F space for the system (18) and

[3]A proof is available from the author upon request. Lizondo (1987b) studies unification in a similar set-up, but with two differences: absence of rationing, and an exogenously given growth rate for domestic money. Lizondo focuses not on the inflationary aspects of unification but on the impact it has on the exchange rate and balance of payments.

Table 1

Illustrative computation of values for $\hat{u}^*$.

(1) Case	(2) a	(3) λ_0	(4) γ	(5) π^* (% per year)	(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	1,000	64

(19). The curve $\dot{F}=0$ is shown as the downward-sloping line, FF, with slope -1. MM is the $\dot{m}=0$ curve. E represents the low inflation ($\eta<1$) steady-state equilibrium, while H represents the high inflation ($\eta>1$) equilibrium. 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 and therefore implies a unique dynamic path for the price level and inflation. D is the dual regime equilibrium: the ratio of domestic to foreign assets ($\lambda/(1-\lambda)$) is higher, and inflation lower. E is the new inflation equilibrium (π_ℓ, m^*, F^*), with higher inflation and therefore a lower domestic-to-foreign asset ratio, $\lambda(\pi_\ell)/(1-\lambda(\pi_\ell))=m^*/F^*$.

VV is the positively sloped saddle path leading to E.[4] Since F is higher in the new steady state, current account surpluses need to be generated. By (18), this requires a reduction in $(m+F)$. With F sticky, $m\equiv M/u$ jumps to the point P on VV. The economy then converges to E along VV. From fig. 3 we see that whether inflation overshoots or undershoots its new steady state level, π_ℓ, depends upon whether VV is flatter or steeper than the line OE with slope m^*/F^*. If the slope of VV equals m^*/F^*, then inflation will jump immediately to π_ℓ.

Comparing the slopes, it turns out that if $a/\pi_\ell>[1-\lambda(\pi_\ell)]$, the inflation rate will overshoot π_ℓ. Otherwise, it will undershoot π_ℓ. Assume $\lambda(\hat{u})$ is a Cagan-type portfolio equation, $\lambda(\hat{u})=\lambda_0 e^{-\gamma\hat{u}}$, $\lambda_0\in(0,1)$. At $\hat{u}^*$, $a/\hat{u}=[1-\lambda(\hat{u})]$. Therefore, if $\pi_\ell<(>)\ \hat{u}^*$, we observe overshooting (undershooting). The determinants of $\hat{u}^*$ 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_ℓ include these as well as the fiscal deficit since $\lambda(\pi_\ell)\cdot\pi_\ell=a(g-t)/(p_x\bar{L}-g)$. Table 1 computes approximate values of $\hat{u}^*$ for various parameter values.

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

[4]A formal derivation of the shape of the MM curve and the slope of the saddle path in fig. 3 is available from the author upon request.

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 $\pi^*=1{,}000$ percent/year. Yet, $\hat{u}^*$ rises modestly to 64 percent/year.

Since inflation rates prior to floating are lower than π_ℓ under conditions (14), *undershooting* of inflation is empirically a distinct possibility for many of the empirical cases from Sub-Saharan Africa.

There are two main conclusions: 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_ℓ and $\hat{u}^*$. Otherwise, we cannot offer the comfort that the rise in inflation is transitory and that inflation will eventually decline.

2.6. Exchange rate rules

As an alternative to instantaneous floats, we consider more gradual rules such as maxi devaluations and accelerated crawls. From eq. (10), 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 [Dornbusch et al. (1983), Lizondo (1987a), Pinto (1986)]. The reason is that growth rates and monetary dynamics do not change fundamentally.[5]

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_ℓ, to start with, in fig. 2. 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. 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 *unless* 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.[6] 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

[5] Empirical support for this result is provided by the experience of Somalia in 1985 when the goal of unifying official and black market exchange rates by December was thwarted by almost immediate equivalent upward movements in the free rate; Sudan in recent times; and Zaire and Zambia in the two or three years before they adopted floating exchange rates in the mid-1980s.

[6] 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!

than being determined on the margin.[7] Thus, it is argued that $e^* = \beta b + (1-\beta)e$, $\beta \in (0,1)$, 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, thus raising inflation [see Kharas and Pinto (1989) for an example].

3. Concluding remarks

Paradoxically the first step in exchange rate reform for high black market premium countries must be a fiscal one: recasting the budget to fix the size of the implicit tax revenues from the premium. 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]? (3) Is there an equitable distribution of the tax burden based on Ramsey-type considerations?

The main conclusion is that if the initial level of the premium is 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 stimulating exports unless it lowers the premium. 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

[7]Nigeria's experience demonstrates 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 about 5 naira/dollar, implying a significant premium. Since official oil exports accounted for more than 95 percent 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.

speed of fiscal reform: there are no quick fixes.[8] Lastly, it would be incorrect to conclude from this study that a developing country 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.

[8]This in fact was the course adopted by Ghana, which in the early 1980s exhibited record levels of black market premia. A detailed account of the Ghanaian experience is contained in Pinto (1989). It is also worth noting that for countries like Nigeria (whose main export is overwhelmingly oil, the proceeds accruing to the government), where the government is a net seller of dollars to the private sector, there is little argument against instantaneous unification through a clean float: not only would this have benign inflationary consequences, it would immediately relieve the fiscal situation by eliminating the transfers to the private sector though import licenses issued at the official exchange rate.

References

Aizenman, Joshua, 1986, On the complementarity of commercial policy, capital controls and inflation tax, Canadian Journal of Economics 19, no. 1, 114–133.

Calvo, Guillermo A. and Carlos Alfredo Rodriguez, 1977, A model of exchange rate determination under currency substitution and rational expectations, Journal of Political Economy 85, 617–625.

Dornbusch, Rudiger, 1986, Special exchange rates for capital account transactions, The World Bank Economic Review 1, 3–34.

Dornbusch, Rudiger, D.V. Dantas, C. Pechman, R. Rocha and D. Simoes, 1983, The black market for dollars in Brazil, Quarterly Journal of Economics 98, no. 1, 25–40.

Kharas, Homi and Brian Pinto, 1989, Exchange rate rules, black market premia and fiscal deficits: The Bolivian hyperinflation, Review of Economic Studies 56, 435–448.

Lizondo, Jose Saul, 1987a, Exchange rate differential and balance of payments under dual exchange markets, Journal of Development Economics 26, 37–53.

Lizondo, Jose Saul, 1987b, Unification of dual exchange markets, Journal of International Economics 22, 57–77.

Pinto, Brian, 1986, Fiscal deficits, inflation and parallel exchange markets in Ghana: Monetarism in the Tropics?, Mimeo. (The World Bank).

Pinto, Brian, 1989, Black market premia, exchange rate unification and inflation in Sub-Saharan Africa, The World Bank Economic Review (forthcoming).

Quirk, Peter J. et al., 1987, Floating exchange rates in developing countries, Occasional paper 53, International Monetary Fund.