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SMUGGLER'S BLUES AT THE CENTRAL BANK: LESSONS FROM SUDAN

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ABSTRACT

The ineffectiveness of real devaluation as stabilization policy does not imply that the nominal exchange rate should be held constant in the face of a domestic inflation. In this circumstance, import duties and export subsidies would have to be escalated to counter the potential erosion of the trade balance. This escalation of trade barriers generates a rising black market premium and offers increasing incentives to smuggling, already a pervasive problem in the African countries. As a consequence, the central bank would find it more and more difficult to hold the nominal exchange rate constant. This leads us to consider a passive exchange rate policy of stabilizing the real exchange rate by moving the nominal rate in line with domestic inflation.

If such passive policy is not accompanied by the elimination of trade barriers, however, the black market premium will not disappear. Unless exchange rate policy and trade policy are consistent with each other, the smuggler's blues will reach the central bank. Indeed, this is not just a theoretical possibility, it is the major lesson from the recent experience of Sudan.

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I. Introduction: Real Devaluation and the Trade Balance

The usual analysis of the effects of real devaluation on trade flows assumes a high degree of substitutability among final goods in consumption and among uses of inputs in production. Thus the typical analysis assumes that all goods are final goods with domestic production of import-competing goods and domestic consumption of exportables. A real devaluation, by reducing the relative price of domestic output, encourages substitution from imports to home goods in consumption, and from production for the home market to production for export. This high degree of substitutability is usually reflected in an assumption that import demand and export supply both have high elasticities with respect to the real exchange rate. The result is a presumption that real devaluation will improve the trade balance.

The structure of trade in same developing countries, especially in sub-Saharan Africa, suggests a different analysis and result, however. This was previously argued by Branson (1985) in the case of Kenya, and is also applicable in Sudan. These countries have as a high proportion of their imports intermediate inputs (such as oil) and capital equipment. In Sudan, this proportion is approximately 80%. These are inputs into a production structure that is to some degree rigidified by the existing capital stock, reducing the short-run price elasticity of demand for imports. These countries' exports are dominated by agricultural output whose supply is inelastic in the shortrun. In both Kenya and Sudan, 90% of exports are agricultural goods.

With inelastic import demand and export supply, a real devaluation will tend to expand export revenues and import receipts proportionately to their initial values in home currency, while leaving them unchanged in

foreign exchange. If the trade balance is initially in deficit, the real devaluation may increase the deficit in home currency, deflating domestic demand, with little gain in foreign exchange. This makes real devaluation potentially counterproductive as part of a stabilization program.

This ineffectiveness of real devaluation as stabilization policy does not imply that the nominal exchange rate should be held constant in the face of a domestic inflation, however. In this circumstance, import duties and export subsidies would have to be escalated to counter the potential erosion of the trade balance. This escalation of trade barriers generates a rising black market premium and offers increasing incentives to smuggling, already a pervasive problem in the African countries. As a consequence, the central bank would find it more and more difficult to hold the nominal exchange rate constant. This leads us to consider a passive exchange rate policy of stabilizing the real exchange rate by moving the nominal rate in line with domestic inflation.

If such passive policy is not accompanied by the elimination of trade barriers, however, the black market premium will not disappear. Unless exchange rate policy and trade policy are consistent with each other, the smuggler's blues will reach the central bank. Indeed, this is not just a theoretical possibility, it is the major lesson from the recent experience of Sudan.

The following section presents a basic model of the trade balance. In this context, we show the consequences of rigidity in import demand and export supply. We note as a by-product that wage indexation can introduce a rigidity that replicates the results with inelastic export supply and import demand.

Sections III and IV of the paper analyze the interaction of trade barriers, smuggling and the black market premium. We first introduce domestic inflation and trade barriers, to show the necessary escalation of the latter to maintain the trade balance with a fixed nominal exchange rate. We then show the effect of smuggling on legal as well as total trade, and relate the rate of increase in the black market premium to the rate of escalation of trade barriers. With a passive exchange rate policy and a constant level of trade barriers, the black market premium will be constant. We finally introduce capital account considerations, showing they exacerbate the rise in the premium if the unreported trade balance is in surplus, and conversely.

Section V applies the analysis to recent policy in Sudan.

II. Devaluation in the "Rigid" Economy

In this section we layout a simple model of export and import supply and demand that illustrates the problems of the "rigid" economy. The model is essentially the same as the one sketched in Branson (1972) and developed in Branson and Katseli (1982). The duality with wage indexation can also be easily demonstrated in this framework.

Export supply and demand can be described by the following two log-linear equations, normalized on the home-currency price of exports p_x for supply and the foreign-exchange price q_x for demand.

(1) Supply: $\ln p_x = \ln p_n + s_x^{-1} \ln X^s$.

(2) Demand: $\ln q_x = \ln q - d_x^{-1} \ln X^d$.

Here X is the quantity of exports, p_n is the cost of production of home goods, and q is the cost of foreign substitutes for our exports. We can interpret p_n as the opportunity cost of exports in the home economy; later we will identify the rate of growth of p_n as the domestic inflation rate. Foreign inflation would be interpreted as growth in q. Stating export supply in terms of the home currency price reflects the assumption that costs of producing exports are given in home currency. Stating demand in terms of the foreign exchange price reflects the assumption that exports compete with foreign goods in demand.

Supply and demand in the export market are brought together by the exchange rate as "translator" between p_x and q_x:

(3) Translator: $\ln p_x = \ln e + \ln q_x$.

The exchange rate is stated in terms of units of home currency per unit of foreign exchange: an increase in e is a devaluation of the home currency.

The export supply and demand model of equations (1)-(3) can be used to track movements of export price and quantity as functions of the domestic inflation rate $\hat{p}_n$, the foreign inflation rate $\hat{q}$, and changes in nominal exchange rate $\hat{e}$. Total differentiation of equations (1) - (3) gives the solutions for $\hat{p}_x$ and $\hat{X}$.

(4) $\hat{p}_x = k(\hat{e} + \hat{q}) + (1 - k)\hat{p}_n$; Export price.

(5) $\hat{X} = ks_x(\hat{e} + \hat{q} - \hat{p}_n)$; Export quantity.

Here the parameter $k \equiv d_x/(d_x + s_x) > 0$. The movement in the home-currency price of exports is a weighted average of foreign influences $(\hat{e} + \hat{q})$ and home influences $\hat{p}_n$. Alternatively, the relative price of exports in terms of home goods p_x/p_n is proportional to the real exchange rate $E = eq/p_n$, and the same is true of the quantity of exports. If the economy is "small" in the export market, $d_x \to \infty$ and $k \to 1$ also, so that there are no home influences on relative prices and $\hat{X} = s_x\hat{E}$.

If we impose the "rigid" economy assumption that $s_x = 0$, export revenue is fixed in foreign exchange. In home currency, export revenue moves proportionately to the change in e, with p_n and q constant:

(6) $\hat{p}_x + \hat{X} = \hat{e}$.

The duality result with domestic wage indexation can be obtained by assuming that $\hat{p}_n = \hat{e} + \hat{q}$ with devaluation. This would be the result if non-traded goods prices were a mark-up over wages, and wages are indexed to the CPI. See Branson (1985) for the derivation. With $\hat{p}_n = \hat{e} + \hat{q}$ from equations (4) and (5) we obtain again the result in equation (6). This is the duality between wage indexation as commonly practiced in Western Europe and the rigidity of $s_x = 0$, which may be more relevant in Africa.

We can re-interpret the duality result in a scenario of an on-going domestic inflation with p_n = the rate of growth of domestic money. If the economy is rigid, there is no fall in export quantity. However, the profit squeeze that follows from the fall in p_x/p_n indicates that in the long run resources will exit the export-producing sector.

The "passive" exchange rate policy sets $\hat{e} = \hat{p}_n$ = the money growth rate, with $\hat{q}$ assumed to be zero. This holds the quantity X constant with $\hat{e} = \hat{p}_n$ in equation (5). The home-currency price of exports p_x rises at the same rate as p_n; from (4) with k = 1, $\hat{p}_x = \hat{e} = \hat{p}_n$. This holds p_x/p_n constant, preventing the profit squeeze in the export sector. The result is that the passive exchange-rate policy with $\hat{e} = \hat{p}_n$ "insulates" the exportable sector from the domestic inflation.

The analysis for imports follows by analogy, except that the relevant rigidity is on the demand side. Import demand and supply are given by

(7) Demand: $\ln p_m = \ln p_n - d_m^{-1} \ln M^d$;

(8) Supply: $\ln q_m = \ln q + s_m^{-1} \ln M^s$.

Here p_n represents competition from import-competing home goods, and q represents foreign costs of production of imports. The small-country assumption sets $s_m = \infty$, whereas, in the "rigid" economy, $d_m = 0$. The translator between p_m and q_m gives us the third equation,

(9) Translator: $\ln p_m = \ln e + \ln q_m$.

The solutions for changes in import price and quantity $\hat{p}_m$ and $\hat{M}$ are obtained from total differentiation of equations (7) - (9). They are:

(10) $\hat{p}_m = k'(\hat{e} + \hat{q}) + (1-k')\hat{p}_n$;

(11) $\hat{M} = -k'd_m(\hat{e} + \hat{q} - \hat{p}_n)$,

where $k' \equiv s_m/(s_m+d_m)$. The formal analogy to the export solutions is obvious. In the small country, $k' \to 1$ as $s_m \to \infty$. In the "rigid" economy, $d_m = 0$ and $k' = 1$ also. Thus the rise in import payments is equal to the devaluation. The same result can be obtained by again imposing $\hat{p}_n = \hat{e}$ in equations (10) and (11).

The duality result can be obtained by again imposing $\hat{p}_n = \hat{e}$ in equations (10) and (11). As in the export case, this result can be reinterpreted to study the effects of a passive exchange-rate policy in the face of domestic inflation. With an infinitely-elastic supply of imports, the rise in domestic costs relative to import prices, p_n/p_m, squeezes profits in the import-competing sectors. If the economy is "rigid," there is no increase in the quantity of imports in the short run. But the profit squeeze in the import-competing sector, to the extent it exists, would augur a longer-run rise in imports.

A passive policy that sets $\hat{e} = \hat{p}_n$ releases this pressure. The home-currency import price p_m rises at the same rate as p_n; from (10) with $k' = 1$, $\hat{p}_m = \hat{e} = \hat{p}_n$. This holds p_m/p_n constant, eliminating the profit squeeze in the import-competing industries, actual or potential.

Combining the equations for import payments and for export receipts, both in terms of home currency, we see that in the "rigid" economy they increase in proportion to the change in the exchange rate. This means that the increase in import payments exceeds that in export receipts if the trade balance showed a deficit at the time of devaluation. So in the "rigid" economy, real devaluation may be counter-productive. However, the passive policy would hold a balanced trade position in the face of a domestic inflation, with the quantities of exports and imports constant:

$$(12) \qquad \hat{p}_x + \hat{X} = \hat{p}_m + \hat{M} = \hat{p}_n = \hat{e} \quad ; \text{ devaluation in the "rigid" economy.}$$

Here, there is no movement in the foreign-exchange trade balance, regardless of the initial condition: the passive policy insulates the trade balance from the domestic inflation. This may be about the best we can expect exchange-rate policy to do in a "rigid" economy.

III. Fixed Exchange Rates and Trade Barriers

An alternative to the passive policy of moving the exchange rate with domestic inflation is to hold the nominal exchange rate constant and use escalating trade barriers to offset the effect on trade quantities. The basic idea is that rising import duties and export subsidies could offset the effects on resource allocation from the increasing divergence between non-traded goods prices and export and import prices.

The model of export supply and demand is modified by introduction of a subsidy on top of the export price received by the seller. We illustrate the case with ad valorem subsidy at rate s that multiplies the export price p_x by a subsidy factor $\sigma = 1 + s$. Thus the price actually received by exporters is σp_x, and export supply becomes:

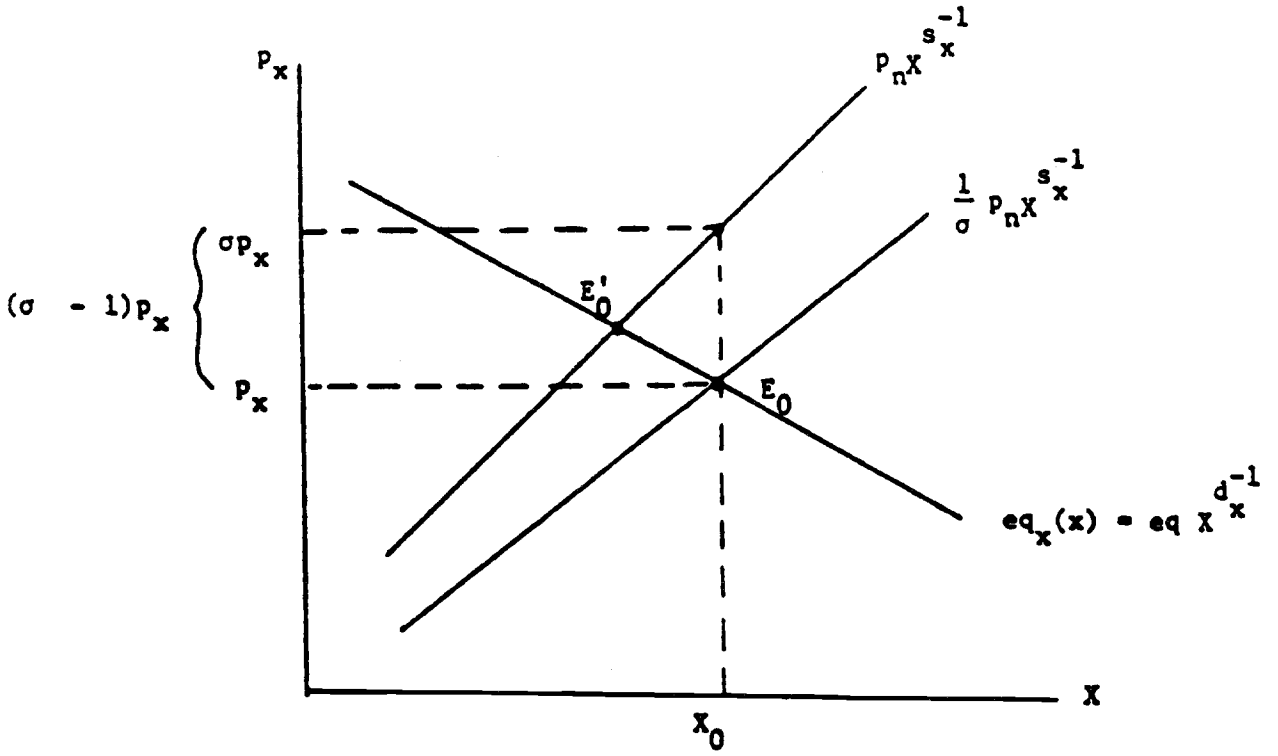
$$\ln p_x + \ln \sigma = \ln p_n + s_x^{-1} \ln X^s. \tag{13}$$

Equilibrium in the export market is shown in Figure 1. The demand curve is equation (2) of section II in non-log, or exponential, form. The underlying supply curve, the one without a σ term, is equation (1). The subsidy factor σ shifts this supply curve down to give the equilibrium intersection at E_0. This shows a higher export volume and a combination of a lower price paid by the buyer abroad and higher price inclusive of the subsidy received by the home producer than at the unsubsidized equilibrium E_0'. The figure shows that if p_n, the domestic price, is rising due to domestic inflation and if the nominal exchange rate e is constant, the export subsidy σ must rise at the same rate to hold the quantity X_0 constant.

This result implies an increasing rate of growth of the actual

FIGURE 1

Export Subsidy



subsidy rate, since $\hat{\sigma} = \dot{s}/(1+s)$, where $\dot{s}$ is the increase in the subsidy rate. The need for an increasing subsidy rate to provide a constant rate of growth of the subsidy factor can be seen from a simple example. If initially $s = 0$, imposition of a 10% subsidy will yield an increase of 10% in σ. But if the subsidy rate is 50%, so $\sigma = 1.5$, to increase σ by 10%, s will have to increase from 0.50 to 0.65, or 30%.

The equilibrium between export demand and subsidized supply in equation (13), (2) and (3), and in Figure 1, is expressed in equations (14) and (15) for changes in export quantity and market price net of subsidy:

$$(14) \quad \hat{p}_x = k\,(\hat{e} + \hat{q}) + (1 - k)(\hat{p}_n - \hat{\sigma}),$$

$$(15) \quad \hat{X} = ks_x[(\hat{e} + \hat{q}) - (\hat{p}_n - \hat{\sigma})].$$

The subsidy factor σ enters both solutions in tandem with the domestic price index p_n. If an inflation driven by domestic money growth or other domestic factors is driving the domestic price index p_n, and policy keeps the nominal exchange rate e constant, then a growth rate of the export subsidy factor σ that equals the rate of inflation $\hat{p}_n$ would be needed to hold the quantity of exports X constant.

Thus in an environment of domestic inflation with rapid monetary growth, a policy of fixing the <u>nominal</u> exchange rate would destabilize the <u>real</u> exchange rate E; in particular, if p_n grows rapidly, an attempt to fix the nominal rate would yield a real appreciation of the exchange rate and shrinking exports. As we see below, this has been the policy

response in Sudan--stabilizing the nominal rate against movements in the real rate.

A regime that attempts to eliminate the effects of stabilizing the nominal rate in the face of a major appreciation of the real rate requires, from equations (14) and (15), a rate of increase of the export subsidy factor equal to the domestic inflation. The subsidy factor σ would have to rise at the domestic inflation rate $\hat{p}_n$ to hold $X = X_0$ in Figure 1. The subsidy rate itself would have to grow at an increasing rate to provide $\hat{\sigma} = \hat{p}_n$. This would, of course, create an ever-increasing incentive to false invoice sales as exports to obtain the subsidy. This is part of the problem we see in developing countries attempting to hold nominal exchange rates in the face of domestic inflation. The policy increases incentives to move transactions to the illegal sector.

The movement in an import tariff needed to hold the quantity of imports constant in the face of a domestic inflation with a fixed nominal exchange rate can be shown by analogy to the export subsidy model. With an import tariff, import demand becomes:

$$(16) \quad \ln p_m + \ln \tau = \ln p_n - d_m^{-1} \ln M^d.$$

The demand curve gives the total price in home-currency that importers pay, inclusive of the tariff factor $\tau = 1 + t$. In equation (16), p_m is the home-currency price the sellers of imports receive, t is the ad-valorem tariff rate added by the government and τp_m is the price paid by the domestic purchaser.

The equilibrium in the import market with the import tariff factor τ is shown in Figure 2. The supply curve is equation (8) in section II in exponential, or non-log, form. The non-tariff demand curve without a τ term is the demand curve of equation (7). These would yield the non-tariff equilibrium E_0'. The tariff factor τ shifts the demand curve inclusive of the tariff down, giving the tariff-inclusive equilibrium at E_0. This shows a lower import quantity M_0 than without the tariff, with a lower price received by the seller p_m, and a higher price paid by the domestic buyer τp_m.

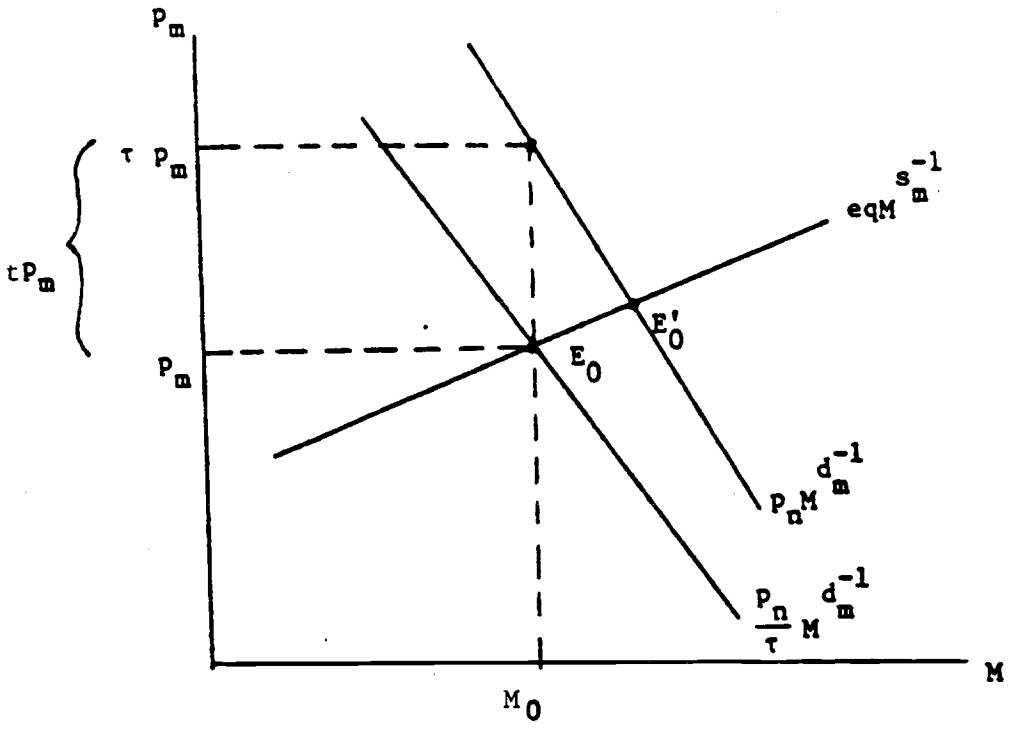
It is clear from Figure 2 that for a given foreign price index q, tariff factor τ and exchange rate e, an increase in domestic prices represented by p_n would shift the demand curves up, increasing import prices and quantities. To prevent the increase in import quantity in the face of a domestic inflation given by $\hat{p}_n$, the tariff factor τ would have to increase at the same rate. This would hold M at M_0 as p_n increases. So, analogously to the export case, the import tariff factor τ would have to grow at the same rate as domestic inflation to hold the quantity of imports constant.

As in the export case, a constant growth rate of the tariff factor τ requires an increasing rate of increase in the actual tariff rate, since $\hat{\tau} = \dot{t}/(1+t)$. To achieve a 10% increase in the tariff factor τ (to offset a 10% domestic inflation), if initially t = 0 (no tariff), a 10% tariff will do. If initially t = 0.50, a 30% increase is needed.

The equilibrium between import supply and demand inclusive of the tariff in equations (16), (8), and (9), and in Figure 2, is expressed in equations (17) and (18) for changes in import quantity and market price net of the import tariff:

FIGURE 2

Import Tariff



$$(17) \quad \hat{p}_m = k'(\hat{e} + \hat{q}) + (1 - k')(\hat{p}_n - \hat{\tau}),$$

$$(18) \quad \hat{M} = -k' d_m[(\hat{e} + \hat{q}) - (\hat{p}_n - \hat{\tau})].$$

The tariff factor $\hat{\tau}$ enters both equations in tandem with domestic inflation $\hat{p}_n$. With a domestic inflation driven by money growth and with a fixed exchange rate, a growth of the tariff factor τ equal to the inflation rate would be needed to hold the quantity of imports M constant.

Consider now the quota alternative to the tariff of Figure 2. If the domestic price level is rising, the non-tariff demand curve shifts up continuously. If a quota of M_0 is imposed, the gap between the demand price given by $p_m M^{\frac{d-1}{m}}$ and the supply price given by eq $M^{\frac{s-1}{m}}$ grows continuously. This gap is the same as the tariff wedge tp_m.

Thus in an environment of a domestic inflation characterized by $\hat{p}_n$ both the tariff and the subsidy factors would have to grow at the same rate given to hold trade quantities constant with a fixed nominal exchange rate. If tariffs and subsidies grow more slowly, import quantity will rise and export quantity fall. But, with the tariff and subsidy factors growing at the domestic inflation rate ($\hat{\sigma} = \hat{\tau} = \hat{p}_n$), the regime with a fixed nominal exchange rate would offer ever-increasing incentives to smuggling, through false invoicing or other means. This, in turn, would generate a rising black market premium, which would make it unsustainable to fix the nominal exchange rate.

IV. Trade Barriers, Smuggling and the Black Market Premium

Rising import tariffs induce smuggling and therefore provide an extra obstacle to the fixed nominal rate policy. An importer will tend to smuggle if the tariff is so high that it pays to purchase foreign exchange in the black market at a premium $\pi = e^b/e$ greater than one, given that the good imported may be confiscated by the government. Denoting the probability of success in smuggling by z, if $z\,\tau > \pi$, the importer will tend to smuggle more. We assume that the probability of success depends on the ratio of smuggled to legal imports, denoted by $m = S_m/L_m$ so that, given trade barriers and the premium, an importer will choose $_m$ such that expected profits are maximized. Associated with the optimal m, there will be a probability of success z(m) and a domestic price which can be expressed as a weighted average of the tariff factor and the premium, with $\tau > \pi$ a necessary condition for import smuggling to occur. Rising subsidies, on the other hand, reduce the incentive to smuggle exports but if the subsidy is smaller than the black market premium weighted by the probability of success, or $\sigma < z\,\pi$, it will pay to smuggle more. Profits will be maximized for a smuggling ratio $x = S_x/L_x$, associated to a probability of success z(x) and a domestic price of exports which can also be expressed as a weighted average of the subsidy factor and the premium, with $\sigma < \pi$ a necessary condition for export smuggling to occur. As a consequence, smuggling requires that $\tau > \sigma$ initially, a condition which is necessarily met when we have an export tax since then $\sigma < 1$. The nature of the smuggling equilibrium is discussed in Macedo (1985), and can be adapted to our purposes.

Domestic prices, net of tariff or subsidy, differ from the domestic currency value of foreign prices at the official exchange rate by the difference between the premium and trade barriers:

$$\hat{p}_x = \hat{e} + \hat{q}_x + \beta_x (\hat{\pi} - \hat{\sigma}) \tag{19}$$

where $\beta_x = \pi \times z(x)/[\sigma + \pi \times z(x)]$

$$\hat{p}_m = \hat{e} + \hat{q}_m - \beta_m(\hat{\pi} - \hat{\tau}) \tag{20}$$

where $\beta_m = \pi m/(\tau + \pi m)$.

We now interpret planned smuggled imports as flow demand for black market foreign exchange and successfully smuggled imports as flow supply of black market foreign exchange. This determines the long-run black market premium consistent with balanced legal and illegal trade. As before, we set foreign prices q at unity, then if legal exports equal legal imports ($L_x = L_m$) and successfully smuggled exports pay for planned smuggling imports ($z(x)S_x = S_m$), the smuggling ratios must satisfy the trade balance equilibrium are such that:

$$z(x)\ x = m \tag{21}$$

Using (21) to solve for the black market premium and the smuggling ratios in terms of trade barriers, it can be shown that these only depend on the ratio $\rho = \tau/\sigma$, with a coefficient capturing the inverse of the sum of the elasticities of the demand for and supply of black market foreign exchange with respect to trade barriers. An increase in τ increases

smuggling only if σ does not increase in proportion. The premium, however, increases with both, since it is a weighted average of τ and σ. It can be expressed as:

$$\hat{\pi} = \hat{\tau} - [\alpha_m/(\alpha_m+\alpha_x)]\hat{\rho} \tag{22}$$

where $\alpha_m(\alpha_x)$ is the elasticity of demand for (supply of) black market foreign exchange.

Using (22) in (19) and (20), it is seen that an increase in the tariff (subsidy) raises (lowers) the domestic net price of exports and lowers (raises) the domestic net price of imports because of the induced increase (decrease) in smuggling. Note also that in the benchmark case where $\tau = \sigma = \pi = 1$, the β coefficients become the share of import smuggling (or of successful export smuggling) in total trade, denoted by β_o. We can then write the condition for the smuggling equilibrium to exist as $\beta_x > \beta_o > \beta_m$.

The smuggling model summarized above can now be adapted to the model of section III. Under the simplifying assumption that the government does not resell confiscated smuggled goods, exports supplied by home producers (X^S) are greater than exports demanded by foreign consumers (X^O) and greater than legal exports (L_x) whereas imports demanded by home consumers (M^d) are smaller than imports supplied by foreign producers (M^S) but still greater than legal imports (L_m). Since the differences involve the smuggling ratios for X^d and M^S and those multiplied by the probability of success in smuggling for X^S and M^d, they can be expressed as a function of the ratio of trade barriers:

$$(23) \qquad \hat{X}^s = \hat{L}_x + [\beta_x/(\alpha_x+\alpha_m)]\hat{\rho}$$

$$(24) \qquad \hat{X}^d = \hat{L}_x + [\beta_o/(\alpha_x+\alpha_m)]\hat{\rho}$$

$$(25) \qquad \hat{M}^s = \hat{L}_m + [\beta_o/(\alpha_x+\alpha_m)]\hat{\rho}$$

$$(26) \qquad \hat{M}^d = \hat{L}_m + [\beta_m/(\alpha_x+\alpha_m)]\hat{\rho}$$

The equality of the wedge between between exports demanded and legal exports on the one hand and between imports supplied and legal imports on the other is a consequence of the long-run equilibrium condition expressed in (21).

Before substituting for quantities in the log differential of the demand and supply equations from sections II and III and solving the model for prices and legal quantities, we note that the solution will be the same as above if $\hat{\rho} = 0$, so that the rule $\hat{p}_n = \hat{\tau} = \hat{\sigma}$ still keeps total import and export quantities constant. The difference, of course, is that the black market premium is growing at the same rate $\hat{\pi} = \hat{p}_n$, independently of the changes in the official exchange rate.

It is convenient to write the solution relative to the no-smuggling model of section III, denoted by a L superscript. We then have:

$$(27) \qquad \hat{p}_x = \hat{p}_x^L + A_x^{-1}[\beta_x(1+\alpha_x d_x) - \beta_o]\hat{\rho}$$

$$(28) \qquad \hat{L}_x = \hat{X}^L + A_x^{-1}[\beta_x d_x(\alpha_x s_x - 1) - \beta_o s_x]\hat{\rho}$$

where $A_x = (\alpha_x+\alpha_m)(d_x+s_x)$

$$(29) \qquad \hat{p}_m = \hat{p}^L_m - A_m^{-1}[\beta_m(1+\alpha_m s_m) - \beta_o]\hat{\rho}$$

$$(30) \qquad \hat{L}_m = \hat{M}^L + A_m^{-1}[\beta_m s_m(d_m\alpha_m - 1) - \beta_o d_m]\hat{\rho}$$

where $A_m = (\alpha_x+\alpha_m)\ (d_m+s_m)$.

We see that the price of exports is always higher than without smuggling, and, in the case of a small economy, the price of imports also increases with rising tariffs. Quantities legally traded are ambiguous. In the "rigid" economy, legal trade falls but a rise in the value of imports and exports requires that the foreign exchange elasticities be greater than one:

$$(31) \qquad \hat{p}_x + \hat{L}_x - \hat{p}^L_x - \hat{X}^L = [\beta_x/(\alpha_x+\alpha_m)](\alpha_x-1)\hat{\rho}$$

$$(32) \qquad \hat{p}_m + \hat{L}_m - \hat{p}^L_m - \hat{M}^L = [\beta_m/\alpha_x+\alpha_m)](\alpha_m-1)\hat{\rho}$$

Independently of legal trade, total trade may rise or fall, except of course for the small, rigid economy. Thus

$$(33) \qquad \hat{X}^s = \hat{X}^L + (\alpha_x+\alpha_m)^{-1}[(\beta_x-\beta_o)(1-k) + \beta_x k s_x \alpha_x]\hat{\rho}$$

$$(34) \qquad \hat{M}^d = \hat{M}^L + (\alpha_x+\alpha_m)^{-1}[(\beta_m-\beta_o)(1-k') + \beta_m k' d_m \alpha_m]\hat{\rho}$$

It is seen that for the small country total trade rises. The only case where this would not obtain is for a country with monopoly power on the import side, say $k'=0$. A country with monopoly power on the export side would still increase its total exports relative to the no-smuggling situation.

The smuggling model shows therefore that, even in the "rigid" economy, legal trade will only fall if tariffs are rising faster than subsidies. However, the black market premium will be growing at the same rate as trade barriers.

To analyze this phenomenon we need to model the short-run black market premium, which importers and exporters take as given because it makes the stock of black market foreign exchange willingly held, as in Macedo (1982).

In this connection, the importance of a given short-term premium is that in order for smuggling to exist, it must be such that $\tau > \pi > \sigma$. Alternatively put, the observed premium provides a lower bound for import tariffs and an upper bound for export subsidies.

The analysis is in Macedo (1985). For our purposes, it is sufficient to stress that if the reported trade balance is zero, the unreported trade balance in foreign currency is given by:

$$(35) \qquad B \simeq Q_m S_m [\hat{\pi} - \alpha\hat{\sigma} - (1-\alpha)\hat{\tau}].$$

When the premium is higher than the weighted average of trade barriers, the unreported balance is in surplus and conversely. The effect of capital flight is therefore to exacerbate the rise in the premium.

V. Lessons from Sudan

Exchange-rate stability is desirable in a developing country because it eliminates a major source of uncertainty as the traded-goods sectors develop. As we saw above, an attempt to stabilize the nominal exchange rate in the face of domestic inflation will require increasing trade restrictions and the rising incentives they provide for illegal activity. An alternative objective is stabilization of the real exchange rate so as to insulate the traded-goods sectors and the trade balance from domestic inflation. To stabilize the real exchange rate, the nominal rate e should be moved to offset the home inflation differential. For a constant E, the nominal rate e would follow the rule

$$\hat{e} = \hat{p}_n - \hat{q} \tag{36}$$

Once we have accepted, on principle, that the objective for exchange-rate stabilization is the real exchange rate, we face the question: to which nominal rate do we apply the rule given in equation (36)? The dollar rate? The sterling rate? An average? Do we use import or export weights in forming the average? The general answer to these questions is that the real effective exchange rate can be stabilized by applying the rule of equation (36) to a nominal effective note, where the same set of weights is used in calculating the effective nominal rate e and the effective traded-goods price q. The optimal choice of weights is discussed in some detail in Branson and Katseli (1982). In the absence of market power in either export or import markets for a small country like Sudan, the appropriate choice is likely to be total trade weights. Thus the nominal effective rate and traded-goods

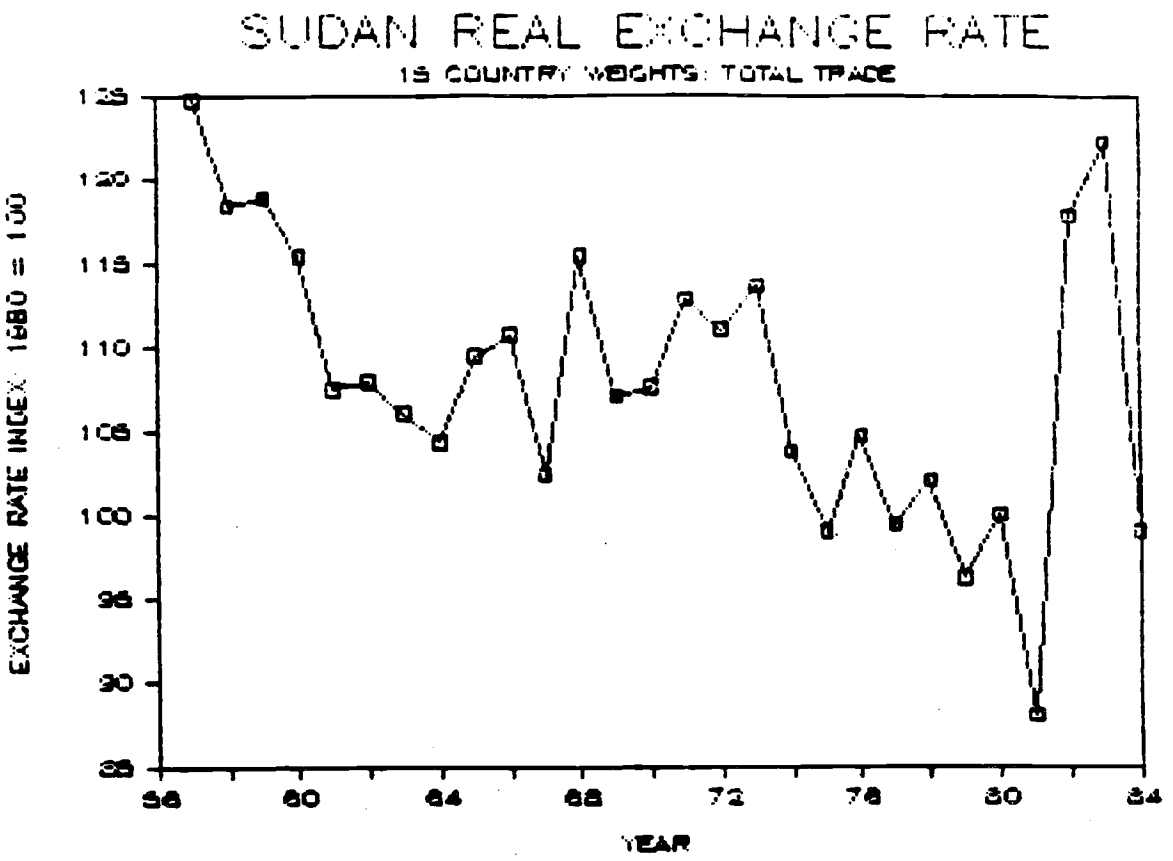
price can be formed by making a weighted average across the sum of exports and imports by trading partner. The nominal exchange rate of a selected numeraire currency such as the U.S. dollar can then be moved so that the effective nominal rate follows equation (36).

The data on official effective exchange rates for the Sudan are summarized in Appendix Tables 1-3. The left-hand side of each Table shows the export, import, and total trade weights for the Sudan's fifteen largest trading partners, with data drawn from the IMF's International Financial Statistics. Appendix Table 1 gives the weighted relative price index p_n/q (1980 = 100) for the Sudan using export, import, and total trade weights, and a three-country approximation weighting Saudi Arabia by .5 and the U.S. and U.K. by .25 each. Appendix Table 2 gives the same calculation for the nominal effective rate e, and Appendix Table 3 (and Figure 3) shows the real effective rate E. In both tables, an increase in the exchange rate index is an appreciation.

After two decades of relative price stability, the relative price index in Appendix Table 1 goes from 60 in 1976 to 64 in 1977 and 73 in 1978. This was the beginning of a period of accelerating inflation. As the inflation began in 1977, the nominal rate was not allowed to move until 1978. Subsequently, it was increased (depreciation of the Sudanese currency) in irregular jumps, compared to the fairly smooth relative inflation path.

The combination of steadily accelerating inflation and irregular movement of the nominal exchange rate resulted in the unstable movement in the real effective rate, as shown in Figure 3. After the late 1960s, the real effective rate fell in an unstable manner to 1980. This real appreciation was bad for output of traded goods and the trade balance.

FIGURE 3


SUDAN REAL EXCHANGE RATE
15 COUNTRY WEIGHTS: TOTAL TRADE
EXCHANGE RATE INDEX: 1980 = 100
125
120
115
110
105
100
95
90
85
56
60
64
68
72
76
80
84
YEAR

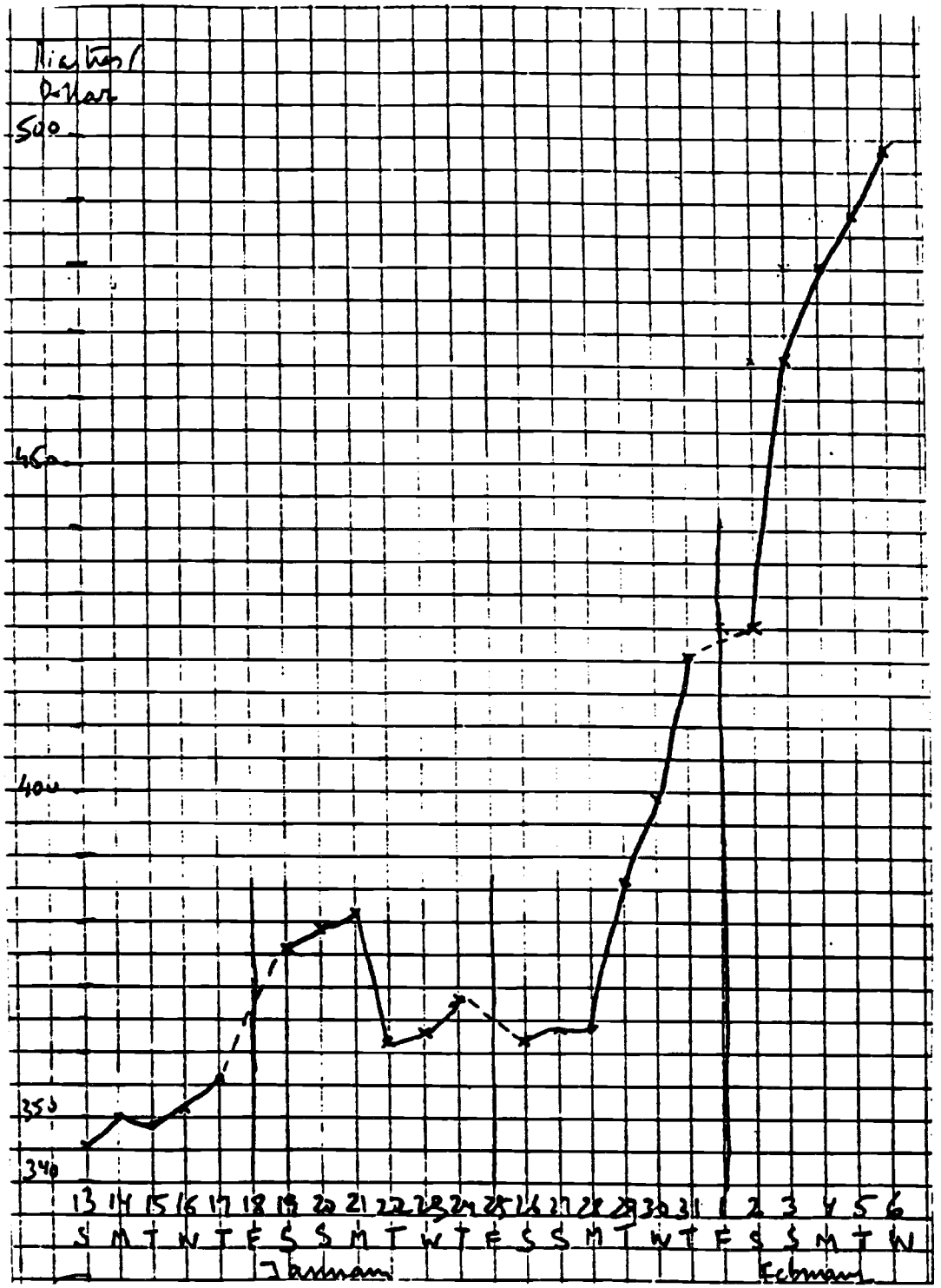
The instability of year-to-year movement in the real rate raises risk and may reduce investment in the traded-goods sector.

The situation worsened after 1980. A sharp real appreciation came in 1981 as the nominal rate was held nearly constant against a rising domestic inflation. The sharp devaluation in 1982 gave a large depreciation in the real effective rate, and the nominal appreciation (!) in 1984 resulted in an appreciation of the real rate back to its level in 1980.

While the causes of the accelerated inflation of the seventies are controversial, it is worth recalling that, after the first oil crisis, the Sudanese authorities embarked on a development program designed to make their country the "bread basket" of the Gulf states. The eagerness of these states to provide development aid to the Sudan as well as the significant migration of Sudanese workers toward the Gulf would seem to have relaxed the foreign exchange constraint. Nevertheless, when Sudan negotiated with the IMF in 1978, it was already in a very difficult financial situation. Nashashibi (1980) illustrates the decline in the competitiveness of major crops in the mid-seventies. Hussain and Thirwall (1984) find the same tendency after the 1978 devaluation. It is as yet unclear whether the deterioriation of Sudan's solvency in seven years of agreements with the IMF is mostly attributable to errors in policy and/or policy advice. An alternative hypothesis, put forth by Brown (1984, 1985), argues that both the United States and the Arab countries managed to use the IMF's "seal of approval" to continue lending to a friendly government. The ability of Sudan to continue dealing with the IMF despite arrears on its debt to the Fund is, of course, consistent with Brown's hypothesis but is not sufficient to establish it. In any event, the situation did deteriorate until negotiations with the IMF

FIGURE 4

The bubble of early 1985



Note: Dealers closed on February 10 and official rate was changed from 130 to 250 Pt 1$.

broke down in late 1984. In early February 1986, the IMF announced it was ceasing to lend to Sudan.

The 1979 partial unification, rather than part of any agreement, seems to have been an initiative of the Sudanese authorities. The financial liberalization which accompanied the partial unification of the exchange rate turned out to have very severe consequences because, while broadening the market where a free exchange rate was determined, it did not induce a more credible official exchange rate policy. As a consequence, the free market premium became a signal of the inability of the authorities to manage the economy and was accordingly viewed with suspicion by the central bank. This may well have exacerbated the potential of informal financial markets for bubbles and crashes, as indeed became reality in 1984-85 (see Figure 4).

Going back to the reforms, they continued to be implemented in 1980 and 1981. Further measures toward "the simplification and unification of the exchange rate" are mentioned in the Annual Report of the Bank of Sudan (1980, p. 50). In September, according to Awad (1985), the official rate became 60 piastres per dollar, the special rate 80 piastres while the free market rate was at 125 piastres, a premium of 2.08, much higher than the average of 1.76 reported in Table 1.

The unification of the exchange system is dated in BS (1981) in November 1981, at a rate of 90 piastres per dollar. According to Awad (1985), the premium was then 1.5, whereas a USAID document reports no premium (i.e. 1.0).

But the unification only lasted a few months. In March 1982, the commercial rate rose to 135 piastres, only slightly below the free market rate of 145. In November, the official rate was set at 130 piastres and

Table 1
Exchange Rates in the Sudan
(1973-84 yearly averages)

	Piastres/Dollar			1976 = 100		
	official	free	free market premium	CPI relative to U.S.	real official	rates free
1973	35	64	1.83	80	125	121
1974	35	67	1.91	91	110	112
1975	35	74	2.11	104	96	108
1976	35	66	1.89	100	100	100
1977	35	66	1.89	108	93	93
1978	38	72	1.89	120	91	91
1979	42	77	1.83	142	85	82
1980	50	88	1.76	156	92	85
1981	53	103	1.94	178	85	88
1982	94	143	1.52	209	129	104
1983	130	193	1.48	264	141	111
1984	130	244	1.88	303	122	122

Sources. official, consumer prices IFS
free 1973-1978 Picks's Currency Yearbook, average of monthly data
1979-1984 Bank of Sudan, average of daily data.

the commercial rate at 175, again very close to the free market rate. While the official rate remained at that level until February 1985 (when it became 250 piastres) the commercial rate was raised to 180 piastres in March of 1983, BS (1983, p. 64) and to 210 piastres in October 1984. Before that, however, the official rate was only applicable to the imports of petroleum and some pharmaceuticals because agricultural exports were valued at a combined rate of 142 piastres (obtained by weighing the official rate with 3/4 and the commercial rate with ¼). Indeed, by then, the commercial rate itself was only applicable to specific "priority" imports.

While during the IMF-period there continued to be continuous changes in exchange rate policy, the major difference with the previous period is the decline in the premium and the real devaluation against the dollar. This started in 1979 for the free market exchange rate and continued until 1984. For the official rate, it is limited to the period 1981-1983. But, as before, the shift of transactions to the commercial rate makes the true pattern look less volatile than the numbers reported in Table 1 above.

The "strong dollar" also causes problems of interpretation, but both the 15 partner real effective exchange rate (using total trade weights) and the simplified three partner rate mirror the evolution of the official real dollar rate. There is of course a difference in magnitude. To a real depreciation of 66% against the dollar in 1982-83, corresponds a 40% depreciation against major trading partners. The real appreciation of 1984 is also much larger relative to trading partners (15:23%, 3:20%) than relative to the dollar (-13%). The free rate, on the other hand,

depreciated by 10% in real terms, underscoring the substantial increase in the average premium over the years, to almost 1.9.

The decline in the premium during the period of IMF devaluations was consistent with a smoother functioning of the free market than the authorities were willing to acknowledge.

Almost by definition, there is little information on quantities transacted in the free, or "black", markets for foreign exchange. The percentages reported in Appendix Table 4 are shares of total transactions, based on data reported by private dealers to the central bank and consolidated in Macedo (1986). The shares are considerable both on the export and on the import side, especially if the premium is taken into account by converting values into domestic currency. The data is subject to caveats, since the authorizations to private dealers were revoked from February 10, 1983 through end of January, 1984, at which time the commercial banks virtually ceased to deal in foreign exchange since they would not use the free market rate.

Comparing various sources and methods, Appendix Table 5 reports the share of unreported transactions. It shows smuggling ratios of .37 (27/100-27) for commodity imports and .49 for commodity exports. The figures on the bottom panel show the importance of smuggling for government transactions (cotton, oil, petroleum, sugar) as well as for livestock.

Appendix Table 6 analyzes the structure of the free market by currency composition, showing a very dominant but variable share for the U.S. dollar, and by firm concentration. While the number of authorized dealers increases substantially during 1984, many of them had a very small share of the market so that the average number equivalent

Herfindahl index for the year is 5.6. This shows a degree of competition far greater than generally believed. For example, Dixit (1985) computes a similar number for U.S. auto firms and finds 2 or 8, depending on whether divisions are counted as separate entities. Another indicator, reported in the last column, is average transaction per authorized dealer. The pattern is erratic, and it would be difficult to ascribe declines to increases in competition in the usual way. But the size of the market was very variable due to the emerging bubble and seasonal factors tend to explain the Summer bulge.

Another piece of evidence concerns remittances. Their importance for the free market is evident from Appendix Table 5. The reported figures show a smuggling ratio of about one, confirmed by the figures based on potential savings reported below, which give 1.11. In a 1983 study of Sudanese workers abroad, discussed by Harris (1986), however, the smuggling ratio for remittances is as high as 7.27, so that as a share of output they would represent 37% rather than 5%. Even if such figure is grossly exaggerated, it seems clear that the stock of foreign exchange held by Sudanese determines the premium in the short run, as postulated in our analysis.

Appendix Table 7 shows that the intended use of these remittances generally requires imports (the exception may be housing). As a consequence, only a small part of the stock of foreign assets held by Sudanese residents is directed to supply foreign exchange to the Khartoum black market. This may account for the low level of net inflows or outflows reported in Appendix Table 4. Harris (1986) also claims that the stock - which he estimates at $2 billion - is held outside Sudan but does not draw the implications for the price of foreign exchange.

Despite the caveats about the quality of the data, this evidence strongly suggests that smuggling and the free market for foreign exchange cannot be ignored in the design of official exchange rate policy in Sudan: the smuggler's blues made its way to the central bank! The black market has offset the effects of official exchange rate policy leading to movements in the premium that were determined by stock demand for foreign assets as well as smuggling activity.

In sum, the failure to match movement in the nominal exchange rate to relative inflation sharply destabilized the real effective rate after 1980. The attempts at stabilizing the nominal exchange rate destabilized the real rate, discouraging investment in the traded-goods sectors and providing inventives for illegal activity. The objective for exchange rate policy in the Sudan may well be stability, but stability of the real exchange rate and the black premium premium, not the nominal official rate against the dollar.

Appendix

Table 1

RELATIVE PRICE INDEX FOR SUDAN: 1980 = 100
GEOMETRIC AVERAGE

WEIGHTS						15 COUNTRY WEIGHT			3 COUNTRY WEIGHT (US:.25, UK:.25,SAUD:.5)
COUNTRY	IFS CODE	EXPORT	IMPORT	TOTAL	YEAR	EXP	IMP	TOTAL	
USA	111	0.0541	0.1497	0.1230	57	55	53	54	55
UK	112	0.0447	0.1770	0.1401	58	58	56	56	57
FRANCE	132	0.0596	0.0587	0.0590	59	57	55	56	57
GERMANY	134	0.0653	0.0898	0.0830	60	56	54	55	56
ITALY	136	0.0977	0.0526	0.0652	61	60	57	58	60
NETHERLAN	138	0.0385	0.0501	0.0469	62	59	57	57	60
SWITZERLA	146	0.0097	0.0000	0.0027	63	60	58	58	62
JAPAN	158	0.0944	0.0587	0.0687	64	60	58	58	62
YUGOSLAVI	188	0.0394	0.0000	0.0110	65	56	55	55	60
KUWAIT	443	0.0000	0.0819	0.0591	66	55	54	54	59
SAUDIA AR	456	0.3237	0.1851	0.2238	67	59	58	58	64
EGYPT	469	0.0645	0.0282	0.0383	68	51	50	51	56
KOREA	542	0.0122	0.0296	0.0247	69	56	54	54	61
THAILAND	578	0.0103	0.0000	0.0029	70	56	54	54	61
CHINA	924	0.0861	0.0385	0.0518	71	54	51	52	59
					72	58	55	56	63
TOTAL:		1.0000	1.0000	1.0000	73	60	58	59	65
					74	64	64	64	70
					75	67	68	67	70
					76	59	61	60	59
					77	63	65	64	62
					78	72	73	73	71
					79	88	89	89	87
					80	100	100	100	100
					81	115	115	115	117
					82	136	136	136	141
					83	168	170	169	179
					84	190	196	195	211

Appendix

Table 2

GEOMETRIC AVERAGE

WEIGHTS

COUNTRY	IFS CODE	EXPORT	IMPORT	TOTAL
USA	111	0.0541	0.1497	0.1230
UK	112	0.0447	0.1770	0.1401
FRANCE	132	0.0596	0.0587	0.0590
GERMANY	134	0.0653	0.0898	0.0830
ITALY	136	0.0977	0.0526	0.0652
NETHERLANDS	138	0.0385	0.0501	0.0469
SWITZERLAND	146	0.0097	0.0000	0.0027
JAPAN	158	0.0944	0.0587	0.0687
YUGOSLAVIA	188	0.0394	0.0000	0.0110
KUWAIT	443	0.0000	0.0819	0.0591
SAUDIA ARABIA	456	0.3237	0.1851	0.2238
EGYPT	469	0.0645	0.0282	0.0383
KOREA	542	0.0122	0.0296	0.0247
THAILAND	578	0.0103	0.0000	0.0029
CHINA	924	0.0861	0.0385	0.0518

SUDAN NOMINAL EICHANGE RATE

INDEI: 1980 = 100

YEAR	15 COUNTRY WEIGHTS EXPORT	IMPORT	TOTAL	3 COUNTRY US: .25, UK: .25 SAUDIA: .5
57	69	66	67	69
58	69	66	67	69
59	68	65	66	69
60	64	63	63	63
61	64	62	62	63
62	63	61	62	63
63	63	61	62	63
64	62	60	61	63
65	60	60	60	63
66	59	60	60	63
67	59	60	60	63
68	58	58	58	60
69	58	58	58	60
70	58	58	58	60
71	58	59	59	61
72	62	62	62	64
73	67	66	67	67
74	68	66	66	68
75	68	66	67	67
76	65	62	63	63
77	66	63	64	63
78	77	73	74	71
79	86	85	85	83
80	100	100	100	100
81	101	101	101	107
82	158	160	160	175
83	203	208	207	229
84	188	195	193	220

Appendix

Table 3

SUDAN
REAL EXCHANGE RATE
GEOMETRIC AVERAGE

WEIGHTS

COUNTRY	IFS CODE	EXPORT	IMPORT	TOTAL
USA	111	0.0541	0.1497	0.1230
UK	112	0.0447	0.1770	0.1401
FRANCE	132	0.0596	0.0587	0.0590
GERMANY	134	0.0653	0.0898	0.0830
ITALY	136	0.0977	0.0526	0.0652
NETHERLANDS	138	0.0385	0.0501	0.0469
SWITZERLAND	146	0.0097	0.0000	0.0027
JAPAN	158	0.0944	0.0587	0.0687
YUGOSLAVIA	188	0.0394	0.0000	0.0110
KUWAIT	443	0.0000	0.0819	0.0591
SAUDIA ARABIA	456	0.3237	0.1851	0.2238
EGYPT	469	0.0645	0.0282	0.0383
KOREA	542	0.0122	0.0296	0.0247
THAILAND	578	0.0103	0.0000	0.0029
CHINA	924	0.0861	0.0385	0.0518

YEAR	15 COUNTRY WEIGHTS EXPORT	IMPORT	TOTAL	3 COUNTRY US: .25, UK: .25, SAUDIA: .5
57	125	125	125	126
58	118	118	118	120
59	119	119	119	121
60	114	116	115	112
61	107	108	107	105
62	107	108	108	105
63	105	106	106	102
64	104	104	104	101
65	108	110	109	105
66	107	112	111	106
67	100	103	102	97
68	113	116	115	107
69	105	108	107	100
70	105	109	108	99
71	109	114	113	103
72	108	112	111	100
73	113	114	114	102
74	105	103	104	96
75	102	98	99	96
76	111	102	105	108
77	106	97	99	102
78	108	100	102	100
79	98	96	96	95
80	100	100	100	100
81	88	88	88	92
82	117	118	118	124
83	121	123	122	128
84	98	99	99	104
85				

Appendix
Table 4

Free Foreign Exchange Transactions (%)

A. As a percentage of "private" current account

	Credit	Debit
1982	21	11
1983	14	8
1984	19	16

B. As a percentage of "official" current account

	Credit		Debit	
	Dollars	Pounds	Dollars	Pounds
1982	123	187	20	30
1983	48	71	14	21
1984	59	111	17	32

Note: Shares in pounds are obtained by valuing exports at official rate.
Official commodities are cotton, petroleum, sugar, wheat and flour.
Sources: Macedo (1986).

Appendix Table 5

Share of Unreported Transactions 1981/82

	Debit	Credit	Net
A.			
Trade	27	33	25
Invisibles	33	44	-
Remittances	100	55	50
Current Account	31	46	-
B.			
Remittances[1]		111	
Exports (total = 100)		weight	
Cotton[2]	10	54	
Oil products[2]	2	25	
Livestock[3] }	25	19	
Sorghum		—	
Weighted average	13.5	98	
Imports			
Petroleum[2]	19	21	
Sugar[2]	5	12	
Weighted average	13.6	33	
Other gov. imports	13.6	12	
Private imports	0.0	55	
Weighted average	6.1	100	

Sources: A. Macedo (1986)
B. El Din and Umbada (1984)

Notes: 1. Adjustment to estimate by Ghol (1982), cited in Source B., $2112 remittance/man-year and 400,000 SWA. Reported remittances from Macedo (1986)
2. Based on difference between contract price and world price
3. Based on direct estimate by Livestock Marketing Public Corp. (1978)

Appendix
Table 6

Structure of the free foreign exchange market

A. Size and Currency Composition

	Sources (Purchases)		Uses (Sales)	
	Total ($M)	Dollar share (%)	Total ($M)	Dollar Share (%)
1982	161	82	128	79
1983	114	68	99	85
1984	175	78	193	88

B. Measures of concentration

	Number of dealers	Number equivalent Herfindahl index	Average transaction ($ million)
1984;2	5	4	1.1
3	5	3	0.9
4	5	3	0.9
5	7	4	1.5
6	9	4	1.2
7	9	6	2.0
8	12	6	2.1
9	13	6	0.8
10	13	7	0.9
11	16	11	2.2
12	19	8	1.0

Sources: Macedo (1986)

Appendix
Table 7
Intended use of
remittances (%)

	Investment	28
of which	Agriculture	(15)
	Commerce	(9)
	Industry	(4)
	Automobiles	18
	Wedding	21
	Housing	28
	Other	5
		100

Source: Sample average of three surveys in 1980-82 reported by El Din and Umbada (1984)

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