

**DUAL EXCHANGE RATES:**

**Theory, Insulation Properties and the  
South African Experience**

**Long Paper Submitted in Partial Fulfillment for  
the Degree, Master of Commerce (in Economics)**

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# INTRODUCTION

Dual exchange rate regimes are not a phenomenon peculiar only to South Africa. In the past they have been implemented by the BLEU, France, Italy and the Netherlands in one form or another. More recently, multiple exchange regimes have been adopted by other developing countries such as Mexico, Brazil, Venezuela and Argentina.

The rationale for imposing a two- or multi-tier exchange regime is to protect the balance of payments from volatile short-term capital flows due to political and economic uncertainty inherent in developing economies.

The focus of this paper is on the insulation properties of dual market systems against foreign shocks. These shocks may take the form of foreign interest rate increases or increases in foreign perceptions of risk. An implication of these insulation properties is that the monetary authorities are able to pursue a monetary policy independent of external constraints.

Section 2 presents an overview of the literature on dual market systems. Since the effectiveness of a two-tier system depends on complete market separation between the official and financial markets, reference is made to this underlying assumption implicit in most models of dual exchange rate systems. A second underlying assumption viz: that of a neutral intervention policy is also briefly discussed.

As regards the insulation of domestic interest rates against foreign interest rate increases, the literature appears divided. Gros' (1988) arbitrage flow model showed that insulation was only temporary and that in the long run domestic interest rates would rise. On the other hand, Marion's (1981) short-run portfolio - balance approach showed that wealth and interest-income effects raised domestic interest rates in response to a foreign interest rate increase.

Section 3 of this paper presents an overview of the dynamics of the South African financial rand mechanism. Mention is made of the two parallel markets in financial rands viz. the cash and securities markets.

Section 4 of this paper tests the theoretical conclusions from Section 2 for the South African economy. The regression results however do not support the assertions made by either Marion or Gros. The findings support the hypothesis that domestic interest rates are indeed insulated against foreign interest rate shocks.

Further empirical tests conducted in Section 4 focus on the ability of the two-tier system to insulate domestic interest rates and the equity market against increased risk.

A notational framework is used to capture the response of domestic interest rates to increased perceptions in risk.<sup>(i)</sup>

$$\uparrow R \Rightarrow \uparrow \mu = i \left( \frac{CR^e}{FR} \right) \uparrow$$

where

$$\uparrow R \Rightarrow \uparrow \mu \text{ only if } \frac{d}{dt} \left( \frac{CR^e}{FR} \right) > \frac{d}{dt} (i).$$

The tests conducted found that the rate of change in the financial rand discount exceeded the rate of change in the domestic interest rate. The inference drawn from this is that the monetary authorities have greater autonomy against external shocks in setting the domestic rate of interest. If risk were to increase, the monetary authorities would be able to set domestic interest rates lower, provided that  $\frac{d}{dt} \left( \frac{CR^e}{FR} \right) > \frac{d}{dt} (i)$ .

- 
- (i) R — is risk  
 u — is the expected return to non-residents for holding domestic assets  
 i — is the 90-day trade finance rate  
 CR<sup>e</sup> — is the expected commercial rand rate of exchange  
 FR — the financial rand rate of exchange.

## SECTION 2

### 2.1 MECHANICS OF A DUAL EXCHANGE RATE SYSTEM

The dual exchange rate mechanism has primarily been adopted to tackle the problem of destabilizing capital flows. Thus, a separate exchange market for capital and current account transactions is proposed. The system is characterized by an official exchange rate for current account transactions (which may be free-floating, fixed or managed) as well as a financial exchange rate for capital account transactions. This financial exchange rate is a free floating rate which removes pressure from official reserves caused by large shifts in capital flows, while at the same time insulating foreign trade from exchange rate fluctuations and eliminating the need for inefficient discretionary restrictions on capital transactions.

Thus any shock resulting in a capital outflow would occur through the financial exchange market, the effect of which is to depreciate the financial exchange rate. There would, however, be no effect on the official reserves, and hence on the official exchange rate. In this way foreign trade is insulated from these capital shocks. It is important, however, to mention that the above discussion assumes that complete market separation is indeed possible. The implications of this assumption will be dealt with later.

The mechanics of the dual rate system can be shown by way of the following expression:<sup>1</sup>

$$\mu = i \frac{CR^e(1-T)}{FR} + \frac{FR^e - FR}{FR} \quad \text{Equation 1}$$

Where :

$\mu$  — expected return to non-residents for holding domestic assets over a given period of time.

---

<sup>1</sup> Adapted from Lanyi (1975) and Kantor and Barr (1983)

- i — domestic rate of interest at a given time period
- CR<sup>e</sup> — average expected spot official exchange rate applicable to interest payments during a given time period.
- FR<sup>e</sup> — average expected spot financial exchange rate at the end of a given time period.
- T — tax rate applicable to non-residents on income earned (interest payments and profits)
- FR — spot financial rate of exchange at a given time period.

The exchange rates are defined as foreign currency per unit of domestic currency.

International capital movements respond to changes in the financial exchange rate as a result of two separate motives on the part of economic units involved. The first of these is the rate of return motive. In the expression above this is defined as:

$$\mu = i \frac{CR^e(1-T)}{FR} \quad \text{Equation 2}$$

This implies that the effective rate of return on foreign investment is a function of the proportionate spread between the official (commercial) and financial exchange rates. This is the case if earnings on foreign investment are repatriated at the official exchange rate<sup>2</sup>.

Thus, a depreciation of the financial exchange rate would increase the effective return on foreign investment (and hence result in capital inflows) while an appreciation of the financial exchange rate would decrease the effective return facilitating capital outflows.

The second way in which a change in the financial exchange rate influences capital flows is through the capital gains motive (the second term in Equation 1). Thus, if economic agents expect the financial exchange rate to appreciate over the tenure of the investment,

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<sup>2</sup> Earnings may however be repatriated at the financial exchange rate as has indeed occurred in the BLEU for short periods during the early seventies. It is worth pointing out that earnings repatriation is a capital flow that generally occurs via the official rate. Thus our earlier assumption of complete market separation must be an unrealistic one in practice.

capital gains would be made and funds would continue to flow into the country.

Conversely, if the financial exchange rate were expected to depreciate, the flow of funds would be in the reverse direction.

The financial exchange rate may be quoted at a discount or a premium to the official rate. In either case the results above are unaffected. An increase in the premium would lower the effective rate of return on investment by foreign investors, while an increase in the discount would increase the effective rate of return on investment by non-residents.

## 2.2 INCOMPLETE MARKET SEPARATION

Implicit in the theoretical models of dual markets is the assumption that perfect market separation exists. In reality however, perfect separation of the markets is virtually impossible. As was mentioned earlier, interest payments or dividend payments, although returns to capital, generally occur at the official rate. Furthermore, payments related to capital service or royalties also occur at the official rate. If these payments are to be effected via the financial rate of exchange, the rate of return motive discussed above ceases to be an investment incentive for non-residents. In the South African context, it is this rate of return motive that compensates non-residents for their negative perceptions of the South African political situation. Failure to provide an incentive to foreign investors in this way must surely penalize the South African economy in terms of lost investment opportunities and hence economic growth.

Swoboda (1974) points out that if interest earnings are repatriated at the official rate, a link is established between the two exchange rates which makes separation between domestic interest rates and foreign returns possible even with perfect capital mobility. It is this separation between domestic and foreign returns that forms the crux of the discussion in Section 4 of this paper.

Certain types of international transfers, while technically current account items, can easily be used as vehicles for the acquisition of foreign assets. Remittances of savings by foreign workers, family remittances and tourist expenditure are such transfers. If these items were to be included in the financial exchange market, this would do away with the threat that the official market poses as a channel through which capital movements occur. However, conducting certain current account transactions – such as tourism – at a different exchange rate from others (such as commodity trade) does involve a palpable distortion of relative prices. (Lanyi, 1975, p.720).

For example, if the official rate is quoted as 50 USc/Rand and the financial rate at 25 USc/Rand, a US tourist to South Africa could buy goods valued at R100,00 for \$25,00, while a US importer would pay \$50,00 for the same goods. Alternatively, a US tourist could buy SA shares in New York and sell these same shares in South Africa, the proceeds being used for the acquisition of domestic goods. Unless the financial rand mechanism was effectively policed, the US tourist could purchase goods (normally traded at the official rate) with money balances designated financial rands.

Trade financing is another capital item that is always conducted at the official exchange rate. "Leads" and "lags" in the settlement of commercial claims, or variations in the initial terms of the commercial financing can be responsible for large, short-term, speculative capital movements. If, for example, the commercial rate of exchange is expected to depreciate, there will be speculative capital outflows before the depreciation occurs. As trade financing is conducted at the official rate and since the dual exchange mechanism is unable to insulate the current account against speculative movements, quantitative restrictions or intervention in the commercial market by the authorities may be necessary.

However, controls on "leads" and "lags" such as fixing the terms of payment by law — interfere with the freedom of exporters and importers to determine mutually convenient terms; as well as being cumbersome and costly to enforce.<sup>3</sup> It is clear that even though trade financing is a capital item, it must be effected at the official rate of exchange. It would not be possible for trade financing to occur at the financial rate as this would imply that most trade must be conducted at the financial rate.<sup>4</sup>

A major implication of incomplete market separation is that the dual exchange market becomes *less* effective in protecting the official reserves against speculative disturbances. This however does not negate the primary function of the dual market, but rather necessitates quantitative controls which are more costly to administer than a dual exchange market with perfect separation.

### 2.3 OFFICIAL INTERVENTION AND BALANCE OF PAYMENTS CONSIDERATIONS

A further implicit assumption in the theoretical models of dual markets is that a broadly neutral intervention policy is pursued and that effective implementation of such a policy is feasible.

The rationale behind such a policy is that it ensures overall balance of payments equilibrium, with an imbalance on the current account being exactly offset by an equal imbalance of opposite sign on the capital account. Furthermore, it ensures a stable official rate of exchange which has important trade implications. It is however important to note that neutral intervention is only necessary if the object of policy is to have a pegged commercial rate of exchange.

<sup>3</sup> Footnote 21. Lanyi (1975).

<sup>4</sup> Countries such as Mexico and Venezuela have adopted a dual exchange system whereby some goods (non-essential imports and exports) have been shifted from the official to the financial market. See Dornbusch (1986).

In the absence of a neutral intervention policy it would become increasingly more difficult for the monetary authorities to peg the official rate of exchange. This would be due to the resultant changes in international reserves.

The dynamics of the neutral intervention policy is drawn on the work by Fleming (1971), Barattieri and Ragazzi (1971), and Lanyi (1975) and is presented below.

### 2.3.1 The Case of a Neutral Intervention Policy

The neutral intervention policy assumes intervention by the monetary authorities in both the official and financial markets. Consider the case where the current account is in surplus (deficit). Any foreign exchange surplus (deficit) on the current account may be sold (bought) in the financial exchange market in order to maintain the level of reserves and official rate of exchange. The increased supply of foreign exchange (due to the sale of reserves) to the financial market causes the financial exchange rate to appreciate. In this case, it is clear that the stock of international reserves has remained constant (and hence the official exchange rate). This result is also supported by Decaluwe and Steinherr (1976).

Swoboda (1974) and Barattieri and Ragazzi (1971) however argue that an unaltered level of international reserves will *not* ensure that the balance of payments has a neutral effect on the monetary base; instead, there will be variations tending to aggravate the current account disequilibrium which could of course be offset by monetary intervention.

In order to establish what effect the balance of payments has on the monetary base, we need to know whether the financial rate is quoted at a premium or a discount. This can be determined by looking at what the state of the balance of payments would be if all transactions had been quoted at the official rate.

If *all* transactions are conducted at the official rate of exchange and the overall balance of payments is in surplus, the financial rate would be quoted at a premium. In the reverse case, the financial rate would be quoted at a discount.

Given then that the overall balance of payments is in deficit (current account surplus < capital outflows), application of the neutral intervention policy will ensure the intervention agency some profit.

Assume for example that the official rate and the financial rate are quoted at 50 USc/1 Rand and 25 USc/1 Rand respectively. Furthermore, assume that the surplus on the current account is \$100. The effective cost of these reserves would be R200 (at official rate of exchange). If the monetary authorities now sell the \$100 in the financial market they would receive R400. The net effect is a R200 profit.<sup>5</sup> Since the intervention agency has made a profit this implies a reduction in the money base. In order to maintain the money base at its initial level, an open-market purchase would be the appropriate policy measure. Hence, an unaltered level of international reserves will *not* ensure that the balance of payments has a neutral effect on the monetary base.

Thus far, we have shown that the financial rate is expected to increase (appreciate) when the current account is in surplus.<sup>6</sup> However, this result is at odds with the analysis of Flood (1978). In Flood's model, the current account is the exact measure of the amount of intervention required for the domestic monetary authority to maintain the fixed current account exchange rate. A current account surplus requires that the monetary authority purchase international reserves equal to the surplus, producing an equal increase in the domestic supply of high powered money. In order for the expanded money supply to be

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<sup>5</sup> The financial rate would, however, tend to appreciate. Thus, the quoted rate may be 30 USc/1 Rand. For simplicity, I have assumed no change in the financial rate.

<sup>6</sup> Assuming a neutral intervention policy is being adopted.

absorbed into domestic portfolios, the financial exchange rate must depreciate. The depreciated financial rate reduces the opportunity cost of holding money and raises domestic wealth due to capital gains on traded securities which further accommodates the increased money supply. Thus, Flood concludes that the larger is the value of the current account surplus, the larger is the expected depreciation of the financial rate.

Flood's model assumes that an increase in international reserves increases the money base and hence money supply. However, an increase in international reserves might well *not* affect money supply via the money base, but merely change the composition of the money base. Thus, if a country has a current account surplus, the rate of growth of credit creation may not change but the degree of accommodation required from the Central Bank may well decrease. In the reverse case of a current account deficit, accommodation may increase while the rate of domestic credit creation is unaffected.<sup>7</sup>

### 2.3.1.1 Criticisms of the Neutral Intervention Policy

Lanyi (1975) has argued that a neutral intervention policy of the type discussed above may however not be adopted by the monetary authorities. The reason given is that any *systematic* intervention of the sort proposed would increase speculative movements in both the financial and official markets. Thus, assuming a current account deficit, intervention would take the form of foreign exchange purchases in the financial market. The increased demand for foreign exchange would increase its price relative to domestic currency and depreciate the financial rate. The increased spread between the official and financial exchange rates may be taken as an indication by speculators that the official rate would be devalued at some later date, and thus consequently provoke additional speculation through the official market.<sup>8</sup> Furthermore, an increased spread would tend to increase the

<sup>7</sup> For a detailed discussion of the link between the money base, money supply and credit creation; see Whittaker, J. (1987).

<sup>8</sup> Speculation may take the form of changes in "leads" and "lags" in trade payments as well as changes in foreign current account balances in the domestic currency.

incentives for evasion and would thus become impossible to maintain. While in theory it is conceivable that a spiral of ever-increasing pressure on official reserves could be offset by ever-increasing official intervention, this is apparently not considered by monetary authorities to be a manageable policy.

Lanyi proposes a "variable" intervention policy as a means of stemming speculative flows. In this case, intervention is *not* systematic. However, he argues that until such a policy of neutral intervention is actually implemented, it is impossible to tell whether such a policy could defeat a heavy speculative movement.

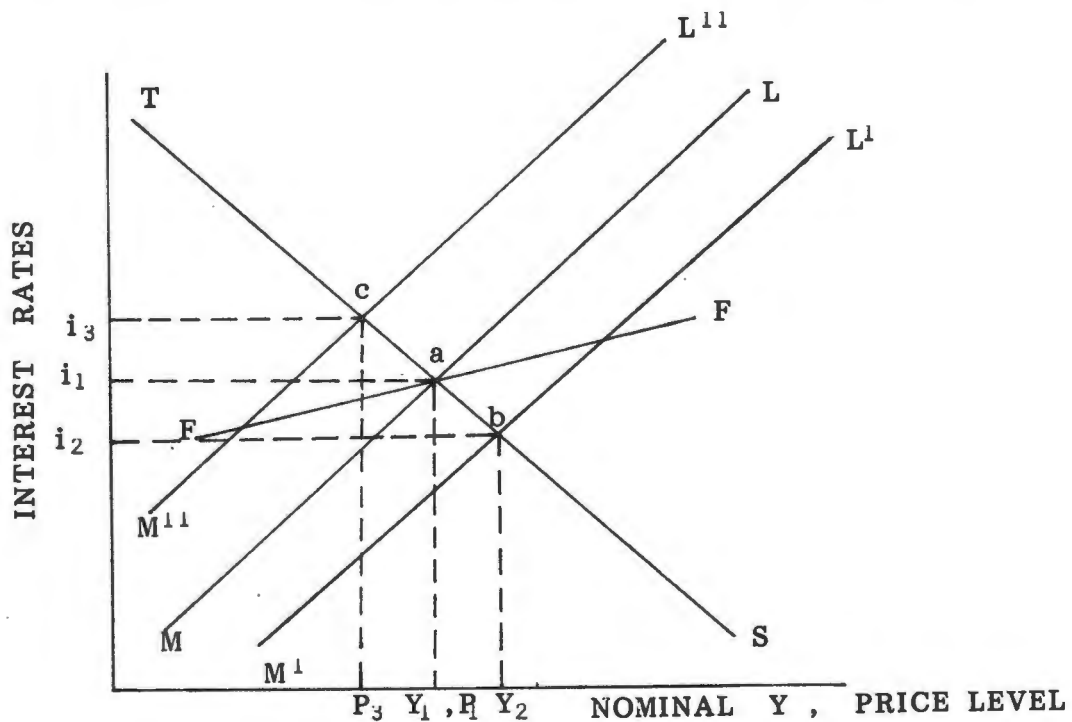
Fleming (1971) refers to a "reverse transfer problem" that arises in connection with the neutral intervention policy discussed above. If a country has an increasing deficit on its current account, it might find that it has to carry out larger and larger proportionate depreciations in its financial exchange rate in order to obtain a given addition to the flow of foreign exchange, accruing to its central reserves, from intervention in the financial exchange market. There might even come a point at which any further depreciation would *reduce* rather than increase that flow.

One would expect that successive depreciations of the financial rate would increase the effective return to foreigners and increase their demand for domestic securities. In the same context, domestic residents would give up more of their remaining holdings of foreign assets due to capital gains considerations. However, if it is the desire of economic agents to maintain a geographical diversification of asset holdings, merely raising the effective yields in the domestic country relative to those abroad may not be enough to induce foreigners to invest still more capital in the home country. By the same token, domestic investors may also be unwilling to give up more of their holdings of foreign assets.

## 2.4 MONETARY POLICY UNDER DUAL EXCHANGE RATES

The literature appears divided on the issue of the effectiveness of monetary policy under dual exchange rates. For this reason it is important to examine the role of monetary policy under different models of dual exchange regimes. In this regard, insight is drawn from Barattieri and Ragazzi (1971), Cumby (1984), Swoboda (1974) and Gros (1988).

Barattieri and Ragazzi use the traditional Mundellian framework to assess the effects of an *expansionary* monetary policy under both unified (fixed) and dual exchange rates. They conclude that in the case of a unified (fixed) exchange rate regime, monetary policy can only have a *temporary* effect in increasing income levels within the economy. However, under a dual exchange rate system monetary policy can be used to sustain a certain level of income provided that the monetary authorities follow a neutral intervention policy. The diagram below explains the adjustment mechanisms under both unified and dual rates.<sup>9</sup>



Mundell Model — Monetary Policy

FIGURE 1

<sup>9</sup> Point 'a' in Figure 1 corresponds to both internal and external equilibrium.

In the case of an expansionary monetary policy under unified (fixed) exchange rates, the LM curve shifts right to  $LM^1$ . The temporary decrease in interest rates results in a capital outflow and hence a capital account deficit, while the increase in income results in a current account deficit. Hence, an overall deficit on the balance of payments prevails. This deficit puts downward pressure on the rate of exchange but if the authorities wish to maintain a pegged rate, the money supply must reverse and equilibrium once again established at point 'a'. In this framework the money supply reverses automatically as reserves flow out of the country. The model is a fixed price model and assumes perfect capital mobility.

The mechanism under a dual exchange rate system is no different from that discussed above except for one exception viz. a neutral intervention policy that is implicit in the discussion of dual exchange systems. The overall balance of payments deficit implies that the financial rate of exchange is quoted at a discount. Thus, if the monetary authorities wish to maintain the income level at  $Y_2$ , purchases of foreign exchange in the financial market must take place in order to maintain internal balance at point 'b' (intersection of IS and LM curves). Since the financial rate of exchange is quoted at a discount, the intervention agency records a profit.<sup>10</sup> This has the effect of putting downward pressure on the money base thus necessitating an open-market purchase to maintain the money supply at its initial level. Thus, an expansionary monetary policy can be effective in sustaining a given level of income in the long run while maintaining the level of reserves at some constant level.<sup>11</sup>

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<sup>10</sup> See my earlier discussion on this issue for a numerical example.

<sup>11</sup> For a criticism of the neutral intervention policy see my earlier discussion.

Swoboda also uses the Mundellian framework in ascertaining the effectiveness of monetary policy under a dual exchange rate system. He however examines the ability of the monetary authorities to lower the price level given an unchanging foreign monetary environment. Figure 1 helps to explain the adjustment process.

Assuming that with initial equilibrium at  $a$  (internal — and external balance) the monetary authorities decrease the money supply consistent with  $L^{11}M^{11}$  in order to lower the price level to  $P_3$ . A position of quasi-equilibrium is attained at point  $C$  in figure 1 with an attendant payments surplus (due to the decrease in money supply) and reserve inflows (due to the higher rate of interest). In order to maintain the system at point  $C$ , it is necessary for the Central Bank to sell bonds to the public to sterilize the inflow of reserves. Note that an open market sale of bonds decreases money supply, while an inflow of reserves expands money supply.<sup>12</sup>

Under a unitary fixed exchange rate regime the required rate of sterilization depends on the interest-sensitivity of capital flows. As the latter increases, the rate of sterilization operations must also increase. As the interest-sensitivity of capital flows tends to infinity so does the rate of sterilization operations. Thus, it is clear that continuous sterilization becomes impossible in a world of perfect capital mobility.<sup>13</sup>

A dual exchange rate system on the other hand, can increase the scope for monetary independence in the SHORT RUN as it eliminates the induced flow of capital on reserves. Thus, a capital inflow will result in an appreciation of the financial exchange rate. Because the financial rate is free-floating the capital account will always be in equilibrium.

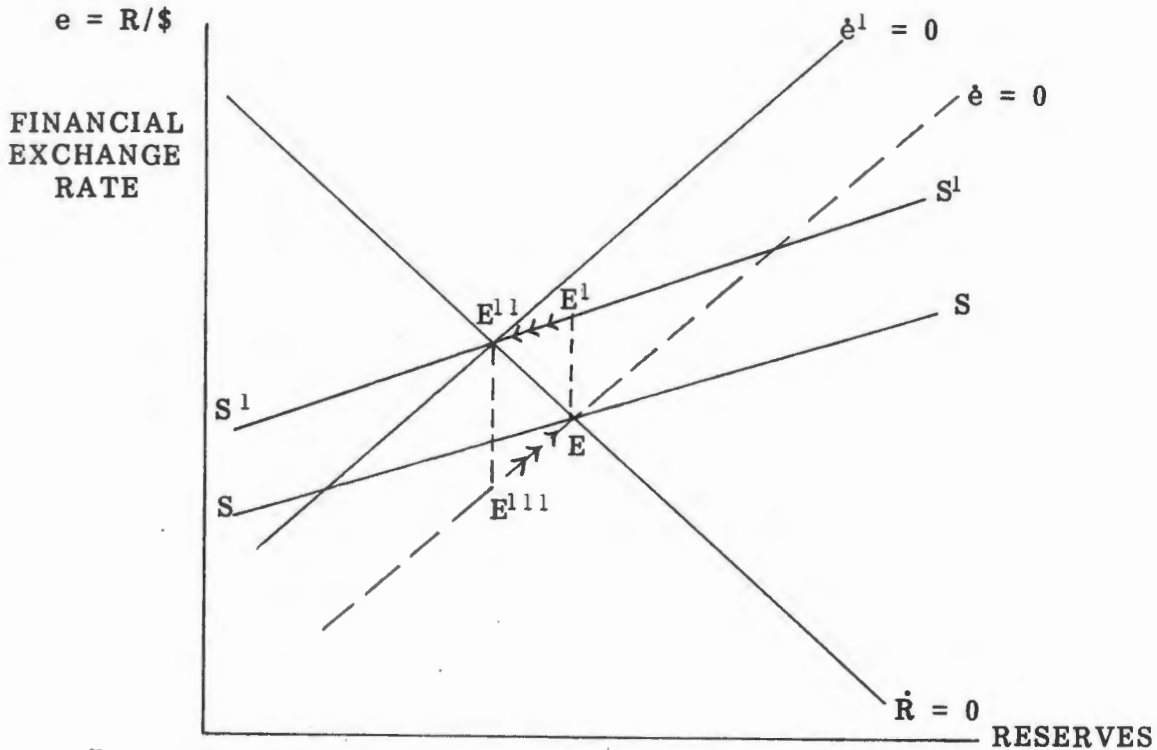
<sup>12</sup> See my earlier criticism of the effect of increased reserves on money supply. (Section 2, page 10)

<sup>13</sup> If a country has a perpetual overall surplus on its balance of payments, open market sales of bonds cannot continue indefinitely as government has a limit on the public debt.

Thus the required rate of sterilization now only depends on the current account disequilibrium. If the current account is initially in equilibrium, the required rate of sterilization is *lower* than that under a unitary fixed exchange rate. An alternative to sterilization is intervention in the financial exchange market. Thus, in the situation discussed above, the overall surplus on the balance of payments results in the financial rate being quoted at a premium. The sale in the free market of foreign exchange acquired at the official rate then results in a loss to the intervention agency. Thus, even though intervention in the financial market provides a substitute for conventional sterilization, it is however a costly substitute. To make up for the loss incurred by the intervention agency, it would have to buy bonds from the public to maintain the money supply at a constant level.

Cumby (1984) also examines the effect of monetary policy on domestic prices as his measure of its effectiveness. He however makes use of the portfolio-balance approach unlike the Mundellian approach used by Swoboda. Irrespective of the various models used, both Swoboda and Cumby reach similar conclusions viz. that monetary policy is effective in the short run but not in the long run.

Cumby's model emphasizes the wealth effects of changes in the financial exchange rate (defined as domestic currency per unit of foreign currency) as the channel through which disturbances affect the domestic economy. He thus adopts Metzler's portfolio balance rule whereby agents are assumed to allocate their financial wealth between domestic money and interest-bearing assets. The short run and long run effects of an unanticipated open-market purchase of securities by the central bank is the measure adopted to ascertain the effectiveness of monetary policy. This effect is depicted diagrammatically below.



### Unanticipated Open-market Purchase

FIGURE 2

SOURCE: Cumby (1984)

The  $\dot{e} = 0$  locus depicts the values of reserves and the financial rate consistent with asset market equilibrium and a stationary financial rate; while the  $\dot{R} = 0$  locus depicts the values of reserves and the financial rate consistent with equilibrium in the goods market and with a balanced current account.

The long-run equilibrium,  $E$ , is disturbed by an open-market purchase of interest-bearing assets. The effect of this is to increase the value of the stock of domestic credit which is equal to the value of securities purchased. Private financial wealth is thus unchanged at  $E$  and the current account remains balanced at all points along the  $\dot{R} = 0$  locus. It is assumed that the interest payments the central bank gains by the open-market purchases are redistributed to the private sector as lump-sum transfer payments in order

to maintain the level of disposable income. Furthermore, due to the change in relative asset supplies there is now an excess supply of money at all points along the  $\dot{e} = 0$  locus. Hence, at each level of reserves a higher (depreciated) value of the financial rate is needed to restore money-market equilibrium. The  $\dot{e} = 0$  locus thus shifts left to  $\dot{e}^1 = 0$ .

At the time of the open-market purchase, the resultant portfolio change results in an excess demand for foreign exchange. The reasoning behind this is the desire of private sector individuals to maintain a desired money to foreign assets ratio. The effect of this portfolio change is a depreciation of the financial rate. Due to this depreciation, the dual exchange system maintains the stock of international reserves at a constant level. Thus, in the short run, the financial rate overshoots its long run level and equilibrium is reached at  $E^1$  and  $S^1S^1$  (the stable arm associated with a higher stock of domestic credit) in Figure 2. The increase (depreciation) of the financial rate, however, increases the wealth of private sector individuals hence resulting in increased absorption and a current account deficit.

This increased absorption puts upward pressure on domestic prices (hence reducing real wealth) resulting in a switch away from domestic goods.

This demand switch has the effect of decreasing the stock of international reserves (increased imports) while the adjustment to the new long-run equilibrium results in an appreciation of the financial rate. The associated decline in real wealth reduces absorption and therefore reduces domestic prices over time. This price decline continues until the original price level is restored at  $E^{11}$  (long run equilibrium).

The inability of the central bank to influence the price level in the long run is not due to an inability to control the money stock.<sup>14</sup> At  $E^{11}$  the higher (depreciated) financial rate

<sup>14</sup> Even in the long run the authorities are able to maintain a certain level of income (stock of money). This result is consistent with that of Barattieri and Ragazzi (1971).

implies that the domestic interest rate must be lower than at E . The INTEREST-PARITY expression below clarifies this point :

$$\downarrow i = i^* \cdot \uparrow \frac{CR}{FR} \quad \text{Equation 3}$$

where

$i$  = domestic interest rate

$i^*$  = foreign interest rate

CR = commercial rate of exchange (assumed fixed)

FR = spot financial rate of exchange

A higher financial rate is shown to reduce the domestic interest rate. Thus, with real output unchanged, asset-market equilibrium requires that a lower domestic interest rate be accompanied by a larger monetary base. The long run reserve loss following an open market purchase is therefore *less* than one for one.

The present framework can be used to examine the effect of a speculative disturbance on the current account and domestic prices. Cumby argues that dual rates are *not* successful in insulating either the current account or domestic prices from speculative disturbances. He models a speculative attack as a change in agents' expectations concerning future policy to be pursued by the domestic monetary authority. We assume that at time  $t_0$  the economy is disturbed by agents' expectations that at some time,  $t_1$ , the monetary authority will engage in an open market expansion of the money stock.

The effect of this speculative disturbance is no different to that presented above. Thus, at  $t_0$ , the economy moves to  $E^1$ , as the expected future monetary expansion creates an excess demand for foreign exchange and results in an immediate depreciation of the financial rate. The resultant wealth effect results in an increase in aggregate demand and domestic prices. If the agents' expectations at  $t_1$  are realized, the adjustment continues

with a continuing current account deficit and appreciating financial exchange rate until equilibrium is reached at  $E^{11}$ . If however expectations are *not* realized, agents' must revise their expectations. If this revision occurs prior to  $t_1$ , the financial rate must appreciate immediately with the economy jumping vertically to  $E^{111}$  on SS in Figure 2. The capital loss that results from the appreciation reduces absorption and prices. A current account surplus results as the economy begins to accumulate reserves and the financial rate depreciates until the initial long run equilibrium,  $E$ , is restored. Dual exchange markets are thus *unsuccessful* in insulating either the current account or domestic prices from speculative disturbances.

Finally, Gros (1988) explains the effect of an expansionary monetary policy by way of an arbitrage flow model.<sup>15</sup> He argues that an increase in domestic credit will be offset in the long run by an equivalent loss in reserves. This is because domestic credit is determined by the fixed (assumed) commercial exchange rate. Thus, an increase in domestic credit will put downward pressure on the commercial rate and thus, in order to reverse this pressure, will require an equivalent loss in reserves. Furthermore, since the behaviour of prices and thus the trade account is also determined by the fixed commercial rate, the reserve loss can be caused only by arbitrage activity between the financial and official markets, which in turn has to be induced by a differential between the financial and commercial exchange rates. An important proposition of this model is that the steady-state differential is always zero. This is so since market separation is impossible in the long-run.

Thus, an increase in domestic credit will result in a depreciation of the financial rate because the required outflow of reserves can take place only if there is a large differential between the rates. After the initial discreet depreciation of the financial rate, it begins to appreciate until the differential again disappears.

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<sup>15</sup> For a brief description of this model see my discussion on "Foreign Interest Rate Shocks and Monetary Policy".

This result is different to the no-leakage models proposed by Barattieri and Ragazzi (1971), Swoboda (1974) and Cumby (1984) above. In those models, the effect of an expansionary monetary policy was to permanently depreciate the financial exchange rate. In Gros' model, an expansionary monetary policy depreciates the financial rate only temporarily.

Thus far we have only discussed monetary policy in the context of the domestic economy. However, we have neglected the use and feasibility of monetary policy as a means of insulating the domestic economy against foreign shocks viz: changes in foreign interest rates and changes in world prices. It is to these considerations that we next turn.

## 2.5 FOREIGN SHOCKS AND MONETARY POLICY

### 2.5.1 Foreign Interest Rate Shocks and Monetary Policy

Gros (1988) criticises existing models on the effects of dual exchange rates as these have *not* challenged the assumption that the authorities can succeed in separating the two markets; or what amounts to the same thing that private arbitrage activity has no important consequences. He argues further that taking private arbitrage activity into account leads to the conclusion that dual exchange rates (as well as capital controls) could succeed only *temporarily* in dampening the effects (on the domestic goods market) of shocks to financial or other markets. Thus, in the long run, private arbitrage activity stops only if the discount or premium of the financial rate disappears.

The effect of an increase in international interest rates,  $i^*$ , on the exchange rate differential and on the domestic interest rate, is now considered. The adjustment mechanism is equivalent to that of an increase in domestic credit with an unanticipated

increase in international interest rates leading to a depreciation of the financial rate. The rate depreciates in order to discourage capital outflows and to encourage inflows.<sup>16</sup> The initial differential however, disappears over time as the financial rate appreciates (at a decreasing rate) until it is once again equal to the commercial rate. The steady-state differential will be zero due to arbitrage activity and incomplete market separation.

The reserve flows induced by this differential reduce the money supply and thus raise domestic interest rates. This result thus implies that dual exchange rates cannot protect domestic financial markets from the effects of disturbances in international financial markets.

However, following a foreign interest rate shock, if the aim of the monetary authorities is to keep the domestic interest rate below that of the international interest rate, an increase in domestic credit (and hence a depreciating financial rate) could achieve this objective only if it comes as a surprise. However, the effect of this measure would only be temporary. Thus, monetary policy is only effective in the short run in insulating the domestic economy from foreign interest rate shocks.

Furthermore, if in response to an increase in foreign interest rates the authorities tried to neutralize the effects of arbitrage flows on domestic interest rates by increasing the rate of domestic credit expansion, the differential between the two exchange rates would widen, thus increasing the arbitrage flows. Any attempt by the authorities to conduct an independent money supply policy would then lead to an unstable spiral of depreciations of the financial rate and increasing arbitrage flows. A dual exchange rate regime (with a fixed commercial exchange rate) imposes, therefore, essentially the same constraints on the conduct of monetary policy as a unified exchange rate.<sup>17</sup>

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<sup>16</sup> Gros assumes a starting point where the differential is zero.

<sup>17</sup> Gros (1988) pp.456. See also Section 2.6.4 on Evasion of capital controls to see how arbitrage flows reduce the differential between the official and financial markets.

Marion (1981),<sup>18</sup> has used a portfolio-balance model in her attempt to examine the effect of a foreign interest-rate shock on the domestic economy. Her conclusions are somewhat different to those of Gros, since in this model the adjustment to a foreign interest rate shock depends on the type of foreign bond that is included in investors' respective portfolios. In the case of foreign consols, the dual exchange system insulates the domestic economy against foreign interest rate shocks. However, if foreign bonds of short term maturity are demanded by domestic residents, then the reverse is true and the two-tier market does *not* insulate the domestic economy.<sup>19</sup>

Consider the case of the inclusion of foreign consols in domestic portfolios. If the foreign interest rate rises, the expected rate of return on foreign assets increases while their value is simultaneously reduced. These effects trigger a portfolio reallocation, with the financial rate depreciating by an amount that leaves the rate of return and the domestic currency value of residents' foreign bond holdings unchanged. There is thus *no* wealth effect to act as a transmission channel for foreign financial disturbances.

In addition, since domestic residents receive a fixed foreign currency coupon payment on their foreign bond holdings, and these proceeds are repatriated at the pegged commercial exchange rate, the two-tier exchange market eliminates the interest income channel as a transmission mechanism.

Finally, since goods are traded at the fixed commercial rate of exchange, there is no way that a portfolio reallocation can alter the domestic currency price of traded goods and affect either the demand for home goods or the value of national income.<sup>20</sup>

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<sup>18</sup> This is a short-run adjustment model.

<sup>19</sup> This conclusion is consistent with that of Gros.

<sup>20</sup> Marion (1981), pp.67.

If domestic residents hold only foreign bonds of short term maturity, then the two-tier exchange market does *not* insulate the domestic economy. In this case, an increase in the foreign interest rate alters domestic rates and depreciates the financial exchange rate. The depreciation of the financial rate leads to capital gains for domestic residents due to the increased domestic value of their foreign assets. This wealth effect results in increased spending which pushes up the price of domestic goods. National income also increases as a result of the wealth effect supporting a rise in domestic interest rates.

Furthermore, the increase in the foreign interest rate also increases the value of interest-income repatriated through the pegged commercial rate resulting in increased spending, increased domestic prices and national income. In this case therefore, wealth and interest-income effects become the transmission channels. In practice, since most countries operating a two-tier system generally allow assets of various maturities to be traded at the financial rate, the two-tier market will *not* insultate the domestic economy from foreign interest rate shocks.<sup>21</sup>

## 2.5.2 Deviations from Interest Rate Parity

It is necessary to incorporate within this theoretical overview a discussion of political risk as well as the effective tax imposed by existing forms of capital controls. Up until now, interest rate differentials between countries have been assumed to depend on exchange rate changes. This idea is consistent with the interest parity conditions for both unified and dual exchange rate systems. These are presented below in Equations 4 and 5 respectively.

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<sup>21</sup> See Appendix A for a discussion of foreign interest rate shocks under both fixed and flexible unified exchange rate regimes.

**Unified Exchange Regime :**

$$i - i^* = \frac{CR - CR^e}{CR} * 100 \quad \text{Equation 4}$$

Where :

- $i$  — domestic interest rate
- $i^*$  — foreign interest rate
- $CR^e$  — expected future spot commercial rate
- $CR$  — spot commercial rate of exchange.

**Dual Exchange Regime :**

$$i - i^* \frac{FR}{CR^e} = \frac{FR - FR^e}{FR} * 100 \quad \text{Equation 5}$$

Where :

- $FR^e$  — expected future spot financial rate
- $FR$  — spot financial rate of exchange.

Dooley and Isard (1980) and Phylaktis (1988) attribute variations in interest parity to political risk as well as the effective tax imposed by capital controls. The equation used to test this assertion is given by Equation 6.<sup>23</sup>

$$i - i^* - \dot{e}t = f (\text{DIFF}_{PR} + \text{DIFF}_{CC}) \quad \text{Equation 6}$$

Where :

- $i - i^* - \dot{e}t$  — is the interest rate differential adjusted for expected exchange rate changes.

<sup>22</sup> Adapted from Lanyi (1975), Kantor and Barr (1983).

<sup>23</sup> This equation is consistent under both unified and dual exchange regimes. However, in the case of the latter, it is assumed that complete market separation is possible and that interest payments occur at the free rate.

- $DIFF_{PR}$  — the interest rate differential attributed to political risk associated with future capital controls.
- $DIFF_{CC}$  — the interest rate differential attributed to existing capital controls.
- $\dot{e}$  — the expected rate of change in the exchange rate defined as foreign currency vs. domestic currency. If a dual exchange system is adopted,  $\dot{e}_f$ , is the expected change in the financial rate of exchange.

However, if it is assumed that interest payments are made at the commercial rate of exchange, the exchange rate differential, is by definition, a measure of political risk.

Within the framework of Equation 6,  $DIFF_{PR}$  and  $DIFF_{CC}$  are defined as follows :

$$DIFF_{PR} = d_0 + d_1B + d_2WR + d_3WNR$$

While :  $DIFF_{CC} = d_4CC$

where :

- B — Stock of domestic currency claims against the domestic government (i.e. total government debt).
- WR — Wealth of domestic residents
- WNR — Wealth of non-residents
- CC — Effective tax imposed by capital controls already in place.

The interest differential due to political risk thus depends on the stock of gross claims against the domestic government and the distribution of world wealth between the domestic private sector and non-residents.

The interest differential due to capital controls was represented by zero-one dummy variables,<sup>24</sup> with the tightness of each measured through a multi-step scale. Thus, if controls were very stringent, the dummy variable would have a value of 1 (or close to 1),

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<sup>24</sup> Note that this measure of the effective tax of capital controls is rather an arbitrary measure.

while the dummy variable would have a value of zero if there were no controls.

Both Dooley and Isard (1980) and Phylaktis (1988) found that both the existing and prospective controls combined, explained about 83% of the variation in interest rates. Of this 83% , Phylaktis found that in the case of Argentina, about one third of the variation between interest rates could be attributed to political risk, while the remaining two thirds of the variation was attributed to capital controls.

In Section 4, a similar approach to that of Dooley and Isard and Phylaktis is taken to measure political and economic risk. In this case, the deviation from interest rate parity under a two-tier system is taken as this measure. The rationale for measuring risk is simply to examine the response of the financial rand discount to increased risk. If risk increases, the financial rand discount is expected to widen.

### 2.5.3 Foreign Price Shocks and Monetary Policy

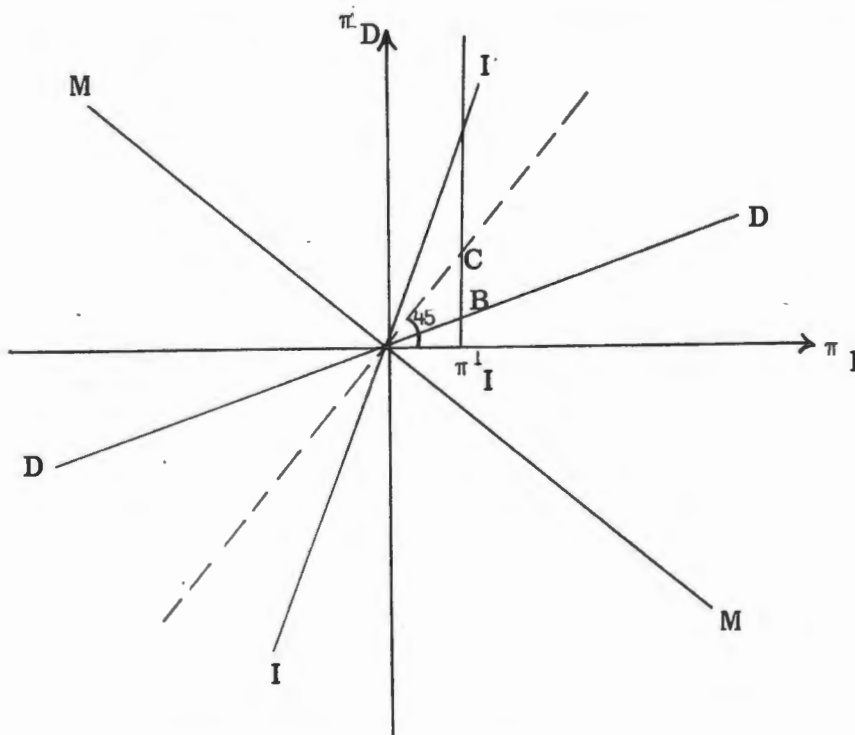
It is the purpose of the present discussion to ascertain whether or not the dual exchange rate mechanism is able to insulate the domestic economy (primarily domestic prices) from foreign price increases. Furthermore, it is necessary to establish the effectiveness of monetary policy as an instrument to assist the domestic economy in its insulation against foreign price shocks.

Marion's (1981) discussion on foreign price shocks shows that *no* exchange rate regime insulates home goods prices and national income from foreign price disturbances. In the case of both a dual – and uniform fixed–rate regime – the fixed exchange rate translates foreign price changes into new domestic currency prices for traded goods. In order to avoid the high prices of traded goods, individuals may substitute into domestic non–traded goods. The increased demand for these goods will however also increase their price.

In the case of uniform flexible-rate regimes, it is assumed that the exchange rate does not respond instantaneously to goods market disturbances. Thus, if foreign prices of traded goods increase, the effect on domestic prices will be no different to that discussed above under either dual – or unified fixed-rate regimes.<sup>25</sup>

Marion's assumption that the goods market reacts more quickly than the asset market to a foreign shock, is an unrealistic one. It is generally accepted that asset markets react more quickly than goods markets to foreign shocks. If this is the case, under a uniform flexible exchange rate regime, a foreign price rise will result in an expected appreciation of the exchange rate insulating the goods market against the shock. Furthermore, under a dual exchange rate regime with a floating official exchange rate, insulation against a foreign price rise will be through the official exchange rate.

Swoboda (1974) addresses the issue of the effectiveness of monetary policy in insulating domestic prices from imported inflation. His model is an extension of earlier work done by Mundell (1971).



Imported Inflation and Monetary Policy

FIGURE 3

SOURCE: Swoboda (1974)

<sup>25</sup> Marion's treatment is within a short time span.

Initially two assumptions are made: there are no capital movements, and real income and the terms of trade are constant. The notation used in Figure 3 is as follows :

- $\pi_D$  — rate of change of domestic goods prices  
 $\pi_I$  — rate of change of traded goods prices  
 II, DD and MM — represent those combinations of rates of change of international and domestic goods prices that maintain equilibrium in the traded goods, domestic goods and money markets respectively.

Initial equilibrium in Figure 3 is at the origin with foreign inflation equal to zero. If the foreign inflation rate now rises,  $\pi_I^1$  corresponds to this increase. In order for full equilibrium to be achieved, it is necessary for all three curves to intersect at C. This would require an increase in the money supply which the authorities may not wish to do, as their policy objective is to maintain domestic inflation as close to zero as possible. Thus, in the absence of domestic credit creation, the source of the increase in the money supply is a steady rate of reserve inflow. In order to prevent the money supply from increasing,<sup>26</sup> sterilization (open-market sales) by the monetary authorities might be adopted, with a quasi-equilibrium being established at point B. As can be seen from Figure 3, point B does not correspond to an inflation rate exactly equal to zero. The reason for this is due to the substitutability of traded — for non-traded goods. If the incidence of substitutability is high, domestic residents will increase their demand for non-traded goods thus pushing up their prices. If, on the other hand, the incidence of substitutability is low, there might only be a small increase in the demand for domestic goods and hence a small increase in domestic prices. Thus, in terms of Figure 3, an increase in substitutability implies that point B will be close to point C.

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<sup>26</sup> An increase in reserves may *not* affect money supply but may only affect levels of accommodation by the Central Bank.

If the assumption of zero capital movements is relaxed, the capital account surplus generated by higher domestic interest rates (due to lower money supply) would require greater levels of sterilization<sup>27</sup> by the authorities, to dampen money supply growth. This would be the case of a unitary fixed-rate regime. In a dual exchange rate regime, the rate of sterilization would be *less* due to the appreciation of the financial rate, stabilizing capital inflows due to the higher domestic rate of interest.

The above discussion thus concludes that monetary policy exhibits limited power in insulating the domestic economy from foreign price shocks, with the dual rate regime exhibiting more insulating capabilities than the unified (fixed) rate regime. This is due to the lower rate of sterilization required to dampen money supply growth.

## 2.6 DOMESTIC SHOCKS AND EXPECTATIONS FORMATION — DUAL RATES

The following discussion attempts to establish the effects of :

- (1) an expected/unexpected devaluation of the commercial rate.
- (2) an expected increase in government spending, and
- (3) the evasion of capital controls, on the exchange rate differential and the balance of payments.<sup>28</sup>

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<sup>27</sup> Note however that sterilization may not continue indefinitely.

<sup>28</sup> Insight is drawn from the work of Dornbusch (1986), Lizondo (1987a) and Gros (1988).

### 2.6.1 Unexpected Devaluation of the Commercial Exchange Rate

In the context of Gros' (1988) arbitrage flow model, an unexpected depreciation of the commercial rate leads to an immediate depreciation of the financial exchange rate. Whether or not the financial rate will depreciate by the same amount as the fall in the commercial rate, depends on whether the effects of the rising price level on the demand for money will be exactly offset by the increased inflows through the trade account .

If the trade account reacts strongly to a devaluation of the commercial rate, as would be expected in a country where the proportion of tradeables in GNP is very high, the financial exchange rate would overshoot its long run equilibrium. The strong reaction of the trade account to the devaluation results in reserve inflows that can only be offset through arbitrage flows. Hence the overshooting of the financial rate. Over time, however, the financial rate appreciates and returns to its long run level where the steady-state differential is zero.

This result is, in principle, no different to that obtained in the usual no-leakage models. In Lizondo's model where the exchange-rate differential is determined by wealth effects, a devaluation of the commercial rate will have no effect on the exchange-rate differential. Initially, however, the devaluation of the commercial rate would reduce the differential but the financial rate would continue to depreciate until the steady-state differential was re-established.

In his model, Lizondo assumes that nominal financial wealth of the private sector comprises domestic money and foreign money. By definition, capital transactions are carried out at the financial rate where domestic money is exchanged for foreign money.

Thus, a devaluation of the commercial rate reduces the real stock of domestic money but does not affect the real stock of foreign money. In order to maintain portfolio equilibrium, the exchange-rate differential must fall. This happens as domestic residents sell foreign money balances for domestic money balances in the financial market, decreasing the domestic price of foreign exchange i.e. the financial rate appreciates and the differential falls.

The initial fall in the differential and the real stock of domestic money results in a decrease in imports improving the balance of payments. However, this effect is only transitory as the improvement in the balance of payments will increase the real stock of domestic money resulting in an increase in the exchange rate differential until the steady-state differential is once again established.

The major difference between Gros and Lizondo's approach is the assumption concerning the steady-state differential. In the case of the former, this steady-state differential is zero while in the latter, it is positive.

## 2.6.2 Expected Devaluation of the Commercial Exchange Rate

In the case of a future anticipated devaluation of the commercial exchange rate, the financial rate must depreciate at the time the market begins to expect the future devaluation. The differential that arises as the financial rate depreciates tends to lead to a loss of reserves because of the arbitrage flows.<sup>29</sup> The loss of reserves implies that the expected rate of devaluation has to increase, and the financial exchange rate will therefore continue to depreciate increasingly until the devaluation of the commercial rate takes place.

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<sup>29</sup> See Gros (1988)

Kantor and Barr (1983) have expressed the above relationship in more concrete terms. Using the interest-parity condition (excluding capital gains)<sup>30</sup> the financial rate of exchange can be expressed as a function of domestic and foreign interest rates as well as the expected commercial rate (Equation 8).

Interest-Parity Condition for dual markets :

$$i^* = i \frac{CR^e(1-T)}{FR} \quad \text{Equation 7}$$

$$\frac{i^*}{i} = \frac{CR^e(1-T)}{FR} \quad \text{Equation 8}$$

$$\frac{i^*}{i} \cdot CR^e(1-T) = FR$$

Now, since the financial rate discount is given as :

$$FR \text{ disc} = \frac{CR - FR}{CR} \cdot 100 \quad \text{Equation 9}$$

by substituting equation 8 and 9 we get :

$$FR \text{ disc} = \frac{CR - \frac{i^*}{i} CR^e(1-T)}{CR} \cdot 100 \quad \text{Equation 10}$$

Where:

- $i^*$  — required world rate of return.
- $i$  — home rate of return.
- $CR^e$  — expected exchange value of the commercial rate over the times at which interest or dividend payments are received.
- $T$  — non-residents tax.
- $FR$  — Spot financial rate of exchange (foreign currency/domestic currency).
- $CR$  — Spot commercial rate of exchange.

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<sup>30</sup> Assume a very short time horizon.

From Equation 10, for any given commercial exchange rate (CR), non-resident tax (T), home rate of return (i), and world rate of return ( $i^*$ ), the financial rate discount (FR disc) would narrow if the expected commercial rate ( $CR^e$ ) were to rise, and widen if  $CR^e$  were to fall.<sup>31</sup>

To sum up, a future anticipated devaluation of the commercial exchange rate will result in a depreciation of the financial rate at the time the market begins to expect the future devaluation. The financial rate continues to depreciate until the devaluation of the commercial rate takes place. In the case of a future anticipated revaluation, the reverse holds.

### 2.6.3 Expected Increase in Government Spending

Dornbusch (1986) examines the expected increase in government spending, brought about by an increase in inflation tax revenue, via an increase in the *rate* of depreciation of the commercial exchange rate. He makes use of a portfolio-balance model in which only two assets: domestic money and foreign nominal interest-earning assets, constitute the asset market. Also, the exchange rate is defined as the domestic currency price relative to the foreign currency price. The diagrams below help to explain the adjustment process :

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<sup>31</sup> Kantor and Barr (1983), pp.17.



commercial rate is implemented officially. In Figure 4(b) this effect is seen by the jump in the commercial exchange rate at  $T^1(B)$ . In Figure 4(a), the adjustment is along  $JJ^1$  until equilibrium is achieved at  $E^1$ , with some adjustment in the premium (i.e. appreciation of the financial rate). Returning to Figure 4(b) it can be seen that the rate of depreciation of the financial rate decreases after the official implementation of the increased rate of depreciation of the commercial rate (point B). Over the range  $T^1(B)$  to  $T^1(E^1)$ , the rate of depreciation of the commercial rate exceeds that of the financial rate. However, the overall effect of these rates of depreciation on the premium, is gauged by areas C and D. As area C is greater than area D, this implies that there must be an overall increase in the premium. This result is depicted in Figure 4(a) as the difference between  $\bar{q}$  and  $\hat{q}^1$ .

The increase in the premium results in a positive wealth effect due to the increased domestic currency price of foreign asset holdings. This wealth effect leads to dissaving and hence a trade account deficit. Furthermore, this deficit is aggravated by the decline in real money balances. This exercise is of interest because it suggests that any disturbance that leads to an increased trade deficit will provoke an increase in the premium (i.e. increase the differential).

Lizondo's (1987a) discussion of increased public expenditures generates results consistent with those of Dornbusch above, although his model differs somewhat to that of Dornbusch. In his model Lizondo assumes all goods are traded goods. Thus, an increase of  $\Delta g$  in public sector expenditure only means  $\Delta g$  of additional imports through the official market. This has the effect of worsening the balance of payments. If however, this model is modified to account for non-traded goods, the increase in public expenditure will increase the steady-state real stock of money which will (a) increase the differential between exchange rates so as to maintain portfolio equilibrium and (b) increase the

inflation tax, thus improving the balance of payments indirectly. This improvement will offset part of the deficit. Thus, an increase of  $\Delta g$  in public sector expenditure that falls at least partially in non-traded goods increases the steady state differential and worsens the balance of payments by less than  $\Delta g$ .<sup>32</sup>

#### 2.6.4 Evasion of Capital Controls<sup>33</sup>

Due to incomplete market separation, it has become more difficult for the monetary authorities to insulate the official rate from speculative disturbances. As seen earlier, a neutral intervention policy does allow the authorities a certain degree of control in defending the official exchange rate against heavy, speculative movements. However, in the case of outright evasion, the neutral intervention policy may not entirely offset the effect on the financial exchange rate of shifts of transactions between the two markets. The reason for this is that evasion may establish an implicit financial exchange rate which changes the net demand for foreign exchange on the financial market at the prevailing market rate. It is argued that evasion of capital controls tends to unify the two exchange rates. Whether the financial and official rates will merge completely depends however on the cost of the evasion. These costs include the official penalties (adjusted for the risk of being caught) and administrative costs for the evader. This cost of evasion, however, will not ensure that the rates in the two markets are kept apart, although it remains a factor tending to keep them apart.

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<sup>32</sup> Balance of payments is defined as: the public sector surplus or deficit plus inflation tax.

<sup>33</sup> The discussion of evasion draws on the work of Fleming (1971), Lanyi (1975), Gros (1988).

Gros (1988) argues that the differential between the two rates of exchange would tend to disappear over time. If private arbitrage activity is accounted for, dual exchange rates can succeed only temporarily in dampening the effects on the domestic goods market of shocks to financial or other markets. Gros does however concede that a small positive exchange rate differential might be compatible with *no* arbitrage flows due to equivalent marginal costs of arbitrage flows.<sup>34</sup>

The mechanism for evasion may be described as follows: If a differential between the financial and official rates exists, individuals have an incentive to send funds out of the domestic country at the higher rate and bring these same funds back at the lower rate, hence realizing a profit in domestic currency. This round-tripping has the effect of unifying the rates. If the financial exchange rate was quoted at a discount to the official rate, the outflow of reserves at the higher official rate would put downward pressure on the rate, while the increased inflow of capital at the financial rate would tend to appreciate this rate. However, there may be limited incentives for round-tripping in the sense that individuals would rather not bring back capital at the financial rate, but rather purchase assets abroad. There would thus be downward pressure on the official rate while there would be no upward pressure on the financial rate. If it is the monetary authorities intention to maintain a pegged official rate, there would be *no* effect on the differential between rates.

It would not be possible, however, to maintain this pegged rate indefinitely, as the authorities would soon run out of international reserves. If a neutral intervention policy was pursued in an attempt to maintain the level of international reserves, successive depreciations in the financial rate would be necessary to effect an inflow of foreign exchange. This would increase the differential between rates increasing the incentive for evasion, as well as giving rise to the "reverse transfer problem" discussed above.

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<sup>34</sup> A similar result is obtained by Lanyi (1975).

If we assume that the financial rate is at a *premium* to the official rate, non-residents will be induced to seek ways of bringing money into the home country at the official rate, while residents will have an incentive to make import payments at the financial rate. Residents thus have an incentive to under-invoice imports, the difference being made up by a separate transaction through the financial exchange market. This transaction can take the form of the importer purchasing a foreign asset, reselling it abroad, and using the proceeds to pay the foreign exporter.

The effect of under-invoicing imports is to reduce the price of imports and increase domestic demand for imports in the home country. This increased demand will decrease the trade surplus or increase the trade deficit. If the monetary authorities intervene in the financial exchange market by purchasing foreign exchange to restore BOP's equilibrium, the financial rate will depreciate (i.e. premium decreases) tending to unify the rates.<sup>35</sup>

If, on the other hand, the financial rate is at a *discount*, residents have an incentive to under-invoice exports. Thus, if the official and financial rates are quoted at 50 USc/1 Rand and 25 USc/1 Rand respectively, total exports of R2000 should generate \$1000 at the official rate. However, exporters will invoice exports of R1000 only, generating \$500 at the official rate. The difference enters the home country as a capital investment at the financial rate. Therefore, \$500 enters the home country converted at the financial rate to R2000. The net gain to the exporter is thus R1000.

This under-invoicing of exports will put downward pressure on the price, increasing the foreign demand for exports. The net effect on this would be to generate a surplus on the trade account. Through intervention in the financial exchange market, the authorities would sell foreign exchange in the financial market appreciating the financial rate.

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<sup>35</sup> See Lanyi, Appendix II.

Illegal arbitrage between the two markets is another type of evasion. For example a multi-national corporation sends funds out of the country at the financial rate (quoted at a premium), and brings these funds back at the official rate under the guise of additional royalty payments. Assuming that the multi-national corporation sends \$600,00 (R1000) out at the financial rate and then brings these same funds back at the official rate (R1200), the net gain in domestic currency is R200. In this case \$600 left at the financial rate and \$600 entered at the official rate. If the monetary authorities resell the \$600 that entered at the official rate, in the financial market, the net change in foreign exchange is zero. Therefore, the financial rate is unchanged. The only effect on the financial rate will be in the very short term.

## 2.7 SYSTEM SWITCHING – FROM TWO-TIER TO UNIFICATION

The following discussion examines the effect of switching from a dual exchange system to a flexible or crawling peg system. Lizondo (1987b) argues that the balance of payments relief offered by the adoption of dual systems has frequently been only transitory. Countries that failed to curb excessively expansionary policies were again confronted with balance of payments deficits in the official market and in large depreciations of the domestic currency in the free market. The question of whether the adoption of a unified flexible rate regime results in a sharp depreciation of the official rate or whether the adoption of a pegged rate regime results in large balance of payments deficits, is addressed.

Lizondo's portfolio—balance model includes commercial transactions in both the official and free markets i.e. certain essential exports and imports are conducted at the official rate while all remaining exports and imports are conducted at the free rate. Assumptions of the model include:

- (a) All goods are traded goods and total output is constant.
- (b) No domestic expenditure on domestically produced goods occur i.e. Total output is exported while total consumption is imported.
- (c) The private sector allocates its wealth between domestic and foreign money.

The balance of payments is defined as the difference in inflation tax,  $\pi m$  (where  $\pi$  is the rate of depreciation of the official exchange rate, and  $m$  is the real stock of money), and the public sector deficit in real terms,  $\mu m$  (where  $\mu$  is the rate of credit creation). Thus, if  $\mu > \pi$  i.e. the rate of growth in credit expansion exceeds that of the rate of depreciation of the official exchange rate, the balance of payments moves into deficit and cannot be sustained indefinitely. Furthermore, under a dual exchange system, the rate of inflation is determined by the rate of depreciation of the official exchange rate, with any excess in domestic credit creation being reflected in a balance of payments deficit rather than in additional inflation. Under a floating system on the other hand, the full amount of domestic credit creation is reflected in the rate of inflation because the central bank no longer offsets part of the additional domestic credit by selling foreign exchange.<sup>36</sup>

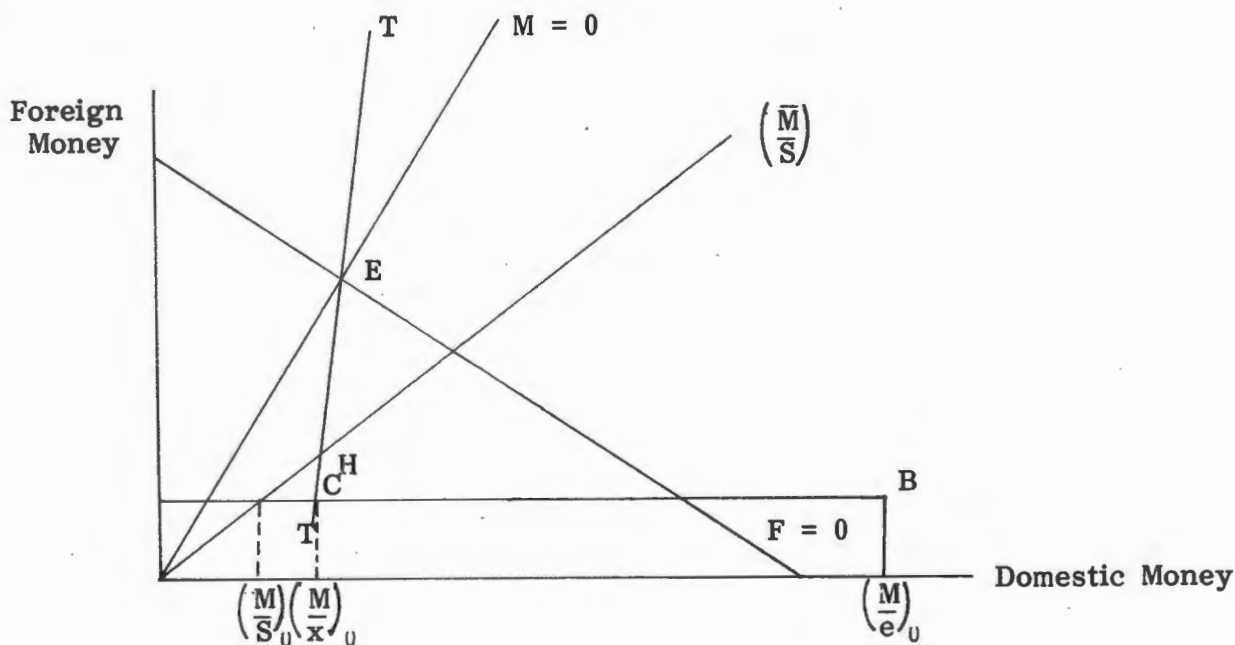
We now consider the case of a country under the dual system that has a balance of payments deficit ( $\mu > \pi$ ) and a free exchange rate that is quoted at a discount to the official rate (i.e. the differential exceeds 1 as the exchange rate is defined as domestic currency vs. foreign currency).

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<sup>36</sup> In the case of a crawling peg system, the rate of inflation is also determined by the rate of domestic credit creation,  $\mu$ . Now, since  $\mu > \pi$ , the rate of inflation is greater under unified rates than under a dual system.

### 2.7.1 Unification – The case of the flexible exchange rate system

The diagram below presents the unification of exchange markets under a floating exchange rate system. Assuming an initial stationary equilibrium under a dual system at point B, the adoption of a flexible rate regime determines the point of equilibrium, at the time of unification, at point C, with a real stock of domestic money equal to  $(M/x)_0$ . From point C, the economy adjusts along TT toward steady-state equilibrium, E. Since  $(M/s)_0 < (M/x)_0 < (M/e)_0$  this implies that  $e < x < s$  i.e. the floating exchange rate depreciates with respect to the official exchange rate but appreciates with respect to the free exchange rate.



Unification-Flexible Exchange System

FIGURE 5

SOURCE: Lizondo (1987b)

Where:

- B — stationary equilibrium under a dual system
- TT — the stock of foreign money is pre-determined under a floating system along the TT-schedule.
- $\dot{F} = 0$  — combinations of  $F$  and  $m$  that are consistent with equilibrium in the current account.
- $\dot{m} = 0$  — indicates the combinations of  $m$  and  $F$  that imply a rate of depreciation of the unified rate,  $x$ , equal to the rate of growth of the nominal stock of domestic money,  $\mu$ .
- $(M/s)$  — corresponds to the real stock of money when,  $\mu > \pi$ .
- $(M/e)_0$ ,  
 $(M/s)_0$  — where  $e$  and  $s$  are the official and financial exchange rates respectively.
- $(M/x)_0$  — real stock of domestic money under a flexible system where  $x$  is the flexible exchange rate.

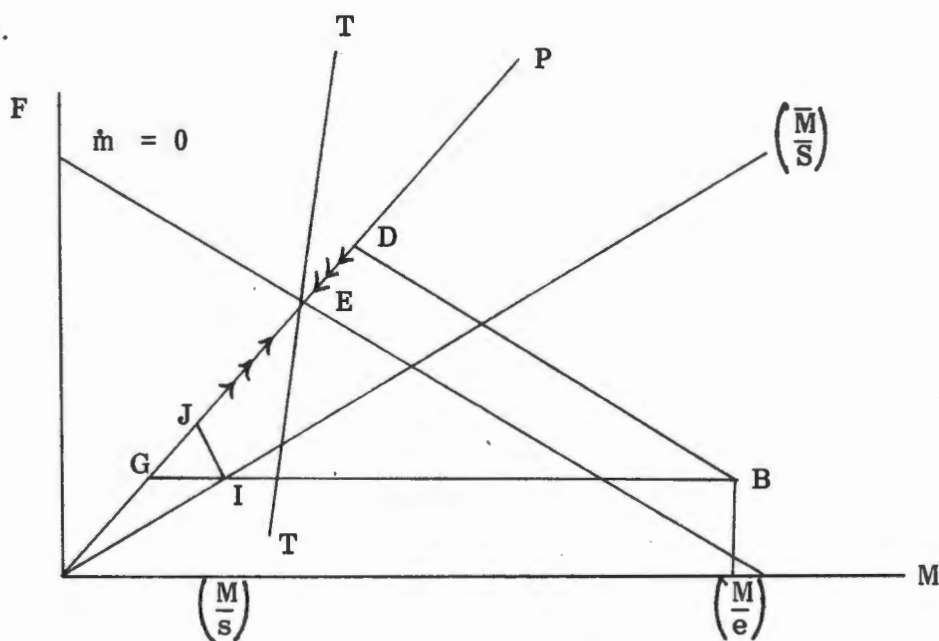
The initial depreciation of  $x$  with respect to  $e$ , is equal to the ratio of the real stock of domestic money under the dual system,  $m = (M/e)_0$ , over the real stock of domestic money under the floating system at the time of unification,  $(M/x)_0$ . Thus, the magnitude of the depreciation of the floating exchange rate will be greater, the greater is the share of imports in the free market; the lower is the share of exports in the free market; the lower is the rate of depreciation of the official rate; and the higher is the rate of domestic credit creation. In terms of the portfolio-balance rule, these factors imply a higher real stock of domestic money under the dual system.

From the diagram above, an increase in imports; a decline in exports; or a decline in the rate of depreciation of the official rate ( $\pi$ ), shifts point B downwards and to the right. A

decline in  $\pi$  in addition rotates  $(M/s)$  clockwise, while an increase in the rate of credit creation,  $\mu$ , shifts  $B$  horizontally to the right, and rotates the  $\dot{m} = 0$  curve counter-clockwise, thus shifting  $TT$  to the left. The higher real stock of domestic money under the dual system implies a *lower* real stock of domestic money under a flexible rate regime at the time of unification. A similar type of argument can be applied for the initial appreciation of the floating rate with respect to the free rate of the dual system.<sup>37</sup>

### 2.7.2 Unification – The case of the crawling peg system

The diagram below is used to explain the dynamics of a unified crawling peg system. In order for the crawling peg system to be sustainable in the long run, the rate of crawl ( $\delta$ ) should be higher than, or equal to, the rate of domestic credit creation ( $\mu$ ). If balance of payments equilibrium is the long run objective under a crawling peg system, it is assumed that  $\delta = \mu$ .



Unification – Crawling Peg System

FIGURE 6

SOURCE: Lizondo (1987b)

<sup>37</sup> Please note that the floating rate may depreciate with respect to the free rate at the time of unification.

Where:

- P — Combinations of  $F$  and  $m$  consistent with portfolio equilibrium under a crawling-peg system.
- ( $M/s$ ) — portfolio equilibrium under a dual system.
- $\dot{m} = 0$  — combinations of  $F$  and  $m$  consistent with a constant real stock of domestic money ( $\delta = \mu$ ).

It is assumed, firstly, that at the time of unification *no maxi-devaluation* of the exchange rate occurs. Thus, the pegged rate,  $c$ , is equal to the official rate ( $e$ ) under the dual system. Once the markets are unified, the economy is out of portfolio equilibrium at point  $B$ , requiring a private sector shift out of domestic money and into foreign money. This portfolio shift results in a move from  $B$  to  $D$ . The increase in private sector holdings of foreign money is matched by a decline in the international reserves of the central bank. Thus the effect is a deficit in the balance of payments due to the capital outflow.<sup>38</sup> The steady-state equilibrium is achieved by the movement from  $D$  to  $E$  along  $P$ . During the adjustment the balance of payments is in deficit, resulting from a current account deficit that is only partially offset by the capital account surplus. At  $E$ , the balance of payments is in equilibrium.

It is now assumed that a *maxi-devaluation* of the pegged rate occurs at the time of unification. Starting from point  $B$ , a *maxi-devaluation* moves the economy to point  $G$  where the initial capital outflows will be eliminated. This *maxi-devaluation* has the effect of reducing the real stock of domestic money as well as initial real wealth. This fall in real wealth then implies a lower deficit (or higher surplus) than otherwise in the current account during the process of adjustment towards the steady state.

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<sup>38</sup> The magnitude of the outflow depends on the initial holdings of domestic money and foreign money as well as the rate of depreciation when switching to the unified system.

In order to completely eliminate the initial capital outflow, the magnitude of the maxi-devaluation is shown to exceed the differential between the free and official rates of the dual system (see Figure 6). If the pegged rate was initially set equal to the free rate (point I), there would be a further move from point I to J due to the reallocation of the private sector portfolio.<sup>39</sup> There would be a capital outflow resulting from the higher than desired ratio of foreign to domestic money. Furthermore, any devaluation beyond point G would result in a capital inflow, adjustment once again occurring along the P-schedule.

The effect of the devaluation on the domestic economy is an inflationary one, as the unified rate depreciates inflation is imported. If consumers substitute towards domestic goods this will put upward pressure on those prices facilitating the inflationary trend.

In summing up, it has been shown that if a two-tier system is replaced by a flexible exchange rate system, the unified exchange rate depreciates to a level either above or below the free rate of exchange. The magnitude of this depreciation depends on the share of imports and exports in the free market as well as the rate of depreciation of the official exchange rate and rate of domestic credit creation.

In the second case of the adoption of a crawling peg system, it has been shown that the unified exchange rate tends to depreciate to a level below the free rate. This is necessary in order to prevent a capital outflow due to a reallocation of the private sector portfolio.

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<sup>39</sup> The desired ratio of foreign money to domestic money is *higher* under a crawling-peg system (given by P) than under a dual system (given by  $(M/s)$ ), due to the higher rate of depreciation under the crawling-peg system ( $\delta > \pi$ ).

## 2.8 SUMMARY

The literature on dual market systems assumes implicitly that complete market separation and a neutral intervention policy are essential for the effective implementation of a two-tier system. However, since complete market separation does not occur in reality, the dual market system becomes less effective in protecting the official reserves against speculative disturbances.

The rationale behind the neutral intervention policy is that it ensures overall balance of payments equilibrium and a stable official rate of exchange. Such a policy will only be adopted if the objective of the monetary authorities is to maintain a fixed official rate of exchange. A neutral intervention policy is however not pursued in practice, making it difficult for the monetary authorities to peg the official rate due to the resultant changes in official reserves.

On the effectiveness of monetary policy under a dual market system, the literature appears divided. Barattieri and Ragazzi argue that monetary policy is effective in sustaining a given level of income in both the short and long run. However, Gros argues that in fact an expansionary monetary policy will only maintain a certain level of income in the short run.

There is consensus however on the ability of monetary policy to effect the domestic price level in the short run. A further implication of dual market systems is that the monetary authorities have greater independence from external constraints than they would normally enjoy under a unified exchange regime.

Allied to this is the insulation capabilities of dual exchange rate systems against foreign shocks viz: interest rate shocks and foreign price shocks.

Marion argues that if investors hold foreign consols within their portfolios, a foreign interest rate shock will have *no* effect on the domestic economy. However, in the case of foreign bonds of short term maturity, the two-tier system is unable to insulate the domestic economy. Gros however argues that insulation is possible although it would only be temporary. Furthermore, if an expansionary monetary policy is used to maintain domestic interest rates below foreign interest rates, the two-tier system will dampen the effects of the shock only temporarily.

The issue of political risk and deviations from interest rate parity is incorporated into the framework of foreign shocks. Phylaktis found that for Argentina about one third of the variation between interest rates could be attributed to political risk.

In the case of foreign price shocks on the domestic economy (especially domestic prices), Marion argues that the two-tier system, in the absence of monetary policy, is unable to insulate domestic prices against the foreign shock. However, in the presence of monetary intervention, the two-tier system is seen to allow a certain degree of insulation against imported inflation, although its power to do so is limited.

The effect of domestic shocks on the exchange rate differential and balance of payments is also discussed. In the case of an unexpected devaluation of the commercial rate, the steady-state differential as well as the balance of payments is *unaffected*. If the devaluation is expected, however, the financial rate discount widens. An expected increase in government spending is seen to increase the differential between rates (financial rate depreciates) and worsen the trade account. Finally, the evasion of capital controls and its impact on the exchange rate differential is considered. It is argued that these shocks tend to unify the official and financial rates of exchange, as well as affect the balance of payments.

Finally, the magnitude of depreciations due to the replacement of the dual system by a unified floating — or crawling peg system — is considered. The implications of this depreciation on the domestic price level is also briefly dealt with.

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## SECTION 3

### 3.1 THE FINANCIAL RAND MECHANISM IN SOUTH AFRICA

The South African financial rand market differs in many respects to those markets discussed above in Section 2. The most fundamental difference is that those models assume perfect capital mobility, an assumption clearly at odds with the South African scenario. The financial rand market is characterized by stringent exchange controls, on flows in and out of the market, on residents and to a lesser extent on non-residents.

There is thus an asymmetry in the financial rand market with non-residents investing domestically at the financial rate while residents are unable to invest abroad at the financial rate. The obvious exceptions involve emigrants who are allowed to transfer a specified amount of capital abroad at the financial rate.

Furthermore, in South Africa, certain capital account transactions are not affected at the financial rand rate. Loans and trade credits while capital account transactions, are affected at the commercial rand rate of exchange.

Exchange controls on residents thus make the South African dual exchange market different to those discussed in the literature. The section below provides a brief historical overview to their emergence.

#### 3.1.1 Historical Overview

In June 1961 after the Sharpeville uprising, South Africa introduced the "blocked rand" mechanism. This measure restricted the repatriation of funds previously invested in South

Africa by foreigners. Thus the sale of local securities on the Johannesburg Stock Exchange (JSE) resulted in funds being deposited at commercial banks in "blocked rand" accounts, repatriation of which was allowed only under certain circumstances. It was not possible, for example, to convert "blocked rand" balances directly to foreign currency nor to transfer "blocked rand" from one non-resident account to another.

The "gilt-wash" was however employed to allow foreigners to transfer "blocked rand" from one account to another and hence repatriate funds abroad. The mechanism is described as follows: "blocked rand" in one account could be used to purchase local securities. The subsequent sale of these securities to another non-resident for another currency, say dollars, was permitted. This non-resident could then purchase local securities resulting from the creation of a new "blocked rand" account. The resulting "blocked rand" rate nearly always stood at a discount to the commercial rate. This meant that foreign investors, in repatriating funds from South Africa through the share market (buy shares in South Africa and sell them in London or New York), were consistently obliged to accept a loss equivalent to the differential between the two rates.

In February 1976, new exchange control regulations came into effect distinguishing between "blocked rand" and "securities rand". The local sale and redemption proceeds of South African securities and other investments in South Africa, owned by non-residents, were designated "securities rand" balances in commercial banks. Transfer of "securities rand" balances between non-residents could occur freely. This deemed the "gilt-wash" as no longer necessary. The funds of emigrants on the other hand, which were blocked in South Africa, continued to be referred to as "blocked rand".

In January 1979, the securities rand market was renamed the financial rand market, its scope being broadened to incorporate the purchase of a proprietor's interest in a business in

South Africa subject to Reserve Bank approval. In 1983 the dual exchange rate system was abolished but re-introduced in September 1985 in the wake of the debt crisis.

### 3.1.2 The Parallel Markets in Financial Rands

#### 3.1.2.1 The Securities Market

The financial rand market incorporates a "pool" of investment currency which is traded in by foreign investors. Financial rands may thus be "created" or "destroyed" in this market. If a non-resident buys shares in London or New York and sells them on the JSE to a South African, he receives financial rands which are then said to be "created".<sup>40</sup> Alternatively, the simultaneous purchase of shares in South Africa and sale in London "destroys" financial rands. The effect of these actions on the financial rate of exchange can be shown by considering the following expression where the financial rate is defined purely as a result of the differential between share prices in Johannesburg and the prices of the same shares quoted in London or New York :

$$FR = \frac{\$ - \text{price of S.A. securities in London/New York}}{R - \text{price of S.A. securities in South Africa}} \quad 41$$

Thus, if a foreign investor purchases S.A. shares in London and sells these same S.A. shares in South Africa, the financial rate will rise (appreciate). This occurs due to the upward pressure on share prices in London and the downward pressure on share prices on the JSE.

Alternatively, the purchase of S.A. shares in London and sale in South Africa may be viewed as an increase in the demand for financial rands, the effect of this increased demand

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<sup>40</sup> The same applies if he sells property, unlisted shares or fixed interest securities in South Africa.

<sup>41</sup> FR = financial rate quoted in US dollars.

(which leads to the creation of financial rands) being reflected as an increase in the financial rate. On the other hand, the simultaneous purchase of shares on the JSE and sale of S.A. shares in London, depreciates the financial rate.

Since foreign investors buy shares at the financial rate and receive dividends at the commercial rate, the dividend yield received by foreigners increases by the premium of the commercial – over the financial rate. Thus, assuming a financial rate of 25 USc and a commercial rate of 50 USc, it can be shown that the dividend yield to foreigners is double the yield to local investors.

If a foreign investor invests \$25 000 in S.A. shares with a yield of 5%, the all-in yield is :

\$25 000 invested via the FR	= R100 000
Yield @ 5%	= R 5 000
Less 15% non-residents tax	= R 4 250
Converted @ commercial rate	= \$ 2 125
All-in-yield = \$2125/\$25 000	= 8.5%

Notice however that in the absence of non-resident's tax, the all-in yield is 10% (double the 5% received by local investors).

### 3.1.2.2 The Cash Market

A parallel market in financial rands has developed steadily since September 1985. This cash market involves the actual purchase or sale of financial rands by foreigners and is made up by a few local banks, with The Standard Bank of South Africa Limited, French Bank of Southern Africa Limited and UAL Merchant Bank Limited among the most active. The important difference between this market and the one discussed above (securities

market), is that financial rands are not "created" or "destroyed" through the securities market. Rather, financial rands may be "created" or "destroyed" through the cash market as a result of, say, disinvestment by multi-national companies (MNC) with South African subsidiaries. The sale of Barclays plc of its South African interests resulted in the creation of financial rand balances, these funds being converted into foreign exchange through the cash market and not via the purchase of shares in Johannesburg and sale in London. The selling of financial rand balances in the cash market has the effect of depreciating the financial rate (due to the increase in supply) a result no different to that had the MNC purchased shares in Johannesburg and sold these same shares in London.

As a result of the emergence of the cash market in financial rands, the financial rand system has come to resemble more closely an actual exchange rate.

### 3.1.3 Arbitrage and Position Taking

Arbitrage ensures that the financial rand rate quoted in the cash market equals the ratio of the \$-price of S.A. shares in London to the rand price on the JSE.

Assume initially that the arbitrageur is able to buy financial rands at \$0.30 in the cash market. If the ruling price of De Beers is R60 on the JSE and \$15 in London, the arbitrageur may obtain his financial rands at  $\$15/R60 = \$0.2500$ .

Since it is cheaper to buy financial rands in the securities market, our arbitrageur will buy De Beers at \$15 in London and sell De Beers at R60 on the JSE. The proceeds, from the sale of De Beers on the JSE, is designated financial rands. The arbitrageur now stands to make a profit by selling these financial rands in the cash market receiving more dollars than he initially paid out.

The effect of this arbitrage activity is to put upward pressure on the financial rate in the securities market while putting downward pressure on the financial rate in the cash market. Arbitrage will continue until the two rates are equalized.

The upward pressure on the financial rate in the securities market comes about due to the fall in the price of De Beers on the JSE (arbitrageurs *sell* De Beers) and the rise in the \$-price of De Beers in London (arbitrageurs *buy* De Beers).

Similarly, the increased supply of financial rands to the cash market (arbitrageurs sell financial rands) puts downward pressure on its price.

In practice, arbitrage is limited by a 0.5 US cent spread between buying and selling quotes for financial rands. The ratio between Johannesburg and London prices of any particular share generally lie within the buying and selling range. If a share lies outside of this range, arbitrage becomes worthwhile.

### 3.1.4 Foreign vs. Local Sentiment

Foreign and local investors tend to have different perceptions of the political risk in South Africa primarily as a result of different information available to each separate group. An unrest related incident reported in the foreign media may cause foreigners to react negatively while local investors may not react at all since they are accustomed to reading about unrest related incidents in the local press.

In the absence of the financial rand mechanism, the domestic stock market would be more volatile due to this asymmetry in perceptions. For this reason, the incorporation of the financial rand mechanism cushions the domestic stock market from negative foreign perceptions.

Consider what effect an unrest related incident reported in the foreign media may have on the domestic stock market.

Foreign investors may attempt to disinvest through the securities market by buying S.A. shares in Johannesburg and simultaneously selling S.A. shares in London. The effect of this is to push up share prices on the JSE while share prices in London fall resulting in a depreciation in the financial rand. Thus, if foreigners disinvest from South Africa, local share prices generally tend to rise.

If on the other hand foreigners attempt to disinvest directly through the cash market, there would be an excess supply of financial rands pushing down the financial rate.

Arbitrageurs would take advantage of this lower rate by buying shares in Johannesburg simultaneously selling shares in London. The effect of this is to put upward pressure on domestic share prices.

In either case, if disinvestment occurs via the securities market or the cash market, the financial rand discount widens and domestic share prices tend to rise.

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## SECTION 4

### 4.1 INSULATION PROPERTIES OF THE DUAL EXCHANGE MECHANISM

#### 4.1.1 Foreign Interest Rate Shocks

In the discussion of Section 2, Marion (1981) argued that the two-tier exchange system was *unable* to insulate the domestic economy against foreign interest rate shocks. An important assumption of this model is that domestic investors hold foreign bonds of short term maturity in their portfolios. In the South African context however, exchange controls prohibit the inclusion of foreign assets in domestic portfolios.

While Marion's results differ somewhat from those of Gros, it is important to realize that the temporary insulation effect Gros refers to is in large part a function of the premise that the steady state differential between the official and financial markets is zero. In South Africa, the steady state differential has *not* been zero. The inference drawn from this is that what Gros refers to as temporary insulation may well be long term insulation in South Africa.

The purpose of the present discussion is to establish whether or not the dual market system in South Africa has insulation properties.

##### 4.1.1.1 Methodology

Since 1980, the South African exchange market has been characterized by three distinct phases viz :

- Phase I :** 1980 to January 1983 – is characterized by the existence of a dual exchange rate system.
- Phase II :** February 1983 to August 1985 – saw the abolition of the two-tier system, this being replaced by a unified rate of exchange and a managed float.
- Phase III :** September 1985 to the present – witnessed the re-introduction of the dual exchange rate mechanism.

Two versions of the interest-parity condition were tested over these three distinct periods. The first of these is the interest-parity condition for a dual exchange regime<sup>42</sup> while the second is the interest-parity expression for a unified exchange regime.<sup>43</sup> Each is presented below :

Dual Exchange Regime :

$$i - i^* \frac{FR}{CR^e} = \frac{FR - FR^e}{FR} \cdot 100 \quad \text{Equation 11}$$

By definition of interest-parity, the difference between the domestic and effective foreign interest rates is equal to the expected depreciation or appreciation of the financial rand.

Since no market in forward financial rands exists, we cannot test equation 11 in quite the same way. Following Levich (1985) the regression equation below, derived from the interest-parity condition was tested.

$$i = \alpha + \beta_1 i^* + \beta_2 \frac{FR}{CR^e} \quad \text{Equation 11(a)}$$

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<sup>42</sup> See Equation 5, Section 2.

<sup>43</sup> See Equation 4, Section 2.

**Hypothesis 1 :**

The null hypothesis to be tested is

$$H_0: \beta_1 = 0 .$$

From Equation 11(a), if  $\beta_1 = 0$  , this indicates that domestic interest rates are insulated against foreign interest rate shocks.

The second expression tested is :

Unified Exchange Regime :

$$i - i^* = \frac{CR - CR^e}{CR} \cdot 100 \quad \text{Equation 12}$$

Clearly, if domestic interest rates stand at a premium to foreign interest rates, the forward commercial rate of exchange is expected to depreciate.

The validity of Equation 12 was tested in the form of the following regression equation.<sup>44</sup>

$$i = \alpha + \beta_1 i^* + \beta_2 \frac{CR - CR^e}{CR} . \quad \text{Equation 12(a)}$$

Theory would expect the value of the coefficient of foreign interest rates,  $\beta_1$  , to be very close to 1 . That is, holding the expected change in the commercial rate constant, an increase in foreign interest rates would be expected to lead to a proportionate increase in domestic interest rates.

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<sup>44</sup>  $CR^e = CR \times (((tfus - tfsa)/400) + 1)$

Where:  $tfus$  - 90 day US Trade finance rate  
 $tfsa$  - 90 day SA trade finance rate

**Hypothesis 2 :**

The above discussion on unified exchange rates necessitates the testing of the following null hypothesis :

$$H_0: \beta_1 = 1 .$$

**4.1.1.2 Findings**

The results from the two respective interest–parity regressions (Equations 11(a) and 12(a)) are presented in Tables 1 to 3 on pages 63 to 64.

**4.1.1.2.1 Interest–Parity Under a Dual Exchange Regime :**

Considering firstly period 1 (January 1980 to January 1983) it was found that the coefficient for foreign interest rates approximated zero. The students t–test was used to establish at what level of significance the null hypothesis could be accepted (see Table 1).

Since  $t^*$  falls within the acceptance region, we accept at a 95% level of significance the null hypothesis (hypothesis 1) that  $\beta_1 = 0$  . This result supports the hypothesis that the dual exchange rate mechanism does exhibit insulation properties against foreign interest rate shocks.

Similarly, from Table 3, the same result can be found for period III (September 1985 to December 1988) when the financial rand was re–introduced.

However, in this later period, the coefficient of the foreign interest rate was significantly different to that found in period I (0.2847954 vs. 0.0503974). In order to establish whether or not this discrepancy could be attributed to statistical error or differences in the estimated functions themselves, the chow test was performed.

PERIOD I : 1980.01 - 1983.01

EQUATION :  $i = \alpha + \beta_1 i^* + \beta_2 \frac{FR}{CR} e$

$i, i^*$	$\alpha$	$\beta_1$	$\beta_2$	CONFIDENCE INTERVAL	$R^2$	ACCEPT/REJECT Ho: $\beta_1 = 0$	DURBIN - WATSON
tfsa, tfus	7.2599985 (1.1551690)	0.0503974 (0.6183124)	9.4828456 (1.7537776)	95%	0.966676	Accept $\beta_1 = 0$	1.083836
BASA90, USBA90	6.3749736 (1.02649)	0.0990370 (1.2104093)	10.764547 (2.2247839)	95%	0.972949	Accept $\beta_1 = 0$	1.204754

INSULATION PROPERTIES OF TWO-TIER EXCHANGE SYSTEMS :

TABLE 1

PERIOD II : 1983.01 - 1985.08

EQUATION :  $i = \alpha + \beta_1 i^* + \beta_2 \frac{CR - CR^e}{CR}$

$i, i^*$	$\alpha$	$\beta_1$	$\beta_2$	CONFIDENCE INTERVAL	$R^2$	ACCEPT/REJECT Ho: $\beta_1 = 1$	DURBIN - WATSON
tfsa, tfus	2.2213668 (0.895633)	0.8889481 (-0.846031)	0.8951605 (-2.4746725)	95%	0.966853	Accept $\beta_1 = 1$	1.733852
BASA90, USBA90	2.0758203 (0.7268152)	0.8827359 (-0.7796405)	0.9041011 (-2.1524292)	95%	0.949042	Accept $\beta_1 = 1$	1.701742

INTESTEST-PARITY UNDER UNIFIED EXCHANGE RATES :

TABLE 2

PERIOD III : 1985.09 - 1988.12

EQUATION :  $i = \alpha + \beta_1 i^* + \beta_2 \frac{FR}{CR^e}$

$i, i^*$	$\alpha$	$\beta_1$	$\beta_2$	CONFIDENCE INTERVAL	$R^2$	ACCEPT/REJECT Ho: $\beta_1 = 0$	DURBIN - WATSON
tfsa, tfus	6.5668381 (2.6743044)	0.2847953 (1.1422149)	3.6775612 (1.8536946)	95%	0.941471	Accept $\beta_1 = 0$	1.303122
BASA90, USBA90	5.9208379 (2.7311564)	0.2915082 (1.2833675)	4.0146915 (2.1347330)	95%	0.950574	Accept $\beta_1 = 0$	1.074816

INSULATION PROPERTIES OF TWO-TIER EXCHANGE SYSTEMS :

TABLE 3

The results of this test are shown in Appendix B. The hypothesis tested was

$$H_0: b_1 = \beta_1$$

where  $b_1$  represents the coefficient of the foreign interest rate in period I, while  $\beta_1$  represents the coefficient in period III. The null hypothesis above was *rejected* verifying the existence of some unexplained factor making the two functions different. Thus, even though the same model explains the behaviour of the dual exchange rate over the two respective periods, the two periods are statistically different.

#### 4.1.1.2.2 Interest-Parity Under a Unified Exchange Regime :

For period II (February 1983 to August 1985) the value of the coefficient for foreign interest rates approximated unity. This result accords with the expectation that under a unified exchange regime, *ceteris paribus*, an increase in foreign interest rates would be expected to lead to a proportionate increase in domestic interest rates.

The students *t*-test was once again used to establish the level of significance at which the null hypothesis (hypothesis 2) could be accepted (see Table 2).

Since  $-2.032 < t^* < 2.032$ , the null hypothesis is accepted at the 95% level of confidence.

#### 4.1.2 Risk and the Domestic Economy Under Dual Exchange Rates

The interest-parity regression equation, Equation 11(a), is reproduced below :

$$i = \alpha + \beta_1 i^* + \beta_2 \frac{FR}{CR_e} . \quad \text{Equation 11(a)}$$

Since  $\beta_1 i^*$  tends to zero, domestic interest rates are shown to be determined by the factor,  $\frac{FR}{CR^e}$ . Hence removing  $\beta_1 i^*$  from Equation 11(a) the relationship between domestic rates and the factor,  $\frac{FR}{CR^e}$ , was tested.

$$i = \alpha + \beta_2 \frac{FR}{CR^e}. \quad \text{Equation 11(b)}$$

The result of this regression is given below in Table 4 for both periods I and III.

**PERIOD I: 1980.01 – 1983.01**

Constant $\alpha$	Coefficient $\beta_2$	Correlation	R <sup>2</sup>	Durbin – Watson	Level of Signifi- cance
10.091605 (1.0847034)	8.7884421 (1.6638255)	0.6979317	0.966928	1.050099	90%

**PERIOD III: 1985.09 – 1988.12**

Constant $\alpha$	Coefficient $\beta_2$	Correlation	R <sup>2</sup>	Durbin – Watson	Level of Signifi- cance
8;5317952 (2.8110243)	4.2406645 (2.1951949)	0.7339303	0.939525	1.304187	95%

**Determination of Domestic Interest Rates**

TABLE 4

In both period I and III, the results are significant at 90% and 95% levels respectively.

Furthermore, the correlation between  $i$  and  $\frac{FR}{CR^e}$  is high at  $\pm 70\%$  over both periods.

This result suggests that the pattern of domestic interest rates is affected by the financial rand discount and not by foreign interest rates.

Before the relationship between risk and domestic interest rates can be established, a suitable measure of risk must be constructed. The measure used is the deviation from interest rate parity under a dual exchange regime. This measure of risk is similar to that used by Dooley and Isard (1980) and Phylaktis (1988).

Risk is therefore given as :

$$\text{Risk} = [i - i^* \frac{FR}{CR^e}] - [\frac{FR - FR^e}{FR} * 100]$$

where

- $i$  – 90 day SA Trade finance rate
- $i^*$  – 90 day US Trade finance rate
- $CR^e$  – expected commercial rand rate
- $FR$  – financial rand rate
- $FR^e$  – expected financial rand rate

Since no forward market in financial rands exists,  $FR^e$  is calculated as follows : <sup>45</sup>

$$FR^e = FR (1 - [i * (\frac{CR^e}{FR}) - i^*])$$

Figure 7(a) shows the deviation from interest rate parity. Furthermore, the figure shows the relationship between the financial rand discount and the measure of risk. Hence, as risk increases, the financial rand differential widens.

After the debt standstill declared in September 1985, the financial rand mechanism was re-introduced to prevent capital flight. However, in spite of the increase in perceived risk (due to the debt moratorium) domestic interest rates fell while the financial rand adjusted return increased.

In terms of Equation 13 below, an increase in risk ( $R$ ) requires an increase in the return to foreigners holding South African assets ( $\mu$ ). Now in order for this to happen, given that domestic rates are falling, the financial rand discount ( $\frac{CR^e}{FR}$ ) would have to widen at a faster *rate* than the fall in domestic interest rates ( $i$ ).

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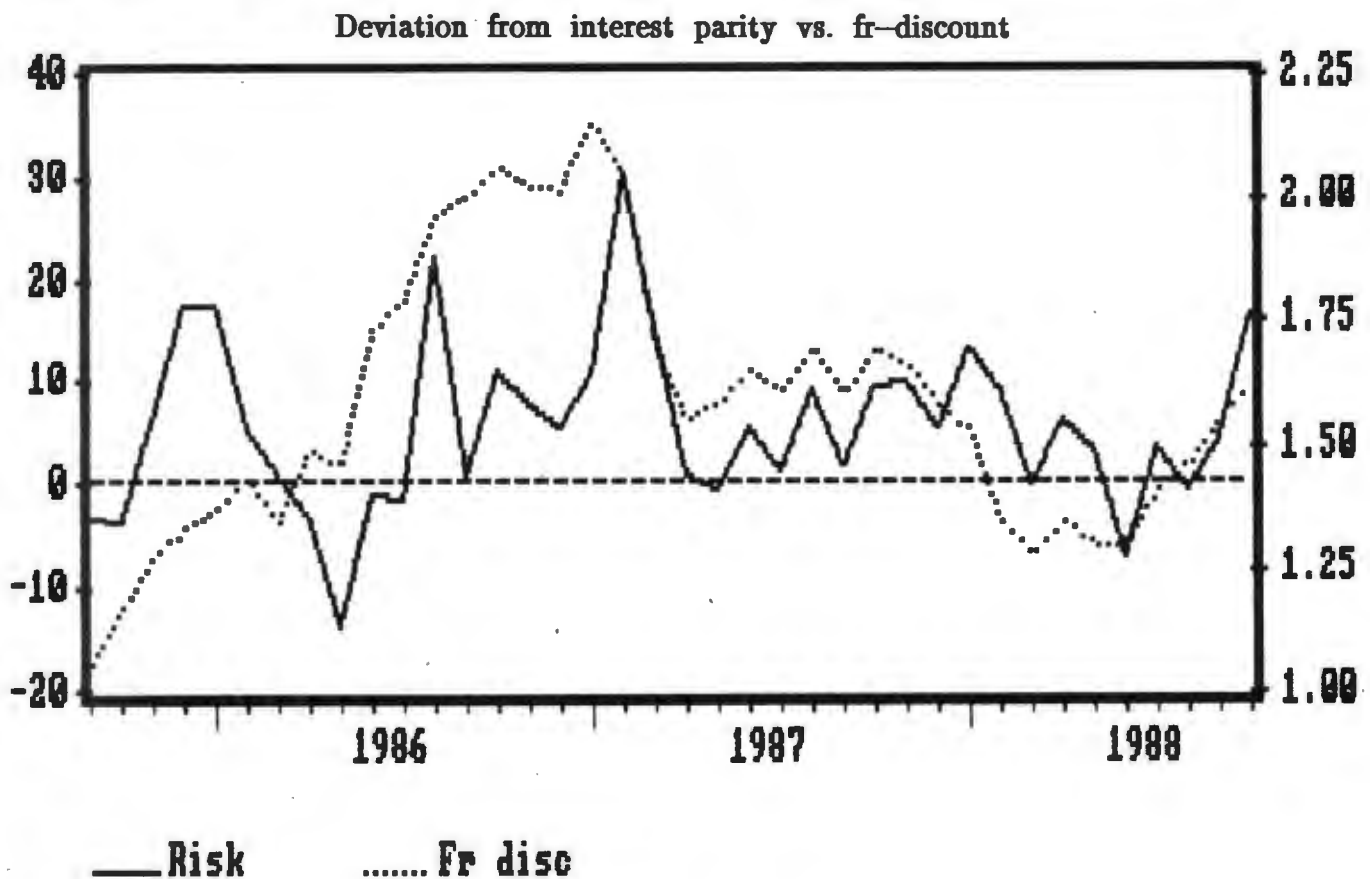
<sup>45</sup> A similar measure is used by Nurick (1982).

Utilizing a notational framework, risk is shown to have the following effect :

$$\begin{aligned} \uparrow R \Rightarrow \uparrow \mu &= i \left( \frac{CR^e}{FR} \right) \uparrow && \text{Equation 13} \\ &\downarrow \\ \uparrow R \Rightarrow \uparrow \mu &\text{ only if } \frac{d}{dt} \left( \frac{CR^e}{FR} \right) > \frac{d}{dt} (i). \end{aligned}$$

Figure 7(b) confirms this result. Taking log changes in the domestic interest rate and financial rand discount, it is seen that the rate of change in the financial rand discount exceeded that of interest rates for most of the period 1985 to 1988.

Referring to Figure 7(c) it can be seen that over the 1983 to 1985 period (period II) when the financial rand mechanism was abolished, there was no longer any differential between the financial and commercial rates by definition.<sup>46</sup>

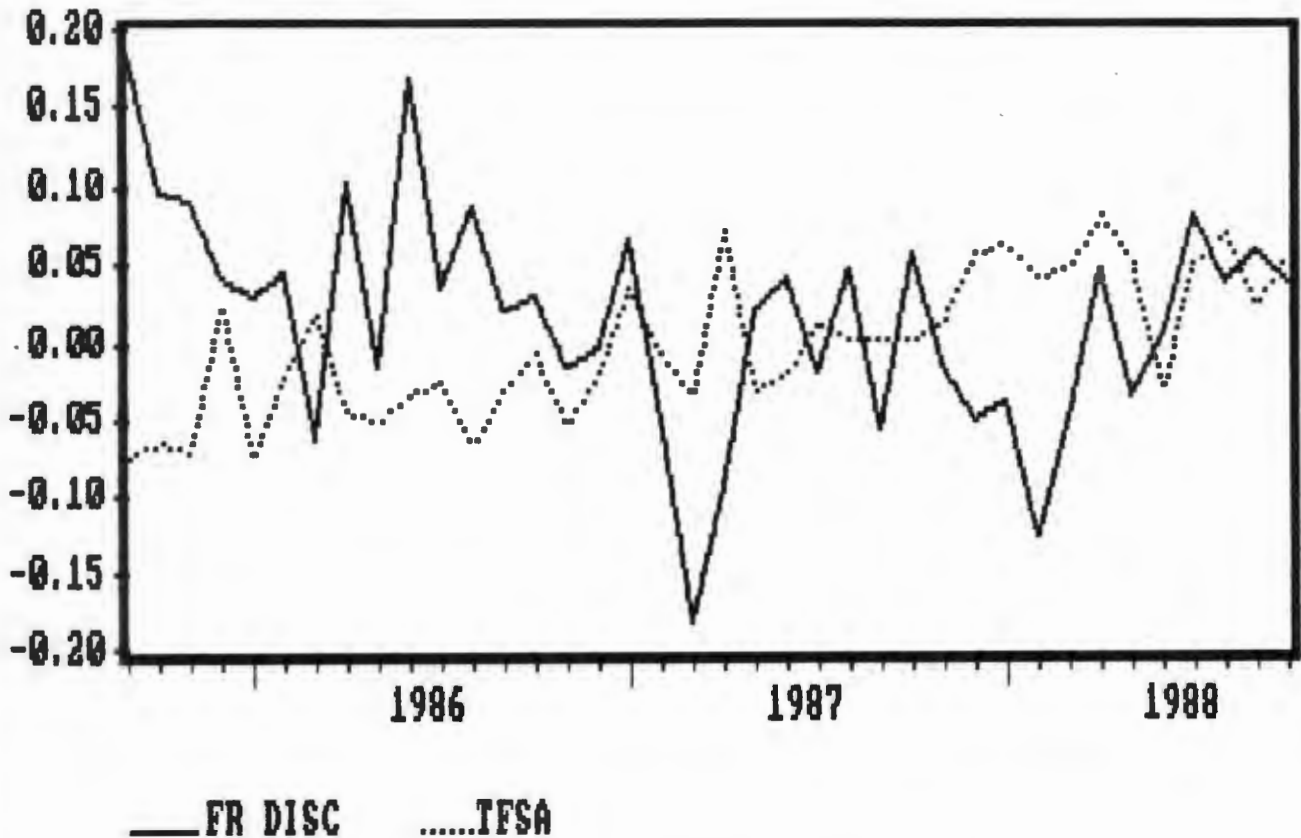


Risk vs Financial Rand Discount

FIGURE 7(a)

<sup>46</sup> In figure 7(c), the small variability between the SA trade finance rate and financial rand adjusted trade finance rate over the 1983 to 1985 period is attributed to the monthly average commercial rand rate used.

## Log Changes : FRDISC vs. TFSA



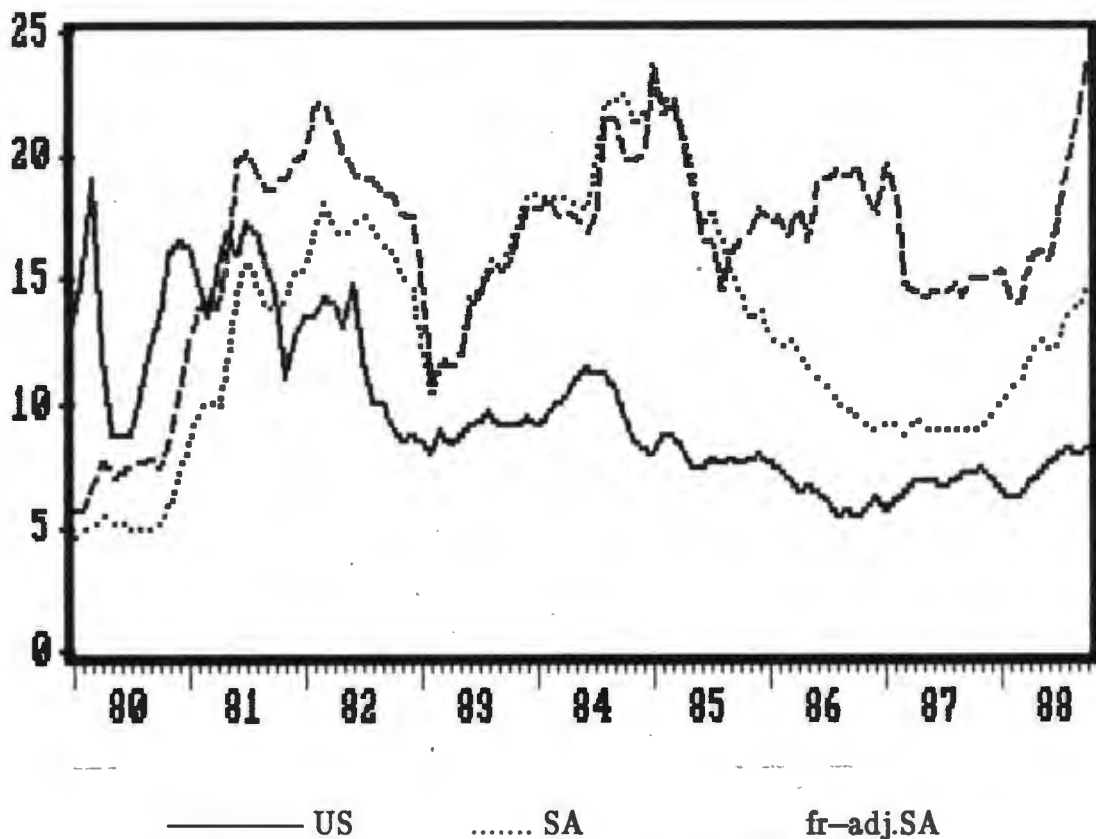
Rates of Change : Financial Rand Discount and  
Domestic Interest Rates

FIGURE 7(b)

In the absence then of the financial rand mechanism any increase in risk would have had to be compensated through higher nominal interest rates. (See Appendix C) This suggests that over the 1983–1985 period, the domestic economy had to bear the brunt of perceived risk through higher domestic interest rates. Admittedly, the monetary authorities raised interest rates over this period in an effort to curb money supply growth and hence inflation as well as to protect the balance of payments. However, had the financial rand mechanism not been abolished these increases in domestic interest rates could well have been lower than they actually were. It can thus be argued that the recession of 1984–1985 was in part self-induced due to the scrapping of the dual exchange rate mechanism.

One further point that lends credibility to this argument can be made by comparing the peaks of domestic as well as financial rand-adjusted interest rates. In Figure 7(c) it is shown that domestic interest rates peaked in 1984. However, this peak is only slightly higher than the financial rand adjusted peaks in 1986. This tends to suggest that domestic interest rates could well have been at lower levels over the 1984–1985 period.

Trade Finance Rates : US, SA and FR-ADJ.SA



Trade Finance Rates : Absolute Level

FIGURE 7(c)

From Equation 13 above, an increase in risk requires a depreciation in the financial rate raising the financial rand adjusted return on South African assets (assuming that the expected commercial rate remains constant).

In terms of the simplified equation,

$$i = \alpha + \beta_2 \frac{FR}{CR^e} \quad \text{Equation 11(b)}$$

a depreciation in the financial rate (assuming risk is constant) allows the monetary authorities autonomy in setting interest rates lower.

However, if risk increases this would normally require a rise in domestic interest rates to compensate foreigners for their negative view of political and economic developments in South Africa. Since the financial rand discount widens in response to this increased risk, the domestic interest rate can remain unchanged while the financial rand adjusted return to foreigners increases. Therefore, the financial rand mechanism tends to insulate domestic interest rates in response to increased risk.

The identity below shows this adjustment :<sup>47</sup>

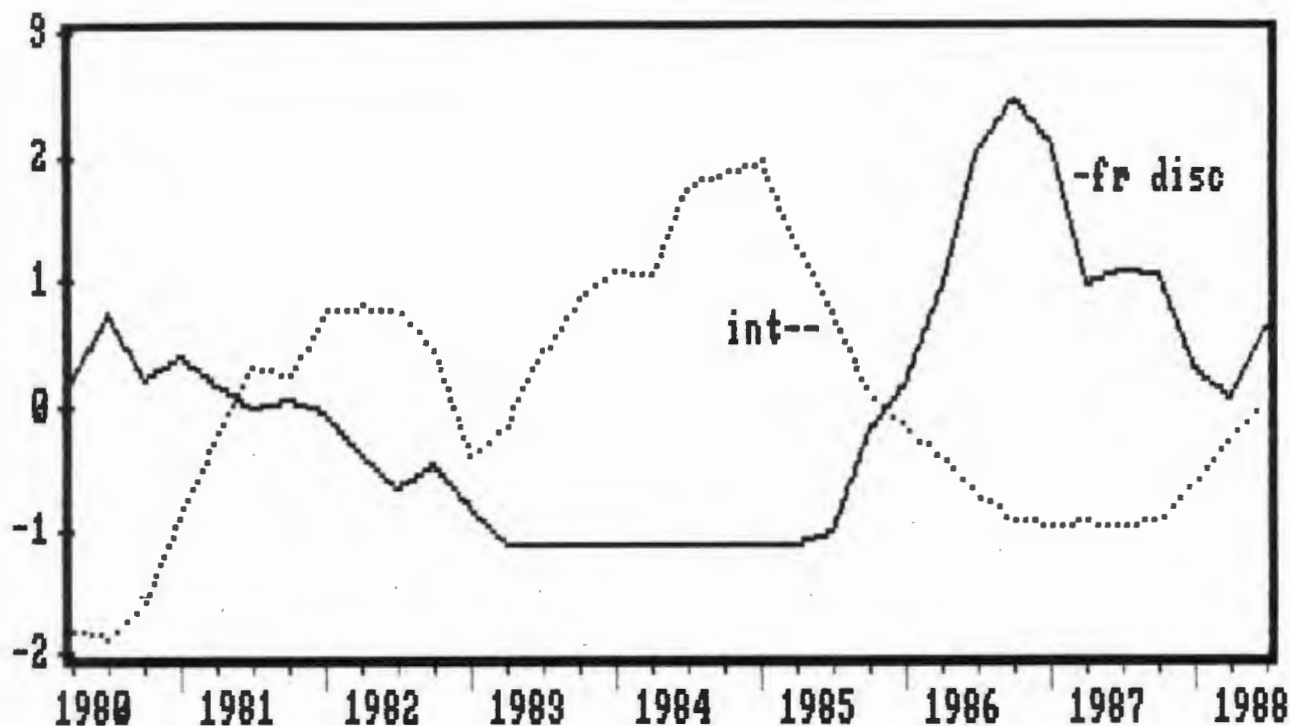
$$\uparrow \mu = \bar{i} \frac{CR^e}{FR}$$

In the section that follows we consider what effect risk has on the equity market and whether the two-tier system is able to cushion the stock market from increased risk.

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<sup>47</sup> Note that this identity is similar to the temporary insulation identity Gros refer to.

Relationship (Normalized): FR disc. and Domestic Interest Rates



Domestic Interest Rates vs. Financial Rand Discount

FIGURE 8

#### 4.1.3 Risk and the Equity Market

Using identity 1 (see Section 3), the adjustment of the equity market to increased perceptions of risk, is discussed.

$$\text{Identity 1:} \quad \text{FR} = \frac{\$ - \text{Value of S.A. Shares Traded in London/New York}}{R - \text{Value of S.A. Shares Traded on the JSE}}$$

In terms of this identity, a depreciation in the financial rand rate (due to increased risk) would tend to raise the value of equities on the JSE, insulating the domestic stock market.

The rationale is simply this: If foreigners holding financial rand balances at commercial banks take a negative view of political and economic developments in South Africa, they will attempt to get rid of these balances. They are able to do so in one of two ways.

Firstly, they may buy S.A. shares on the JSE and simultaneously sell these same shares in London. In terms of our identity above, the prices of shares on the JSE are bid up whilst those in London are bid down. The net result is a depreciation in the financial rand.

Alternatively, foreigners may simply convert their financial rand balances into foreign exchange in the cash market. This will put downward pressure on the financial rand rate. However, since the financial rand rate is higher in the securities market, arbitrageurs will bring in foreign currency at the lower cash market rate and buy shares on the JSE simultaneously selling them in London. This will put downward pressure on the financial rand rate in the securities market, arbitrage being complete when the two rates are equated.

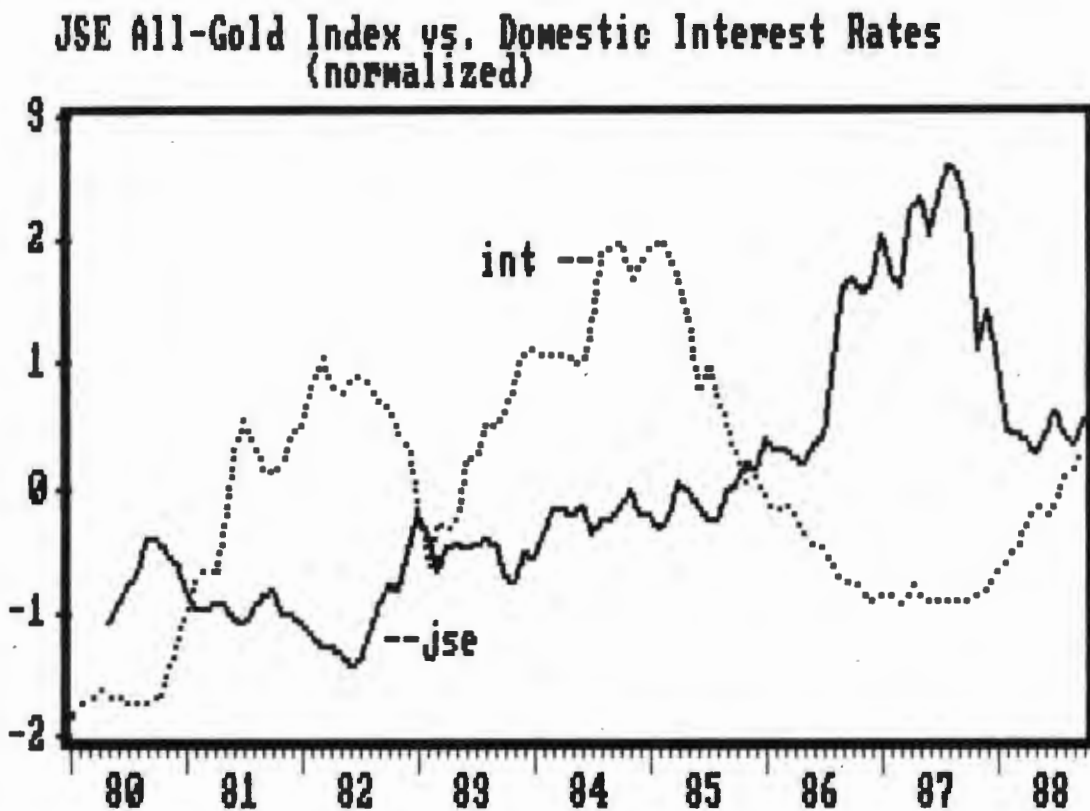
From this discussion it is clear that the financial rand mechanism cushions the domestic stock market from increased perceptions of risk by foreign investors.

Having discussed foreign investor's response to increased risk, how then do domestic investors respond to the widening of the financial rand discount.

From Figure 8, the widening of the differential allows lower domestic interest rates. These lower rates of interest tend to raise the value of domestic equities. The reasoning is simply this: When interest rates are low, domestic investors seek returns in excess of the rate of inflation. They are thus attracted by the high real rates of return on equities. This increased demand for equities will tend to bid up their price.

On the other hand, when interest rates are high, the opportunity cost of holding shares also rises inducing people to sell equities and move into alternative investments e.g. fixed-interest investments.

Figure 9 below shows the inverse relationship between the JSE All-Gold Index and the 90-day B.A. rate.



**JSE All-Gold Index vs. 90-day B.A. Rate**

FIGURE 9

The relationship between risk and the equity market can now be shown via Figure 10.

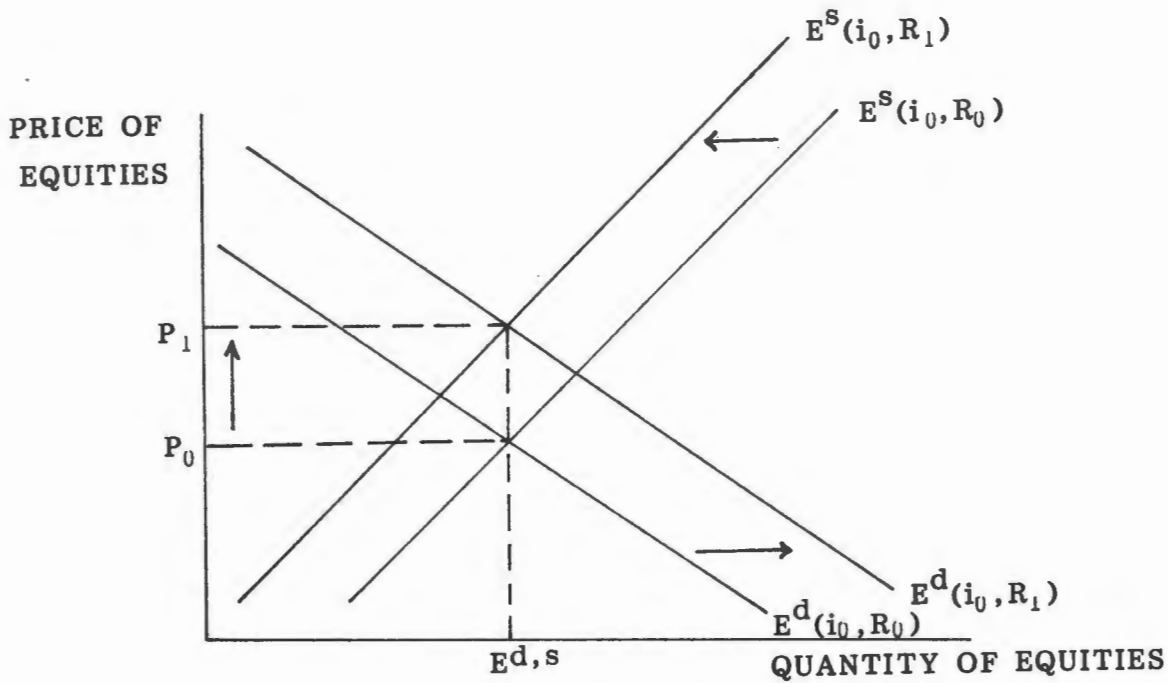


FIGURE 10 : Risk and the Equity Market

The equity-demand schedule is shown as a downward sloping function of the price of equities. As prices fall, the quantity of equities demanded tends to rise. Similarly the equity-supply schedule is an upward sloping function of the price of equities.<sup>48</sup> The justification for an upward sloping supply schedule is that as prices of shares rise (bull market) the supply of shares through rights issues, increases. An increase in risk,  $R$ , shifts the equity demand schedule outwards and the equity-supply schedule inwards.

Equations 15(a) and 15(b) below specify the demand and supply determinants.

$$E^d = f\left(\begin{matrix} i \\ (-) \end{matrix}, \begin{matrix} Risk \\ (+) \end{matrix}\right) \quad \text{Equation 15(a)}$$

$$E^s = f\left(\begin{matrix} i \\ (+) \end{matrix}, \begin{matrix} Risk \\ (-) \end{matrix}\right) \quad \text{Equation 15(b)}$$

<sup>48</sup> Note that this is a static model. At any one point in time, the stock of equities is fixed.

From Figure 10, the increase in risk shifts the supply schedule  $E^s(i_0, R_0)$  to  $E^s(i_0, R_1)$  and the demand schedule  $E^d(i_0, R_0)$  to  $E^d(i_0, R_1)$ . Assuming domestic interest rates remain unchanged at  $i_0$ , the effect of these shifts in demand and supply is a *rise* in the price of equities.

Thus, the financial rand mechanism cushions the domestic share market from increases in perceived risk.

#### 4.1.4 Covered Interest Rate Parity and Forward Exchange Losses

Recent developments in the international community have raised doubts about the insulation properties of the financial rand mechanism. Foreign interest rate increases have recently been followed by similar increases in domestic interest rates. The reason for this can be attributed to Reserve Bank intervention in the forward market and the resulting forward losses.

The rationale for this argument is given in the October United Bank Economic Perspective. It is argued that in order for the Reserve Bank to balance its forward books, nominal interest rates must increase. Utilizing the covered-interest parity condition the adjustment mechanism is discussed.

Covered Interest Rate Parity :

$$i - i^* = \frac{F - S}{s}$$

where :

F = forward exchange rate

S = spot exchange rate (defined as the domestic price per unit of foreign currency).

From the above expression the forward rate is determined by the nominal interest rate differential between two countries e.g.: South Africa and the United States. However, if the forward rate is quoted below the expected future spot rate, foreign exchange losses are made. Therefore, in order to prevent these losses, the domestic interest rate must rise.

It is this intervention in the forward market that comes under criticism. A market determined forward rate overcomes these forward losses due to the intervention of market forces.

Consider the following hypothetical example. Assume that on any one particular day the following rates are quoted.

$$\text{Spot exchange rate} = \text{R}2.60/\text{1\$}$$

$$\text{Forward exchange rate} = \text{R}2.70/\text{1\$}$$

Furthermore, assume now that the expected future spot rate is  $\text{R}2.80/\text{1\$}$ . Speculators will then buy \$'s forward at  $\text{R}2.70/\text{1\$}$  and sell these \$'s in the future spot market at  $\text{R}2.80/\text{1\$}$ . A profit is made.

The increased demand for \$'s will push up its price until the forward rate equals the expected future spot rate. In order for the covered interest parity condition to hold, without any change in domestic interest rates, the spot exchange rate must depreciate (speculators will sell rands or buy \$'s spot).

From the covered interest parity condition, it is clear that nominal interest rates could be increased to prevent losses on forward cover or alternatively for spot rates to depreciate where forward rates are market determined.

It is this latter option that appears to be more plausible given the workings of the dual exchange rate mechanism. Any foreign interest rate shock need not be accompanied by a rise in domestic interest rates. The adjustment merely takes place through the depreciating financial rand.

The linkage between the forward market and the financial rand market can be shown via the following equations.

Forward Market :

$$i - i^* = \frac{F - S}{s} \quad \text{Equation 16}$$

Financial Rand Market :

$$\mu = i \frac{FR}{CR^e} \quad \text{Equation 17}$$

In response to a foreign interest rate increase, the spot exchange rate will depreciate in Equation 16 for the reasons discussed above.

In Equation 17, the rate of return to foreign investment will increase due to the depreciation of the financial rand (response to foreign interest rate increase).

The notational adjustment is then given as :

Forward Market :

$$i - i^* = \frac{\overset{\uparrow}{F} - \overset{\uparrow}{S}}{s} \quad \text{Equation 16(a)}$$

Financial Rand Market :

$$\uparrow \mu = i \frac{\overset{\uparrow}{FR}}{\overset{\uparrow}{CR^e}} \quad \text{Equation 17(a)}$$

From Equation 16(a), if the spot rate depreciates the forward rate may also change. However, the rate of return to foreign investors will still increase in Equation 17(a) provided that

$$\frac{d}{dt} (CR^e \equiv F) < \frac{d}{dt} (FR).$$

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- Note: Data Source : Standard Bank Ecocats.

## SECTION 5

### 5. CONCLUSION

This paper has emphasized the insulation properties of dual market systems. Since there are in principle two implicit underlying assumptions regarding the effectiveness of two-tier systems these were discussed in Section 2.

In reality however, since complete market separation and a neutral intervention policy don't exist, it has become necessary to impose quantitative restrictions in the form of exchange controls.

Furthermore, an implication of the theoretical models dealt with, indicate that under a two-tier system monetary authorities do have a certain degree of autonomy against external constraints. This autonomy translates into the ability of the monetary authorities to pursue a monetary policy independent of developments externally.

Consider for example what effect an increase in foreign interest rates has on the domestic economy; notably domestic interest rates. The theoretical models developed by Gros and Marion amongst others, indicate that at best the dual market system will only insulate domestic interest rates temporarily. This result is however dependent on certain underlying assumptions implicit in their models. Gros assumes that the steady-state differential between the official and financial markets is zero. However, in South Africa we witness a positive differential. The inference drawn from this, is that what Gros considers temporary insulation may well be permanent insulation in the South African case. Furthermore, Marion assumes that domestic investors hold foreign assets in their

portfolios. Given the fact that in South Africa domestic investors are prevented from holding foreign assets due to exchange controls, Marion's conclusions don't seem to apply.

The regression models used to test the effects of foreign interest rate increases on domestic interest rates, supported the hypothesis that domestic interest rates are insulated against foreign shocks. Further tests were also conducted to ascertain the response of domestic interest rates to increased perceptions in risk. If risk increases, the effective rate of return to foreigners investing in South Africa must also increase. This is only possible if the financial rand rate depreciates. The equation below helps clarify this process.

$$\uparrow R \Rightarrow \uparrow \mu = i \left( \frac{CR^e}{FR} \right) \uparrow$$

In the equation above, the financial rand differential widens increasing the effective return to foreigners. In this case however, domestic interest rates are unaffected although this need not be so. It would be possible for the monetary authorities to set lower domestic interest rates provided that the rate of change in the financial rand discount exceeded the rate of change in the domestic rate of interest. Since  $\frac{d}{dt} \left( \frac{CR^e}{FR} \right) > \frac{d}{dt} (i)$  holds, the above equation can be re-written as:

$$\uparrow R \Rightarrow \uparrow \mu = i \left( \frac{CR^e}{FR} \right) \uparrow$$

↓

Turning finally to the equity market, it was argued that any negative sentiment on the part of foreign investors would not adversely affect domestic share prices. In fact, if foreign perceptions of risk increased, domestic share prices rose. Section 3 of this paper addressed the mechanics of the financial rand mechanism the insulation properties being fully developed in Section 4. Quite simply, if foreign investors wished to disinvest, they could do so either directly through the cash market or through the securities market. In either case the net result is the same.

Consider a disinvestment via the securities market. The foreigner holding financial rand balances would purchase SA shares on the JSE and simultaneously sell these shares in London. As a result the financial rand depreciates and domestic share prices rise.

Finally, as regards Reserve Bank intervention in the forward market, it is argued that this intervention dilutes the insulation capabilities of the two-tier system. For this reason it is suggested that forward rates be more market determined although this remains an area for future research.

## APPENDIX A

### FOREIGN INTEREST RATE SHOCKS AND UNIFIED EXCHANGE RATES

We consider firstly the effect of a foreign interest rate rise under a uniform flexible exchange rate regime. The increase in the foreign interest rate will affect domestic interest rates, home good prices and national income. Hence, as the foreign rate rises, residents seek to increase their holdings of foreign bonds. To discourage this, the domestic interest rate is affected and the exchange rate depreciates. This depreciation does not restore the original rate of return on foreign assets as it does in the dual market; the depreciation needed to restore portfolio balance is greater in the case of a uniform flexible exchange rate regime. There is consequently a positive net wealth effect which increases consumption and domestic prices, as well as national income.

In addition, if the foreign interest rate rises, the domestic currency value of repatriated interest income also rises, further increasing consumption, domestic prices and national income. Finally, the domestic price of traded goods rises due to the exchange rate depreciation. This price effect shifts demand away from imported goods to domestic goods, raising their prices and national production. Thus, in the case of a foreign interest rate shock, domestic prices and gross domestic product move in the same direction as the shock. The effect on domestic interest rates is, however, uncertain.<sup>1</sup>

In the case of a unified fixed exchange rate regime, an increase in foreign interest rates created an immediate capital loss on residents' foreign bond holdings.<sup>2</sup> This negative

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<sup>1</sup> The domestic interest rate may rise initially and then gradually fall as the exchange rate depreciates. This is due to the inability of the exchange rate to respond instantly to the shock.

<sup>2</sup> In the case of consols, an increase in the interest rate lowers the value of the bond.

wealth effect reduces consumption, domestic prices and national product. The effect on domestic interest rates is, however, positive. Hence, a rise in foreign interest rates results in a rise in domestic interest rates. There are no interest-income or price effects due to the *fixed* nature of the exchange rate. Hence only wealth effects serve as a channel for adjustment.

It is thus clear that in neither of the above cases does the unified exchange rate regime insulate the domestic economy against the foreign shock.

## APPENDIX B

THE CHOW TEST<sup>1</sup>

The null hypothesis to be tested is

$$H_0: b_1 = B_1$$

for the two functions specified in period's I and III. The purpose of the test is to establish whether or not the two estimated functions differ significantly.

## Step 1 :

The observations from the two respective periods are "pooled" together from which a new regression is constructed. The coefficient, sum of the square residual, and the degrees of freedom is presented in the table below for each of the data sources used.

$i, i^*$	$B_p$	$\Sigma e_p^e$	$n_1 + n_2 - k$
tfsa, tfus	0.0490263	42.10697	71
BASA90, USBA90	0.10049962	33.94386	71

## Step 2 :

Regression analysis is performed on observations in each period separately. The relevant results are given below :

$i, i^*$	PERIOD I			PERIOD III		
	$b_1$	$\Sigma e_1^2$	$n_1 - k$	$B_1$	$\Sigma e_2^2$	$n_2 - k$
tfsa,tfus	0.0503974	27.58855	33	0.2847953	8.712025	35
BASA90, USBA90	0.0990370	22.70782	33	0.2915082	7.287098	35

<sup>1</sup> Koutsoyiannis (1977), pp.164-168.

**Step 3 :**

The sum of the squared residual for each period is added together.

$i, \dot{i}$	$\Sigma e_1^2 + \Sigma e_2^2$	$n_1 + n_2 - 2k$
tfsa, tfus	36.300575	68
BASA90, USBA90	29.994913	68

**Step 4 :**

The above sum of residual variations is subtracted from the "pooled" residual variance of Step 1.

	$\Sigma e_p^2 - (\Sigma e_1^2 + \Sigma e_2^2)$	$k$
tfsa, tfus	5.806395	3
BASA90, USBA90	3.948947	3

**Step 5 :**

The following ratio is formed :

$$F^* = \frac{[\Sigma e_p^2 - (\Sigma e_1^2 + \Sigma e_2^2)] / k}{(\Sigma e_1^2 + \Sigma e_2^2) / (n_1 + n_2 - 2k)}$$

The observed  $F^*$  ratio is compared with the theoretical value of  $F_{0,05}$  (or other levels of significance) with  $V_1 = k$  and  $V_2 = (n_1 + n_2 - 2k)$  degrees of freedom. The theoretical value of  $F$  is the value that defines the critical region of the test (at the chosen level of significance).

If  $F^* > F_{0.05}$  we *reject* the null hypothesis, that is, we accept that the two functions differ significantly.

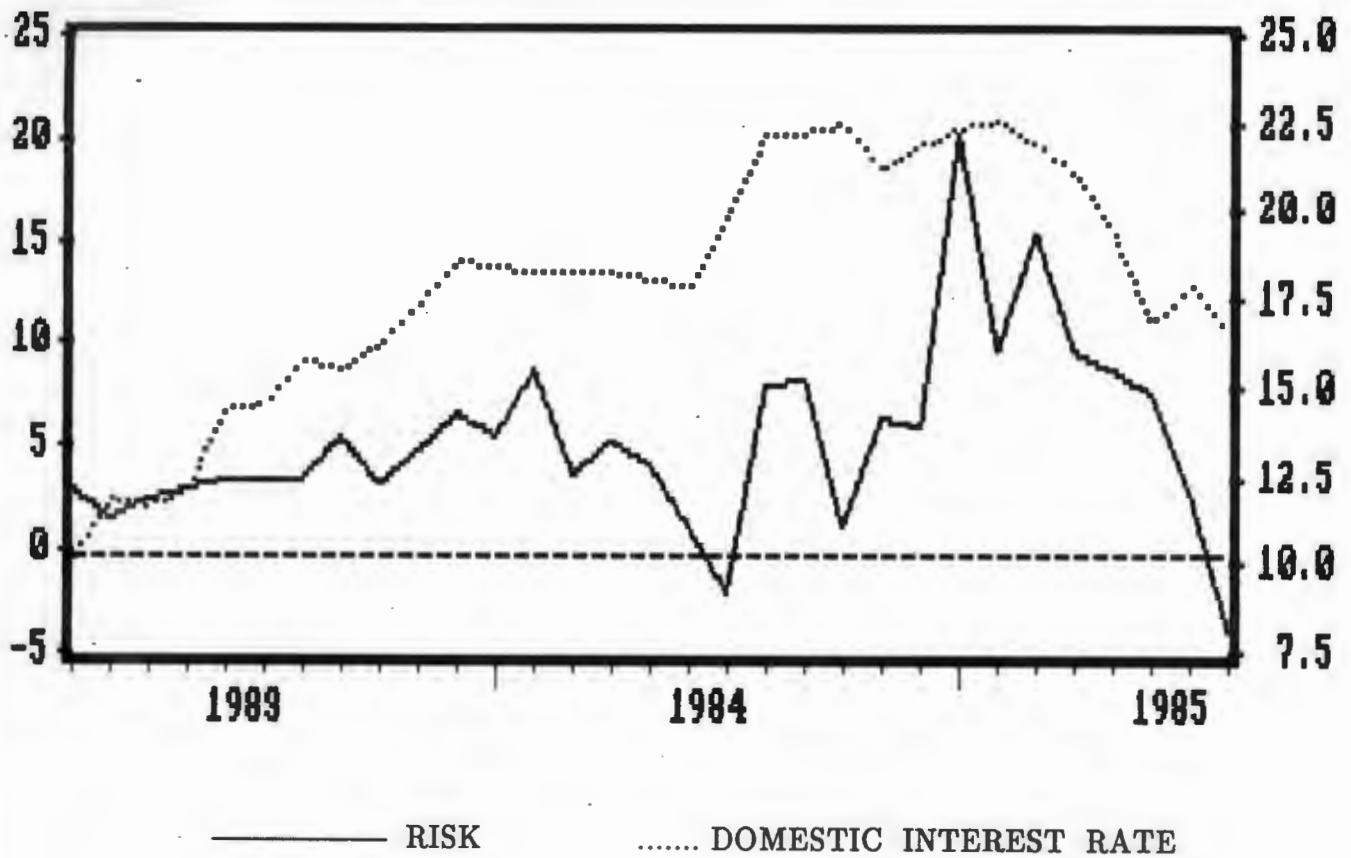
The results for the acceptance/rejection of the null hypothesis are presented below :

	F*	$F_{0.05}^{(3,68)}$	Ho: $b_1 = B_1$
tfsa, tfus	3.6256076	2.74	REJECT
BASA90, USBA90	2.99841554	2.74	REJECT

## APPENDIX C

RISK AND DOMESTIC INTEREST RATES UNDER A  
UNIFIED EXCHANGE REGIME

Deviation from interest rate parity vs. Domestic interest rates



where :

$$\text{Risk} = (i - i^*) - \left( \frac{CR - CR^e}{CR} * 100 \right)$$