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Should the Developing Countries Peg to a "Real" Basket of Currencies?

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I. Introduction

The floating of the major currencies against each other since 1973 has created special difficulties for the exchange rate policies of the developing countries. For various reasons, the large majority of these countries have preferred to keep their currencies pegged. In an increasing number of cases, these pegs have actually taken the form of currency-composite baskets, either the SDR or some country-specific basket. 1/

It is in principle possible to design "optimal" baskets to reduce the adverse domestic effects of fluctuations among the major currencies, and there is a fairly large body of literature devoted to this question. This literature is largely concerned with the design of baskets that will minimize the variability of some domestic target variable such as: the relative price of traded goods (Black, 1976); the terms of trade (Branson and Katseli, 1980); the real effective exchange rate (Lipschitz and Sundararajan, 1982); the domestic inflation rate (Connolly, 1982 and 1983); domestic real income (Flanders and Helpman, 1979); domestic income distribution (Lipschitz, 1979); and the balance of trade (Flanders and Helpman, 1979). 2/ While such baskets may help insulate the home country from the effects of fluctuations among major currencies, most of them fail to offset what is frequently alleged to be the main shortcoming of exchange rate policy in many developing countries: the tendency of the real exchange rate to appreciate as a result of high domestic inflation rates coupled with passive exchange rate policies. The chronic balance of payments weakness of many developing countries is commonly attributed, inter alia, to overvalued exchange rates. The required periodic large devaluations are often politically very difficult to undertake, thus adding to the delay in the authorities' response to external imbalance. Under the circumstances, the use of a fairly regular and automatic method for altering exchange rates would appear to present both economic and practical advantages.

There are at least three possible ways for designing such a method. The first would be to make the level of the exchange rate subject to a number of balance of payments indicators, such as the current account or the change in reserve levels. This method has been analyzed by Kenen (1975) and Branson and de Macedo (1982). While attractive in principle, the method suffers from an important shortcoming as far as the developing countries are concerned. Due to the thinness of their asset markets and the resultant weakness of stabilizing speculation, J-curve effects are likely to be dominant in the short-run in the balance of payments of such

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1/ As of the second quarter of 1983, 39 countries were listed by the Fund as pegging to a basket, 14 of which were pegged to the SDR.

2/ This does not exhaust the studies on the subject. For a survey on the optimal peg, see Williamson (1982).

countries. Therefore, a frequent and automatic use of balance of payments indicators for adjusting the exchange rate may be fraught with instability.

The second method, suggested by Lipschitz and Sundararajan (1980), is to peg the nominal exchange rate to a basket that will minimize variations in the real effective exchange rate. The authors propose this as a second-best measure since, they argue, the real rate cannot be a direct policy instrument itself due to the lag with which price data are published. 1/ The problem with this approach is that it may simply not be possible to stabilize the real rate through a nominal peg when the home country inflates at a much greater pace than do its trade partners. The method breaks down precisely in cases where it would have been most useful.

The last method, and the one considered here, is to peg the <u>real</u> effective exchange rate itself. Ignoring the problem of the unavailability of contemporaneous price data which will be taken up below, the method implies adjusting the nominal rate continuously against an appropriate basket of currencies so as to offset differential inflation rates at home and abroad. 2/ The country concerned would, in effect, be pegging to a real (i.e. relative-price deflated) basket, and not to a nominal basket of the sort that has been the main preoccupation to date in the literature on the optimal peg. The requisite adjustments in the nominal rate would accordingly be undertaken on a regular and automatic basis. The initial value of the real peg would, of course, have to be sufficiently close to its equilibrium value for the policy to make sense. This paper is devoted to elucidating some of the practical, conceptual, and theoretical problems of this kind of a real basket peg policy.

The outline of the paper is as follows. Part II analyzes the real peg policy from a theoretical standpoint, and evaluates the circumstances under which the policy might be an appropriate one. In the first instance, the real peg is viewed in the context of external balance only. Later, the scope of the analysis is broadened to include considerations of internal balance as well, and the real peg is compared to a nominal peg strategy in terms of its contribution to the short-run stabilization of the economy. The last section of Part II investigates the "optimal" degree of real pegging, and attempts to identify the structural characteristics of the economies for which the real peg rule is more likely to be desirable. Part III turns to some conceptual problems arising from the fact that a real peg policy would have to be practiced in a world of generalized floating. In such a world, the real peg has to be reformulated in terms of a basket of currencies, and the design of an appropriate basket--i.e., the weights that should be attached to particular currencies--becomes an important issue. Part IV, in turn, analyzes some practical questions related to the real peg policy. In particular, it attempts to estimate the likely magnitude

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1/ This will be discussed in Part IV below.

2/ This approach has a long intellectual history. For a recent proposal along these lines, see McKinnon and Mathieson (1981).

of deviations from the aimed peg that would result from a real peg policy which perforce uses noncontemporaneous price data. Simulation results are also presented for fourteen developing countries over the 1975-82 period, comparing hypothetical real basket peg and nominal peg policies to the actual exchange rate policies followed. Finally, Part V offers a summary and some conclusions.

II. Theoretical Considerations

A real peg policy has to be evaluated from at least two vantage points: first, as a policy designed to maintain external competitiveness and hence external balance over the medium run; second, as a means of short-run stabilization for an economy faced with transient shocks. This section is devoted to an evaluation of the policy from both of these angles, and will investigate the circumstances under which its use would appear to be appropriate.

1. The real peg, competitiveness, and the balance of payments

On the face of it, the theoretical rationale of a real peg policy for developing countries is at once powerful and simple. To help fix ideas, consider the following representation of the trade balance in foreign currency:

$$T^* = (p/e)\cdot X(\overset{+}{r}, \overset{+}{a^*}) - p^*M(\overset{-}{r}, \overset{+}{a}), \qquad (1)$$

where $r = (ep^*)/p$ (the real exchange rate), X(M) is the volume of exports (imports), $p(p^*)$ is the domestic (foreign) price level, and $a(a^*)$ is the level of domestic (foreign) real expenditures. We assume that the country concerned is initially in external balance. Supply elasticities are assumed to be infinite, and exports and imports are taken to depend on foreign and domestic real expenditures, respectively, as well as on the real exchange rate. Note that the exchange rate is here (and throughout) defined in units of domestic currency per unit of foreign currency, so that an increase implies a depreciation.

Holding the income terms constant for the moment, we can investigate the effects of changes in prices and the exchange rate on the trade balance. Differentiating (1) with respect to e, p and p^*, and letting a dot over a variable indicate proportionate changes, we get:

$$dT^* = \phi \cdot(\dot{e} + \dot{p}^* - \dot{p}) + T^*\dot{p}^*, \qquad (2)$$

where

$$\phi = (p/e)X \left\{\varepsilon_x + \left(\frac{rM}{X}\right)\varepsilon_m - 1\right\} > 0 \qquad (3)$$

if the Marshall-Lerner condition (modified for the possibility of initial trade imbalance) holds. In the latter expression ε_x (ε_m) refers to the price elasticity of demand for exports (imports). If the authorities follow a real peg policy, the implied rule for the nominal exchange rate is

$$\dot{e} = \dot{p} - \dot{p}^*. \qquad (4)$$

Consequently, the first term on the right-hand side of expression (2) will be zero. If trade was initially in balance, such that $T^* = 0$, the second-term would have been zero as well. Hence, a real peg policy enables the authorities to shield the trade balance from the loss--or gain, as the case may be--in competitiveness due to the difference between home and foreign inflation rates. Starting from a position of initial trade balance, a real peg policy can completely offset the adverse effects of a relatively high domestic inflation rate.

There are, however, several obvious complications even at this simple level of analysis. First, it is clear from the above that a real peg will not necessarily keep the trade balance unchanged unless this balance was initially at zero. Since a sustainable external balance position need not imply trade balance--and, indeed, in most developing countries it will not--this is an important qualification and will be returned to below in the context of a broader look at the external balance.

Secondly, remember that we have ignored changes in real expenditure levels at home and abroad. When incomes change, maintaining a constant real rate will not in general maintain the trade balance at its initial value. Thus, continuing with the above characterization of the trade flows, and assuming now initial trade balance ($T^* = 0$), it is easy to see that the change in the balance of trade when the authorities follow a real peg policy and expenditures are not constant is given by:

$$dT^* = (p/e)X\eta^*\dot{a}^* - p^*M\eta\dot{a}, \qquad (5)$$

where η (η^*) is the income elasticity of home (foreign) demand for home imports (exports). An increase in home demand for imports due to a rise in domestic real expenditure levels, in the absence of a fully offsetting increase in foreign demand for home goods, would result in a deterioration of the trade balance. Consequently, a depreciation of the nominal exchange rate in excess of the inflation differential would be called for. A real peg policy simply does not address the question of trade effects of changes in income and expenditure. In principle, there can be no theoretical justification for singling out relative price effects and ignoring income effects. Conceptually it is just as easy to introduce income effects into the formula for the crawl as it is to include relative price effects.

So far the analysis has been concerned exclusively with the trade balance. Yet the relevant medium-term target for exchange rate policy, as has been pointed out by Lipschitz (1979, pp. 437-38) is the overall balance which also includes services, aid, debt repayments, and short- and long-term capital. Ignoring services, we can now write the overall balance (in foreign currency) as follows:

$$B^* = (p/e)\cdot X(r, a^*) - p^*M(r, a) - D^* + K^*. \qquad (6)$$

D^* and K^* refer to debt servicing and the sum of aid and capital inflows, respectively. As before, we assume initial balance of payments equilibrium.

Ignoring changes in real expenditure levels once again, will a policy of real peg keep the balance of payments in equilibrium ($dB^*=0$) in the face of price disturbances? The simple answer is no, unless D^* and K^* are indexed to the foreign rate of inflation or there is trade balance initially. This can be seen by differentiating (6) totally with respect to e, p^*, and p, to obtain

$$dB^* = \phi\cdot(\dot{e} + \dot{p}^* - \dot{p}) + (D^* - K^*)\dot{p}^* \qquad (7)$$

which is the counterpart of (2) above. From (7), then, it can be seen that a policy of real peg will have the following result.

$$dB^* = (D^* - K^*)\ \dot{p}^*. \qquad (7')$$

As long as there is an initial trade deficit (such that $D^* - K^* < 0$) and a positive rate of inflation abroad, the outcome is a worsening of the balance of payments. Accordingly, the requisite deviation from purchasing power parity in order to maintain external balance is given by

$$(\dot{e} + \dot{p}^* - \dot{p}) = \frac{1}{\phi}\ (K^* - D^*)\ \dot{p}^* \qquad (8)$$

In the "normal" case, a real depreciation is required.

What is going on here is that a real peg is successful only to the extent that it ensures equal proportionate changes in the values of exports and imports. In a situation of trade <u>deficit</u> financed by stable capital inflows, however, these proportionate changes translate into a widened trade deficit. Unless D^* and K^* are indexed to foreign inflation, the result is an overall balance deficit as well. A change in the real exchange rate is needed to correct the situation. Of course, in the longer run capital inflows would be expected to follow some sort of relationship with the foreign price level, allowing the real peg to achieve its objective. Nevertheless, the lesson of the above is an important one: an evaluation of the real peg policy has to take into account as well other components of the balance of payments beside the trade account. As seen in the above, valuation effects of exchange rate and price changes can play an important role in the overall balance, and these effects need not be offset by a real peg policy. Remember also that income-expenditure effects on the balance of payments, as discussed earlier, would complicate the picture even more.

2. The real peg and internal-external balance

At a more general level, an exchange rate system must be evaluated in terms of its contribution to internal balance--i.e., full employment and price stability--as well. In fact, a good exchange rate policy would aim at maintaining internal balance in the short run, while also ensuring external balance in the medium run. To be sure, the two objectives need at least two independent policy instruments and the exchange rate cannot be expected to singlehandedly solve all imbalances. The normal policy assignment would be to assign exchange rate policy to external balance and fiscal and/or monetary policy to internal balance. Yet in the short run the authorities can be assumed to remain passive or unable to fine-tune in face of random shocks, and the exchange rate system in use can be legitimately evaluated in terms of its contribution to short-run internal balance.

The approach taken here is accordingly of a short-run nature. It seeks to compare a pegged real exchange rate to a pegged nominal rate--the realistic present alternative for most developing countries--when the economy is subject to a host of random shocks, both monetary and real. The analysis is a synthesis and extension of previous studies in the same vein by Black (1976), Fischer (1977), Lipschitz (1978), and Frenkel and Aizenman (1982). These studies compared fixed and flexible exchange rates, but did not explicity evaluate a real peg policy. 1/ It will be seen in the present context that a real peg is the better alternative for stabilization purposes when the shocks are monetary in origin. The next section, in turn, will investigate the optimal mix between nominal and real peg strategies when the authorities are unable to distinguish between the sources of disturbances.

Since most developing countries are individually small in the world market, it is appropriate to analyze these issues in the context of a small open economy model. Following a long tradition of such models, the

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1/ Fischer (1977) and Lipschitz (1978), in fact, concentrated on one-good models with continuous PPP. Some explicit theoretical evaluations of a real peg policy can be found in Williamson (1981), Part One, and especially in the contribution by Hans Genberg. However, as Williamson himself points out, much of the theoretical literature related to these issues has concentrated on developed countries.

economy can be divided into a tradables (T) and a nontradables (N) sector. The constancy of the terms of trade for a small trading economy allows the exportables and importables to be lumped together into a Hicksian composite good. 1/

Equations (9) - (13) describe a simple version of such a model:

$$T^s(\overset{+}{\alpha}, \overset{+}{r}) - T^d(\overset{-}{r}, \overset{+}{a}) + K = B \qquad (9)$$

$$N^s(\overset{+}{\beta}, \overset{-}{r}) - N^d(\overset{+}{r}, \overset{+}{a}) = 0 \qquad (10)$$

$$M = kpa \qquad (11)$$

$$p = p_N^{\gamma}\,(e\,p_T)^{1-\gamma} \qquad (12)$$

$$r = \frac{ep_T}{p_N} \qquad (13)$$

The first two expressions are equilibrium conditions in the markets for traded and nontraded goods, respectively. As regards the former, the excess of tradables supply over tradables demand represents net exports, the sum of which with capital inflows (K) gives the balance of payments position. 2/ For external balance, the condition that $B = 0$ is added. Expression (10), on the other hand, states the equality of demand and supply in the nontradables sector, and determines the internal balance condition. In both cases, the signs of the partial derivatives of the supply and demand functions are given above the variable in question. Besides the obvious notation, α and β represent shift parameters that stand in for supply shocks in the tradables and nontradables markets, respectively. Supplies in both markets are taken to be a function of these parameters ("weather") as well as of the real exchange rate, while demands depend on the real exchange rate and the level of real absorption or expenditures.

Equation (11) represents a Prais-type expenditure function with real expenditures being proportional to real money balances. Note that the link between the balance of payments and the money supply is neglected on the assumption either that it is unimportant in the short-run, or, as is more likely, that the authorities sterilize changes in the foreign component of the money supply. Equation (12) is the definition of the price index, with γ, the consumption share of the nontradable sector, being an inverse measure of the openness of the economy. Finally, (13) is the definition of the real exchange rate, which in the

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1/ For a justification and elaboration of the small open economy model, see Dornbusch (1980), Chapter 6.

2/ Note that capital inflows are now given in real terms, in contradistinction to the earlier treatment.

context of small open economy models is the domestic price of traded goods deflated by the price of nontraded goods. Fiscal policy and the government budget are also ignored although that could be remedied relatively easily. In the absence of government expenditures and investment, absorption (a) is equivalent in the present model to consumption.

In the equilibrium version of the model, where the real exchange rate (r) is fully flexible, the five endogenous variables are r, a, p_N, p and e, while the exogenous variables are K, B, α, β, M, and p_T. With a pegged real (nominal) rate, r(e) becomes exogenous and B endogenous instead.

The model is segmented in the sense that the real sector (equations [9] and [10]) determines r and a independently from the rest. In other words, money is completely neutral in the present framework. As in all models of such type, we here associate internal and external balance with equilibrium in the markets for nontraded and traded goods, respectively. Making use of the equilibrium conditions in the T- and N-sectors, internal and external balance can be represented using the familiar Swan diagram as in Figure 1. Schedule II defines the locus of all combinations of r and a which maintain internal balance; it is downward sloping because an increase in the real exchange rate (the relative price of traded goods) creates excess demand in the N-sector which has to be offset by a decrease in absorption. Schedule EE represents all combinations of r and a that maintain external balance; it is upward sloping because a real depreciation has to be offset by increased imports generated by a rise in expenditures. The intersection of the two schedules defines the equilibrium levels of real absorption and the real exchange rate. The four zones I-IV, on the other hand, represent various combinations of external and internal imbalance:

Zone I:	balance of payments deficit and "inflation"
Zone II:	balance of payments deficit and "unemployment"
Zone III:	balance of payments surplus and "unemployment"
Zone IV:	balance of payments surplus and "inflation"

Starting from an initial position of equilibrium, we can now investigate the effects of the exchange rate system on real absorption (a) and the balance of payments (B) under various shocks.

a. An increase in domestic money supply

Since r and a are determined independently by equations (9) and (10), an increase in the money supply does not affect the position of the internal and external balance schedules in Figure 1. The equilibrium levels of r and a do not change. Hence, an equilibrium exchange rate policy would result in a depreciation of the exchange rate to exactly offset the increase in the price of N-goods that results from the increase in M. What a policy of real peg does is to achieve precisely the same thing.

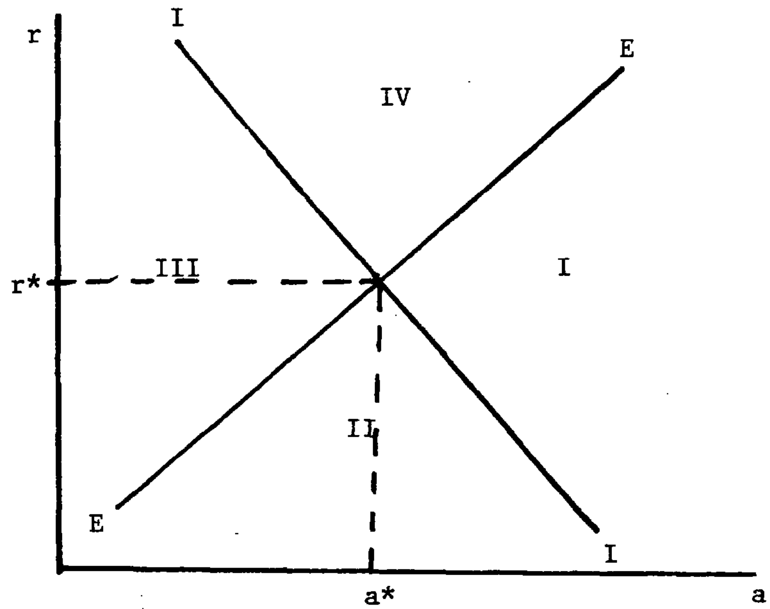

Figure 1: Internal and external balance in the small open economy

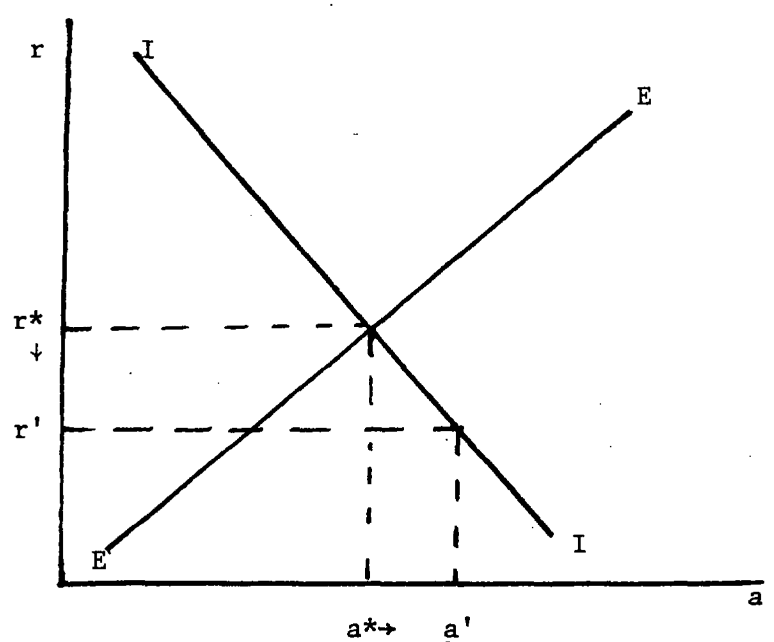

Figure 2: Effects of increase in money supply with a pegged nominal exchange rate

A policy of nominal peg, on the other hand, leads to an appreciation of the real exchange rate, and a deviation from the combination of r and a which achieves full employment and balance of payments equilibrium jointly. The magnitude of the appreciation in r is given by

$$\dot{r}\,\Big|_M = -\left[\frac{aN_a^d}{(N_r^d - N_r^s)r + \gamma aN_a^d}\right]\dot{M}. \qquad (14)$$

Graphically, the effect can be seen in Figure 2: the fall in r from r* to r' leads to a change from a* to a' and a consequent balance of payments deficit.

b. *A decrease in the foreign price of traded goods*

An exogenous decrease in the foreign price of traded goods (due, say, to a contractionary monetary policy abroad) operates in much the same way as in the previous instance, and need not be much elaborated on. Once again, the real peg is equivalent to an equilibrium exchange rate policy in that the economy can be completely insulated from the effects of the shock by increasing e by the same proportion as the fall in p_T. With a nominal peg, the real exchange rate is allowed to appreciate, resulting in the same configuration as that depicted in Figure 2.

c. *A supply shock in the traded goods sector*

Let us now turn to a real disturbance in the form of a shock that reduces the supply of tradable output ($d\alpha<0$). External balance now requires a higher real exchange rate for every level of real absorption, so that the EE schedule moves to the left (Figure 3). At the new equilibrium, the real exchange rate depreciates to r** while absorption falls to a**.

If r is pegged, it can be seen from Figure 3 that real absorption is maintained at the original level a*, at the cost of a balance of payments deficit. The same outcome obtains when it is the nominal exchange rate that is fixed: to see this note from (10)-(13) that a fixed r and a keep both the money market and the N-sector in equilibrium, while the balance of payments deteriorates by

$$\frac{\partial B}{\partial \alpha} = T_\alpha^s . \qquad (15)$$

A pegged nominal rate policy is thus identical to a pegged real rate policy in the case of supply shock in the tradables sector. Both policies imply using the balance of payments as a shock absorber to insulate real absorption from a disturbance in the T-sector.

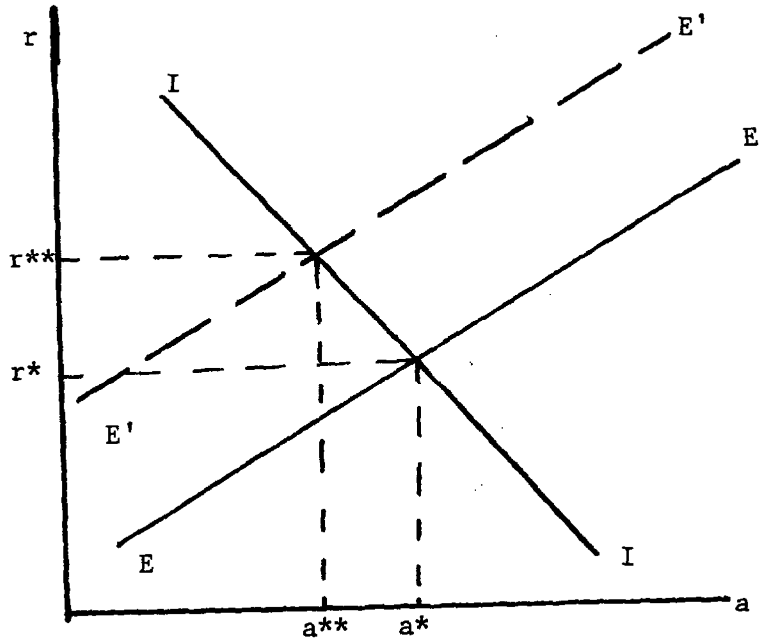

Figure 3: Effects of a supply shock in the traded goods sector

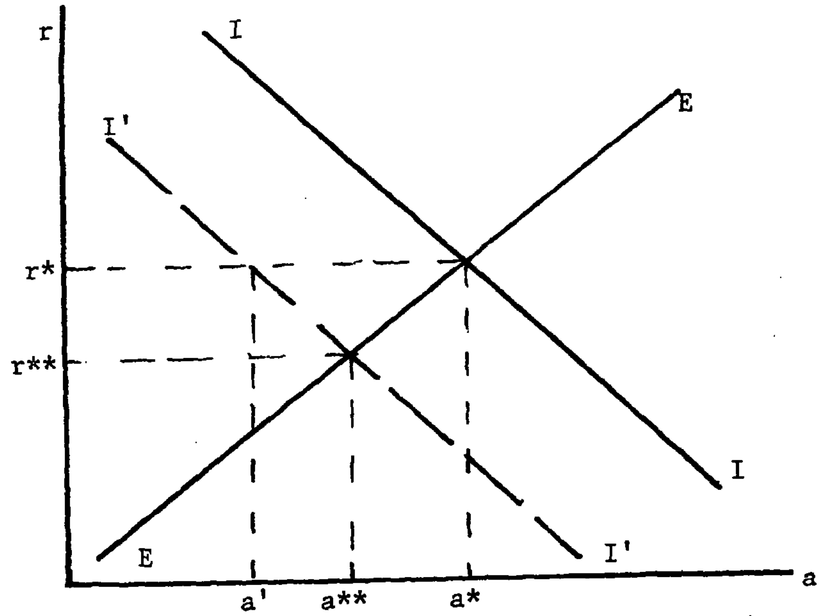

Figure 4: Effects of a supply shock in the nontraded goods sector

d. A supply shock in the nontraded goods sector

Now consider a supply shock in the N-sector ($d\beta<0$), which could be, for example, a poor harvest in subsistence agriculture. Figure 4 depicts the situation where the resulting leftward shift of the internal balance schedule yields a fall in absorption and a decline in the real exchange rate at the new equilibrium. The real rate has to fall because an increase in the relative price of nontraded goods is required to equilibrate demand and supply in the N-sector following a supply shortfall. The change in real absorption when r (and e) are allowed to adjust freely is given by

$$da = \frac{N^s_\beta}{N^d_a + \theta} d\beta \qquad (16)$$

where

$$\theta = \frac{(N^d_r - N^s_r)}{T^s_r - T^d_r} T^d_a > 0.$$

When the real exchange rate is fixed, however, equilibrium in the N-sector can be achieved only by reducing demand through a more severe cut in real expenditures. Figure 4 portrays this case and the consequent change in absorption from a* to a', which is larger than that obtaining with the flexible rate policy. The precise magnitude of the absorption change now is given by

$$da \Big|_{\bar{r}} = \frac{N^s_\beta}{N^d_a} d\beta \qquad (17)$$

which exceeds that in expression (16). The counterpart of the magnified impact on absorption is a balance of payment surplus.

Under a pegged nominal exchange rate system, by contrast, the rise in nontraded goods prices resulting from the supply shock is allowed to appreciate the real exchange rate. Consequently, real absorption has to bear less of the burden of re-equilibrating the N-goods sector. The change in real absorption is now given by

$$da\Big|_{\bar{e}} = \frac{N^s_\beta}{N^d_a + \Psi} d\beta \qquad (18)$$

where

$$\Psi = \frac{r}{\gamma a} (N^d_r - N^s_r) > 0.$$

As can be seen from comparing (18) to (17), a pegged nominal rate does a better job of insulating domestic absorption from the effects of nontraded supply shocks than does a policy of real peg. 1/ It is even possible that a nominal peg might here outperform an equilibrium exchange rate policy: a comparison of (18) with (16) shows that this will be the case when $\Psi > \Theta$. In effect, a nominal peg would then be turning an incipient balance of payments surplus into a deficit, thus alleviating the supply shortfall at home even more.

e. A recapitulation

By way of summary, Table 1 presents the conclusions of the comparative static exercises discussed above. The table ranks the real peg policy against nominal peg and equilibrium exchange rate policies in terms of its performance with respect to the absorption ($da = 0$) and balance of payments ($dB = 0$) objectives. The ranking is done for all four shocks considered above, but the two monetary disturbances are lumped together since they were identical as regards their consequences under the various policy options.

The comparative rankings show that a pegged real rate is a first-best policy when the origin of the shock confronting the economy is purely monetary. 2/ Hence, when the disturbance in question is a change in the domestic money supply or in the foreign price level, a policy of maintaining the real rate constant, unlike that of a nominal peg, is successful in holding real absorption at its original level and keeping the balance of payments in equilibrium. In such instances a real peg is equivalent to a policy of maintaining the exchange rate at its equilibrium level--i.e., free floating. When the shocks are of a real nature, on the other hand, a pegged nominal rate tends to perform better in terms of the economic stabilization objective. This is true particularly in the case of a real shock in the nontraded goods sector. Here, a constant real rate exacerbates the impact of the shock on the level of real absorption, while a constant nominal rate transfers some of the burden of adjustment to the real exchange rate, with less drastic consequences for absorption.

Finally, with a real disturbance in the traded goods sector the pegged real and pegged nominal rate policies are equivalent. Both use the balance of payments as a shock absorber in the short term, and minimize the absorption effects of the shock.

How general are these results? Many studies comparing alternative exchange rate regimes under different types of shocks have stressed the short-run superiority of fixed nominal exchange rates when the economy is

1/ Essentially this is the case that authors such as Lipschitz (1979) have in mind when they criticize the policy of maintaining a real peg.

2/ And, it should be added, when money is neutral.

Table 1. Rankings of Policy Options with Respect to Absorption and Balance of Payments Objectives 1/

Policy	Nature of Shock		
	Monetary (dM, dp_T)	Real on T-sector ($d\alpha$)	Real on N-sector ($d\beta$)
(1) Equilibrium exchange rate	1	3(1)	2(1) 2/
(2) Pegged real rate	1	1(3)	3
(3) Pegged nominal rate	3	1(3)	1(2) 2/

1/ Numbers in parentheses refer to ranks with respect to the balance of payments objective when these differ from those for the absorption objective.

2/ The relative ranking of (1) and (3) depend on the relative magnitudes of Θ and Ψ (see text). Here it is assumed that $\Psi > \theta$.

faced with temporary real shocks. 1/ Similarly, several theoretical analyses of the PPP doctrine as a basis for defining the "equilibrium" exchange rate have concluded that the validity of the PPP approach rests on the existence of solely monetary or "neutral" disturbances. 2/ The results from both of these lines of research fit in nicely with the conclusions drawn in the present context.

However, as Kiguel (1983, chap. 3) points out, the desirability of alternative exchange rate regimes under random disturbances also depends crucially on the extent of capital mobility. This can be seen most clearly in the context of the Mundell-Fleming model: With perfect capital mobility, monetary disturbances have no effects in this model on real income under pegged nominal exchange rates; consequently, the above conclusions are reversed and a pegged nominal rate becomes the optimal strategy against monetary shocks. While the neglect of capital mobility in the model analysed here is therefore a limitation on the applicability of the results, there are also sound reasons for believing that this limitation may not be too great. The capital accounts of the great majority of the developing countries are heavily controlled, and even in the few cases where capital transactions have been liberalized the insulating properties of pegged nominal exchange rates with nominal disturbances have been scarcely in evidence. If the automatic Mundell-Fleming adjustment mechanism did indeed operate so as to neutralize the effects of excess money creation at home through the capital account, the problem which the real peg policy is designed to solve would not have existed in the first place. It is, nonetheless, the case that the presence of capital mobility would complicate stabilization policy in ways not well captured in the present framework.

It might also be mentioned that the above analysis depends heavily on the assumption that the economy is in equilibrium initially, and that the desired income and balance of payments targets have been achieved. It would make little sense to think of the stabilization of absorption at its initial value as a goal for policy when this value is far from that which is consistent with achieving, say, full employment. The justification for the above analysis rests on the fact that the exchange rate is only one tool among many in the authorities' armory to attain the long-term income and external balance objectives. Therefore, it is not appropriate to consider the exchange rate regime in isolation in terms of its contribution to the achievement of the long-term objectives. What was done here, instead, was to evaluate alternative exchange rate regimes in the short run when the economy is subject to a variety of transient shocks.

While the focus has been on temporary shocks, however, the above framework also tells us a few things about the comparative performance of the real peg policy in face of <u>permanent</u> shocks. When shocks are

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1/ See Fischer (1977), Lipschitz (1978), Frenkel and Aizenman (1982), Lipschitz (1979, p. 445), and Black (1976).

2/ See Genberg (1981), Katseli (1979), and the references cited by Katseli.

permanent, the balance of payments cannot be used as a shock absorber since that would imply long-term external imbalance. Consequently, adjustments in absorption may be both desirable and necessary. The appropriate standard against which to compare the performances of the real and nominal pegs now becomes the equilibrium exchange rate, and not the stabilization of real absorption. Against this benchmark, the real peg will once again perform better than the nominal peg when the source of the permanent shock is monetary. Faced with a real permanent shock, on the other hand, while a nominal peg might tend to better approximate the requisite change in the real rate, it would still be a second best policy to that of promptly adjusting the real rate by the requisite amount. A real peg itself, sustained indefinitely, will hardly ever be desirable with permanent real shocks.

From a theoretical standpoint, it should come as no surprise that a rigid pegged real exchange rate policy is inappropriate when the economy is faced with real shocks. Fixing any relative price will in general lead to resource misallocations when demand and supply schedules move around. This is the case all the more so for such an important relative price as the real exchange rate.

3. The optimal degree of real pegging

Given a choice between nominal and real peg strategies, the analysis of the previous section provides some guidance as to which is likely to be the more desirable option for temporary shocks of differing origin. Yet this begs an important question. In practice, the authorities are unlikely to be able to distinguish among the sources of the disturbances, and even if they could, they would be unable to costlessly and instantaneously switch to the more desirable strategy as demanded by the circumstances. Therefore, policymakers are more likely to be concerned with the overall desirability of one exchange rate strategy as against the other. In this vein, this section is devoted to identifying some of the key structural characteristics of the shocks and the economy in question that would determine the desirability of maintaining a real peg.

For analytical convenience, the policy variable of the authorities can be conceptualized as a continuous variable λ indicating the extent to which the exchange rate is made to track relative inflation differentials. 1/ The relationship between the nominal exchange rate and relative price levels is given by

$$\dot{e} = \lambda\ (\dot{p}_N - \dot{p}_T). \qquad (19)$$

1/ The approach taken here has been inspired by Frenkel and Aizenman (1982) who investigate the optimal degree of floating. An earlier and essentially identical treatment is in Lipschitz (1978).

For a nominal peg strategy, the choice variable λ is set equal to zero, whereas for a real peg strategy λ would be set to unity. Any value of λ less than unity indicates less than complete real pegging. The policy choice of the authorities can now be formalized as the optimal value of λ .

Continuing with our short-term focus, we shall assume that all shocks faced by the economy are transitory, and that these shocks can be described by stable statistical processes. The problem for the authorities is to minimize the variance of real absorption around its equilibrium value a* subject to the constraint that the balance of payments remains within certain bounds:

$$\min_{\lambda} \; E(a - a^*)^2 \text{ s.t. } |dB| \leq \varepsilon$$

For purposes of computational simplicity, however, we shall assume that the constraint never holds strictly, i.e., that temporary changes in the balance of payments can always be financed by changes in reserves. Note that, as pointed out above, real absorption is equivalent to real consumption in the present framework. The authorities' desire to minimize the variability in absorption has therefore a valid choice-theoretic rationale.

Given (19), the reduced form expression for da of the model of the previous section can be written as

$$da = \frac{1}{N_a^d + \frac{bc}{a}} \left[N_\beta^s \, d\beta - \frac{bc}{p_T} dp_T + \frac{bc}{M} dM \right] \quad (20)$$

where

$$b \equiv N_r^d - N_r^s > 0$$

$$c \equiv \frac{r(1-\lambda)}{\gamma + (1-\gamma)\lambda} . \quad (21)$$

Notice that $d\alpha$ (supply shock in traded sector) does not enter the expression since, as was mentioned above, it does not affect the choice between nominal and real pegging. Equation (20) defines an implicit function of the form

$$a = f(\beta, p_T, M).$$

Taking a Taylor's expansion around the equilibrium values of a*, β^*, p_T^*, and M*, we can express the deviation of absorption from its equilibrium value in terms of deviations in the exogenous variables:

$$a - a^* = \frac{\partial f(.)}{\partial \beta} (\beta - \beta^*) + \frac{\partial f(.)}{\partial p_T} (p_T - p_T^*) + \frac{\partial f(.)}{\partial M} (M - M^*),$$

where the partial derivatives are evaluated at the equilibrium values. Or,

$$a - a^* = \frac{1}{N_a^d + \frac{bc}{a}} \left[N_\beta^s \; (\beta-\beta^*) - \frac{bc}{p_T} \; (p_T - p_T^*) + \frac{bc}{M} \; (M-M^*) \right] .$$

Under the assumption that the shocks are independent of each other, we can now express the variance of real absorption as follows:

$$\mathrm{var}(a) = \frac{1}{(N_a^d + \frac{bc}{a})^2} \left[(N_\beta^s)^2 \; \sigma_\beta^2 + (\frac{bc}{p_T})^2 \sigma_{p_T}^2 + (\frac{bc}{M})^2 \; \sigma_M^2 \right] . \qquad (22)$$

Noting that c in the above expression is a function of λ, the problem now consists of minimizing (22) with respect to c.

The solution for optimal c* is given by

$$c^* = \frac{(N_\beta^s)^2}{ba \; N_a^d} \left[\frac{\sigma_\beta^2}{(\frac{1}{M})^2 \sigma_M^2 + (\frac{1}{p_T})^2 \sigma_{p_T}^2} \right] . \qquad (23)$$

Or, putting everything in elasticity form,

$$c^* = \frac{\nu^2}{\mu(\varepsilon^s + \varepsilon^d)} \left[\frac{\sigma_\beta^2}{(\frac{1}{M})^2 \; \sigma_M^2 + (\frac{1}{p_T})^2 \; \sigma_{p_T}^2} \right] , \qquad (23')$$

where r and β have been fixed at unity at their equilibrium values without any loss of generality, ν equals the elasticity of N-supply with respect to supply shock, μ is the income elasticity of demand for N-goods, and ε^s and ε^d are price elasticities of supply and demand (both positive) of N-goods with respect to the real exchange rate. Using expression (21), the optimal value for the choice variable λ can then be calculated as follows:

$$\lambda^* = \frac{1 - \gamma c^*}{1 + (1-\gamma) c^*} \qquad (24)$$

Hence, the optimal value for the coefficient of real pegging is a function of the various variance terms for the shocks and of price and income elasticities. It is also a function of the degree of openness of the economy since γ, the weight of nontraded goods in the aggregate price index (and hence in total consumption), is an inverse measure of openness. From (24) it can be seen that λ and c are inversely related, so that anything that increases c* will decrease the optimality of real pegging.

In light of (23') and (24) we can now relate the desirability of a real peg policy to the structural characteristics of the economy. Remembering that the higher and closer to unity λ is the closer we approximate a real peg, the following conclusion can be drawn from the above exercise. A real peg policy is more likely to be desirable:

(i) the lower the variance of real shocks in the N-sector (σ^2_β);

(ii) the higher the variances of the domestic money supply (σ^2_M) and of the foreign price level ($\sigma^2_{P_T}$);

(iii) the lower the sensitivity of nontraded goods output to supply shocks (ν);

(iv) the higher the income elasticity of demand for N-goods (μ);

(v) the higher the elasticities of demand and supply for N-goods (ε^d and ε^s); and

(vi) the more open the economy ($1-\gamma$).

These results can be checked by looking at the partial derivatives of λ^* with respect to the parameters listed above. The results with respect to the role of the relative size of variances are of the expected kind and need not be elaborated further in light of the discussion in the previous section. As regards the price and income elasticities, we have *a confirmation of the idea that a more flexible economic structure* is less susceptible to the adverse effects of a real peg; ceteris paribus, a real peg makes more sense for a flexible economy. As well, a more open economy will be less affected by domestic supply shocks since the requisite adjustment in the price of nontraded goods will exert a smaller impact on the aggregate price level and consumption. Thus a more open economy is more likely to benefit from a policy of real peg.

Note that it is always sub-optimal to have a complete real peg ($\lambda = 1$) unless the variance of nontraded supply shocks is zero. As long as there are some such real shocks to be reckoned with, the economy will have been better off ex post if the exchange rate was not made to fully adjust for relative inflation differentials. In practice, of course, it is impossible to determine the precise magnitude of λ^*. Therefore, as a practical matter, the choice between a nominal and real peg would be made on the basis of a consideration as to whether λ^* is closer to zero or unity.

The analysis so far has assumed that the various shocks are independent of each other. It might be also of some interest to briefly consider the case where monetary authorities do not remain passive and they attempt to accommodate the effects of supply shocks by manipulating the money supply. If monetary accommodation is the rule, the variance of the money supply can be thought of having two components: one having to do with the stochastic process of the money stock itself, and the other related to the variance of supply shocks. Hence, we can now write

$$\text{var }(M) = \sigma_M^2 + h\sigma_\beta^2 \quad ,$$

where h is some arbitrary positive constant. As a consequence, the optimal value of c will be given as:

$$c^* = \frac{\nu^2}{\mu(\varepsilon^s + \varepsilon^d)} \quad \frac{\sigma_\beta^2}{(\frac{1}{M})^2(\sigma_M^2 + h\sigma_\beta^2) + (\frac{1}{p_T})^2 \sigma_{p_T}^2} \quad . \quad (23'')$$

A comparison with (23') will show that the new value of c* is smaller, and hence the optimal λ* is now larger. In other words, a greater degree of monetary accommodation increases the desirability of the real peg strategy.

Finally, let us consider also the effects of wage-price indexation. How does the desirability of the real peg depend on the extent of indexation within the economy? A convenient way to account for indexation in the above model is to let the price of nontraded goods be a function of the domestic currency price of traded goods, as well as of an autonomous and endogenous component:

$$p_N = (ep_T)^{\delta} \bar{p}_N^{(1-\delta)}$$

where δ is the coefficient of indexation and $\bar{p}_N$ is the autonomous component. Such a situation would arise when labor costs are important in the production of N-goods and wages are linked to the general price level through real wage resistance. The price index of expression (25) can consequently be written as

$$p = \bar{p}_N^{\gamma(1-\delta)} \cdot (ep_T)^{\gamma\delta + (1-\gamma)} \quad .$$

Notice that the only difference this formulation makes is an increse in the weight of traded goods in the aggregate price index. Hence a high degree of indexation (δ) in the economy is formally equivalent to a high degree of openness (1-γ). In line with the earlier conclusion on openness, therefore, the desirability of the real peg policy increases with the extent of indexation. 1/ As with openness, a high degree of

1/ A real peg increases the likelihood of inflationary wage-price spirals in an indexed economy, however. The impact of wage disturbances on the price level will be amplified through the feed-back effects of exchange rate changes on wages. Thus, as Dornbusch (1981, 1982) points out, the stabilization of real income achieved by a real peg (under monetary disturbances) may come at the cost of increased price variability.

indexation tends to offset the variability in the real exchange rate that would result from a pegged nominal rate. Ceteris paribus, it reduces the gains to be had from the flexibility of the real rate (with a nominal peg) when the economy is faced with real shocks. In the limit, with full indexation (δ=1), the real rate is effectively fixed, irrespective of the policy pursued.

To conclude, then, the analysis of this section suggests that a real peg policy is unlikely to be beneficial to all developing countries across the board. Instead, it appears that maintaining a constant real exchange rate will be most desirable for a country that possesses a relatively open, flexible, and diversified economic structure that is not much sensitive and subject to supply shocks, that is faced with a preponderance of monetary shocks, and a tradition of monetary accommodation and indexation. These characteristics tend to fit the description of some middle-income developing countries which are exporters of manufactured products and have inflation-prone economies. It is, of course, not possible to determine precisely for each country the extent to which real pegging would be optimal since it is hard to quantify many of these characteristics in any meaningful sense. Table A.1 in Appendix I, however, presents some suggestive statistics on openness and the relative variances of monetary and real shocks in selected developing countries.

III. The Real Peg in a World of Floating Currencies

The discussion up to this point has been concerned with the appropriateness of pegging "the" real exchange rate. In a world where major currencies float against each other and where inflation rates vary widely across countries, however, the home country faces as many real exchange rates as it has trade partners. Consequently, the appropriate notion of the exchange rate becomes an "average" of these bilateral rates, or an effective exchange rate. The exchange rate to be pegged, in turn, becomes the real effective rate. The mechanics of pegging the real effective exchange rate are developed in Appendix II. The present section concentrates on the implications of reformulating the real peg policy in terms of a basket of currencies, especially in the context of sustained deviations from purchasing power parity (PPP) between major currencies.

1. PPP and the real basket peg

In a multilateral context, maintaining a constant real effective rate amounts to adhering to the following equality (see Appendix II):

$$\sum_{i=1}^{n} w_i \{\dot{e}_{ijt} + \dot{P}_{it} - \dot{P}_{jt}\} = 0, \qquad (25)$$

where subscript j refers to home country and i is an index variable over the trade partners concerned. The weights attached to the currencies of the trading partners (w_i) are assumed to remain constant over the relevant time period and sum to one. The rule embodied in equation (25) is the multilateral counterpart of the rule expressed in (4) above. Alternatively, the rule can be expressed in terms of the requisite adjustments in the nominal value of home currency against the composite basket, where the basket is defined by currencies i = 1, 2, ..., n and the weights w_i. Letting the value of the basket against the home (foreign) currency be e_{bjt} (e_{bit}), Appendix II shows that the real basket peg policy yields the following rule:

$$\dot{e}_{bjt} = \dot{P}_{jt} + \sum_{i=1}^{n} w_i \, (\dot{e}_{bit} - \dot{P}_{it}). \qquad (26)$$

In words, the policy requires depreciating the (nominal) value of home currency against the basket by the sum of the home inflation rate and the weighted average of foreign depreciations against the basket in excess of own inflation rates.

Notice that a real basket peg, as expressed in (25) does not necessarily imply adhering to PPP on a strictly bilateral basis. In fact, when the basket currencies fail to follow PPP among themselves, the policy will require home-country deviations from bilateral PPP as well. As is well known, PPP does not appear to hold in the short- and medium-run between the major floating currencies which are likely to dominate the basket for a developing country. 1/ Therefore, a real basket peg is in practice unlikely to yield constancy of bilateral real exchange rates. 2/ In such cases, it is easy to show that the deviation of home currency from PPP with any particular basket currency will be identical, and of opposite sign, to the weighted deviation of that currency from PPP with all other currencies in the basket.

2. Implications of bilateral deviations from PPP

When the major currencies do not follow PPP, a real basket peg can maintain competitiveness only in an average sense. Even with a stable real effective rate, a pegging country is likely to experience fluctuations in its bilateral real rates. 3/ This in turn implies that a real basket

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1/ See Kreinin and Officer (1978), Isard (1977), and Kravis and Lipsey (1978).

2/ This is implicit in Lipschitz and Sundararajan (1980) who consider the optimal basket that will minimize variations in the real rate index that are due to transitory deviations from PPP among trading partners.

3/ This is the same problem as that faced by countries which want to maintain a pegged nominal rate in a world of floating currencies. Suitably modified to include a real peg, the following statement by Branson and Katšeli (1982, p. 194) holds equally well. "If [a country] pegs its currency to one of the major currencies, it floats against the others. If it pegs to the SDR, it floats against all currencies. Thus, in the system begun in the early 1970s the very concept of a fixed exchange rate is unclear."

peg might not completely insulate the home country even from purely financial disturbances. This is due to the fact that changes in competitiveness levels vis-à-vis individual trading partners are likely to have real effects on resource allocation, despite the fact that competitiveness is being maintained on average. Consider a reshuffling of the foreign inflation rates, and a consequent change in the nominal basket peg at home to keep the real effective rate constant. The resulting structure of bilateral real rates will in general be different from the old one. And to the extent that the home country trades different goods with different partners, these changes in bilateral real rates will lead to complementary changes in the allocation of resources toward tradables sectors dominated by trade with countries whose real rates (vis-à-vis home country) have appreciated. Hence, a financial shock will not only have real effects but also will cause, in all but the most frictionless world, adjustment costs.

A real basket peg, therefore, will not be entirely successful in insulating the home economy from the effects of changes in differential inflation rates, unless the basket currencies follow PPP. What is true of a real peg in a two-country world is not true of a real basket peg in a many-country world with fluctuating exchange rates. However, it is unclear how important the effects mentioned above are. Sizable adjustment costs would result only from substantial and frequent changes in the relationship of basket currencies to PPP. In the absence of these, the importance of real effects at home is likely to be of second order. 1/

A second implication of bilateral deviations from PPP has to do with the design of the appropriate basket. To see this, return to (25) which expresses the necessary condition for the constancy of the real effective rate. When the basket currencies follow PPP, a policy of real basket peg will always maintain the term in brackets equal to zero, and hence the weights attached to the currencies will be of no practical significance. However, when basket currencies deviate from PPP, the structure of weights will determine the relative magnitudes of the requisite changes in bilateral real rates so as to maintain competitiveness. What is involved now for the home country is a loss in competitiveness against some trading partners, to be made up by gains against others. The selection of the appropriate weights now becomes crucial to ensure that these individual changes in competitiveness exactly offset each other in terms of their respective effects on trade flows.

The desired weights are clearly MERM-like competitiveness weights, which will in general be calculated from a model of trade and be a function of trade shares and elasticities. These weights take into account trade

1/ It might be mentioned that if these fluctuations in bilateral real rates are cause for concern, an alternative to the real basket peg would be a policy of minimizing these fluctuations subject to the constraint that the real effective rate remain within a specified band. This alternative is not pursued here.

effects of currency realignments not only on a bilateral basis but in third markets as well. While much of the MERM literature has concentrated on industrial countries (Artus and Rhomberg, 1973; Artus and McGuirk, 1981), there have also been a few attempts to derive MERM-type weights for primary producing developing countries (Belanger, 1976; Feltenstein et al, 1979). 1/ In principle, these weights are derived from fairly complicated models of trade. For most developing countries, however, the paucity of reliable parameter estimates diminishes the usefulness of complex models.

IV. Practical Issues

After the theoretical and conceptual tour d'horizon of Parts II and III, we now turn to some of the practical problems raised by the real basket peg policy. Chief among these is the problem associated with the price series used to construct real effective exchange rate indices. First, we have question of the availability of the theoretically appropriate price series. In the context of the small open economy discussed above, the appropriate price indices would be those pertaining to nontraded and traded goods, respectively. For a developing country possessing some market power--and this is often the case on the export side--price indices for exportables and foreign importables might be more relevant. Very few developing countries, however, possess the statistical basis to compute more than one or a few of these indices. The price indices that are available may reflect the underlying developments only imperfectly due to well-known problems having to do with incomplete coverage, presence of administrative price ceilings, limited relevance to traded goods, and so forth. While these are important shortcomings, it is equally clear that trends in competitiveness have to be assessed somehow, and that using the available price indices might be the best that policy makers can do under the circumstances.

Second, and related to the above, there is the problem of which series to use if more than one price index is available. Many developing countries publish both CPI and WPI series. On theoretical grounds, a second-best case could be made for each of these. Does it matter much, in practice, if one is used instead of the other? 2/

But most important, there is the problem that price indices (of whatever kind) are always published with a lag--a lag that tends to be considerable for some developing countries. A strict policy of real basket peg is therefore out of the question since the actual real effective rate within any period (day? week? month?) is unknown to the authorities

1/ See also the models in Lipschitz and Sundararajan (1982) and Branson and Katseli (1982).

2/ For an extended discussion of the available price series and their appropriateness, the reader is referred to Maciejewski (1982).

and cannot be stabilized with complete precision. This has led some observers to reject the real peg policy on the grounds of impracticality. Lipschitz and Sundararajan (1980, p. 80), for example, argue that since "continuous discretionary management of the real exchange rate is impossible, [...] a rule is needed for fixing the nominal exchange rate so that the real exchange rate is stabilized" (emphasis added). Others, like Williamson (1982, p. 53), have argued that inflation rates have a high degree of serial correlation and that "[t]his fact can be exploited in order to choose a rate of crawl of the peg that will come reasonably close to neutralizing differential inflation." In effect, Williamson's argument is that the variability in the real exchange rate obtaining from the use of inflation rates from some period in the past is unlikely to be too large.

Clearly, a real basket peg policy will make sense (under appropriate conditions) only to the extent that the index which is being pegged is economically meaningful. It is therefore crucial to know which of the two sides in the above debate comes closer to reality. Fortunately, it is possible to estimate the magnitude of the errors that are likely to result in practice from the use of out-of-date price data in the real effective rate which is being pegged. The next section is devoted to this question.

1. The real basket peg policy in practice

Consider a country that has opted for the real basket policy, and that adjusts its nominal exchange rate according to the rule expressed in (26). We assume that adjustments are carried out on a monthly basis. Since contemporaneous price data is not available for the home country or any of its trade partners, the authorities estimate the current monthly inflation rate from the most recent inflation data available. The rule that is followed is in effect:

$$\dot{e}_{bjt} = \dot{P}'_{jt} + \sum_{i=1}^{n} w_i \, (\dot{e}_{bit} - \dot{P}'_{it}), \qquad (26')$$

where the primed price variables denote estimated inflation rates to distinguish them from the actual (unknown) inflation rates prevailing at month t. The actual movement in the real effective exchange rate is then given by (substituting (26') in (A2') in Appendix II)

$$\dot{r}._{jt} = (\dot{P}'_{jt} - \dot{P}_{jt}) + \sum_{i=1}^{n} w_i \, (\dot{P}_{it} - \dot{P}'_{it}). \qquad (27)$$

Therefore, the deviation of the real effective rate from the aimed peg is the sum of the forecasting mistakes made for domestic and (weighted) foreign inflation rates. The question of interest is the likely magnitude of this deviation in practice.

To answer this question a simulation exercise was performed for fourteen developing countries over the period January 1975 to December 1982. In each case, four different policies were compared:

(a) Policy R1: A real basket peg policy, using the inflation rate prevailing three months ago 1/ as the best estimate of current inflation ($\dot{P}_t^{'} = \dot{P}_{t-3}$). 2/

(b) Policy R2: Same as above, except that nominal rates are adjusted not only on the basis of inflation rates prevailing three months ago but also to fully offset the actual deviation from the aimed real peg having taken place three months ago.

(c) Policy N: A nominal peg policy, with the domestic currency pegged to the U.S. dollar over the entire period.

(d) Actual Policy: The actual policy followed by the country concerned, as revealed by the actual movement of the exchange rate.

The basket used for each country includes ten industrial countries 3/, and was constructed on the basis of trade (exports plus imports) weights 4/ for 1980. CPI series were used for the price indices in all cases. The resulting changes in the real effective exchange rates were then calculated under each of the four policy regimes.

A summary of the simulation results is presented in Table 2. Columns (1) and (3) portray the mean monthly percentage change in the real effective rates of the fourteen countries that would have obtained had they subscribed

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1/ Among the 108 developing countries listed in the August 1983 issue of the International Financial Statistics (pp. 50-53), the distribution of dates for the latest available monthly (CPI) inflation rates was as follows:

	June	May	April	March	February	January	Earlier
lag	2	3	4	5	6	7	8+
countries	3	21	15	12	12	4	41

2/ Clearly, more sophisticated forecasting techniques could be devised. The simulations here are designed to illustrate the implications of relatively straightforward extrapolation rules.

3/ U.S., Japan, France, Germany, Italy, Netherlands, Switzerland, Sweden, U.K., and Belgium.

4/ Incidentally, this raises another practical problem with the real basket peg policy, namely the unavailability of elasticity weights for the great majority of developing countries. In practice, countries are likely to use trade weights, as is done here. For a study that attempts to measure the costs of using a "wrong" basket see Flanders and Tishler (1981).

[redacted]

to a real basket peg policy over the 1975-1982 period. As expected, in no country would the real effective rate have been fully stabilized, since the method of inflation-forecasting used here is necessarily imperfect. Still, the deviations are on the whole not very large, ranging from a 0.19 percent mean monthly appreciation in Mexico (under R1) to a 0.24 percent depreciation in Chile (under R1) and a 0.56 percent depreciation in Argentina (under R2). The mean monthly change is less than one-twentieth of a percentage point for seven countries under Policy R1 (Israel, Korea, Pakistan, Philippines, Sri Lanka, Ivory Coast, and Tunisia) and for six countries under Policy R2 (Brazil, Mexico, India, Korea, Sri Lanka, and Tunisia).

One slightly troublesome finding for the real basket policy is that under the simple extrapolative rule embodied in Policy R1 the real rates would have had an overall bias toward appreciation. This is true for eleven out of the fourteen countries, and the only important exception is Chile. The explanation for the downward bias under R1 must be that the sample of countries under investigation were increasing their rates of inflation at a faster pace than their trade partners. In other words, the inflation differential at any given month tended to underestimate the differential some months hence. The opposite, of course, occurred in Chile where a sharp reduction in the inflation rate took place. 1/

Turning to a comparison between policies R1 and R2, Table 2 shows that the downward bias under R1 would have been offset under R2 for all of the countries involved. This is due to the fact that Policy R2 adjusts continuously (albeit with a lag) for past forecasting mistakes. The trend-correction mechanism used in R2 comes at the cost of increased variability of the real effective exchange rate, however. A comparison of columns (4) and (2) shows that, without exception, Policy R2 would have yielded a less stable real rate than R1. This conflict between trend and variability comes across clearly in the charts presented in Appendix I.

While the mean monthly percentage changes in real rates appear to have been on the whole quite small under R1, it is also true that the accumulated effects of such changes over long stretches of time could be sizeable. Over the entire 1975-82 period, the total real appreciation of the Mexican peso would have been 16.3 percent and the accumulated real depreciation of the Chilean peso would have been 23.0 percent (both under R1). This suggests that, even leaving aside the necessary adjustments that have to be made in

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1/ The experience of Chile also draws attention to the link between commercial policies in general and the appropriate level of the exchange rate. As was pointed out above in Part II, any real shock of permanent nature will necessitate a change in the real exchange rate. This applies equally well to changes in commercial policies: a dismantling of protective structures, as ocurred in Chile, is likely to require a concomitant real depreciation for the maintenance of external balance. A strict real peg policy is clearly inappropriate at a time when a program of trade liberalization is being carried out.

Table 2: Summary of Simulation Results, January 1975 to December 1982

Country	Monthly percentage changes in real effective exchange rates a/ under:								Monthly inflation:	
	Policy R1 b/		Policy R2 b/		Policy N b/		Actual Policy b/			
	mean (1)	st. dev. (2)	mean (3)	st. dev. (4)	mean (5)	st. dev. (6)	mean (7)	st. dev. (8)	mean (9)	st. dev. (10)
Argentina	-0.17	8.19	0.56	10.53	-8.76	6.62	1.77	18.90	9.29	6.14
Brazil	-0.15	1.72	C.03	2.69	-3.63	2.43	0.13	2.90	4.17	1.81
Chile	0.24	2.99	0.09	4.61	-3.95	4.77	0.24	3.76	4.49	4.66
Mexico	-0.19	1.67	0.02	2.51	-1.57	2.03	0.79	9.55	2.19	1.86
Israel	-0.01	3.15	0.19	5.68	-4.23	3.42	0.15	4.74	4.75	2.95
India	-0.07	1.34	0.04	2.03	0.10	1.94	0.30	1.62	0.45	1.08
Korea	-0.02	1.41	0.02	2.29	-0.68	1.75	-0.18	2.11	1.29	1.10
Pakistan	0.01	2.02	0.07	3.50	-0.22	2.04	0.06	2.05	0.78	1.43
Philippines	-0.01	1.84	0.07	2.94	-0.22	1.94	0.04	1.95	0.83	1.23
Sri Lanka	-0.03	1.93	0.04	3.32	-0.27	2.37	1.22	9.62	0.83	1.48
Ivory Coast	0.01	3.83	0.16	6.19	-0.61	3.31	-0.14	2.88	1.05	2.77
Kenya	-0.05	1.98	0.06	3.35	-0.62	2.32	-0.05	2.72	1.15	1.37
Tunisia	-0.02	1.54	0.03	2.83	-0.26	2.19	0.18	1.61	0.71	0.95
Turkey	-0.07	4.86	0.29	7.76	-2.54	3.92	0.42	6.61	3.00	3.58

NOTES: a/ Real effective exchange rates were calculated using trade shares in flows with ten industrial countries (in 1980) as weights. CPI series were used for the price variables. A "-" ("+") sign indicates appreciation (depreciation).

b/ For description of policies, see text.

Sources: IMF, International Financial Statistics and Direction of Trade.

face of real shocks, a real basket peg would have to be periodically re-adjusted to counter any tendencies towards appreciation or depreciation due to the price forecasting method used. As pointed out above, Policy R2 does this automatically but at the cost of increased volatility.

Lest this be taken as a more serious problem for the real peg than it actually is, it is also useful to take a comparative look at the outcome with a nominal peg, i.e., Policy N. This helps put the deficiencies of the real basket peg policy of the sort contemplated here in their proper perspective. As column (5) makes clear, a nominal peg would have implied sizable real appreciations for all countries in our list except for India which had a relatively low average inflation rate. It is also evident that the downward bias that appears to have been inherent in the real basket peg policy is only a small fraction of the much greater downward bias of the nominal peg. Thus, in Argentina the 16.3 percent accumulated appreciation with a real peg (R1) is only about 2 percent of that which would have obtained with a nominal peg (841.0 percent). Similar ratios hold for most of the remaining countries. The lesson here is that the imperfections of the real basket peg policy due to the lack of contemporaneous price data are likely to be minimal compared to the distortions introduced by pegging the nominal rate for any sizable stretch of time.

Finally, let us compare the real peg policy with the actual exchange rate policies followed by the fourteen countries. Charts portraying the movement of the real effective exchange rates of these countries as against the hypothetical real basket peg policy are presented in Appendix I. It can be seen from column (7) of Table 2 that most of these countries experienced an average real depreciation in the 1975-82 period, the exceptions being Korea, Ivory Coast and Kenya. 1/ What the summary statistics hide is that in most cases this was achieved by periodic large devaluations after the exchange rate had gotten perceptibly out of line. In Mexico, for example, the single devaluation of September 1976 accounts for 0.60 percentage points of the 0.79 percent mean real depreciation over the entire period. In Turkey, a major devaluation in January 1980 accounts for the entire real depreciation of the Turkish lira. The reason for stressing these individual episodes is that they endow the real effective rate with undue variability. Another advantage of the real peg policy lies in the fact that it can accomplish the exchange rate objective with much less variability. Indeed, a comparison of column (8) with column (2) shows that in all cases but one (Ivory Coast) the real peg policy R1 would have yielded less volatility than the actual policy followed--and sometimes so by a large margin. Of course, with contemporaneous price data available the volatility in question would be identically zero under a real peg. It is of interest that even with the crude price forecasting method used in R1 this policy would have been relatively successful in stabilizing the real effective rate compared to the highly active exchange rate policies actually followed by some of the countries on the list (e.g. Brazil). 2/

1/ This is clearly an artifact of the base period chosen (December 1974). At the time, a severe oil shock had made it imperative for most developing countries to (sooner or later) achieve a real depreciation.

2/ This comparison might be misleading insofar as the authorities' target for the real rate undergoes periodical changes.

The charts in Appendix I also show that a real basket policy would have been successful in most countries in achieving its primary objective: stabilizing the real rate in periods where a passive exchange rate policy would have resulted in progressive appreciation. This is most clearly seen in Argentina (1977 to 1980), Chile (mid-1979 to 1981), Mexico (1977 to 1981), Philippines (1979 to 1982), and Ivory Coast (1977 to 1980). As mentioned above, however, the real basket peg policy R1 would have lent a somewhat downward (appreciating) bias to the real rates of most countries when the period is considered as a whole.

Note finally that these simulations have been carried out using a very simple extrapolative rule for forecasting inflation. In practice, authorities are likely to have some information regarding likely price trends in the near future based on current and anticipated developments in the major macroeconomic aggregates. This information could be used to improve on an inflation forecast made through simple extrapolation. In this sense, the simulations reported here overstate the extent of likely over- or under-shooting in the management of the real rate.

2. <u>The use of CPI vs. WPI</u>

The real effective exchange rate indices discussed above were constructed using consumer price indices for all countries and trade partners. Returning to a question posed at the beginning of Part IV, we now ask how much of a practical difference it makes whether one uses CPI or WPI. To answer this question let us define an index of divergence as the difference between the movements of the real effective rates constructed using CPI and WPI, respectively.

$$(\dot{r}^{CPI}_{.jt} - \dot{r}^{WPI}_{.jt}) = (\dot{P}^{WPI}_{jt} - P^{CPI}_{jt}) + \sum_{i=1}^{n} w_i\, (\dot{P}^{CPI}_{it} - \dot{P}^{WPI}_{it})$$

Table 3 presents summary information on the divergence between the two indices for ten of the fourteen countries. Without exception, the indices using CPI appear to depreciate relative to those using WPI. This is a result of the fact that in all of the ten countries, the inflation rate portrayed by the WPI has been higher than that portrayed by the CPI over the 1975-1982 period, and that this gap has been larger than in their trade partners. The WPI, which includes services, might tend to overestimate the actual inflation rate due to the inherent double-counting involved in its calculation.

Once again, to put the errors of the type considered here in perspective, it is useful to compare the numbers in Table 3 with the outcomes under a nominal peg policy (column (5), Table 2). With the exception of India, the margin of uncertainty resulting from the use of one price index as against another is a fraction of the average movement in the real rate under a nominal peg. In practice, then, the choice of CPI versus WPI is unlikely to be a very important one, especially in the case of high-inflation countries such as Argentina, Brazil and Israel.

Table 3: Divergences of CPI-deflated effective exchange rates from WPI-deflated rates, January 1975 to December 1982 1/

Country	Mean monthly divergence (%)	St. dev. of monthly divergence	Sum of divergences over entire period (%)
Argentina	0.43	4.73	41.07
Brazil	0.19	1.33	18.37
Chile	0.40	2.22	38.20
Mexico	0.15	1.03	14.78
Israel	0.18	1.53	17.32
India	0.16	0.96	15.41
Korea	0.05	1.47	5.03
Pakistan	0.04	1.48	4.20
Philippines	0.13	1.41	12.62
Tunisia	0.04	1.15	3.99

1/ See text for explanation

Sources: IMF, International Financial Statistics and Direction of Trade.

V. Summary and Conclusions

It should be clear that the real peg policy of the type considered here is meant to provide a simple and useful rule for short run exchange-rate management, and not a rigidly maintained standard over the longer run. This paper has touched on a wide range of issues relevant to an evaluation of such a policy from the perspective of a developing country that finds floating unfeasible. It is far from having covered all questions of related interest, however. Nothing has been said, for example, on how to choose a base period for a real peg. It is clear that such a policy would have to be instituted at a time when the real exchange rate was fairly close to its "equilibrium" value. How does one know what the equilibrium value of the exchange rate is? This is a somewhat thorny problem theoretically, since the answer depends on the particular theory of exchange rate determination one subscribes to. In practice, however, a rough answer may not be too hard to provide for many developing countries. At least, it is not usually too difficult to tell when an exchange rate is patently overvalued.

Similarly, there is the question of how frequently the adjustments in the nominal exchange rates should be carried out. The analysis in Part IV above assumed monthly adjustments, but there is no reason why the frequency could not be higher and the changes carried out, say, on a daily basis. The monthly inflation differentials would then need to be converted to a daily basis, and exchange rates adjusted accordingly. There is a case to be made for daily adjustments since these would tend to minimize speculative pressures that might become important with less frequent changes. 1/

The present analysis also has largely neglected some dynamic problems that might arise in connection with a real peg policy. One such problem is the possibility that indexing the exchange rate will have inflationary feedback effects on the price level through the traded-goods component. This could indeed be an important drawback, although, of course, the feedback effects will generally be dampened unless all consumption goods are imported. To an important extent, the problem here is with exchange rate policy in general, and not with the real peg policy per se. It might even be the case that small and frequent changes in the nominal exchange rates are less likely to spark off inflationary spirals than are infrequent but large ones. 2/

In order to recapitulate the arguments made in this paper, it might be a good idea to go in a different order than that followed in the text. The analysis in Part IV suggests that the unavailability of contemporaneous inflation data does not pose an insurmountable obstacle for practising a real basket peg policy. Inflation information from some months ago is likely to be a good substitute for current inflation rates. Neither does the choice between CPI and WPI appear to be of much practical significance. In both cases, however, the possibility that the real exchange rate might get out

1/ See McKinnon and Mathieson (1981), p.20.
2/ Rodriguez (1978) suggests this possibility.

of line over the longer term due to consistent under- or over-estimation of actual inflation rates has to be accounted for. The tendency of the real rate to appreciate in practice under a simple extrapolative rule for forecasting inflation rates was noted in the text. Consequently, a country opting for the real peg strategy is not entirely freed of the responsibility of periodically re-evaluating the appropriateness of its exchange rate.

Other, and more important, reasons for why the real exchange rate might need to be changed were analyzed in Part II. In general, a real peg strategy is appropriate only for purely monetary shocks that leave the underlying demand and supply conditions unaffected. Any shift in demand and supply schedules (i.e. a real shock) will normally require a change in the real exchange rate as well. If such a shock is of a temporary nature, the analysis in Part II shows that a nominal peg strategy (which allows the real exchange rate to change) might perform better than a real peg one. In addition, even under purely monetary disturbances, a real peg might not equilibrate the balance of payments in the short- to medium-run when important flows such as debt servicing and capital inflows are not indexed to the foreign inflation rate.

Part II also attempted to delineate the structural characteristics of an economy for which the real peg might be an optimal strategy in the short-run. It was shown that the desirability of the policy increases with the extent of openness to trade, wage-price indexation, monetary accommodation, price and income elasticity of demands and supplies, resistance to supply shocks, and the relative variance of monetary shocks to real shocks. Strictly speaking, a rigid real peg is an appropriate policy only in the limiting case of an economy which is not subject to real shocks at all. In the final analysis, the prescription of a real basket peg strategy is tantamount to a belief that monetary conditions are the preponderant source of disequilibrium in the economy in question.

How would the real basket policy be executed in practice? Part II tried to sort out some of the conceptual issues related to the policy in the context of generalized floating. It was argued here that, when major currencies deviate from purchasing power parity, a real basket peg in a many-country world is not equivalent to a real peg in a two-country world. This is due to the fact that the constancy of the real effective exchange rate is unlikely to bring with it constancy of bilateral real rates as well. This, in turn, is a reason why a real basket peg may not insulate the economy even from purely monetary disturbances. Also, the possibility that bilateral real rates may be subject to fluctuations necessitates the design of an appropriate basket such that changes in bilateral competitiveness levels exactly offset each other. It was pointed out that this basket ought to be constructed using MERM-type elasticity weights, although for many countries the unavailability of parameter estimates would require simpler approaches.

Additional problems associated with the real basket peg policy derive from the exclusive reliance on aggregate price indices as indicators of trends in international competitiveness. The limitations of such indices--due to incomplete coverage, existence of pervasive price controls, and the like--are likely to be sufficiently important in practice to make one wonder whether a policy that commits itself to adjust the exchange rate to every twist and turn in these price indices would not be an instance of misplaced concreteness. To some extent, the problem is alleviated in highly inflationary countries where an adherence to faulty price indices is likely to be a more sensible policy than complete inaction on the exchange-rate front. These practical considerations strengthen the arguments made above regarding the relative desirability of the real peg strategy in high-inflation economies.

In conclusion, a real basket peg policy might be considered as a second-best policy for a country which possesses some or most of the characteristics listed above, and which is unwilling (or unable) to float its currency. For such a country, the benefits of a real basket peg policy might outweigh its disadvantages, especially if the only realistic alternative is that of pegging the nominal exchange rate. It would be advisable even then to supplement the policy with a fairly systematic use of reserve and balance-of-payments indicators so as to ensure that the real exchange rate never gets too much out of line. The advantage of the real peg is that it regularizes the process of adjusting the nominal exchange rate so as to offset differential rates of inflation, and that it avoids recourse to infrequent--and as a result highly visible--jumps in the parity long after the loss in competitiveness has started to creep in. Its greatest disadvantage, at the same practical level, is that it may result in undue confidence in the appropriateness of the current level of the real rate under circumstances that continuously require real rate adjustments.

Table I. Variances of Money and Real Income, and Openness in Selected Developing Countries

Country	Variance of annual percent changes 1/ Money (1)	Real Income (2)	Ratio (1)/(2)	Openness 2/ (X+M)/Y
Venezuela	10.01	2.29	4.37	0.59
Kenya	10.72	2.53	4.24	0.65
Morocco	6.40	4.44	1.44	0.46
Tanzania	8.10	2.33	3.48	0.42
India	4.42	4.15	1.07	0.16
Korea	14.37	3.28	4.38	0.75
Philippines	10.41	1.38	7.54	0.45
Sri Lanka	20.58	3.85	5.35	0.83
Egypt	11.42	4.52	2.53	0.68
Israel	28.37	4.84	5.86	1.22
Argentina	87.23	3.78	23.08	0.17
Brazil	11.97	3.02	3.96	0.18
Chile	149.41	6.35	23.53	0.51
Colombia	10.80	1.48	7.30	0.31
Jamaica	12.59	5.06	2.49	1.01
Peru	29.81	2.95	10.11	0.51
Mexico	34.18	1.86	18.38	0.26
Nigeria	207.28	20.46	10.13	0.61 3/
Tunisia	5.96	4.66	1.28	0.72 3/
Turkey	14.54	3.20	4.54	0.16 3/

Source: IMF, International Financial Statistics.

1/ 1966-1979.
2/ 1979-80 average, unless otherwise specified.
3/ 1977-78 average.

CHART 1

SIMULATED REAL EFFECTIVE EXCHANGE RATES

(December 1974 = 100)

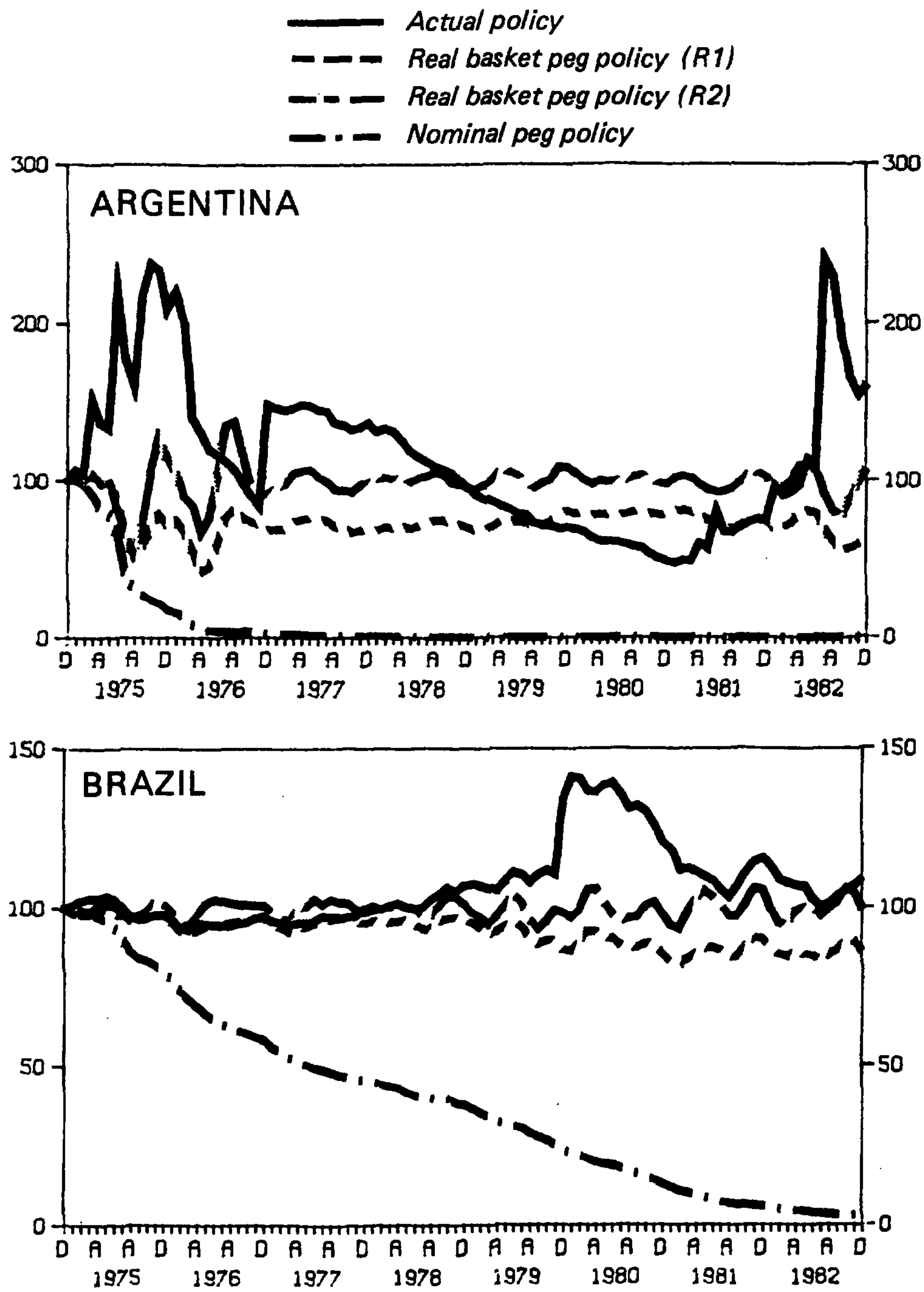


CHART 2

SIMULATED REAL EFFECTIVE EXCHANGE RATES

(December 1974 = 100)

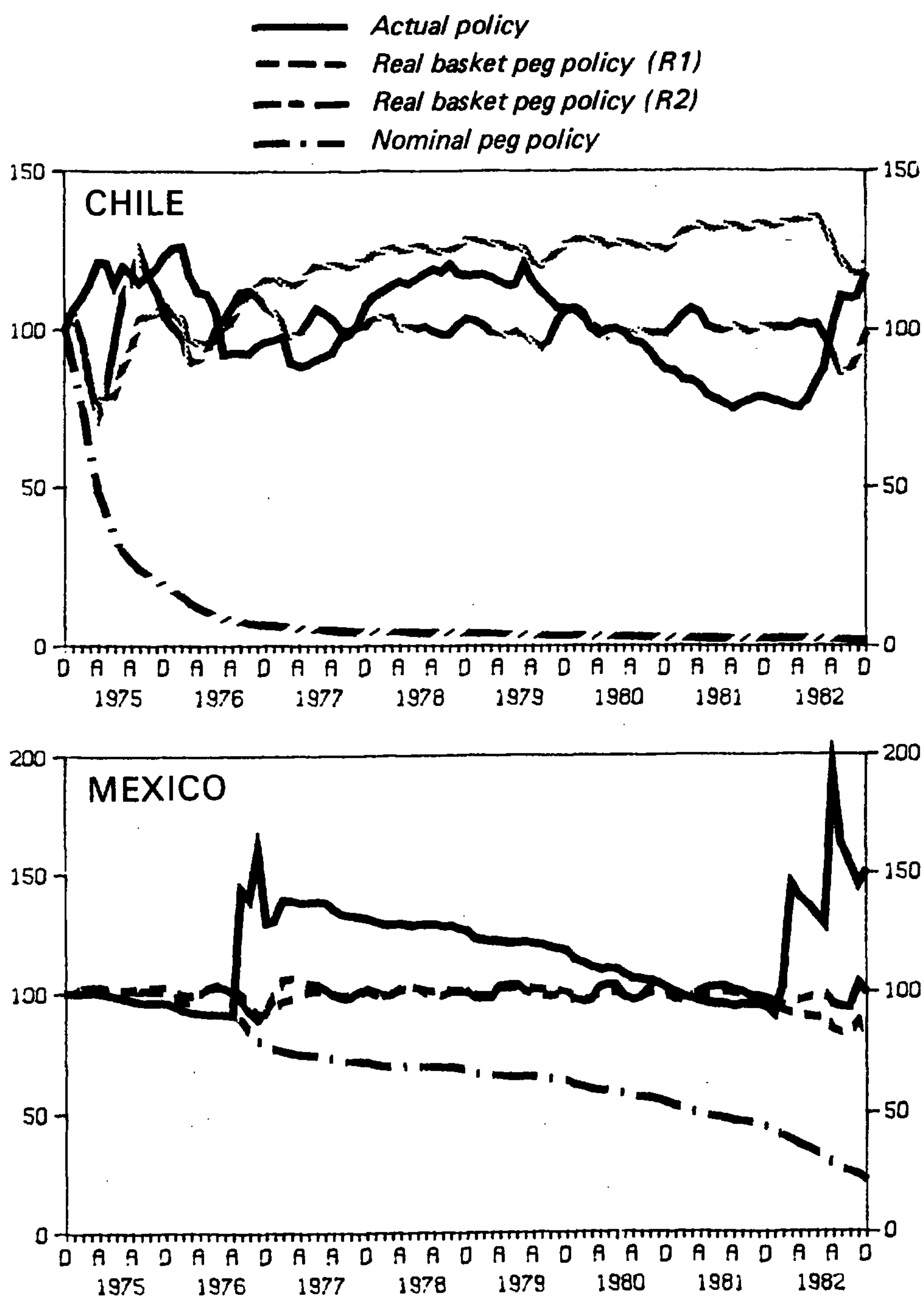


CHART 3

SIMULATED REAL EFFECTIVE EXCHANGE RATES

(December 1974 = 100)

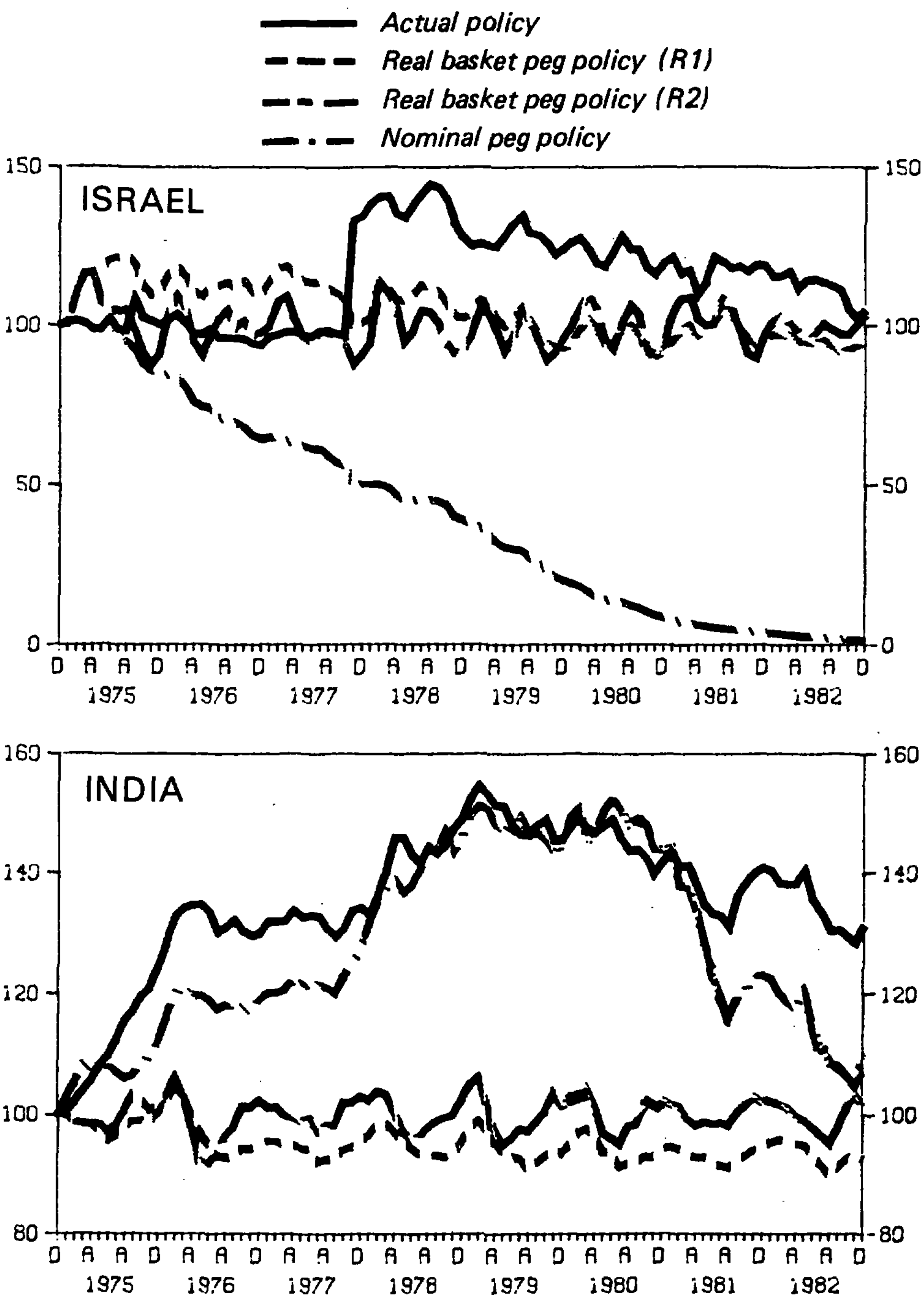


CHART 4

SIMULATED REAL EFFECTIVE EXCHANGE RATES

(December 1974 = 100)

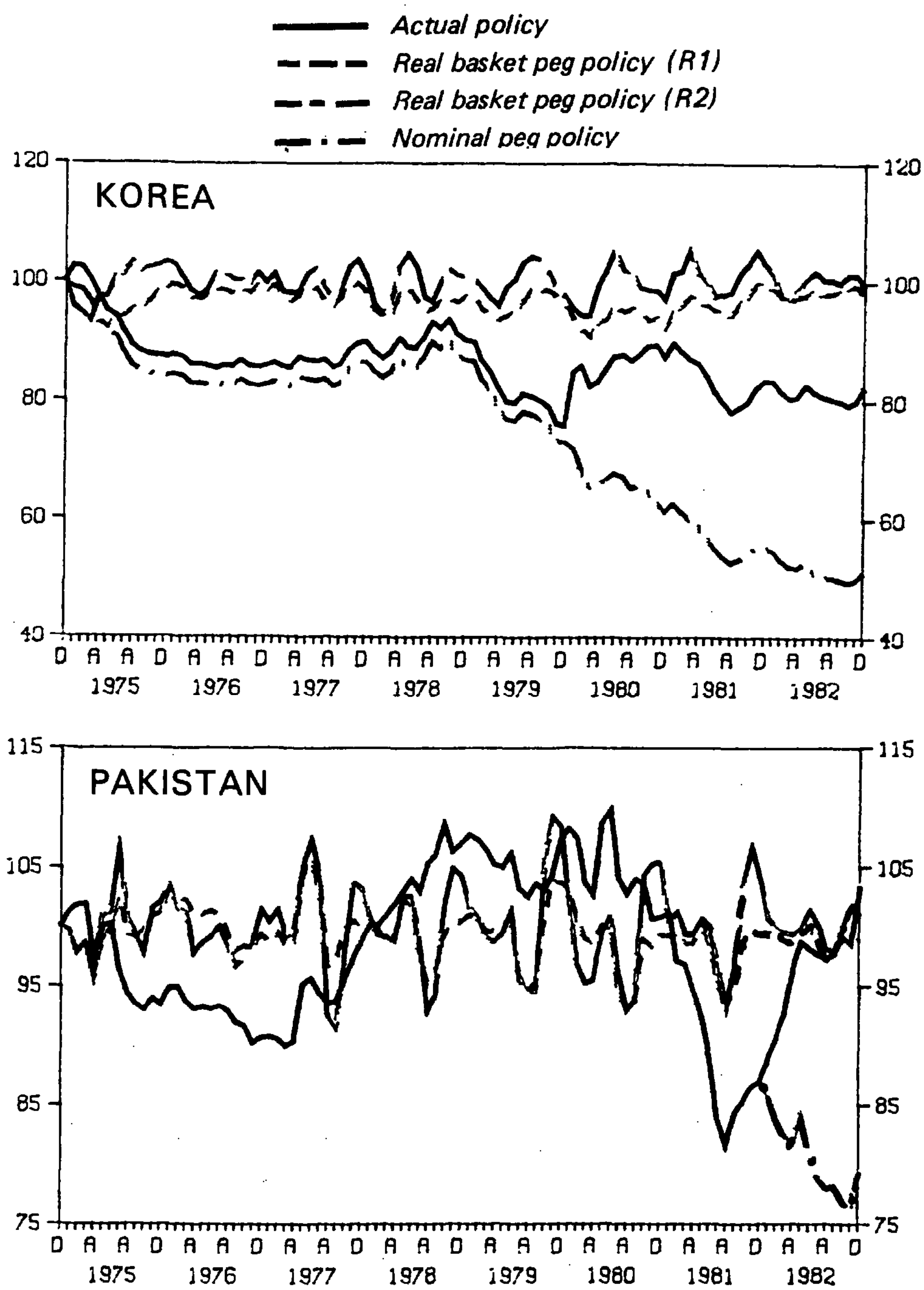


CHART 5

SIMULATED REAL EFFECTIVE EXCHANGE RATES

(December 1974 = 100)

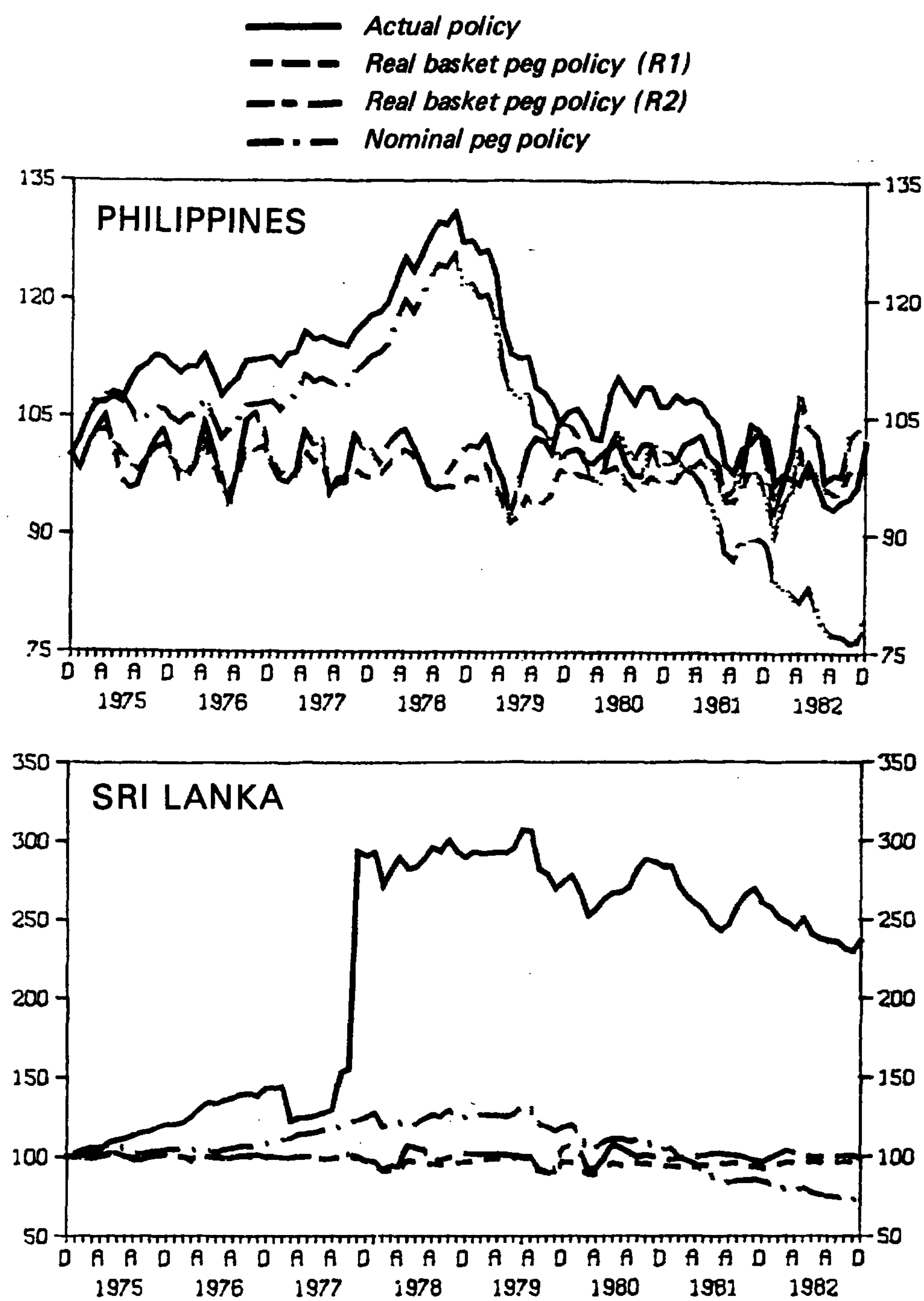


CHART 6

SIMULATED REAL EFFECTIVE EXCHANGE RATES

(December 1974 = 100)

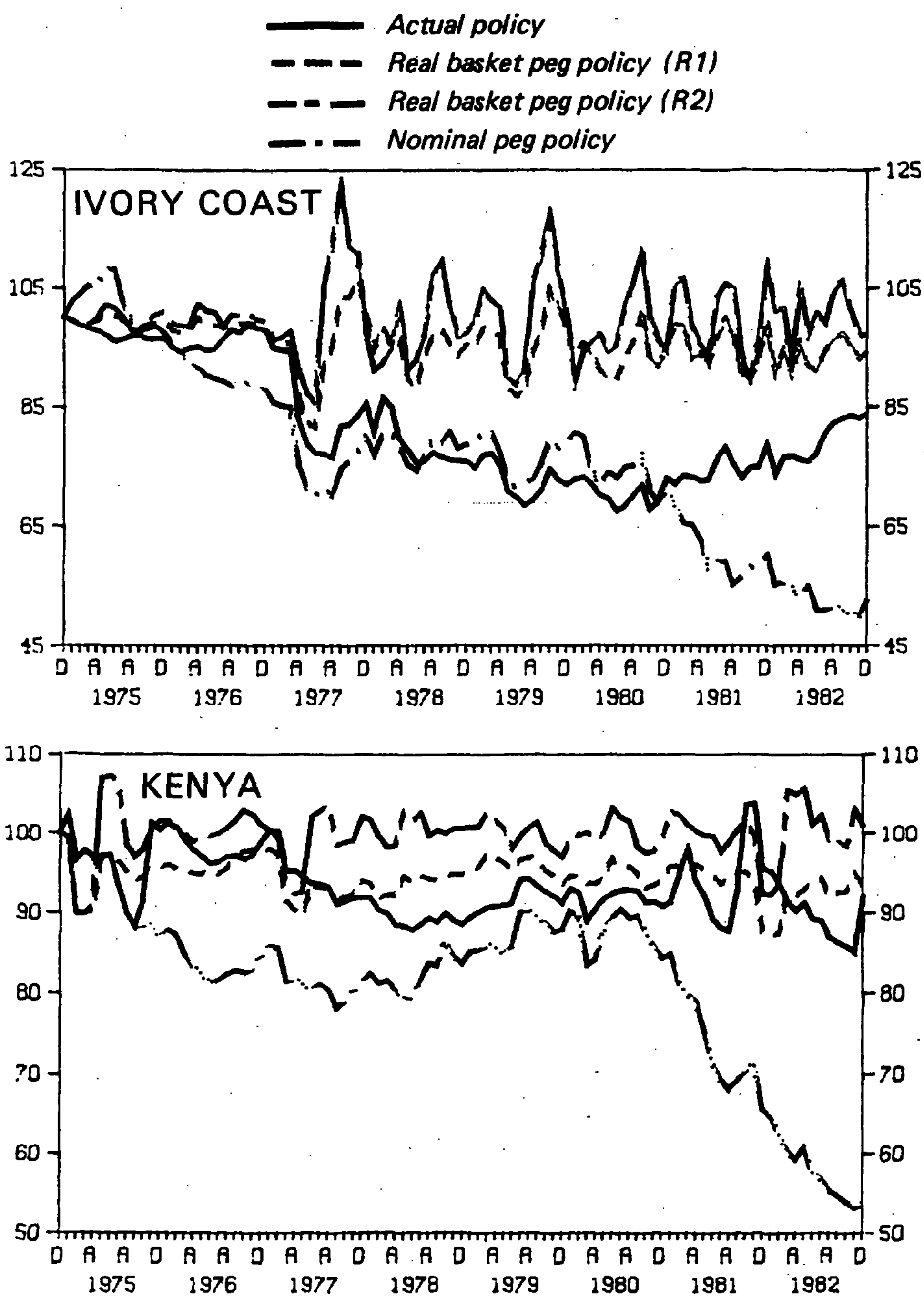
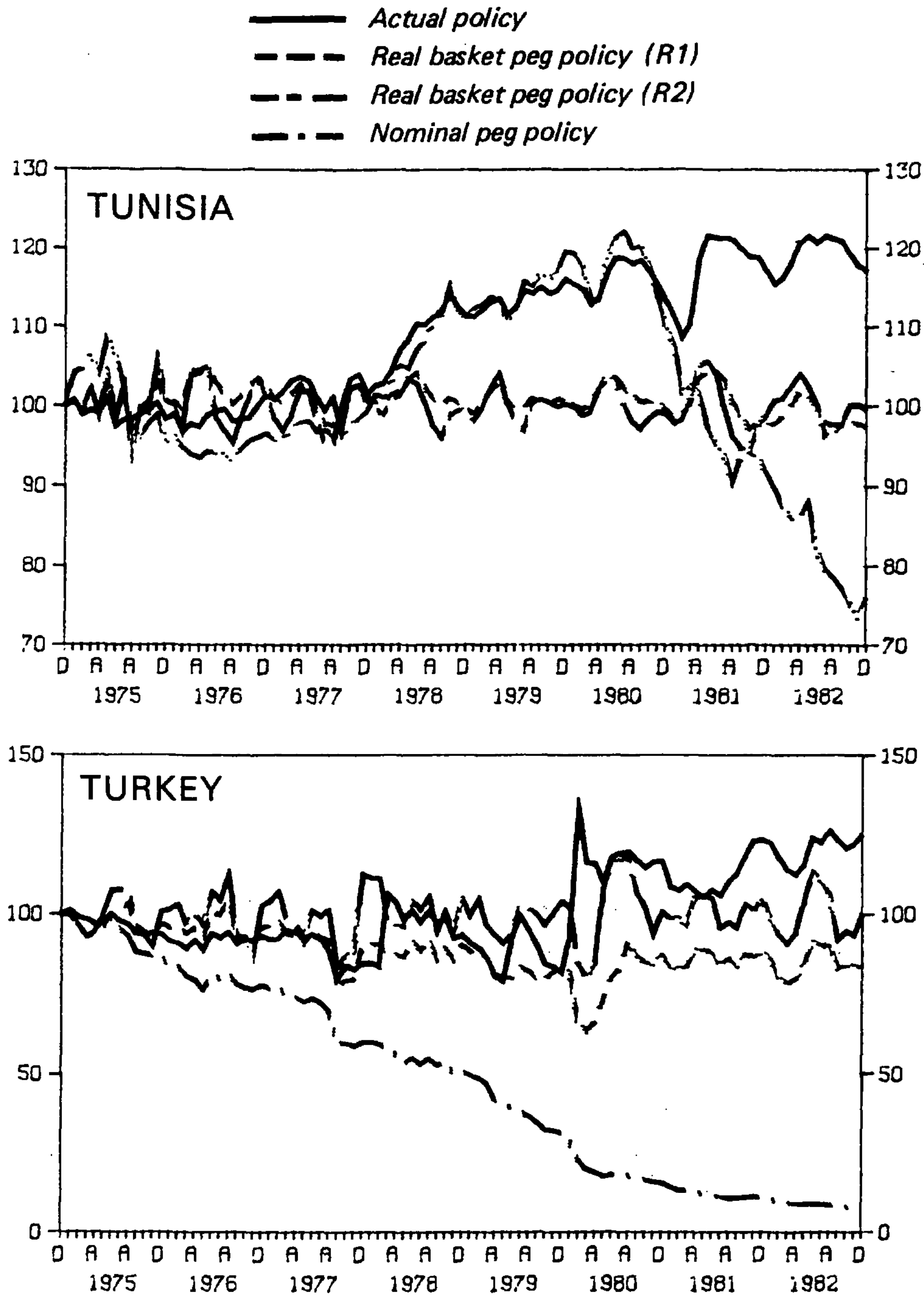


CHART 7

SIMULATED REAL EFFECTIVE EXCHANGE RATES

(December 1974 = 100)



The Mechanics of a Real Basket Peg

An index of real effective exchange rate for country j can be defined as:

$$\ln r_{\cdot jt} \equiv \sum_{i-1}^{n} w_i \ln \{ (\frac{e_{ijt} P_{it}}{P_{jt}}) (\frac{P_{jo}}{e_{ijo} P_{io}}) \} \quad (A1)$$

when e, r, and P denote nominal exchange rates, real exchange rates, and the price level, respectively. All exchange rates carry three subscripts, the first relating to partner country (or currency), the second to home country, and the third to time period concerned. An index of effective exchange rate will be distinguished by a "." as the first subscript. Note that exchange rates are here defined as the price of foreign currency in terms of home currency, so that an increase in the rate implies a depreciation. Price levels carry two subscripts, refering to home country and time period, respectively. The base period used in constructing the index is denoted by t=0. Finally the weights (w_i) used in the calculation of the basket are assumed to remain constant over the relevant time period and carry the subscripts of the currencies in the basket. The effective rate is expressed as a geometric average since this is the only formulation that treats appreciating and depreciating currencies symmetrically (Brodsky, 1982).

The real effective rate index can be decomposed into indices of (a) the nominal effective rate, and (b) the weighted average of relative price levels:

$$\ln r_{\cdot jt} = \sum_{i=1}^{n} w_i \ln (\frac{e_{ijt}}{e_{ijo}}) + \sum_{i=1}^{n} w_i \ln (\frac{P_{it} P_{jo}}{P_{jt} P_{io}}). \quad (A1')$$

Alternatively, the index can be expressed as a function of the bilateral real rates:

$$\ln r_{\cdot jt} = \sum_{i=1}^{n} w_i (\ln r_{ijt} - \ln r_{ijo}) \quad (A1'')$$

In terms of the last formulation, the proportional change in the real effective rate against the basket--where the basket is defined by the weights w_i and the currencies i = 1,..., n--is given by

$$\dot{r}_{\cdot jt} = \sum_{i=1}^{n} w_i \dot{r}_{ijt}$$
$$= \sum_{i=1}^{n} w_i \{\dot{e}_{ijt} + \dot{P}_{it} - \dot{P}_{jt}\}, \quad (A2)$$

where dots over variables indicate proportionate changes. Given a set of weights, a constant real effective rate ($\dot{r}_{\cdot jt} = 0$) then translates into the following rule for adjusting bilateral nominal rates:

$$\sum_{i=1}^{n} w_i \{\dot{e}_{ijt} + \dot{P}_{it} - \dot{P}_{jt}\} = 0. \qquad \text{(A3)}$$

This is expression (25) in the main text.

The nature of the rule becomes clearer when we insert into (A1') the value of the basket in terms of home currency--i.e. if the basket consists of the SDR, the value of SDR in terms of home currency. Defining the value of the basket against the home (foreign) currency as e_{bjt} (e_{bit}) we have

$$e_{ijt} = \frac{e_{bjt}}{e_{bit}}, \qquad \text{(A4)}$$

and the first term of expression (A1')--the index of nominal effective rate--becomes

$$\ln e_{\cdot jt} = \ln \left(\frac{e_{bjt}}{e_{bjo}}\right) - \sum_{i=1}^{n} w_i \ln \left(\frac{e_{bit}}{e_{bio}}\right). \qquad \text{(A5)}$$

Hence, the proportional change in the real effective rate index can now be expressed as

$$\dot{r}_{\cdot jt} = \dot{e}_{bjt} - \sum_{i=1}^{n} w_i \dot{e}_{bit} + \sum_{i=1}^{n} w_i (\dot{P}_{it} - \dot{P}_{jt}). \qquad \text{(A2')}$$

This shows that the changes in the real effective rate of country j can be decomposed into: (a) changes in the value of the peg to the basket; (b) weighted changes in basket currency rates vis-à-vis the basket; and (c) weighted differentials between foreign and home inflation rates.

Within the framework of expression (A2'), a real basket peg yields the following rule for adjustments in the nominal value of home currency against the basket:

$$\dot{e}_{bjt} = \dot{P}_{jt} + \sum_{i=1}^{n} w_i (\dot{e}_{bit} - \dot{P}_{it}). \qquad \text{(A6)}$$

This is expression (26) in the main text.

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