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EXCHANGE POLICIES FOR LESS DEVELOPED COUNTRIES IN A WORLD OF FLOATING RATES

STANLEY W. BLACK

INTERNATIONAL FINANCE SECTION

DEPARTMENT OF ECONOMICS

PRINCETON UNIVERSITY

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The author, Stanley W. Black, is Associate Professor of Economics at Vanderbilt University. He has also taught at Princeton University and been at the Council of Economic Advisers and the Board of Governors of the Federal Reserve System. He has most recently spent a year as Research Associate at the Institute for International Economic Studies of the University of Stockholm. Professor Black has written a number of articles in the areas of macroeconomics and international monetary economics, among them International Money Markets and Flexible Exchange Rates, *No. 32 in the series Princeton Studies in International Finance.*

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PETER B. KENEN, *Director*
International Finance Section

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Exchange Policies for Less Developed Countries in a World of Floating Rates

1 Introduction

The adoption of a system of floating exchange rates by the world's leading industrial nations in March 1973 has posed two serious questions for many of the world's less developed countries (LDCs). The first concerns the position they should take in international monetary negotiations vis-à-vis the continuation of worldwide floating rates. The second is how their own exchange policies should adapt to the realities of the floating-rate system with which they are now faced.[1] As Helleiner has pointed out, "A more detailed consideration of the theoretical and practical merits and disadvantages of flexible exchange rates in less developed countries is by now certainly called for."

This essay is devoted to an analysis of the choice of exchange policies, either pegged or floating, by LDCs under the assumption that the world's major currencies will continue to float for the foreseeable future. While the theoretical benefits of a floating exchange rate are not necessarily limited to developed countries, the *feasibility* of such an exchange-rate policy for less developed countries depends on (a) the development of adequate domestic financial markets integrated with world markets and (b) the willingness of their governments to allow the exchange market to operate at least relatively free of the multitude of controls, special rates, and other devices so frequently utilized by less developed countries.

For one reason or another, most of these countries have rejected floating and have chosen to tie their exchange rates to one of the world's major trading currencies: the dollar, the pound, or the franc. While the decision to peg avoids certain problems, it raises a number of others. As the Joint Economic Committee's Subcommittee on Inter-

[1] The first issue has been examined by Helleiner (1974) and Cline (1975), while some aspects of the second issue have been explored by Díaz-Alejandro (1975).

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national Economics pointed out in its August 14, 1973, Report, "Among such costs are the need to adjust to exchange rate changes that result from events wholly external to developing nations and that may shortly be reversed." In testimony on June 21, 1973, Ricardo Arriazu of the International Monetary Fund pointed out numerous other difficulties, including shifts in the direction of trade induced by tying to particular currencies, effects of fluctuations in the tied rate on the domestic money supply and price level, fluctuations in the values of external assets and debts, a need to diversify holdings of reserves, and effects of the increased cost of covering short-term exchange risks.

Discussion of these problems and the designing of policies to deal with them have been hampered by the lack of an adequate theoretical and institutional framework in which to consider them, and yet the tools with which to construct it are readily available. Accordingly, this essay attempts to lay out such a framework and to evaluate policies in that context.

In the next three sections, the macroeconomic implications of the choice between different types of exchange-rate policies for the adjustment problems of less developed countries are analyzed in a framework of internal and external balance.

Section 2 develops the "small country" model of traded and nontraded goods for the case of a less developed country. The responses of the model to various shocks under pegged and floating exchange rates are studied in section 3. Section 3 broadens the framework to include worldwide multilateral floating rates and examines formulae for effective exchange rates. Section 4 then considers the effects of alternative exchange-rate policies on the economy, as measured by the variance of domestic prices of traded goods relative to prices of nontraded goods. The alternative policies include free floating, managed floating, pegging to a single currency, and pegging to the SDR.

Section 5 discusses the institutional structure of money markets and exchange markets in less developed countries. The implications of poorly developed exchange markets and money markets are then examined, especially those deriving from the depth, efficiency, and stability of the exchange market, as well as its responsiveness to internal and external disturbances.

Section 6 combines the institutional analysis of section 5 with the macroeconomic analysis of section 4 in a cost-benefit discussion of five specific exchange-rate policies. Section 7 deals with a number of alternative financial policies, such as development of forward markets, diversification of debt and reserve assets, clearing arrangements, and borrowing versus adjustment to the oil situation. Finally, section 8

uses data on variances of effective exchange rates for one hundred less developed countries to discuss the effects of alternative exchange-rate policies in the period 1970–74.

2 A Model of Internal and External Balance for Less Developed Countries

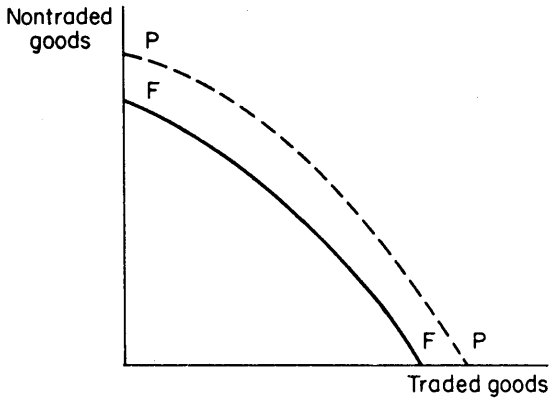
In order to analyze the effects on less developed countries of floating exchange rates among the developed countries, we need a model of the typical less developed country. Of course, there is no such thing as a "typical" less developed country because there are vast differences among them in culture, structure of production, resources, education, health, climate, etc. Nevertheless, in this essay all these long-run factors are taken as given. Furthermore, I assume that the exchange markets and financial markets have the six general characteristics (discussed in section 5) that lead to low capital mobility. For most less developed countries, it will also be appropriate to assume that the economy is open but is too small to be able to affect the world prices of its exports or imports. In addition, domestic resources may be underutilized relative to standards of efficiency applied to developed countries, but more efficient utilization may be difficult because of local culture, tradition, habits, and training, as well as distortions in markets.

It is obvious that the standard model of internal and external balance, which assumes high capital mobility, a developed financial market, and Keynesian supply conditions (Stein, 1963, or Argy and Porter, 1972) cannot realistically be applied to such economies. Therefore, the following simple model of a small, open, underemployed economy with a poor capital market has been put together from the ideas of Salter (1959), Hansen (1973), and Prachowny (1973).[2]

Since the terms of trade cannot be affected by changes in the domestic economy, exportables and importables can be collapsed into a single tradable good. Because relative prices are fixed, moreover, there is no difficulty in dealing with exports that do not compete in consumption or imports that do not compete in production. Such goods become part of the composite "tradable." There is also a nontradable good. The country's supply functions of the tradable and nontradable goods are assumed to depend on relative prices. In some cases, it may be desirable to assume that supplies also depend to some extent on real money balances, on the grounds that availability of finance may be

[2] See section A-1 of the Appendix for a formal development of this model, which has also been analyzed by Mundell (1971, Chap. 9) and Dornbusch (1974).

FIGURE 1
FEASIBLE PRODUCTION



a real constraint on production (McKinnon, 1973, Chap. 6). This production structure is described by a "feasibility locus" (*FF*) in Figure 1, indicating that resources may be underemployed. Full-production possibilities (*PP*) can be realized only by some thoroughgoing structural changes.

Domestic demand for each of the two goods is assumed to depend on relative prices, real income, and real money balances. The price of nontradables is assumed to be sufficiently flexible to equate the demand for nontradables with the supply. In the tradable-goods market, a perfectly elastic world demand guarantees that (a) the domestic-currency price of the traded good is always equal to the product of the exogenous world price and the exchange rate of the local currency and (b) net exports always adjust immediately to the excess of domestic production over consumption of the traded good.

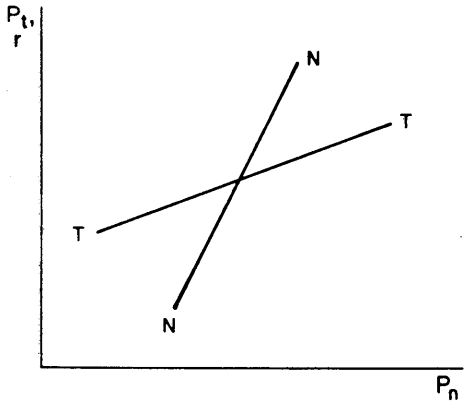
The balance of payments equates the sum of net exports and net capital inflow to the net inflow of reserves, all valued in terms of domestic currency. The foreign-currency value of net capital flow is assumed to be exogenous, unless manipulated by government policy as a tool to influence the exchange rate. Pegged exchange rates can be achieved in this model in any of three ways: (a) reserve movements, resulting from government intervention in the foreign-exchange market (the absence of such intervention will imply zero reserve movements); (b) official borrowing to finance deficits, which makes capital inflows endogenous and reserve movements zero; and (c) a system of import controls, which assures that net exports will always equal the exogenous net capital inflow but breaks the equality between the

domestic and world prices of traded goods. In the absence of such efforts to peg the exchange rate, it will adjust to equate net exports (the country's excess supply of the tradable goods) with the exogenous net capital inflows.

Finally, the money supply is assumed to depend on the government budget deficit, the accumulation or loss of foreign-exchange reserves, and the extension of credit to the domestic business sector via the banking system. In less developed countries, government budget deficits are generally financed either through money creation or spending of foreign-exchange reserves, because of the difficulty of issuing government bonds in an underdeveloped financial system. Growth in the money supply is of course crucial in affecting domestic demand for traded and nontraded goods, and hence the prices of these goods in domestic markets and the exchange rate.

The market-clearing process of the model, given the stock of money, can be seen in Figure 2 (originally developed in Mundell, 1971, Chap. 9) for the case of flexible exchange rates. In this model, internal balance requires equality of supply and demand for the nontraded good, since the infinite elasticity of foreign demand for the tradable good implies that disequilibrium in that market can easily be resolved. Thus the internal-balance curve (*NN*) is the locus of domestic prices of nontraded goods (p_n) and traded goods (p_t) that equilibrate the market for nontradables. Given the world price of traded goods ($\bar{p}_t^f$), movements in the domestic price of traded goods are of course equivalent to movements in the domestic price of foreign exchange (r). Similarly, the *TT* curve in Figure 2 is the locus of domestic prices of nontraded

FIGURE 2
EQUILIBRIUM WITH A FLEXIBLE EXCHANGE RATE



goods and traded goods that satisfies external balance, given by the balance-of-payments condition that the excess demand for traded goods must just equal the exogenous net capital inflow.

One can demonstrate easily that the slope of the *NN* curve is greater than unity, while the slope of the *TT* curve is less than unity, under the behavioral assumptions of the model. The argument goes as follows: A proportional increase in both prices (along a 45-degree line through the intersection point) would leave supply unaffected and reduce demand in both markets, because of the exogenous money supply. Equilibrium in the market for nontradables therefore requires the price of nontradables to rise *less* than proportionately, as shown by the steep *NN* curve. Likewise, equilibrium in the balance of payments requires the price of tradables to rise less than proportionately to sustain the demand for traded goods, as shown by the flat *TT* curve.

Under pegged exchange rates, achieved either by reserve movements or borrowing, the *TT* curve no longer determines the domestic price of traded goods but is replaced by a horizontal line determined by the fixed exchange rate times the exogenous world price of traded goods. The *TT* curve still determines external balance, in the sense that positions above or below the curve indicate a reserve inflow or outflow via a balance-of-payments surplus or deficit. If exchange controls are used to peg the exchange rate, a modified version of Figure 2 can still be used to determine the *domestic* prices of traded and nontraded goods based on conditions of demand and supply in the *domestic* markets for traded and nontraded goods. Foreign trade will be transacted at international prices and producers of exports will receive the world price in domestic currency, but this will be considerably less than the domestic price of exportables. Producers of importables will receive the (high) domestic price, and the resulting distortion of production away from export goods will reduce their aggregate supply compared with the results expected under floating rates.

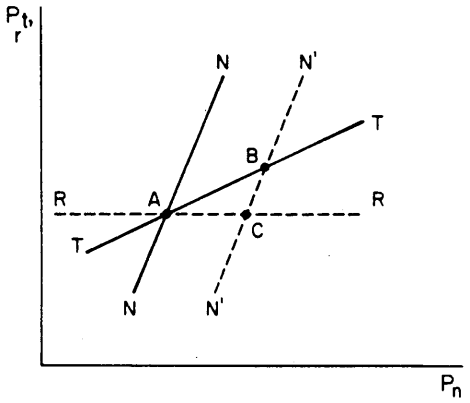
3 Internal and External Balance: Response to Shocks

Let us now consider several types of shocks to the economy and the effects of pegged versus floating exchange rates.

a. Domestic Crop Failure

As shown in Figure 3, a reduction in supply of the nontraded good caused by a domestic crop failure can be regarded as a rightward shift in the *NN* curve, leading to a depreciation of the exchange rate from *A* to *B* under flexible rates. The price of the nontraded good rises more

FIGURE 3
CROP FAILURE



than that of the foreign good, increasing the consumption of the foreign good and shifting resources toward more production of the nontraded good. If the crop failure is expected to be temporary, a more appropriate exchange policy would be to peg the exchange rate at the initial level given by the dashed horizontal line through A, by either a reserve loss or foreign borrowing. By holding down the domestic price of tradable goods, more demand could be shifted to the traded-goods sector, reducing hardship in the country. The balance-of-payments deficit is indicated by the fact that point C is below the external-balance line TT. The reserve outflow at C would reduce the money stock, shifting $N'N'$ and TT left and down, respectively. Pegging via exchange controls would *not* reduce the variance of prices and consumption in this way, since domestic prices would still be determined by TT and NN, and could even increase the variance of imports of capital goods as consumption imports fluctuate.

b. Differential Inflation Rates

If world prices rise more rapidly than domestic prices, this can be shown as a (relative) rise in the world price of tradable goods. (The opposite case would yield a fall in the world price.) Assume that the country is a capital importer with a trade deficit. The real value of the capital inflow in terms of traded goods falls and the TT curve shifts up. Under a flexible rate, the country's currency appreciates, but by less than the rise in world prices in order to earn the additional foreign exchange needed to replace the lost real capital inflow. The domestic prices of traded and nontraded goods rise. If the exchange rate were

pegged, the rise in the domestic price of traded goods would generate a surplus in the balance of payments, leading to reserve gains and monetary expansion.

c. Fall in Terms of Trade

As Salter (1959) has shown, a fall in the terms of trade changes the definition of the traded good. Therefore, it is necessary to go back to first principles.[3] Consider first a rise in import prices. The supply of foreign exchange is reduced as supply shifts from exportables to importables. The demand for foreign exchange rises or falls according to whether the demand for imports is inelastic or elastic, since the supply of imports is infinitely elastic in this model.

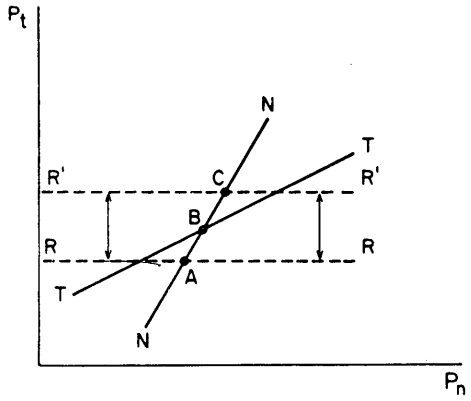
If the demand is inelastic, the exchange rate depreciates, further raising the price of imports, and that of exportables as well. The result is probably a shift of demand toward nontraded goods and of supply away from nontraded goods, thus raising their price as well, although the result depends on the strength of substitution and/or complementarity relations between the three types of goods in both production and consumption. With pegged exchange rates and an inelastic demand for imports, all prices would rise less, since the depreciation is avoided (or postponed).

If the import demand is sufficiently elastic to overcome the reduction in export supply, the exchange rate appreciates, reducing the magnitude of the increase in import prices and lowering the domestic price of exports. The price of nontraded goods rises by less than in the inelastic case, if at all. Pegged exchange rates would cause import prices to rise more and prevent export prices from falling.

Now let us consider a fall in export prices. The reduction in foreign-exchange earnings will result in a depreciation of the exchange rate, partially offsetting the reduced domestic price of exports and raising the price of imported goods. The price of nontraded goods may rise or fall, depending on the strength of the substitution toward exportables and away from imports. Pegged exchange rates would eliminate the depreciation, so that import prices could not rise. In this case, demand would shift toward exportables and supply toward nontradables, reducing the price of nontradables.

[3] See Meade (1951, Chap. VIII) and Kemp (1970) for discussion of the terms-of-trade effects of devaluation, which can be manipulated to give the exchange-rate effects of changes in the terms of trade. The elasticities used here are "total" elasticities, including the effects of induced changes in the price of nontraded goods, as in Kemp. Some might prefer to restate the following results in the equivalent language of real balance effects (see Kemp for the connection).

FIGURE 4
FLUCTUATIONS IN INFLATION RATE

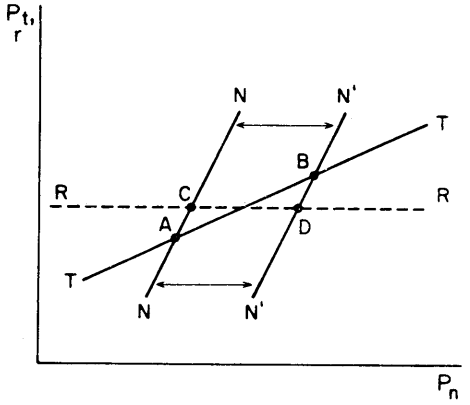


d. Exchange-Rate Policies for Stabilization

Since any economy is frequently buffeted by random shocks of various types, stabilization policies can be defined as policies devoted to maintaining internal and external balance in the face of such shocks. In the context of this model of a less developed country, the optimal exchange-rate policy from a stabilization point of view depends on the type of shock to which the economy is most frequently exposed. For example, if most shocks are generated by changes in the level of world prices relative to domestic prices, the goals of internal and external balance will be served best by a flexible-exchange-rate policy, as it will tend to insulate domestic prices from the effects of fluctuations in world prices. For example, in Figure 4 a country with no net capital imports is faced with random fluctuations in world price levels. A flexible exchange rate could allow the *TT* curve to remain unaffected by the world-price fluctuations. But a pegged exchange rate would cause domestic prices of tradables to fluctuate, say from *RR* to *R'R'*, so that prices, including those of nontradables, would fluctuate from point *A* to point *C*.

If instead most shocks come from temporary fluctuations in harvests or other domestic production, a pegged-exchange-rate policy achieved by use of reserves or borrowing is optimal. In Figure 5 we consider fluctuations in domestic production of the nontraded good. It is obvious that price fluctuations will be substantially reduced by pegging the exchange rate at a level indicated by the line *RR*, since the range is reduced from *AB* to *CD*. This result holds with much more force in the

FIGURE 5
FLUCTUATIONS IN DOMESTIC PRODUCTION



case of fluctuations in domestic production of the traded good, since the pegged exchange rate can wipe out the effects on prices of shifts in the *TT* curve.

If most shocks come from temporary shifts in the terms of trade, the situation is more complex. Let us begin with the case of sufficiently elastic demand for imports and assume that either export prices fall or import prices rise. Pegging the exchange rate prevents the other traded-good price from moving in the opposite direction, but prices of nontraded goods will move *more* under pegged exchange rates, as will the *average* price of traded goods. If import demand is inelastic, however, a rise in import prices will raise all prices under flexible exchange rates. Pegging the exchange rate will prevent the increase in the domestic price of the traded good whose world price has not changed and will therefore lead to a smaller movement in the price of nontraded goods.

e. The Effects of Worldwide Floating Exchange Rates

When the exchange rates of most of the major trading nations are floating, the model developed above needs to be modified to take account of the multiplicity of foreign price levels for tradable goods. The standard technique for dealing with a group of floating rates is the concept of an "effective exchange rate" (*Economic Report of the President,* 1974, pp. 220–226).

The effective exchange rate for a country can be defined as a weighted average of the exchange rates of its trading partners, with all rates being measured relative to some base year. An index can then be computed by comparing the *actual* dollar exchange rate of the country

to the weighted average of the dollar rates of its trading partners. The simplest type of weighting system is a *bilateral* system of weights, using export shares or import shares or an average of both. For example, an export-weighted effective-rate index can be defined as

$$e_j = \sum_{k \neq j} E_{jk} r_k, \qquad \text{index} = r_j / e_j ,$$

where the rates r_k are defined as units of currency k per dollar and E_{jk} = share of j's total exports going to k. Similarly, an import-weighted index, where M_{kj} = share of j's imports coming from k, can be defined as

$$e_j = \sum_{k \neq j} M_{kj} r_k , \qquad \text{index} = r_j / e_j .$$

These indexes give extremely useful information concerning the effect of shifts in world exchange rates on the competitive position of a given country. Nevertheless, they have at least two major shortcomings from the point of view of this essay. One generally acknowledged drawback is that bilateral-weight indexes ignore the effects of competition between the products of countries j and k in *third markets*. An additional problem is that an index of exchange rates is not a price index of tradable goods. Both of these limitations can in principle be resolved through the use of the IMF's Multilateral Exchange Rate Model (MERM) (Artus and Rhomberg, 1973).

When a less developed country is a major factor in the world market for one of its primary-product exports, it can indeed be shown that more complicated weights based on the MERM system are needed to measure the effects of exchange-rate changes on the prices of traded goods. But when the country can be regarded as a price taker for its imports, the import-weighted index given above is a good measure of the effects of floating rates in other countries on the less developed country's import prices. Similarly, if the country is one of a group of price takers with respect to its exports, an export-weighted index gives a useful measure of the effects of other countries' exchange-rate movements on its export prices (Black, 1976). The use of such measures is suggested in the next section.

4 Types of Exchange-Rate Policy in a World of Floating Rates

Utilizing the results of the previous two sections, we can now turn to the analysis of the various types of exchange-rate policy for a less developed country in a world of floating rates. The main focus is on the design of exchange-rate policy for stabilization with respect to external and internal disturbances, as discussed in section 3. The *variance* of the domestic relative price of tradable goods is taken to be the main,

though not exclusive, measure of stability.[4] Choice of the variance as a criterion implies that stabilization is a goal and further that the average or mean future price is not really subject to choice. If the future movements of floating exchange rates among the major nations are not predictable, exchange-rate policy cannot be designed to affect the mean price of tradable goods. In a world of managed floating, of course, changes in exchange rates *may* be predictable when central banks intervene to delay upward or downward movements in exchange rates. If it is possible to predict movements in exchange rates, a country may choose to peg its currency to a major currency that is expected to appreciate or depreciate, depending on whether the country in question needs to appreciate or depreciate from its own point of view. But such possibilities will be ignored in the following discussion.

The variance of relative price is used as a measure of instability for a number of reasons. Stiglitz (1972) has shown that consumers in a two-good world of the sort developed in section 2 will pay an insurance premium to avoid uncertainty if they are sufficiently risk-averse. The amount of the premium depends positively on the degree of risk aversion and net purchases of the traded good, negatively on the compensated price elasticity and income elasticity of demand for the traded good, and positively on the variance of the relative price of the traded good. The basic reason for this result is that individuals with diminishing marginal utility of income will attach less value to increases in income due to favorable price outcomes than to losses in income due to unfavorable outcomes. Thus consumers will be better off if the variance of prices can be reduced without excessive cost in terms of the resources devoted to the effort.

With respect to production, Sandmo (1971) and others have shown under fairly general conditions that risk-averse firms will produce less if prices are random than if prices are known (and equal to the means of the random prices). Diminishing marginal utility of profits implies that increments to profits from high prices are worth less than losses due to low prices. An increased variance of prices is likely to reduce production if firms are averse to risk.[5]

[4] In some conditions, fluctuations in relative prices may not be the major cause of fluctuations in real incomes. In particular, when the exchange rate is pegged by means of a system of import controls, fluctuations in real import capacity as measured by the income terms of trade may be an important constraint on real incomes. In such cases, import controls should be supplemented or replaced by reserve use or borrowing as the pegging technique, for example, in the case of crop failure.

[5] Under some conditions, it is possible for uncertainty to make a country better off, as shown by Turnovsky (1974).

a. Choice of Weights

It has been shown above that fluctuations in the world price of tradable goods to a given country can be measured by a weighted average of fluctuations in exchange rates (and, of course, other factors causing changes in prices). The specific weights in that average will obviously have great influence on the type of policy that will minimize the variance of the domestic price of tradables. The weights chosen should exclude barter trade, which is independent of exchange rates. They could be based on exports, imports, or an average of the two. They could be based on merchandise trade or total trade in goods and services, or even on the balance of payments (i.e., payments and receipts).

If it is assumed that capital flows are exogenously determined because of low capital mobility, then weights based on total trade in goods and services appear most appropriate (*Economic Report of the President,* 1974, pp. 220–226). Such weights will take into account not only changes in prices of goods that move in international trade, but also changes in the prices of services, of which the most important are payments for the use of foreign capital and receipts from tourism. To the extent that exchange-rate fluctuations affect the value of such payments and receipts, it is essential to include them in the measure of price changes for tradables.

A further technical point affecting the choice of weights is the "currency contract" issue raised by Magee (1973). For one thing, the short-run variance of, say, weekly or monthly data on domestic prices of tradable goods is affected by the currency of denomination of trade contracts. If short-run variance is being minimized, the appropriate weights should not be based on origin and destination of trade, but rather on currency of denomination of trade, whether we are speaking of trade in goods or in services. These same short-term risks, however, are often hedged in one way or another. For example, a trader may offset exports against imports in the same currency. Alternatively, forward cover may be used to offset such risks. Finally, the contract itself may provide for the other party to assume some or all of the exchange risk during the contract period. Where risks have been hedged in such ways, currency-of-denomination trade weights should be reduced by the fraction of trade so hedged.

More fundamentally, however, currency-contract risk is less significant than the longer-run risks of engaging in trade as opposed to production of nontraded goods. Such risks depend more on the long-run variance of prices of traded goods. Since the currency of denomination

is of significance only in the short run, the longer-run analysis should instead be based on direction of trade.

Finally, to the extent that a country cannot be considered a price taker in international trade, more complicated weights from the MERM system should be adopted. To summarize, for a less developed country that faces given but fluctuating world prices, stabilization policy should focus on a weighted average of exchange-rate movements, with weights based on the direction of trade in goods and services, discounted for the proportion of trade that is hedged or carried out by barter.

For a given country, then, the benefits of different exchange-rate policies can be compared in terms of their effects on the variance of domestic relative prices. The institutional *costs* of adopting different policies will be considered later. The following policies will be considered: free-market floating, managed floating, pegging to the SDR, and pegging to a single currency such as the dollar or pound sterling. Let us assume that a given set of weights α_i has been chosen for a country's index of changes in the world price of tradable goods. Let T_i be the dollar price of currency i and $r_i = 1/T_i$ be the local-currency price of the dollar, so $\overset{*}{r}_i = -\overset{*}{T}_i$, where the asterisk denotes percentage change. Then the percentage change in the *world* price of tradable goods in country j due to changes in other countries' exchange rates can be written as

$$\overset{*}{P}_{tj}{}^{f} = \Sigma_{i \neq j}\, \alpha_i \overset{*}{T}_i ,$$

while the percentage change in the *domestic* relative price of tradables is

$$\overset{*}{P}_{tj} - \overset{*}{P}_{nj} = \overset{*}{r}_j + \overset{*}{P}_{tj}{}^{f} - \overset{*}{P}_{nj} = \overset{*}{r}_j - \Sigma_{i \neq j}\, \alpha_i \overset{*}{r}_i - \overset{*}{P}_{nj} .$$

b. Floating Exchange Rate

By free floating, a country with sufficiently developed exchange and financial markets can allow the market to determine its exchange rate vis-à-vis the dollar and all other currencies. In the context of the theory developed above, the exchange rate will then depend on movements in the domestic price of tradable goods as given by Figure 2 and exogenous movements in the world price of tradable goods. As pointed out in the discussion of stabilization policy in section 3, such a policy will minimize the variance of domestic prices when the most important shocks come from exogenous changes in world prices relative to domestic prices or from exogenous changes in exchange rates.

Free floating will *not* be optimal if most shocks come from internal sources such as crop failures. If most shocks come from changes in the terms of trade, a country with an elastic demand for imports will have less variance in its prices under floating exchange rates than under pegged rates, generally speaking. The converse is true for a country with an inelastic demand for imports, as argued in section 3. Furthermore, if the country is very open, in the sense that the proportion of nontraded goods is very low, monetary policy becomes crucial. In such cases, the *NN* curve essentially collapses into the *TT* curve, leaving indeterminate the relative prices of traded and nontraded goods. The absolute price level and the exchange rate are then determined solely by the money supply.

A result similar to free floating can be obtained by *government-managed* floating designed to stabilize the domestic relative price of tradable goods. By setting $\hat{r}_j$ equal to $\sum_{i \neq j} \alpha_i \hat{r}_i + \hat{P}_{nj}$, a country can insulate its domestic relative price of tradables from the effects of exchange-rate fluctuations elsewhere and from domestic inflation. In other words, the country acts so as to stabilize its *effective* exchange rate, discounted for the domestic rate of inflation. This policy will be appropriate when most shocks come from changes in exchange rates among the major countries. But changes in world prices of tradable goods that are *not* due to changes in exchange rates will be passed through to the domestic economy by such a policy. The actual dollar exchange rate should therefore be allowed to appreciate relative to the weighted average effective rate in order to offset the effect of world inflation. (This policy is the reverse of depreciating when the domestic economy is inflating faster than world prices are rising.)

In the absence of changes in world prices, stabilization of the effective exchange rate by managed floating is also an optimal policy with respect to domestic disturbances. The domestic price of tradables is then held constant in the face of shifts in domestic demand and supply, allowing the foreign sector to absorb more of the disturbances than would occur under free floating (see Figure 5).

c. Pegging to the SDR

Since the SDR itself has been floating since July 1974, an attractive possibility for many countries to consider is pegging to the SDR. Such a policy might generate many of the benefits of the managed float discussed above while having an appearance of greater stability as well as various technical advantages.

The SDR is now defined as a weighted average of a "basket" of

sixteen major currencies. In terms of our notation, the percentage change in the SDR price of the dollar is $\overset{*}{s} = \sum_{i=1}^{16} w_i \overset{*}{r}_i$.

A policy of pegging the domestic currency to the SDR then involves putting $\overset{*}{r}_j$ equal to $\overset{*}{s}$, so that the local-currency price of the dollar changes exactly as does the SDR price of the dollar. This implies that the percentage change in the domestic price of tradables is equal to $\overset{*}{P}_{tj} = \sum_{i=1}^{16} w_i \overset{*}{r}_i - \sum_{i \neq j} \alpha_i \overset{*}{r}_i$. Unless the SDR weights w_i are equal to the effective exchange-rate weights α_i of the country, this policy will clearly be inferior to the policy of managed floating.

Yet, since the currencies of many of the trading partners of a less developed country may either be themselves pegged to the SDR or else be among the sixteen major currencies in the SDR basket, this condition of equal weights is not as farfetched as it might seem. It is shown in section A-2 of the Appendix that an SDR peg will have the same properties as a managed float if, for each member of the group of sixteen, the share of the less developed country's trade with countries that are pegged to the member is equal to the weight of the member's currency in the SDR times the share of the less developed country's trade with all countries that are pegged to the currency of one of the sixteen major countries.

This criterion would hold, for example, if 33 per cent of the country's trade with countries not pegged to the SDR was with countries pegged to the dollar, 12.5 per cent with countries pegged to the German mark, etc. Otherwise, the variance of the domestic price of tradables will be positive. The greater the number of countries that peg to the SDR, the more likely is the criterion for pegging to the SDR to hold for any given country.

d. Minimizing Variance by Choice of Peg

If neither managed floating nor an equivalent SDR peg is chosen, various other pegs may be evaluated in terms of their effects on the variance of the domestic price of tradable goods.[6] This variance will essentially be a linear combination of the variances and covariances of the exchange rates of the trading partners, with the weights depending on the choice of the peg.

Let $V = [v_{ij}]$ denote the matrix of variances (v_{ii}) and covariances (v_{ij}) of the percentage changes in the dollar prices of the various currencies ($\overset{*}{T}_i$). If $i = 1$ for the dollar, the first row and column of V are all zeros. Pegging currency j to a given currency k implies that $\overset{*}{T}_j = \overset{*}{T}_k$. The

[6] Allowing for differential inflation of nontraded-goods prices would involve a managed float.

percentage change in the domestic price of country j's tradable good is then $\overset{*}{p}_{tj} = \sum_{i \neq j} \alpha_i \overset{*}{T}_i - \overset{*}{T}_k$. As shown in section A-3 of the Appendix, the variance of $\overset{*}{p}_{tj}$ will be minimized by choosing to peg to that currency k which has the smallest value of $\sum_{i \neq j} \sum_{h \neq j} \alpha_i v_{ih} \alpha_h + (1 - 2\alpha_k) v_{kk} - 2 \sum_{j \neq k} v_{kj} \alpha_j$. When the dollar is chosen as the peg, $k = 1$ and the last two terms of this expression vanish. A nondollar peg should therefore be chosen only if the sum of the last two terms is negative. The choice thus depends on both the shares and the variances and covariances. The optimal choice, if not the dollar, is the currency of a large trading partner whose dollar exchange rate has a low variance and a high covariance with the rates of other important trading partners.

This formula brings out the importance of considering all the major trading partners. Pegging to the currency of a low-variance trading partner will not be optimal if currencies of other trading partners are negatively correlated with that of the low-variance country. Similarly, the currency of the major trading partner may not be the best choice of peg if it has a high variance in its dollar exchange rate.

5 Characteristics of Less Developed Exchange Markets and Money Markets

In what ways do the exchange markets and money markets of less developed countries differ from the institutional and market structure of developed countries?

The normal institutions in a developed financial system are the central bank, the commercial banking system, the national treasury, the private business sector, securities brokers and dealers, and foreign-exchange brokers and dealers (the latter will include most commercial banks). The asset markets deal in short-term treasury bills, bank deposits, bank loans, currency, and spot and forward exchange (see Black, 1973, for a thorough analysis). An alternative to a short-term treasury-bill market would be a market in private short-term paper, such as banker's acceptances or other paper eligible for discount at the central bank. Not only should these institutions and asset markets exist, but they should function competitively, charging the same price or interest rate to each participant (after correcting for differences in risk or other similar attributes). The markets must be broad enough, with a sufficient number of participants, to approximate the concept of an efficient market in which current prices always fully reflect all available information (Fama, 1970).

While it is obvious that there is a wide range of financial development within the set of countries usually called "less developed," a

survey of relevant institutional literature and discussion with knowledgeable staff people at the IMF have turned up six major aspects in which the financial markets of most less developed countries differ from those of most developed countries: (a) There is a low degree of substitutability between domestic and foreign securities, including a thin market for domestic securities and an absence of a network of securities brokers and dealers. (b) Because of low substitutability of domestic and foreign assets and much higher uncertainty concerning political and economic developments, speculation is more likely to be destabilizing. (c) There is no forward market. (d) Interest rates on domestic securities are likely to be pegged at unrealistically low rates, leading to fragmentation of the securities markets and a multiplicity of interest rates paid in a disorganized market. There may be no market in short-term securities. (e) The government is likely to impose an exchange-control regime involving government monopoly of exchange dealings, often with multiple discriminatory exchange rates. As a result, the domestic network of exchange dealers will be tightly controlled and have a minute capital position. (f) Finally, less developed countries tend to have *small* financial markets relative to those of developed countries.

The implications of each of these six characteristics will now be developed in the context of financial relationships between two countries, assuming that the *domestic* country is less developed and the foreign country is highly developed.

a. Effects of a poor domestic securities market. Low substitutability of domestic and foreign securities in the portfolios of both domestic and foreign residents is a major effect of a thin, illiquid, or even nonexistent market for domestic securities. As a result, changes in one country's money-market conditions will tend to have less effect on the other country's money market, and changes in exchange-market conditions will therefore have less effect on interest rates. The reduced amount of substitutability, or reduced capital mobility, will mean that changes in money-market conditions will tend to have bigger effects at home and smaller effects abroad.

Likewise, factors which cause exchange-market conditions to change will have smaller effects on the interest differential. Suppose there is speculative flight from the domestic currency. Normally, one would expect a rise in the forward premium on foreign currency, owing to forward-market speculation. With low capital mobility, the interest differential favoring the foreign country will fall by less than with high capital mobility. The spot foreign-exchange rate will thus appreciate relatively more and the forward rate relatively less than

with high capital mobility. Thus, speculative episodes will have more violent effects on exchange rates if money markets are poorly developed in the less developed country.

Furthermore, if the domestic securities market is poorly developed, the main interest rates relevant for arbitrage become the relative costs of trade credit at home and abroad. These costs are likely to be much higher at home than interest rates on securities would be if there were a developed securities market. Arbitrage considerations will then lead to a larger forward discount on the domestic currency, making the cost of forward cover of domestic-currency assets much more expensive.

b. Effects of destabilizing speculation. If the elasticity of expectations about the future spot exchange rate is sufficiently high, an increase in the price of foreign exchange (fall in the value of domestic currency) could generate expectations of an even larger increase in the future. The result is that an increase in the spot exchange rate requires an even larger increase in the forward rate to equilibrate the forward market. This sort of instability is even more likely when combined with low capital mobility. Unstable exchange markets can and presumably will be stabilized by the introduction of pegged exchange rates.

c. Effects of no forward market. In the absence of a forward-exchange market, foreign-currency assets must either be held without cover against exchange risk or balanced against foreign-currency liabilities. In practice, there is usually less concern about risk on foreign-currency assets than there is about uncovered foreign-currency liabilities and *domestic*-currency assets. As long as speculation remains stabilizing, the foreign-exchange market can still be cleared by movements in the spot exchange rate. In the absence of forward cover, however, one would expect capital to be relatively less mobile, and, without the cushioning effects of stabilizing capital flows, shocks in the exchange market must be borne almost completely by changes in the exchange rate (if the exchange rate is not pegged). Furthermore, the relative weakness of stabilizing capital flows implies that the movement of the exchange rate over time may be influenced heavily by the trade account. The so-called "J-curve" (Magee, 1973) indicates, however, that the short-run response of the trade account to a change in exchange rates can be perverse because of low short-run elasticities. If there is a J-curve, stabilizing capital flows are required for the overall stability of the balance of payments. Thus, reduced capital mobility owing to the absence of a forward market may make instability of the balance of payments more likely.

d. Pegged domestic interest rates and fragmented securities mar-

kets. If the central bank pegs interest rates in the domestic securities market, the domestic interest rate is independent of changes in exchange rates, including the premium on forward foreign exchange. The result is that changes in the forward discount have a smaller effect on the interest differential, since they affect only the foreign interest rate. The general effects of this case appear to be similar to those of case *a.*

e. Exchange control and/or multiple exchange rates. Exchange-control regimes are usually adopted when the exchange rate is pegged at a disequilibrium level. When the chosen tool of pegging is exchange control rather than reserve movements, imports will be limited to the amount of foreign exchange earned by exporting at the disequilibrium exchange rate, plus capital inflows. If the exchange control is effective, the supply of imports will always be less than the amount of imports demanded, with the result that the domestic price of imports will tend to exceed their foreign-exchange cost translated into domestic currency. The familiar litany of misallocated resources can be recited here: excessive production of high-cost import substitutes, insufficient production of low-cost exports, distorted consumption patterns, excessive production of home goods relative to foreign-trade goods, and distorted distribution of income (Krueger, 1969, section 3). These problems are obviously aggravated if multiple exchange rates are adopted as the government uses monopoly power to raise revenue from the foreign-exchange business.

The decreased efficiency of the economy caused by exchange controls will show up on the supply side of the economy rather than in the financial markets. However, the use of exchange controls will also strongly discourage the sort of two-way capital mobility that helps exchange markets to work smoothly between developed countries. Thus, capital will become less mobile, as in case *a.*

f. Small relative size of domestic financial market. Even the most developed financial market in Europe is much smaller than the New York market. The consideration of relative size is even more important for a less developed country. Having a small financial market means that it will not be economic to develop the wide network of broker-dealer relationships, interbank markets, and organized exchanges that larger volumes in industrial centers can support. Under these conditions, a less developed country will typically make extensive use of the facilities of its partner's financial market rather than try to make do with its own inadequate, relatively slow, and expensive facilities for financing trade and capital movements. A thorough study of the extent of such behavior among the members of the Economic Commission for

Asia and the Far East (ECAFE) demonstrates its significance (Mookerjee *et al.*, 1969).

A relatively small domestic financial market means that the domestic market has less effect on the foreign interest rate, but the foreign market has *more* effect on the domestic rate. In the exchange market, small size has more serious disadvantages. Fewer traders and investors will want to hold the currency of a relatively small country with small financial markets, since its trade and investment position must both be relatively small.

6 Policy Choices for Less Developed Countries in a World of Floating Exchange Rates

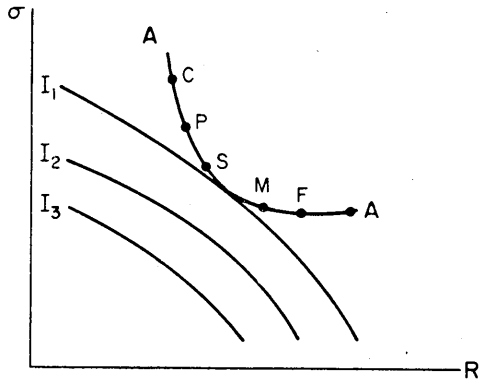
Section 5 outlined a number of institutional features of the exchange and financial markets of less developed countries. Each of the possible choices of exchange policy discussed in section 4 has its own implications for changes in the institutional structure of exchange and financial markets. For example, successful adoption of freely floating exchange rates in a less developed country may require abandonment of exchange controls, greater stability of domestic policies, development of a forward-exchange market, abandonment of pegged interest rates in the domestic securities market, and development of a network of brokers and dealers in securities and foreign exchange. Such changes would have substantial costs in terms of the required commitment of both financial and human resources, substantial benefits in the form of improved resource allocation and reduced control apparatus, as well as political costs involved in a move toward a market determination of exchange rates and interest rates. Against such costs and benefits must be weighed the macroeconomic benefits of free floating, discussed in section 4, compared with other policies having less significant political and resource costs. For example, managed floating may achieve many of the benefits of free floating without requiring nearly as many institutional changes. Pegging to a major currency, the traditional policy, may in some cases be the solution with the greatest net benefits.

a. Framework for Analysis of Policy Choices

A simplified picture can be constructed of the type of analysis that should be applied to a specific country. Ignoring political costs for the moment as even less quantifiable than economic costs, one can try to evaluate the resource costs involved in any given exchange policy, including the costs of changing institutions and the costs of holding different levels of reserves. One can likewise try to evaluate the prob-

FIGURE 6

OPTIMAL CHOICE OF EXCHANGE POLICY



able effects of each policy on the variance of traded-goods prices, following the precepts of section 4. The results of such calculations might generate a trade-off locus between resource costs R and the standard deviation of traded-goods prices σ, such as the curve AA in Figure 6. The various policies (placed along the curve quite arbitrarily) are C, exchange controls or import quotas plus reluctant adjustment of a single-currency peg; P, optimally chosen and managed single-currency peg; S, SDR peg; M, managed float; and F, free float. If it is assumed that the decision maker's loss function is an increasing function of both variance and resource cost, with nice curvature properties for convenience, the indifference loci can be sketched in as the curves I_1, I_2, and I_3. Political costs of various policy choices (including the costs of implied income redistribution) must of course be superimposed on this economic analysis in some third, nonquantifiable dimension.

In this context, the shift to floating exchange rates among the major trading nations has had the effect of increasing the variance faced by individual countries that peg to a single currency. Thus, the portion of the locus including the points C and P will have shifted up, making points such as F, M, or S relatively more attractive to policy makers.

Now, I do not seriously propose that the calculations involved in Figure 6 actually be carried out in full. My main purpose in presenting the figure is to provide an organizing framework for analysis. The basic point is that each policy alternative should be evaluated in terms of its institutional costs, reserve needs, stabilization benefits, and political costs. Some net balancing of these costs and benefits must then be made by the decision makers.

It is important to recognize that the framework of analysis proposed here includes the costs and benefits usually dealt with under the rubric of "optimal currency areas." For example, Aliber (1972) has recently categorized these costs and benefits as "utilization costs" and "efficiency costs." Utilization costs include the adjustment costs of maintaining excessive unemployment or shifting resources between sectors, which can be measured by the costs of holding the reserves used to avoid such costs (Heller, 1966). Efficiency costs, on the other hand, include the resource costs of operating an exchange market and the costs of the differing degree of uncertainty about the prices of traded goods. Thus, all the costs considered by Aliber are included in Figure 6, although they are broken down in a different way.

b. Costs and Benefits of Different Exchange Policies

I have suggested that the five exchange policies portrayed in Figure 6, as well as other possible exchange policies, have different implications for the kinds of institutional arrangements that were discussed in section 5. They also have different implications for the use of reserves and the variance of prices. This section will discuss the kinds of differences that should be examined and quantified, if possible, for a given country. Table 1 gives a tabular summary of the main differences.

Policy C, utilizing exchange controls or import quotas and capital controls to peg to a single currency, is now probably the most prevalent form of exchange policy in the less developed countries. For

TABLE 1

HYPOTHETICAL COSTS OF ALTERNATIVE EXCHANGE POLICIES
(*H = High, M = Medium, L = Low*)

				Institutional Requirements			
	Variance	*Resource Misallocation*	*Reserves*	*Official Controls*	*Private-Exchange Market*	*Forward Market*	*Securities Market*
Controls (C)	H	H	L	H	H[a]	—	—
Peg to single currency (P)	M	M	H	L	L	—	—
SDR peg (S)	L/M	L	M	L	M	M	—
Managed float (M)	L	L	M	L	M	M	—
Free float (F)	L	L	L	L	M	M	M

[a] The black market.

example, the *25th Annual Report on Exchange Restrictions of the International Monetary Fund* listed fifty-six less developed countries as maintaining restrictions on current- and capital-account payments. Most of these countries pegged to a single foreign currency. This type of policy requires a substantial commitment of resources to the mechanism of exchange control,[7] but relatively little commitment to the development of market institutions. Forward-exchange markets and domestic-securities markets are relatively neglected. Even spot-exchange markets are typically thin, most legal transactions taking place either directly with the exchange authority or with authorized dealers acting on behalf of the exchange authority. The black market, on the other hand, flourishes.

While policy C saves on the resource costs of holding reserves or borrowing reserves, it probably imposes substantial costs of resource misallocation due to the maintenance of inappropriate exchange rates. The result is a distortion of production from traded to nontraded goods and a suppressed distortion of consumption from nontraded to traded goods. Furthermore, the very large abrupt devaluations that become inevitable in such a system give rise to high variances in effective exchange rates, as will be seen in the empirical computations in section 8.

Policy P, pegging to a single foreign currency by means of reserves or borrowing, eliminates the costs of exchange control and black markets but implies greater costs of reserve holding than policy C. In this situation, it is no longer necessary for the exchange authority to monopolize legal exchange transactions, so that the legal private exchange market will become more developed. Furthermore, an inappropriate exchange rate probably cannot be maintained for as long through reserve use as it can through exchange controls. As a result, the resource misallocation involved will probably be much less than with policy C. And since required devaluations will probably occur more frequently, the high variance contributed by very large devaluations will be mitigated. It is even probable that greater exposure to the "discipline of the balance of payments" will result in more responsible domestic policies and less need for devaluations.

Of course, in a world of floating exchange rates, pegging to a single currency will not minimize the variance of traded-goods prices. But, as shown in section 4, it is possible to define a "best" single-currency peg. If this involves a *different* currency from the traditional peg, there are costs involved in changing the peg. Using a different intervention

[7] See Meade (1951, Part V) for a discussion of the required supervision involved in exchange control, import quotas, and capital controls.

currency implies holding balances in a different currency and building working relationships with a different foreign financial center. New communications arrangements may be required, and new lines of credit may have to be developed to replace existing facilities. The extent to which such facilities are made available by a foreign financial center may be an important qualification to the aim of minimizing fluctuations in traded-goods prices. Development of forward-exchange facilities is a feasible option under policy P, although it would require an investment of resources. Given a world of floating rates, however, such facilities have become more desirable as a means of reducing short-term exchange risks.

Policy S, pegging to the SDR, might substantially reduce the variance of the effective exchange rate if the country's trade pattern approximates the weights of currencies in the SDR package. On the other hand, it would not avoid the need for a single intervention currency, since the SDR itself is not a currency but a means of settlement. The exchange authority would have to obtain from the IMF daily quotations of the SDR value of the intervention currency. Buying and selling rates for the intervention currency would have then to be set daily so as to maintain the SDR value of the domestic currency. Settlement would be by means of reserves or borrowing, including SDRs.

This policy would require more frequent calculations and communications between the exchange authority and authorized dealers in foreign exchange, since it involves the same techniques as a managed float. Furthermore, this policy almost *requires* the development of forward-exchange facilities vis-à-vis the intervention currency, since the domestic currency would now *float* relative to the intervention currency.

The need for reserves might be reduced by an SDR peg *if* it came close to stabilizing the effective exchange rate under noninflationary conditions. On the other hand, it is conceivable that a country trading mainly with a single partner could find itself using *more* reserves under an SDR peg than under a single-currency peg.

Policy M, the managed float designed to stabilize the effective exchange rate or move it in the direction indicated by differential inflation rates, is more difficult to carry out than the SDR peg because the country itself must compute the weighted average of exchange rates of its trading partners. Otherwise, it is similar to the SDR peg in requiring a single intervention currency with an ever-changing quotation in terms of the domestic currency. The advantage of the managed float is that it can reduce essentially to zero the variance in the relative price of traded goods.

Since the managed float reduces the impact of external disturbances

by moving the exchange rate *and* reduces the impact of internal disturbances by not moving the rate, it has the greatest potential for reducing needed reserve holdings as well as other adjustment costs. On the other hand, the operation of a managed float would clearly require a substantially increased investment in exchange-market facilities for many less developed countries. The choice of appropriate weights in itself involves a significant amount of analysis, as indicated in section 4. In addition, data would have to be collected daily on the exchange rates of currencies in the average, presumably quotations in the financial center of the intervention currency. The resulting quotations for the intervention currency in terms of the domestic currency would have to be disseminated quickly and regularly to all authorized exchange dealers. Since the domestic currency would be floating relative to the intervention currency, forward-exchange facilities vis-à-vis the intervention currency would be essential.

It is useful to compare the formula-managed float suggested here with the formula-managed float of Brazil, even though that policy was devised prior to the adoption of floating exchange rates by the major trading nations. Brazil changes its exchange rate at frequent intervals, the amount of change depending on the domestic rate of inflation (relative to the foreign rate of inflation). The managed float suggested in section 4, by contrast, changes the exchange rate in accordance with changes in the exchange rates of major trading partners and changes in the differential rate of inflation.

Policy F, free floating, probably requires a substantial further commitment of resources to the development of exchange markets and related financial markets for most less developed countries. Such a policy clearly requires well-developed spot- and forward-exchange markets, including substantial networks of dealers in foreign exchange, together with well-developed domestic financial markets. Only a few less developed countries can claim such facilities, for example, Israel, Lebanon, Kuwait, and Singapore. One crude measure of the breadth of foreign-exchange markets is the ratio of commercial-bank holdings of foreign-currency assets to central-bank holdings of foreign-currency assets. Table 2 shows the distribution of this ratio for the eighty-three less developed countries with country pages in *International Financial Statistics.*[8] It is obvious from the table that, in

[8] This includes all the countries listed in Table 4 below except the Bahamas, Bahrein, Bangladesh, Barbados, Equatorial Guinea, Fiji, Guinea, Khmer Republic, Laos, Liberia, Malta, Oman, Qatar, Rumania, United Arab Emirates, Western Samoa, and Yemen Arab Republic. In a few cases, 1972 or 1971 data are used in the absence of 1973 figures. When the ratio exceeds unity, the commercial banks' holdings of foreign exchange are greater than the central bank's holdings. Such countries include Kuwait, Lebanon, Costa Rica, Israel, and, for some reason, the Central African Republic.

TABLE 2

DISTRIBUTION OF RATIOS OF COMMERCIAL-BANK HOLDINGS TO CENTRAL-BANK HOLDINGS OF FOREIGN-EXCHANGE ASSETS, DECEMBER 1973

Ratio	*Number of Countries*	*Per Cent of Countries*
0–0.099	35	42.2
0.1–0.199	18	21.7
0.2–0.299	8	9.6
0.3–0.399	3	3.6
0.4–0.499	2	2.4
0.5–0.599	2	2.4
0.6–0.699	3	3.6
0.7–0.799	1	1.2
0.8–0.899	0	0
0.9–0.999	2	2.4
1.0–1.099	2	2.4
1.1–1.199	0	0
1.2–1.299	2	2.4
1.3–2.9	2	2.4
3.0+	3	3.6

SOURCE: *International Financial Statistics.*

the large majority of countries, the commercial banks, and presumably other private dealers, are not allowed to maintain substantial working balances of foreign exchange.

The development of an extensive set of private markets for foreign exchange and domestic securities is not the only cost of relying on a freely floating exchange rate. It would surely be necessary for the exchange authorities to be prepared to intervene in the market to smooth out minor fluctuations in exchange rates threatening to disrupt the market. This is necessary even in the largest and most developed financial centers. The expertise required to carry out such operations is a scarce commodity in any part of the world.

Since one of the requirements for free floating would be a considerable liberalization and expansion of the domestic loan and securities market, substantial political costs may be attached to this solution. If minority groups hold a good deal of economic power, these political costs may be very high. On the other hand, there may also be substantial gains for the efficient allocation of resources and the mobilization of domestic savings resulting from such reforms (McKinnon, 1973).

While the resource costs of policy F may be large, its savings in reserves and in the variance of traded-goods prices may well be significant, assuming that the exchange market is in fact stable. The balancing of these costs and benefits is, of course, what is suggested in Figure 6 and Table 1.

The policy of *dual exchange markets* has also been recommended as an alternative to the policies discussed above, especially where it is desired to control disequilibrating capital movements (Fleming, 1974). Under this type of policy, capital-account transactions are conducted at a variable "free market" rate, while current-account transactions occur at a pegged "official" exchange rate. The effect is that of a tax on the purchase of foreign securities by residents and a subsidy to the purchase of domestic securities by foreigners. Many less developed countries now have a variant of this policy, in which only a favored subset of current-account transactions may pass through the "official" market. The difficulty with dual markets in less developed countries is their tendency to turn into discriminatory multiple-rate schemes.

7 Other Means of Reducing Adjustment Costs

The choices depicted in Figure 6 and Table 1 between types of exchange-rate policies do not exhaust the possibilities open to less developed countries for improving their welfare in a world of floating exchange rates. In particular, the following types of policies should also be evaluated as possible components of a well-designed response to the current situation: development of forward-market facilities, choice of currency denomination of debt issue, choice of reserve mix, regional reserve pooling or clearing arrangements, and borrowing versus adjustment to worsened terms of trade. This section will discuss these issues briefly, giving some suggestions for the major considerations to be weighed in each case.

a. Forward markets have been mentioned as a potential component of most of the exchange-rate policies discussed above (Miller, 1975). Their independent contribution to reducing instability in the prices of traded goods is subject to several limitations. First, the availability of forward facilities even in the advanced industrial countries has never succeeded in convincing all traders to cover their exchange risks. In less developed countries, the extent of use of such facilities would probably be quite limited. Second, forward cover can reduce the variance of prices due to exchange-rate fluctuation only *within the period of the contract*. Price variation between contracts will still affect producers of exported goods and consumers of imported goods. Nevertheless, forward cover does protect domestic consumers of exportables and domestic producers of importables from the fluctuations in traded-goods prices due to exchange-rate movements; it does so to the same extent that traders themselves are protected. Finally, forward

facilities seem most needed when the exchange rate is not pegged to a single foreign currency, since there is a floating spot exchange rate.

Either these facilities must be provided by the central bank, or else private securities and loan markets must be developed sufficiently to enable arbitrage to become a viable force in the market. Unless enough comparable borrowing and/or lending alternatives are available in both domestic and foreign markets, the type of covered arbitrage that is essential for the efficient operation of a private market in forward exchange will not be able to develop.

If these facilities are to be provided by the central bank, the bank should scrupulously maintain a balanced position sheet, with any imbalance in its forward position in the intervention currency matched by an opposite imbalance in its spot position. Such a policy would avoid the temptation that might arise to avoid losses on an unbalanced position by breaking the managed-float formula. Alternatively, resources could be devoted to developing a genuine private forward-exchange market, with the implied further development of the domestic loan and securities markets.

Few less developed countries should try to develop forward facilities vis-à-vis more than one or at most two foreign currencies. The provision of forward cover vis-à-vis the intervention currency should suffice for most countries. If banks in the foreign center will agree to provide forward facilities between the intervention currency and other major trading currencies, there is no reason why effective forward cover cannot be provided in this indirect way between the domestic currency and *any* major trading currency.

While forward cover offers a type of insurance against certain exchange risks, other sorts of insurance schemes are also conceivable. Many foreign concerns operating in countries without forward facilities protect themselves against exchange risk by maintaining roughly equal assets and liabilities in the weak currency. Domestic exporters and importers can hedge their foreign-currency risks similarly if they can match up foreign-currency claims arising from exports with liabilities arising from imports. This should be feasible, since most LDC exports and imports are thought to be denominated in hard currencies (Mookerjee *et al.*, 1969, Table 2, p. 401).

An alternative approach adopted in some export and import contracts involves the use of a hard-currency price that is adjusted according to some agreed average of the movements of a group of major trading currencies. The oil producers in particular have sought this type of protection against floating exchange rates (Silard, 1973, 1974).

b. Currency denomination of debt issue is usually a function of the

market in which borrowing is done. Thus diversification among sources of borrowing would be a prudent policy. The share to be borrowed in each market should be roughly the same as the share of the specific foreign currency in the merchandise trade balance of the country. As a result, fluctuations in debt service costs would be approximately offset by fluctuations in net earnings from foreign trade in goods. The same policy can be followed with respect to *reserve holdings*, which should be coordinated with debt service and merchandise trade to hedge against the impact of shifts in exchange rates.

The implications of such diversification can be seen through an example given in Table 3. The country shown in Table 3 has a merchandise surplus of 100 to pay net debt service of 100. Debt and reserve holdings have been diversified so as to match the currency pattern of the service account to the merchandise trade account. Suppose the country's currency is pegged to the pound sterling and that the dollar depreciates 10 per cent relative to sterling, while the German mark appreciates 10 per cent. The merchandise and service balances in dollars fall to 45 and −45, respectively, while the German mark balances rise to 88 and −88, leaving the current account unaffected. The diversification rule implicit in Table 3 is "Borrow from countries to which you export and lend to countries from which you import." This reverses the typical practice of trade finance, but then much LDC trade is financed in foreign centers (Mookerjee *et al.*, 1969).

The benefits to be gained from such diversification can be calculated in terms of reduced uncertainty about the exchange value of payments and receipts on debts and reserves, which reduces the certainty-equivalent interest rates on debts for countries with risk-averse governments. This gain must be weighed against possible losses due to floating exchange rates and costs due to higher interest rates. Tabula-

TABLE 3

DIVERSIFICATION OF DEBT AND RESERVES

Currency	*Exports*	*Imports*	*Merchandise Balance*	*Debt Service*	*Interest Earnings on Reserves*	*Service Balance*	*Current Balance*
Dollar	100	50	50	80	30	−50	0
Sterling	70	100	−30	10	40	30	0
German mark	100	20	80	110	30	−80	0
	270	170	100	200	100	−100	0

tions of the effects of the exchange-rate realignments of 1971 and 1973 on the values of reserves and debts are given in the *IMF Annual Reports* for 1972 and 1973 (pp. 22–23 and 29–31). These figures make it clear that borrowing an overvalued currency can be beneficial, while holding reserves in such form is dangerous. But the gains that many less developed countries achieved in these two episodes were due to correction of the long-standing overvaluation of the dollar. Such events are both less likely and less predictable in a world of floating exchange rates.

c. Clearing arrangements have also been suggested as alternative means for less developed countries to reduce their exposure to the effects of floating exchange rates among developed countries. The major way in which such benefits would arise is by the use of a regional unit of account for denomination of balances arising through intraregional trade. As Michalopoulos (1973) has pointed out, about 85 per cent of intraregional transactions in the Central American Common Market area are handled through the clearing union, compared with a figure of 40 per cent in the Latin American Free Trade Area. Exchange risk on such transactions is absent, since the transactions take place under exchange-rate guarantees.

The advantages of participation in such agreements would be higher under a regime of floating exchange rates. Unfortunately, the cost of participation may also be higher, for the cost to the union of providing the exchange guarantee can be expected to increase with increased flexibility among the member countries' currencies. Of course, if all members peg to the same foreign currency, this problem does not arise.

d. Borrowing versus adjustment to the worsened terms of trade implied by soaring oil prices has been a major problem for all countries. The less developed countries that are not members of OPEC have inevitably followed a relatively passive policy, relying on the major nations to negotiate a decline in the oil price and, in the interim, negotiating such charitable lending as the OPEC nations were willing to provide. Most less developed countries were fortunate in having relatively high reserves in 1974, due largely to the dramatic rise in the prices of their primary commodity exports in 1973.

Nevertheless, this cushion of reserves did not suffice for very long, and some countries such as Bangladesh of course had no cushion at all. If a less developed country were facing an increase in the price of oil, *ceteris paribus,* the scenario would go as follows: Given an inelastic demand for oil, the balance of payments deteriorates, even though

demand for oil declines in the face of higher prices. If the exchange rate is allowed to depreciate, the domestic price of imported oil will rise even further, cutting down on oil demand (and demand for other imports) even further. If the country had been facing buoyant export demand and, as a result, inflationary pressures prior to the increased oil price, a contractionary monetary and fiscal policy could substitute for the relatively inflationary exchange depreciation. Either policy would tend to reduce consumption of traded goods, though depreciation of the exchange rate would also tend to increase production and thereby facilitate adjustment.

Unfortunately, *ceteris paribus* did not hold in this case. First of all, many countries faced the same choices. It would have been a fallacy of composition to think that all could improve their trade balances by adjustment, especially vis-à-vis the OPEC countries. The better-off countries borrowed heavily in the Euro-markets in 1975 and resisted depreciation, thus leaving more room for the worse-off to adjust, given their inability to borrow. The solution to the problem, of course, does not ultimately lie with adjustment but with a fall in oil prices combined with increased assistance from the better-off countries.

The other important violation of *ceteris paribus* is the effect on the less developed countries of fluctuations in major-currency exchange rates. A country pegged to the dollar, say, could easily find its exchange rate appreciating in the face of rising oil prices, the opposite of the depreciation recommended above. To avoid this situation, the country should devalue relative to its peg if the currency to which it is pegged rises in an undesirable fashion. An example of this sort of problem was Italy's decision to drop out of the European Community "snake" in January 1973 because of a tendency for the snake to rise against the dollar while the Italian balance of payments was in deficit.

8 The Experience of Less Developed Countries under Floating Exchange Rates

Table 4 shows estimates of the variances of monthly data on import-weighted effective exchange rates for 100 less developed countries, for the periods January 1970–May 1972 and June 1972–April 1974. The indexes, which weight the effective rates by shares in imports of manufactured goods, are of the type given in section 3e.[9] The countries are grouped in the table according to the exchange-rate policy they were following in mid-1973, as reported in Appendix Table

[9] These indexes were kindly made available by the staff of the IMF.

TABLE 4

VARIANCES OF IMPORT-WEIGHTED EFFECTIVE EXCHANGE RATES FOR 100 LESS DEVELOPED COUNTRIES: PERIOD I, JANUARY 1970–MAY 1972; PERIOD II, JUNE 1972–APRIL 1974

Country	*Period* I	II
Pegged to gold or SDR (dollar, *de facto*):		
Algeria	0.7	4.2
Bahrein	1.8	19.4
Bolivia	7.9	249.6*
Burma	69.7*	5.5
Burundi	17.4	9.1
China	20.3	6.7
Dominican Republic	4.6	6.1
Ecuador	162.4*	4.8
Ethiopia	2.1	11.4
Guinea	1.4	15.6
Haiti	4.3	6.5
Iran	11.6	8.2
Iraq	1.4	13.8
Israel	104.7*	11.8
Jamaica	4.2	36.5
Jordan	11.7	9.2
Kenya	11.3	8.0
Kuwait	2.0	9.5
Libya	1.6	16.2
Nepal	17.4	27.5
Nigeria	1.8	17.5
Oman	1.9	38.4
Pakistan	122.7*	1.5
Panama	9.1	13.4
Qatar	1.8	16.5
Rumania	2.0	15.4
Rwanda	4.6	15.0
Saudi Arabia	1.8	22.2
Somalia	6.6	14.2
Tanzania	13.2	12.3
Thailand	18.5	14.6
Tunisia	1.1	18.1
Turkey	311.3*	9.7
Uganda	13.6	11.1
United Arab Emirates	2.0	10.2
Western Samoa	1.8	2.4
Yemen P.D.R.	2.4	12.7
Zaire	12.9	22.3
Zambia	10.8	11.5
Average**	6.7	14.4
Pegged to dollar:		
Argentina	634.6*	1.7
Bahamas	2.8	3.8
Chile	154.9*	464.5*
Costa Rica	5.9	32.1

TABLE 4 (Continued)

Country	Period I	Period II
Egypt	8.3	10.6
El Salvador	7.8	13.7
Ghana	207.2*	6.3
Guatemala	6.8	11.7
Honduras	2.9	5.3
Laos	261.3*	2.4
Liberia	22.9	21.6
Mexico	2.4	6.0
Nicaragua	3.7	6.4
Paraguay	10.7	22.4
Peru	6.7	13.3
Sudan	9.5	19.8
Syria	13.0	23.5
Venezuela	1.9	4.8
Average**	7.5	13.9
Pegged to sterling:		
Bangladesh	251.5*	5.1
Barbados	2.9	19.6
Fiji	2.7	49.5
Gambia	2.4	58.7
Guyana	6.5	20.4
India	1.8	11.8
Malawi	1.8	34.0
Mauritius	2.0	11.5
Sierra Leone	2.0	41.6
Sri Lanka	14.4	13.5
Trinidad and Tobago	2.3	26.9
Average**	3.8	28.8
Pegged to French franc:		
Cameroon	0.4	2.0
Central African Republic	0.4	0.7
Chad	0.3	0.6
Congo	0.6	1.0
Dahomey	1.0	1.6
Gabon	0.4	1.5
Ivory Coast	0.5	2.4
Malagasy	0.5	1.0
Mali	2.0	8.2
Mauritania	0.5	3.4
Niger	0.5	0.7
Senegal	0.4	1.0
Togo	1.5	3.1
Upper Volta	0.2	0.3
Average	0.7	2.0
Pegged to Spanish peseta:		
Equatorial Guinea	0.1	1.5
Flexible exchange rate:		
Afghanistan	27.8	136.0
Brazil	111.5*	12.9*

TABLE 4 (Continued)

Country	Period I	Period II
Colombia	49.1*	27.1*
Cyprus	1.7	5.0
Indonesia	101.9*	16.0
Khmer Republic	797.7*	33.8
Korea	135.6*	9.7*
Lebanon	1.9	55.4
Malaysia	0.6	18.8
Malta	6.7	3.9
Morocco	0.9	3.3
Phillipines	162.9*	10.5
Singapore	0.5	13.7
Uruguay	373.1*	44.6
Vietnam	7.0	228.8*
Yemen Arab Republic	52.8	20.6
Yugoslavia	169.8*	6.5
Average**	11.6	32.1

* Indicates large and/or continuous devaluation during the period.

** Includes only those countries with no asterisk in both periods.

SOURCE: Effective exchange rates from International Monetary Fund.

I.1 of the 1973 *Annual Report* of the IMF.[10] It should be noted that the currencies tied formally to gold or the SDR were in effect pegged to the dollar during this period except on the two occasions when the gold, SDR–dollar ratio changed: December 1971 and February 1973. The reader should be aware of significant limitations in the quality of the data, with respect to both the import weights and the exchange-rate data. Furthermore, as pointed out in section 4a, current-account-balance weights taking account of elasticities of foreign demand and supply would be more appropriate for most purposes.

The first period, January 1970–May 1972, covers the last period of the adjustable-peg system, including the exchange-rate realignments of the Smithsonian Agreement of December 1971 as well as the limited floating of the yen, German mark, and pound sterling during August–December 1971. This period ends with the floating of the pound in June 1972, followed by generalized floating in March 1973. The second period, June 1972–April 1974, thus covers the beginning of the current system of floating rates among the major currencies.

The first thing evident from Table 4 is that countries which maintain

[10] With the exception of Afghanistan, which is formally pegged to the dollar but conducts most transactions at a free-market rate for the dollar quoted in the bazaar.

drastically overvalued exchange rates and then devalue them sharply suffer high variances in their effective exchange rates, as shown by the entries marked with asterisks for large and/or continuous devaluations. The average variance for these cases is 215.6.

The next conclusion is that the African countries pegged to the franc and the peseta have achieved very low variances in effective exchange rates, because the bulk of their trade is with the country to which they peg.

A third striking conclusion is that countries pegged to sterling have suffered a dramatic sevenfold increase in the average variance of their effective exchange rates in the period of floating. This is a much larger increase in variance than has been observed for any other group. Compared with the experience of the franc or dollar groups, it probably reflects the much smaller fraction of trade the countries of the sterling group have with each other and with the United Kingdom. A natural result has been for such countries to break away from the sterling group. In fact, Cyprus, Malaysia, Malta, and Singapore had broken away to the flexible-rate group by mid-1973, Jamaica broke away to the dollar in the same year, and Malawi began floating in late 1973. From the data in Table 4, some other countries are also obvious candidates for departure from sterling, notably Fiji, Gambia, Sierra Leone, and Trinidad and Tobago.

The dollar group has suffered a more modest increase in the variance of effective rates, with an average increase from 7 to 14 for both the formally pegged and the *de facto* group. Within this large group, several divergent subgroups can be noted. Among the Latin American countries, one subgroup has a moderately increased variance (El Salvador, Guatemala, Panama, Paraguay, Peru), while another subgroup still has quite a low variance, despite being tied to the floating dollar (Bahamas, Haiti, Honduras, Mexico, Nicaragua, Venezuela). The countries of the East African Monetary Union (Kenya, Tanzania, and Uganda) do not appear to have suffered, nor have Zambia and Burundi. On the other hand, Liberia, Ethiopia, Guinea, Rwanda, and Somalia have high or increased variance. The Middle Eastern countries tied directly or indirectly to the dollar have mostly incurred significantly higher variance (Bahrein, Libya, Kuwait, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen P. D. R.); the chief exceptions are Egypt and Iran. On the other hand, Morocco, which began floating in May 1973, has maintained a low variance.

The members of the floating-rate group are about equally divided between those that have followed inflationary domestic policies and

rely on floating exchange rates for continuous devaluation (shown by asterisks) and others. If we take the latter group, it appears that generalized floating has also increased the variance of effective rates for the floating group. The average increase from 11.6 to 32.1 is less than the increase for the sterling group but more than the increase for the dollar and franc/peseta groups. The countries that contributed most of this increased average variance are Afghanistan, Lebanon, Malaysia, and Singapore, all of whose currencies have appreciated rather sharply relative to the dollar. These are all countries whose terms of trade have improved substantially because of price increases in such primary products as oil, tin, rubber, cotton, and hides. In addition, Lebanon and Singapore, which act as banking centers for the Near East and Southeast Asia, have been the recipients of large recorded and unrecorded inflows of private capital. These countries have chosen to follow a very different exchange policy from the Arab countries, which have kept their currencies pegged to the dollar while accumulating huge foreign-exchange reserves.

9 Conclusion

This essay has attempted, no doubt imperfectly, to explore the important factors that should enter into the designing of exchange policies for less developed countries in a world of floating exchange rates. Such factors include the existing structure of exchange markets and money markets, the geographical pattern and price elasticity of foreign trade, and the types of disturbances that most significantly affect the economy: changing inflation, changing domestic production, or changing terms of trade.

Simplified overall conclusions do not readily flow from careful analysis of the array of issues that have been explored. Each argument has a qualification, and an accumulation of qualifications makes each country a special case. Nevertheless, there is a certain broad pattern to the discussion that can be summarized here.

Most less developed countries also have less developed financial markets. This fact implies that capital does not have high mobility on a two-way basis and that market institutions for operating freely floating exchange rates are sparse. Less developed countries typically have relatively little influence over their terms of trade, so that the main channel through which exchange rates affect the economy is the ratio of traded-goods prices to nontraded-goods prices. A key concept in a world of floating exchange rates is the trade-weighted index of the effective exchange rate, showing the movement of a country's ex-

change rate relative to a weighted average of rates of its major trading partners. The stability of an economy facing fluctuating domestic production of export or food crops will generally be greater if the effective exchange rate is pegged. On the other hand, an economy that faces fluctuating inflation rates can more appropriately let its effective exchange rate float. For an economy facing fluctuating terms of trade, a floating rate may be better if import demand is elastic, and a pegged rate better if import demand is inelastic, but the qualifications to these findings are especially strong.

The costs and benefits of various exchange policies, such as controls, pegging with reserves to a single currency, pegging to the SDR, managed floating, or free floating, can at least be analyzed conceptually in terms of resource costs, institutional costs, instability costs, and political costs. The choice of exchange policy should be based on careful consideration of each of these costs, quantifying those which can be measured. All countries that have not recently evaluated their exchange policy should carry out such a re-evaluation in the near future. Such studies should not be done simplistically, however, as a wide variety of important considerations bear on the question.

In closing, let me make a general comment suggested by the empirical results in Table 4. A superficial conclusion from the table is that, since mid-1972, floating exchange rates have increased the variance of effective exchange rates and therefore of traded-goods prices.[11] One is tempted to conclude that adjustment costs have increased *pari passu*. This may be true, but it is also possible that reserve usage by less developed countries has changed significantly in this period. If reserve usage has increased, it seems clear that adjustment costs have also increased. On the other hand, if reserve usage has decreased substantially while exchange-rate variation has increased, adjustment costs may even have been lower for some less developed countries.

[11] Thomas Willett has suggested that exchange rates and prices of traded goods move in opposite directions for some major industrial countries, as one could expect for flexible exchange rates (see section 3 above). Thus, exchange-rate variability may indicate greater *stability* in domestic prices for countries in Table 4 with flexible rates. This argument does not apply to the eighty-three countries with pegged rates, however.

APPENDIX

A-1 A Model of Internal and External Balance

In the model of section 2, domestic demand for nontraded and traded goods depends on relative prices, real income, and real money balances. Supplies depend on relative prices. Net exports of tradables (X) are equal to the excess of domestic production over consumption. These conditions are described by equations (1) and (2), equating demands to supplies in each market:

$$A_n(\overset{+}{p_t}, \overset{-}{p_n}, \overset{+}{pY}, \overset{+}{M}) = Y_n(\overset{-}{p_t}, \overset{+}{p_n}), \tag{1}$$

$$A_t(\overset{-}{p_t}, \overset{+}{p_n}, \overset{+}{pY}, \overset{+}{M}) + X = Y_t(\overset{+}{p_t}, \overset{-}{p_n}). \tag{2}$$

These functions are assumed differentiable and homogeneous of degree zero in the nominal variables (p_t, p_n, pY, M). The signs of the partial derivatives are given above the arguments. Money income (pY) is equal to the factor cost of production plus the excess of government spending over taxes:

$$pY = p_tY_t + p_nY_n + \overline{G} - \overline{T}. \tag{3}$$

The price level (p) is a weighted average of the domestic prices of tradables and nontradables:

$$p = \alpha_t p_t + \alpha_n p_n. \tag{4}$$

The balance of payments shows the domestic-currency value of additions to reserves (ΔF) as equal to the value of net exports (p_tX) plus exogenous net capital imports ($\overline{K}$) valued at the current exchange rate of the domestic currency (r = units of local currency per dollar):

$$\Delta F = p_tX + r\overline{K}. \tag{5}$$

Assume that all foreign exchange is held by the central bank. The change in the domestic money supply is equal to foreign-exchange accumulation plus the government deficit plus credit granted to domestic business ($\Delta\overline{L}$):

$$\Delta M = \Delta F + \overline{G} - \overline{T} + \Delta\overline{L}. \tag{6}$$

Note that if foreign currency circulates in the hands of the public, the value of the money supply will not be independent of the exchange rate. Finally, the domestic price of tradable goods is equal to the

exogenous world (dollar) price of tradables ($\bar{p}_t^f$) times the (dollar) exchange rate of local currency (r). Thus foreign demand for tradables is infinitely elastic:

$$p_t = \bar{p}_t^f r . \tag{7}$$

Under pegged exchange rates ($r = \bar{r}$), these seven equations suffice to determine the seven variables (p_t, p_n, p, Y, M, X, F). As noted in the text, such pegged rates can be achieved in any of three ways: (a) reserve movements, as assumed in equation (5); (b) official borrowing to finance deficits, which makes capital inflows (K) endogenous and reserve flows exogenous ($\Delta\bar{F}$); (c) import controls, which also make reserve flows exogenous but break the equality (7) between domestic and world prices of traded goods.

The solution of this model in the case of flexible rates is quite simple. Since $\Delta F = 0$, from equation (6), the money stock is an exogenous variable controlled by the central bank. Net exports must equal the value of capital outflow ($X = -\bar{K}/\bar{p}_t^f$). Then equation (3) can be substituted into (1) and (2) for money income, leaving two equations in two unknowns, the prices of tradables (or, equivalently, the exchange rate) and nontradables.

A-2 Properties of an SDR Peg (section 4c)

Let $\alpha_{i(k)}$ = the weight in the effective-exchange-rate index of a country i whose currency is pegged to that of a major country k included in the definition of the SDR ($k = 1, \ldots, 16$). Let $k = 0$ for all countries pegged to the SDR. Then

$$\begin{aligned} \textstyle\sum_{i \neq j} \alpha_i \overset{*}{r}_i &= \textstyle\sum_{k=0}^{16} \alpha_{i(k)} \overset{*}{r}_i = \sum_{i(0)} \alpha_{i(0)} \overset{*}{s} + \sum_{k=1}^{16} \sum_{i(k)} \alpha_{i(k)} \overset{*}{r}_k \\ &= \textstyle\sum_{k=1}^{16} [w_k \sum_{i(0)} \alpha_{i(0)} + \sum_{i(k)} \alpha_{i(k)}] \overset{*}{r}_k , \end{aligned} \tag{8}$$

using $\overset{*}{s} = \sum_{i=1}^{16} w_i \overset{*}{r}_i$. The weights in the last expression of (8) will be equal to w_k if

$$w_k \textstyle\sum_k \alpha_{i(k)} = \sum_{i(k)} \alpha_{i(k)} , \tag{9}$$

since $\sum_{i(0)} \alpha_{i(0)} + \sum_k \alpha_{i(k)} = 1$.

A-3 Minimizing Variance by Choice of Peg (section 4d)

The variance of $\overset{*}{p}_{tj}$ when country j pegs to country k can be written

as

$$E[(\alpha^j - \delta_k)'t^*]^2 = (\alpha^j - \delta_k)' V(\alpha^j - \delta_k)$$
$$= \alpha^{j\prime} V\alpha^j - 2\delta_k' V\alpha^j + \delta_k' V\delta_k, \tag{10}$$

where $\alpha^{j\prime} = (\alpha_1, \ldots, 0, \ldots, \alpha_n)$, with a zero in the jth place, $\delta_k' = (0, \ldots, 1, \ldots, 0)$ with a one in the kth place and zeros elsewhere, and $\overset{*}{t}' = (\overset{*}{T}_1, \ldots, \overset{*}{T}_k)$. This simplifies to the expression in the text.

REFERENCES

Aliber, Robert Z., "Uncertainty, Currency Areas, and the Exchange Rate System," *Economica,* 39 (November 1972), pp. 432–441.

Argy, Victor, and Michael G. Porter, "The Forward Exchange Market and the Effects of Domestic and External Disturbances under Alternative Exchange Rate Systems," *IMF Staff Papers,* 19 (November 1972), pp. 503–532.

Artus, J., and R. Rhomberg, "A Multilateral Exchange Rate Model," *IMF Staff Papers,* 20 (November 1973), pp. 591–611.

Black, Stanley W., *International Money Markets and Flexible Exchange Rates,* Studies in International Finance No. 32, Princeton, N.J., 1973.

———, "Multilateral and Bilateral Measures of Effective Exchange Rates in a World Model of Traded Goods," *Journal of Political Economy,* 84 (June 1976), pp. 615–622.

Cline, William, *Flexible Exchange Rates and the Developing Countries,* Washington, D.C., The Brookings Institution, 1975.

Díaz-Alejandro, Carlos F., *Less Developed Countries and the Post-1971 International Financial System,* Essays in International Finance No. 108, Princeton, N.J., 1975.

Dornbusch, Rudiger, "Real and Monetary Aspects of the Effects of Exchange Rate Changes," in Robert Z. Aliber, ed., *National Monetary Policies and the International Financial System,* Chicago, University of Chicago Press, 1974, pp. 64–81.

Economic Report of the President, Washington, U.S. Government Printing Office, 1974.

Fama, Eugene F., "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance,* 25 (May 1970), pp. 383–417.

Fleming, J. Marcus, "Dual Exchange Markets and Other Remedies for Disruptive Capital Flows," *IMF Staff Papers,* 21 (March 1974), pp. 1–27.

Hansen, Bent, "Simulation of Fiscal, Monetary and Exchange Policy in a Primitive Economy: Afghanistan," *Economic Structure and Development,* Amsterdam, North-Holland, 1973, pp. 215–237.

Helleiner, Gerald K., "The Less Developed Countries and the International Monetary System," *Journal of Development Studies,* 10 (April/July 1974), pp. 347–373.

Heller, H. R., "Optimal International Reserves," *Economic Journal,* 76 (June 1966), pp. 296–311.

Kemp, Murray C., "The Balance of Payments and the Terms of Trade in Relation to Financial Controls," *Review of Economic Studies,* 37 (January 1970), pp. 25–31.

Krueger, Anne O., "Balance of Payments Theory," *Journal of Economic Literature,* 7 (March 1969), pp. 1–26.

Magee, Stephen P., "Currency Contracts, Pass-Through, and Devaluation," *Brookings Papers on Economic Activity* (1973:1), pp. 303–323.

McKinnon, Ronald, *Money and Capital in Economic Development,* Washington, D.C., The Brookings Institution, 1973.

Meade, James, *The Balance of Payments,* London, Oxford University Press, 1951.

Michalopoulos, Constantine, *Payments Arrangements for Less Developed Countries: The Role of Foreign Assistance,* Essays in International Finance No. 102, Princeton, N.J., 1973.

Miller, Richard H., "Forward Exchange Facilities in Developing Countries," *Finance and Development,* 12 (March 1975), pp. 12–15.

Mookerjee, S., A. Chandavarkar, and D. Cleary, "Existing International Banking and Credit Facilities in the ECAFE Region," *IMF Staff Papers,* 16 (November 1969), pp. 391–433.

Mundell, Robert A., *Monetary Theory,* Pacific Palisades, Calif., Goodyear, 1971.

Prachowny, Martin, F., "The Effectiveness of Stabilization Policy in a Small, Open Economy," *Weltwirtschaftliches Archiv* 109 (1973:2), pp. 214–231.

Salter, W. E. G., "Internal and External Balance: The Role of Price and Expenditure Effects," *Economic Record,* 35 (August 1959) pp. 226–238.

Sandmo, Agnar, "On the Theory of the Competitive Firm under Price Uncertainty," *American Economic Review,* 61 (March 1971), pp. 65–73.

Silard, Stephen A., "Maintenance-of-Value Arrangements in International Transactions," *Law and Policy in International Business,* 5 (Spring 1973), pp. 398–439.

———, "The Effects of Current International Monetary Uncertainties on Exporters," *Revue de la Banque,* 38 (1974:1), pp. 77–84.

Stein, Jerome, "The Optimum Foreign Exchange Market," *American Economic Review,* 53 (June, 1963), pp. 384–402.

Stiglitz, Joseph E., "Portfolio Allocation with Many Risky Assets," in G. P. Szegö and Karl Shell, eds., *Mathematical Methods in Investment and Finance,* Amsterdam, North-Holland, 1972.

Turnovsky, S. J., "Technological and Price Uncertainty in a Ricardian Model of International Trade," *Review of Economic Studies,* 41 (April 1974), pp. 201–217.

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This does not mean that a STUDY or SPECIAL PAPER may be awkward and clumsy, but it may be more technical. It may include statistics and algebra, and may have many footnotes. STUDIES and SPECIAL PAPERS may also be longer than ESSAYS; indeed, these two series are meant to accommodate manuscripts too long for journal articles and too short for books.

To facilitate prompt evaluation, please submit three copies of your manuscript. Retain one copy for your files. The manuscript should be typed on one side of 8½ by 11 strong white paper. All material should be double-spaced—text, excerpts, footnotes, tables, references, and figure legends. More complete guidance appears in the Section's style guide; prospective contributors are urged to send for it before preparing their manuscripts.

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List of Publications

The following is a list of the recent publications of the International Finance Section. Essays Nos. 1 through 60, Studies Nos. 1 through 10, and the issues of the four series marked by asterisks are no longer available from the Section. They may be obtained in Xerographic and microfilm editions from Xerox University Microfilms, 300 N. Zeeb Road, Ann Arbor, Michigan 48106, or University Microfilms Ltd., St. John's Road, Tylers Green, Penn Buckinghamshire, England. Xerographic editions are priced at $6 and microfilm editions at $5.[1]

ESSAYS IN INTERNATIONAL FINANCE

91. Fritz Machlup, *The Book Value of Monetary Gold.* (Dec. 1971)
92. Samuel I. Katz, *The Case for the Par-Value System, 1972.* (March 1972)
93. W. M. Corden, *Monetary Integration.* (April 1972)
94. Alexandre Kafka, *The IMF: The Second Coming?* (July 1972)
*95. Tom de Vries, *An Agenda for Monetary Reform.* (Sept. 1972)
96. Michael V. Posner, *The World Monetary System: A Minimal Reform Program.* (Oct. 1972)
97. Robert M. Dunn, Jr., *Exchange-Rate Rigidity, Investment Distortions, and the Failure of Bretton Woods.* (Feb. 1973)
*98. James C. Ingram, *The Case for European Monetary Integration.* (April 1973)
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100. Y. S. Park, *The Link between Special Drawing Rights and Development Finance.* (Sept. 1973)
101. Robert Z. Aliber, *National Preferences and the Scope for International Monetary Reform.* (Nov. 1973)
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103. John H. Makin, *Capital Flows and Exchange-Rate Flexibility in the Post–Bretton Woods Era.* (Feb. 1974)
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111. Gerald A. Pollack, *Are the Oil-Payments Deficits Manageable?* (June 1975)
112. Wilfred Ethier and Arthur I. Bloomfield, *Managing the Managed Float.* (Oct. 1975)
113. Thomas D. Willett, *The Oil-Transfer Problem and International Economic Stability.* (Dec. 1975)

[1] Essays 62, 67, 71, 73, 75, 88, and 90; Studies 12, 14, and 15; and Reprints 4, 6, 7, 8, 9, and 10 are still available from the Section. For a complete list of publications issued by the Section, write to the Section or consult the publications list in Essay 91 or earlier.

114. Joseph Aschheim and Y. S. Park, *Artificial Currency Units: The Formation of Functional Currency Areas.* (April 1976)
115. Edward M. Bernstein *et al.*, *Reflections on Jamaica.* (April 1976)
116. Weir M. Brown, *World Afloat: National Policies Ruling the Waves.* (May 1976)
117. Herbert G. Grubel, *Domestic Origins of the Monetary Approach to the Balance of Payments.* (June 1976)
118. Alexandre Kafka, *The International Monetary Fund: Reform without Reconstruction?* (October 1976)
119. Stanley W. Black, *Exchange Policies for Less Developed Countries in a World of Floating Rates.* (December 1976)

PRINCETON STUDIES IN INTERNATIONAL FINANCE

16. Ronald I. McKinnon and Wallace E. Oates, *The Implications of International Economic Integration for Monetary, Fiscal, and Exchange-Rate Policy.* (March 1966)
17. Egon Sohmen, *The Theory of Forward Exchange.* (Aug. 1966)
18. Benjamin J. Cohen, *Adjustment Costs and the Distribution of New Reserves.* (Oct. 1966)
19. Marina von Neumann Whitman, *International and Interregional Payments Adjustment: A Synthetic View.* (Feb. 1967)
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38. Polly Reynolds Allen, *Organization and Administration of a Monetary Union.* (June 1976)

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1. Gottfried Haberler, *A Survey of International Trade Theory.* (Sept. 1955; Revised edition, July 1961)
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*3. Fritz Machlup, *Plans for Reform of the International Monetary System.* (Aug. 1962; Revised edition, March 1964)
*4. Egon Sohmen, *International Monetary Problems and the Foreign Exchanges.* (April 1963)
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*7. W. M. Corden, *Recent Developments in the Theory of International Trade.* (March 1965)
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9. Marina von Neumann Whitman, *Policies for Internal and External Balance.* (Dec. 1970)
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11. Edward Tower and Thomas D. Willett, *The Theory of Optimum Currency Areas and Exchange-Rate Flexibility.* (May 1976)

REPRINTS IN INTERNATIONAL FINANCE

11. Fritz Machlup, *The Transfer Gap of the United States.* [Reprinted from *Banca Nazionale del Lavoro Quarterly Review*, No. 86 (Sept. 1968)]
12. Fritz Machlup, *Speculations on Gold Speculations.* [Reprinted from *American Economic Review, Papers and Proceedings*, Vol. 56 (May 1969)]
13. Benjamin J. Cohen, *Sterling and the City.* [Reprinted from *The Banker*, Vol. 120 (Feb. 1970)]
14. Fritz Machlup, *On Terms, Concepts, Theories and Strategies in the Discussion of Greater Flexibility of Exchange Rates.* [Reprinted from *Banca Nazionale del Lavoro Quarterly Review*, No. 92 (March 1970)]
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