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EXCHANGE RATE POLICY FOR DEVELOPING COUNTRIES

William H. Branson and Louka T. Katseli-Papaefstratiou

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1. INTRODUCTION

In his Per Jacobsson lecture, Arthur Lewis said:

> "It is now the conventional wisdom that the currencies of the developed countries should float, but the currencies of the less-developed (LDCs) should not; that is to say that each LDC should choose a more developed country (MDC) as a partner -- or the SDR -- and tie itself in a fixed relationship." (Lewis, 1977, p.33).

This statement led us to think about the meaning of fixing the exchange rate in a world where the major currencies are floating, and about the implications for domestic policy targets of pegging to one or a combination of these major currencies. Under the Bretton Woods System and in the absence of major currency readjustments, the choice of a numeraire was only of minor importance: pegging to any one of the major currencies was equivalent to maintaining a fixed parity with all others. In a world of floating rates, however, pegging to any one of the major currencies implies floating vis-à-vis all others. It is precisely for this reason that in their effort to

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of developing countries have abandoned single-peg policies and have started experimenting with composite pegs; and it is exactly this trend that poses new and interesting analytical questions regarding the choice of a numeraire or the choice of weights for a composite peg. These are the issues that we address in this paper.

In our discussion of choice of exchange rate regimes, we begin by separating considerations of feasibility and optimality in the float vs. peg decision. In section II we introduce two major feasibility conditions for floating: incomplete openness and internationally-integrated capital markets. We argue that in general developing countries are not feasible floaters.

The question of pegging to a single currency or a "currency basket" is raised in section III. The degree of geographic concentration of trade becomes important for that choice. Countries which opt for a basket peg in turn must decide on weights for the currencies in the basket. These can be chosen to eliminate the effects of third-counry exchange rate fluctuations on any of a number of policy targets.

In section IV we explicitly derive the weighting schemes for basket pegs that would eliminate the effects of third country exchange rate variation alternatively on the home country's terms of trade, relative price of traded vs. non-traded goods, or balance of trade. These weighting schemes are given in equations (28), (32), and (37), respectively. Thus, section IV presents a menu of weighting schemes, one for each policy target. The choice among policy targets is discussed in section V. Fluctuations in relative prices are related to fluctuations in real income. This gives us the contribution of each weighting scheme to reduction in real-income variations stemming from variations in third-country exchange rates. It also gives us the residual income instability that would remain in each case. Finally, we note cases in which the choice of a policy target is clearly dictated by the structure of the economy.

In that sense this paper is the beginning of a larger project where structural characteristics of the economy are explicitly introduced in the analysis of macroeconomic policy. Such an approach is especially relevant to the comparative study of policy choices for developing vs. developed economies.

II. FLOATING VS. PEGGING: FEASIBILITY CONSIDERATIONS

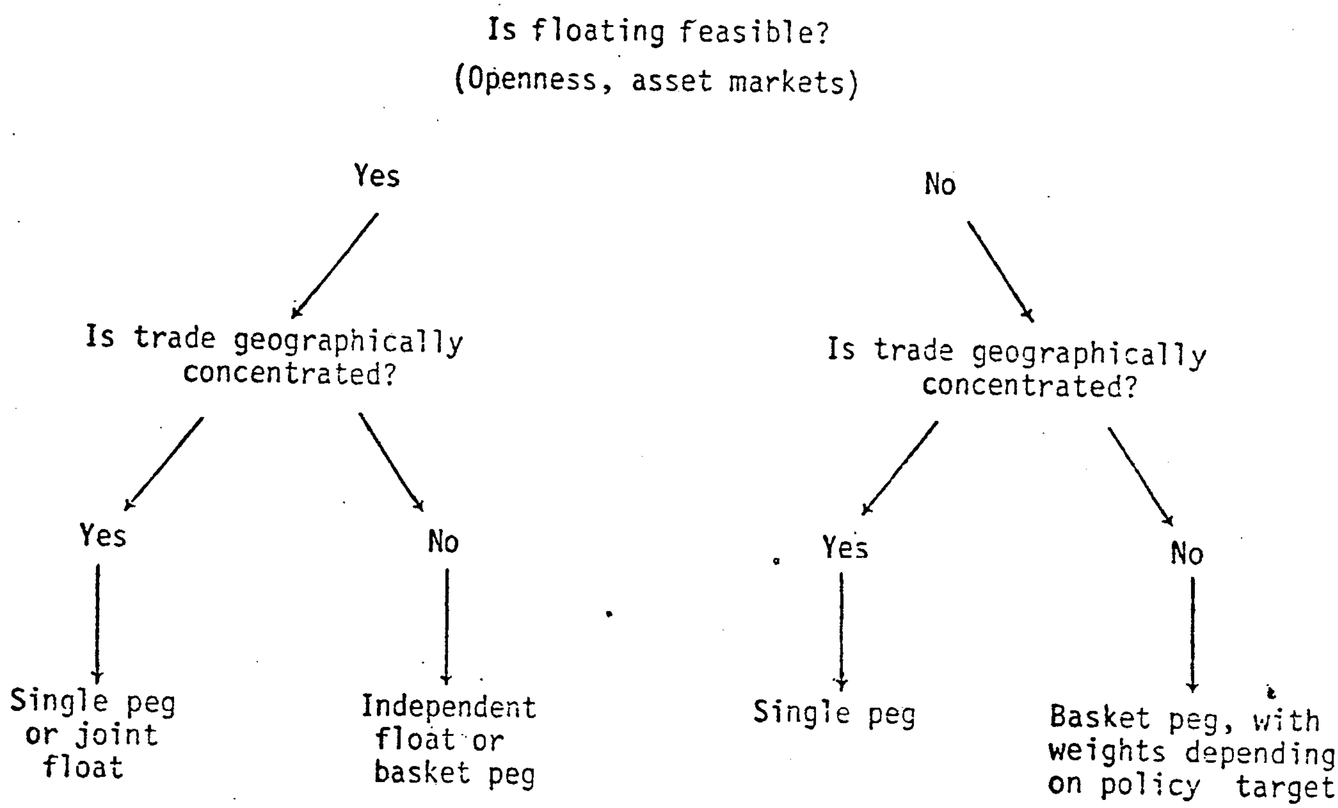
In choosing an exchange rate policy, the first decision a country faces is whether to permit the rate to float, with its value being determined by the "market". In this section we provide some arguments and evidence suggesting that floating is not feasible for most developing countries. Thus the real policy choices are what to peg to, in a world in which most major currencies are floating, and how to adjust the peg. These are topics taken up in succeeding sections of the paper.

Our discussion will be cast in the framework set by Corden in Monetary Integration (1972). There Corden separated factors or considerations bearing on the dual questions of (a) choice of exchange rate regime, and (b) optimal size of currency areas, into two sets. First we consider factors determining whether it is feasible for a country to decide to be a currency area and to float its exchange rate. Only after we make a determination on feasibility is it reasonable to move ahead to considerations bearing on the optimal choice of regime.

Most of the arguments concerning optimum currency areas and choice of exchange rate regime are well known, and will be mentioned only briefly below. Ishiyama (1975) has recently surveyed the literature on optimal currency areas; Black (1976 a, b) and Crockett-Nsouli (1977) have focused on exchange-rate policies for less-developed countries; Heller (1976) has provided some empirical evidence on actual choice of regimes. The new considerations, or twists on old considerations, in our discussion involve mainly (a) the role of asset markets in determining feasibility of floating and (b) the role of market power in determining the currency basket to use when pegging.

Our discussion of exchange rate policy is illustrated by Figure 1, which organises sections II and III of the paper. It differs from a similar figure in Heller (1976, p. 24a) in that our structure separates feasibility and optimality considerations. Countries must first decide whether floating is feasible. Those for whom it is <u>not</u> feasible go on to consider various types of peg. This is the usual case for developing countries. Those who <u>can</u> float must then decide

Figure 1: Choice of Exchange Rate Regimes



whether it is optimal to float independently or jointly as in the European snake, or to peg to a currency basket. These are mainly the industrial OECD countries. Since our discussion concentrates on policy choices for developing countries, we will discuss mainly the right half of Figure 1.

The two major feasibility conditions are (a) degree of openness, and (b) existence of asset markets integrated into the international system. The openness criterion was introduced into the literature by Mc Kinnon (1963), who noted that an economy can be so open that if the exchange rate were to float, domestic citizens would want contracts effectively denominated in foreign exchange. In that case, there would be no basis for demand for home currency, except for artificial legal constraints such as the requirement that taxes be paid in local currency. On the Mc Kinnon argument, the more open an economy, the less likely it is that floating is feasible. This argument is supported by Heller's results, which show that relatively closed economies tend to float, alone or jointly, while relatively open economies tend to peg (Heller 1976, p. 5).

The asset market argument involves the likely stability of the foreign exchange market under floating. The argument runs as follows. If a country has financial markets which are integrated into international markets, then in the short run its exchange rate is determined by equilibrium conditions in those markets. Short-run stability of the foreign exchange market in this case depends on overall stability of the financial markets; in general, gross substitutability of domestic and foreign assets in private portfolios will suffice for stability. Thus countries with integrated asset markets can expect a floating rate to be stable in the short run. This asset market view of exchange rate determination has been described by Branson (1977), Dornbusch (1976), Kouri (1976), and others. For initial empirical results showing the stability of the most important floating rate - the dollar-Deutschemark rate - See Artus (1976) and Branson-Halttunen-Masson (1977).

If, on the other hand, a country does not have capital markets which are integrated internationally, then supply and demand in the foreign exchange market are determined by current flows, and the short-run stability conditions are the Marshall-Lerner conditions on trade elasticities. This is the model recently elaborated by Black (1976 a). The feasibility problem appearing here is that for countries with any market power, the Marshall-Lerner elasticity conditions probably do not hold in the shortest of runs. A cursory review of the trade models surveyed by Stern-Francis-Schumacher (1976) shows that many of the trade equations do not even have contemporaneous price terms, and that in general short-run price elasticities are low. This is such a strong empirical regularity that it is part of the conventional wisdom about J-curves, etc. See, for example, Klein's (1972) comment on Branson, or Dornbusch-Krugman (1976).

If the Marshall-Lerner conditions do not hold in the short run and financial market separation prevents stabilising speculation, then the floating rate will be unstable[1/]. Essentially, the argument is that if the financial markets, including the banking system, do not make a stable market in foreign exchange, the central bank must make the market, eliminating floating as a feasible policy. If, on the other hand, a country has well-integrated capital markets, it can expect a floating rate to be stable.

This argument could clarify an anomaly in Heller's (1976) results. There he argued that capital market integration should result in pegging, since external adjustment could be achieved easily through capital flows. But when he looked at the data, he found that countries with integrated capital markets tend to be floaters.[2/] This is consistent with our argument that coun-

1/ In Black's model, for example, the external balance (TT) curve will become steeper than the internal balance (NN) curve as the short-run price elasticity of the excess demand goes toward zero, and the system becomes unstable.

2/ See Heller (1976), Table 8 and p.15.

tries with integrated asset markets are feasible stable floaters.

One apparent difficulty with the asset-market argument is that countries that are small in the strict sense of being price-takers on international markets meet the Marshall-Lerner conditions for stability of a flow-determined exchange rate, and thus on this argument could float even without integrated asset markets. However, these small countries are likely to be sufficiently open that they fail the feasibility test on the openness ground.

The feasibility arguments can be summarised as follows: Countries (or groups of countries) which are relatively closed and have internationally-integrated asset markets are feasible floaters, singly or jointly. Other countries are not feasible floaters and will choose one form of peg or another. In general, we would expect the set of feasible floaters to be the developed OECD countries, while the developing countries would peg their currencies either to one of the major currencies or to a basket. This conclusion is supported by Heller's discriminant analysis of floating vs. pegging, and by the data in Table 1.

Table 1: Income Level and Exchange Rate Regime

	Mean GDP per Capita (1975) ($ thousand)	Mean GDP (1975) ($ Billion)	Number of Countries
I. Floaters	4.4	156.4	22
A. Independent	3.3 (0.7)[1]	184.6 (100.5)	15
B. Joint	6.5 (2.8)	96.1 (53.9)	7
II. Managed Flexibility	1.6	35.1	11
A. Announced Indicators	1.4 (0.4)	28.2 (14.2)	7
B. Others	2.0 (1.3)	47.3 (16.2)	4
III. Basket Peg	1.7 (0.6)	17.8 (8.1)	11
IV. Single Currency Peg	0.5	3.4	64
A. Non-unified rates	0.5 (0.1)	5.1 (1.3)	32
B. Others	0.5 (0.1)	1.5 (0.4)	32

[1] Standard errors of the means are in parentheses.

Using the World Bank Atlas (1976), we calculated the average levels of real GDP and real GDP per capita in 1975 for the countries following the exchange-rate regimes indicated in Table 1. These are reported along with their standard errors and the number of countries in each type of regime. Countries not in the Atlas were excluded from the computation: Guinea-Bissau, the Khmer Republic, the Peoples Democratic Republic of Laos, Lebanon, Malta, and the Yemen Arab Republic. We also excluded OPEC members and Bahrein from the calculations on the ground that their recent jump in income was not matched by an equally rapid development of industry and financial markets.

In Table 1, the 22 countries that are classified by the IMF as having floating exchange rates, either independent or joint, have a mean income of $4.4 thousand per capita, as compared with about $1.6 thousand for the 22 countries that have managed flexibility or peg to a currency basket, and $0.5 thousand for the 64 countries that peg to a single currency (as of 1975). Thus, in general, it is the high-income countries with internationally-integrated capital markets that float, while the developing countries peg.

III. OPTIONS AND TARGETS FOR PEGGING

Once floating is excluded on feasibility grounds, the next question is what to peg the currency to. The problem can be broken down into two steps. First, should the currency be pegged to a single major currency, and if so, which one? Second, if the single peg is rejected in favour of a currency basket, what can be achieved by a weighting scheme, and how should the weights be chosen for the basket? We see below and in section IV that there exist optimal weighting schemes for currency baskets that eliminate the effects of third-country exchange rates on variables such as the terms of trade, the relative price of traded and non-traded goods, or the balance on current account. The basket peg can then be adjusted to meet other targets. But first we look at the determinants of the choice of a single currency peg.

Pegging to a Single Currency

Countries with trade that is highly concentrated in one currency area can gain from pegging to that currency area for two related reasons. First, pegging to the dominant trade currency will tend to minimise fluctuations in traded-good prices.[1/] Second, the single peg achieves this stability with a minimum administrative cost and difficulty with public acceptance. Thus we expect small open economies with trade oriented to one major currency area to peg to that currency.

The smaller ex-colonial countries with relatively undiversified economies and geographically concentrated trade are likely candidates for single-currency pegs. These are likely to be also relatively low-income countries. This presumption is supported by the data of Table 1, where we saw that the average GDP per capita of the countries with single-currency pegs is $0.5 thousand (1975), the lowest of the groups of countries given there.

To perform a preliminary test of the hypothesis that countries with concentrated trade who peg to a single currency, peg to that of the major trading partner, we have calculated the proportions of these countries' exports and imports allocated to each currency area. Countries were divided into

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1/ In the basket-peg formula for P_T below, equation (32), if at the limit α and β for a particular i go to unity, the weight for that i is one, i.e. a single-currency peg to i.

groups according to the exchange rate regimes reported to the IMF in 1974. The five groups included countries pegging to the U.S. dollar, the pound sterling, or the French franc; countries in the European snake; and countries allowing their exchange rate to float.

Using 1974 data from the UN Yearbook of International Trade Statistics, 1976 it was possible to calculate the percentage of exports to and imports from each of the five currency areas for a representative sample of countries. These are shown in Tables 2 and 3. To simplify calculations, 1974 data for the ten historically predominant export partners were used.[1/] To the extent that the pattern of exports fluctuated during the 1970's, the percentage distribution of exports by currency area may be slightly understated. Currency areas which provided less than 5 per cent of the export

1/ 1974 is the latest year directions of trade are available in UN statistics for all countries in the sample.

Table 2: Percentage Export Shares by Currency Bloc in 1974

Exporter	$	£	FFR	SNAKE	FLOAT
$ peg					
Argentina	22.1	-	-	10.9	22.3
Bahamas	92.8	-	-	-	-
Burundi	32.5	-	-	42.8	5.5
Columbia	45.5	-	-	18.8	6.4
Costa Rica	57.9	-	-	21.1	6.5
Ethiopia	30.6	-	-	15.7	15.8
Guatemala	61.4	-	-	14.5	7.0
Haiti	68.6	-	8.3	12.5	7.3
Indonesia	22.6	-	-	-	62.2
Jordan	38.1	14.6	-	-	17.2
Kenya	10.1	11.3	-	25.6	8.0
Liberia	23.6	-	7.8	42.6	17.4
Nicaragua	43.4	-	-	19.8	13.7
Panama	73.3	-	-	12.3	6.5
Romania	-	-	-	9.7	5.3
Syrian A.R.	-	9.8	-	17.1	31.2
Thailand	12.5	-	-	10.8	38.5
Uganda	26.5	18.2	-	8.3	17.2
Venezuela	48.1	-	-	-	12.6
Western Samoa	13.9	6.0	-	33.0	43.5
£ peg					
Barbados	31.2	23.2	-	-	5.6
Ireland	9.1	56.4	-	14.4	-
Mauritius	18.4	35.3	-	-	37.2
Sierra Leone	5.7	63.9	-	20.1	6.8
FFR peg					
Central African Empire	11.5	-	45.4	10.3	19.8
Congo	-	-	49.0	9.9	26.8
Ivory Coast	-	-	30.8	27.4	13.1
Niger	-	-	59.3	7.4	28.8
Togo	-	-	46.6	42.7	6.3

Table 2 (continued)

Exporter	$	£	FFR	SNAKE	FLOAT
SNAKE					
Denmark	5.8	17.1	-	38.2	6.9
Germany	7.5	-	11.9	21.2	12.5
Netherlands	-	9.1	9.8	48.2	6.7
Sweden	5.3	13.2	5.2	36.3	10.1
FLOATERS					
Austria	-	6.4	-	26.6	14.7
Finland	-	18.9	-	36.3	-
Iceland	22.5	8.5	-	14.6	17.8
Japan	38.5	-	-	-	-
Malaysia	16.2	6.6	-	9.4	40.9
New Zealand	24.5	20.2	-	6.8	15.6
Singapore	25.8	-	-	-	28.0
Spain	11.7	9.1	12.6	19.2	10.6
Tunisia	16.3	-	21.7	6.6	36.6

Table 3: Percentage Import Shares by Currency Bloc in 1974

Importer	$	£	FFR	SNAKE	FLOAT
$ peg					
Argentina	39.5	-	-	10.8	16.3
Bahamas	64.5	-	-	-	16.8
Burundi	13.2	-	10.6	36.9	6.8
Columbia	41.6	-	-	9.1	17.0
Costa Rica	59.5	-	-	6.1	12.4
Ethiopia	13.8	7.8	-	14.3	28.5
Guatemala	63.1	-	-	8.2	9.0
Haiti	45.5	-	5.7	10.5	15.7
Indonesia	21.5	-	-	10.9	36.2
Jordan	22.2	7.7	-	9.3	15.8
Kenya	23.0	18.0	-	16.2	15.0
Liberia	46.8	9.4	-	17.6	5.4
Nicaragua	66.8	-	-	7.0	7.4
Panama	67.2	-	-	-	7.4
Romania	-	5.6	-	15.3	-
Syrian A.R-	6.3	-	8.8	12.1	20.1
Thailand	32.7	-	-	7.3	33.1
Uganda	-	30.9	-	16.0	17.4
Venezuela	49.5	-	-	11.5	19.4
Western Samoa	37.3	5.3	-	-	45.7
£ peg					
Barbados	32.1	32.3	-	5.2	13.5
Ireland	9.0	46.6	-	15.8	3.4
Mauritius	18.2	14.4	7.6	6.3	14.9
Sierra Leone	14.3	21.5	-	10.8	17.6
FFR peg					
Central African Empire	7.5	-	55.3	13.4	6.0
Congo	6.3	-	59.1	13.4	5.2
Ivory Coast	17.7	-	38.6	12.3	12.7
Niger	12.8	-	41.5	11.1	13.4
Togo	10.4	8.7	33.5	15.0	5.8

Table 3 (continued)

Importer	$	£	FFR	SNAKE	FLOAT
SNAKE					
Denmark	6.4	9.8	-	48.8	5.8
Germany	7.8	-	11.8	25.5	12.4
Netherlands	19.5	5.4	7.2	41.6	7.1
Sweden	6.6	11.1	-	42.2	8.5
FLOATERS					
Austria	6.7	-	-	45.8	-
Finland	5.1	8.5	-	39.8	-
Iceland	13.2	10.9	-	43.6	-
Japan	59.7	-	-	-	-
Malaysia	25.4	9.4	-	6.3	30.6
New Zealand	39.3	17.9	-	-	20.0
Singapore	33.7	-	-	-	31.1
Spain	31.5	-	8.5	14.0	7.6
Tunisia	14.9	-	31.0	13.1	12.6

market for a given country were excluded from the tables. This accounts for the large number of blanks.

As Tables 2 and 3 indicate, the trade data tend to support the hypothesis that the choice of a key currency is influenced by the geographic concentration of trade. Countries pegged to a key currency generally traded more with members of their own currency area that with members of other single-currency areas. Countries within the European Snake also concentrated their trade within their own currency area.

Nevertheless, there are some notable exceptions to the hypothesis of exchange rate regime choice. Although Romania and the Syrian Arab Republic have little trade with countries pegged to the U.S. dollar, they have substantial export markets among the centrally planned economies that independently declare parities vis-à-vis the dollar; this would account for their pegs to the dollar.

It is difficult to rationalize membership in the dollar currency area for several Asian countries on the basis of export distribution. Indonesia, Thailand, and Western Samoa trade more heavily with Japan alone that with the U.S. dollar area. However, in these cases political alliances and historical antipathies probably take precedence in the choice of a key currency.

A number of exchange rate regime changes which have occurred since 1974 are explained by previous trade patterns. In 1974 Barbados traded more with the dollar area than with the sterling area; by 1977 Barbados had switched to the U.S. dollar as a key currency. In 1974 Argentina had a diversified export market in several currency areas with imports more concentrated on the dollar area; by 1977 Argentina had dropped the dollar standard and wasmaintaining a flexible exchange rate. Countries adopting the Special Drawing Right (SDR) as a currency peg since 1974 may have been motivated by trade factors. In 1974 the trade of Kenya and Western Samoa was not particularly concentrated in the dollar area; by 1977 both countries had switched to a SDR peg. Although closely related to the dollar before 1971, the SDR exchange rate has since been determined by the basket of currencies pegged to it.

As expected, the trade of countries with flexible rates did not follow a pattern based on currency areas. It is also not surprising that exports for key currency countries were not concentrated in "their" currency areas, since key currencies have flexible market-determined parities.

The data of Tables 2 and 3 are roughly consistent with the story of Figure 1 in section II, i.e., that geographical concentration of trade matters for the choice between (a) a joint or independent float and (b) a single or composite peg, Countries with concentrated trade tend to choose a single peg or a joint float; these are in effect identical policy choices, since with the major currencies floating, a country that pegs to one of them joins the float with all other currencies pegging to that one.

The single-currency peg can be either fixed with $r = \overline{r}$, where r is the exchange rate in units of home currency per unit of the chosen numeraire, or adjustable. If movements in tastes, technology, etc., relative to the other members of the currency area move the equilibrium value of r through time, then the single-currency peg could be moved gradually following a rule such as

$$\dot{r} = F(B); \quad F' > 0; \quad F(0) = 0, \tag{1}$$

where B is the relevant balance, perhaps current account or basic balance. This is a "gliding parity" formula, as recently discussed by Kenen (1975). Some such managed adjustment relative to a single currency peg has been chosen by many of the middle-income developing countries of Table 1.

Pegging to a Currency Basket

Countries which choose to (or must) peg, and have sufficiently diversified trade so that a single-currency peg is not appropriate, are left with the choice of a currency basket for the peg. Since 1973 a number of countries have turned to this option in the face of generalised floating of the major currencies. Pegging to a currency basket means stabilising the own-currency price of an arbitrarily chosen numeraire relative to an average of other currency prices of the numeraire. More formally, a fixed peg by country j to a currency basket defined over all other currencies ($i = 1, \ldots, J;\ i \neq j$) is defined as

$$\hat{r}_j = -\sum_{i \neq j} w_i \dot{J}_i, \tag{2}$$

where:

r_j = j currency units per unit of numeraire (assumed here to be the U S. dollar);

J_i = \$ per unit of i currency ;

w_i = weight to be assigned to the i'th currency;

$\dot{x}$ = dx/x, the proportional change in x, for any variable x.

The weights w_i are the weights assigned to movements in non-j currencies in terms of the numeraire in forming the currency basket. The rest of this paper is basically about how to choose the w_i. Since J_i is defined as dollars per i currency, while r_j is j currency per dollar, a minus sign enters (2). The integral of (2) gives the level of the exchange rate:

$$r_j = r_j^o \prod_{i \neq j} J_i^{-w_i}. \qquad (3)$$

The value r_j^o is the initial value of the index, or in mathematical terms the constant of integration from (2).

The fixed currency-basket peg rule (2) gives the movement in the j currency price of the numeraire which holds the j currency constant against an average of all non-j currencies at the value given by r_j^o. Intervention to make r_j follow (2) could be in any of the non-j currencies if the markets maintain consistent cross rates, but the natural intervention procedure would be to use the numeraire. Indeed, choice of numeraire might be dictated by which currency is most natural for intervention.

As in the case of the single-currency peg, the basket peg could be adjusted by a formula reflecting movement in the underlying equilibrium rate. A gliding basket peg, for example, could be defined by:

$$\dot{r}_j = - \Sigma w_i \dot{J}_i + G(B); \quad G' > 0; \quad G(0) = 0. \tag{4}$$

Here the home currency value of the numeraire is moved relative to the basket by a rule defined on the relevant balance.

Policy Targets and Choice of Weights

For the country which does not float or peg to a single currency, choice of exchange rate regime reduces to choice of the weights w_i (implicitly or explicitly) for the basket peg. On what principles can this choice be made?

The w_i will determine the effects of third country (non-j and non-numeraire) exchange rate movements $\dot{J}_i$ on important variables such as the terms of trade (p_x/p_m), the relative price of traded and non-traded goods (p_T/p_N), and the balance of trade (BT) of country j. As the Deutschemark-dollar rate moves, for example, p_x/p_m, p_T/p_N, and BT of, say, Argentina will all normally be influenced. As we see in the next section of the paper, weights can be chosen that minimise the influence of $\dot{J}_i$ on each of these, and other, policy targets.

More precisely, we can solve for the sets of weights for a basket peg that will eliminate the effects of third-country exchange rate changes $\dot{J}_i$ on each of the policy variables. To each target variable corresponds a different set of weights. Of course, if we use the weights eliminating the influence of $\dot{J}_i$ on p_T/p_N, for example, this will imply a predictable effect on p_x/p_m and on BT, and symmetrically for the choice of any other particular set of weights. So the choice of weights will come down to the choice of policy targets.

We should point out explicitly here that in choosing weights we are eliminating the influence of $\dot{J}_i$ on the policy target chosen, <u>not</u> stabilising that variable altogether. There will be other influences than $\dot{J}_i$ on those variables, in general; choice of weights for the basket peg eliminates just one source of instability.

In section IV we lay out the menu, deriving the weighting scheme for each of the three targets mentioned, and showing the general method for deriving weights, given a target. Then in section V we discuss choice among targets as their instability generates instability in income; this suggests one way to choose among the menu items.

IV. WEIGHTS FOR CURRENCY BASKETS

In the previous two sections of the paper, we have narrowed the question of choice of exchange rate regimes for an important class of developing countries down to the question of the choice of weights for a basket peg. The next step is to show the derivation of different optimal sets of weights corresponding to different policy targets, minimising the effects of third-country exchange-rate variation on (a) the terms of trade, (b) the relative price of traded vs. non-traded goods, (c) the balance of trade. To do this we decompose fluctuations in export and import prices into their components, namely fluctuations in (1) world-market demand prices for exports and supply prices for imports, (2) home supply prices for exports and demand prices for imports, and (3) exchange rates. We do the decomposition in a log-linear supply-and-demand model for one country j in a many-country (i = 1, ..., I) world, allowing for the possibility of the existence of market power. The small country facing infinite demand elasticity for its exports and supply elasticity for its imports will be treated as a special case. We begin with a model in which there is one export good and one import good, and the country j faces a unified world market. Disaggregation by commodity or trading partners should follow easily. Then we extend this model to include variations in all exchange rates in the system. This model can then be solved for the weighting schemes that meet our alternative policy targets.

A Log-Linear Model of Movements in Trade Prices and Quantities

To relate exchange rate changes to movements in export and import prices and quantities, we use a simple log-linear supply-and-demand model that includes the exchange rate as the translator between prices in home currency p and prices in foreign exchange q. The model follows, for example, Sohmen (1969, ch. 4). A listing of symbols and definitions used in this section is given in Table 4.

Export Price Movements

We assume that export supply prices are stated in home currency units, p_x, while demand prices are stated in foreign exchange units q_x. The exchange rate e links p_x to q_x. The supply function is written as,

$$\ln p_x = \ln p_x^o + s_x^{-1} \ln X. \tag{5}$$

Here p_x^o is a vertical shift parameter which can represent changes in domestic supply conditions, s_x is the price elasticity of supply, and X is the quantity exported. The demand function for exports, priced in foreign exchange units, is

$$\ln q_x = \ln q_x^o + d_x^{-1} \ln X. \tag{6}$$

q_x^o is a vertical shift parameter which can represent changes in

Table 4: Symbols and Definitions in the Trade Model of Section IV

i	= index over I countries, $i = 1, \ldots I$. We study the jth country.
p_x, p_m	= home (jth) country prices of exports and imports.
q_x, q_m	= foreign exchange (\$) prices of jth country exports and imports
d_x, s_x	= price-elasticities of export demand and supply in j.
k	= $d_x/(d_x - s_x)$, an inverse index of export market power of j.
d_m, s_m	= price-elasticities of import demand and supply of j.
k'	= $s_m/(s_m - d_m)$, and inverse index of import market power of j.
π	= terms of trade of j: $\pi \equiv p_x/p_m$
e	= exchange rate of j in aggregate model: units of j currency per unit of foreign exchange; $p = eq$.
X, M	= export and import quantities of j.
T_i	= units of j currency per unit of i currency
J_i	= units of numeraire (\$) per unit of i currency
r	= units of j currency per unit of numeraire (\$); $T_i = J_i \cdot r$.
α_i, β_i	= j's export and import weights.
w_i	= weights for j's basket peg.
$\dot{z}$	= dz/z, for any variable z.

world market conditions, and d_x is the price elasticity of demand.

To translate demand into home currency units, we use the relationship

$$p_x = eq_x, \text{ or } \ln p_x = \ln e + \ln q_x, \tag{7}$$

where e is the exchange rate in units of home currency per unit of foreign exchange. Substitution of ($\ln p_x - \ln e$) for $\ln q_x$ in (7) gives export demand in home currency units,

$$\ln p_x = \ln q_x^o + d_x^{-1} \ln X + \ln e \tag{8}$$

We can now combine the supply function (5) and the demand function (8) to solve for market equilibrium p_x and X, and then use (7) to get q. The total differentials of (5) and (8) are

$$\dot{p}_x - s_x^{-1}\dot{X} = \dot{p}_x^o\text{, and} \tag{5'}$$

$$\dot{p}_x - d_x^{-1}\dot{X} = \dot{q}_x^o + \dot{e}. \tag{8'}$$

In matrix form we have

$$\begin{bmatrix} 1 & -s_x^{-1} \\ 1 & -d_x^{-1} \end{bmatrix} \begin{pmatrix} \dot{p}_x \\ \dot{X} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix} \begin{pmatrix} \dot{p}_x^0 \\ \dot{q}_x^o \\ \dot{e} \end{pmatrix} \tag{9}$$

(1+t)

The solutions for $\dot{X}$ and $\dot{p}_x$ are given by

$$\dot{p}_x = \frac{d_x}{d_x - s_x}(\dot{q}_x^{\,o} + \dot{e}) - \frac{s_x}{d_x - s_x}\dot{p}_x^{\,o}; \tag{10}$$

$$\dot{X} = \frac{s_x d_x}{d_x - s_x}\{ (\dot{q}_x{}^o + \dot{e}) - \dot{p}_x{}^o \}. \tag{11}$$

We will write the equation for $\dot{p}_x$ as

$$\dot{p}_x = k(\dot{q}_x{}^o + \dot{e}) + (1 - k)\dot{p}_x{}^o . \tag{12}$$

Here k is defined as

$$k = \frac{d_x}{d_x - s_x} = \frac{1}{1 - \frac{s_x}{d_x}} ; \quad 0 < k \leq 1.$$

In (12) $\dot{p}_x$ is expressed as a weighted average of external and internal disturbances, with the weights given by k. We can use k as an index of market power on the export side. In the small- country case where $d_x \to -\infty$, k approaches unity. As d_x rises from $-\infty$ (demand become less than perfectly elastic), k falls from unity.

In the small- country case where $d_x = -\infty$ and $k = 1$, equation (12) reduces to:

$$\dot{p}_x = \dot{q}_x{}^o + \dot{e} \tag{13}$$

Export prices are affected only by shifts in world market prices $q_x{}^o$ and the exchange rate e. With market power, fluctuations in home-currency export prices are smaller than movements in $q_x{}^o$ or e, by the factor of k.

Import Price Movements

Since the model for movements in the import price $\dot{p}_m$ is analogous to the model of the export market, we can develop the import side more briefly. Import supply is given in terms of foreign exchange prices:

$$\ln q_m = \ln q_m^{\,o} + s_m^{-1} \ln M. \tag{14}$$

The translation between p_m and q_m is $p_m = eq_m$, so in home currency prices import supply is:

$$\ln p_m = \ln q_m^{\,o} + s_m^{-1} \ln M + \ln e. \tag{15}$$

Import demand, in home-currency terms, is:

$$\ln p_m = \ln p_m^{\,o} + d_m^{-1} \ln M. \tag{16}$$

Total differentiation of (15) and (16) gives us the matrix equation:

$$\begin{bmatrix} 1 & -s_m^{-1} \\ 1 & -d_m^{-1} \end{bmatrix} \begin{pmatrix} \dot{p}_m \\ \dot{M} \end{pmatrix} = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} \begin{pmatrix} \dot{p}_m^{\,o} \\ \dot{q}_m^{\,o} \\ \dot{e} \end{pmatrix}. \tag{17}$$

The solutions for $\dot{p}_m$ and $\dot{M}$ are:

$$\dot{p}_m = \frac{s_m}{s_m - d_m} (\dot{q}_m{}^o + \dot{e}) - \frac{d_m}{s_m - d_m} \dot{p}_m{}^o ; \tag{18}$$

$$\dot{M} = \frac{s_m d_m}{s_m - d_m} \{(\dot{q}_m{}^o + \dot{e}) - \dot{p}_m{}^o\} , \tag{19}$$

We will write the equation for $\dot{p}_m$ as

$$\dot{p}_m = k'(\dot{q}_m{}^o + \dot{e}) + (1 - k')\, \dot{p}_m{}^o . \tag{20}$$

On the import side, we define k' as :

$$k' \equiv \frac{s_m}{s_m - d_m} = \frac{1}{1 - \frac{d_m}{s_m}} ; \quad 0 < k' \leq 1.$$

We can use k' as an index of market power on the import side. In the small-country case where $s_m \to \infty$, k' goes to unity. To the extent that the country has market power, s_m and k' become smaller. Thus k' is an inverse index of market power on the import side.

Again, in the small-country case where $s_m = \infty$ and k' = 1, equation (18) reduces to:

$$\dot{p}_m = \dot{q}_m{}^o + \dot{e}. \tag{21}$$

Disaggregation to Many Countries ($i = 1, .., I$)

In a world of floating exchange rates, movements in any rate will influence trade prices of all countries. Thus to study the effects of exchange rate changes on p_x and p_m, we should expand the model to include many countries, each defined as a separate currency unit. The extension will allow us to study exchange rate policies that minimize the effects of fluctuations in exchange rates on the terms of trade, relative prices of traded and non-traded goods, or the balance of trade.

In disaggregating the model, we will consider a world of I countries, $i = 1, \ldots, I$, and focus on the terms of trade of the j'th country, which we will call the "home country". The home country faces I-1 exchange rates T_i (= units of j currency per unit of i currency). It will be convenient to single out a numeraire, which we will call the dollar, and to define J_i as the dollar price of each ith currency, and r as the jth currency price of the dollar. Then we can decompose movements of T_i as follows:

$$T_i = J_i r, \text{ or } \ln T_i = \ln J_i + \ln r,$$

and

$$\dot{T}_i = \dot{J}_i + \dot{r}. \qquad (22)$$

Now in place of the single $\dot{e}$, $\dot{q}_x{}^o$, and $\dot{q}_m{}^o$ in equations (12) and (20) for $\dot{p}_x$ and $\dot{p}_m$, we have weighted averages of movements in all the exchange rates $\dot{T}_i$ and weighted averages of the shift factors $\dot{q}_{xi}{}^o$ and $\dot{q}_{mi}{}^o$.

On the export side, in place of equation (12), we have the weighted average equation:

$$\dot{p}_x = k \sum_{i \neq j} \alpha_i \dot{T}_i + k \sum_{i \neq j} \alpha_i \dot{q}_{xi}{}^o + (1-k) \dot{p}_x{}^o. \qquad (23)$$

Here α_i are export-share weights with the properties $\alpha_i \geq 0; \Sigma \alpha_i = 1$. In place of the single $\dot{e}$ of equation (12) we have a weighted average $\Sigma \alpha_i \dot{T}_i$, and in place of $\dot{q}_x{}^o$ we have $\Sigma \alpha_i \dot{q}_{xi}{}^o$ in (23)

Similarly, in place of (20) for $\dot{p}_m$ we now have

$$\dot{p}_m = k' \sum_{i \neq j} \beta_i \dot{T}_i + k' \sum_{i \neq j} \beta_i \dot{q}^o{}_{mi} + (1-k) \dot{p}^o{}_m \qquad (24)$$

On the import side the single $\dot{e}$ of equation (20) is replaced by an import-weighted average $\Sigma \beta_i \dot{T}_i$, and similarly for $\dot{q}_m{}^o$. Equations (23) and (24) assume that d_x and s_m are the same for all trading partners. We could further disaggregate by making the market-power terms k and k' weighted averages combining country-by-country d_x and s_m elasticities. How to do this further extension is clear, but would complicate the story here with no gain.

Thus far, (23) and (24) are simply the weighted-average versions of (12) and (18). The more interesting step is to break $\dot{T}_i$ in these equations into $\dot{J}_i$ and $\dot{r}$. This will be the key to our solutions for optimal basket weights. Replacing $\dot{T}_i$ by $(\dot{J}_i + \dot{r})$ in (23) and noting that $\Sigma\alpha_i = 1$, we have for $\dot{p}_x$,

$$\dot{p}_x = k\dot{r} + k \sum_{i\neq j}\alpha_i\dot{J}_i + k\sum_{i\neq j}\alpha_i \dot{q}^o_{xi} + (1-k)\, \dot{p}^o_x. \qquad (25)$$

Similarly for $\dot{p}_m$ we have

$$\dot{p}_m = k'\dot{r} + k'\sum_{i\neq j} \alpha_i \dot{J}_i + k'\sum_{i\neq j} \alpha_i \dot{q}^o_{mi} + (1-k')\dot{p}^o_m. \qquad (26)$$

The first terms in equations (25) and (26) give the effect of the home-currency-price of the numeraire, the second the effect of other countries' exchange rates, the third the effect of world market price disturbances, and the fourth the effect of home price disturbances, in moving export and import prices of the home country j.

Terms-of-Trade Weights

The terms of trade is defined as $\pi = p_x/p_m$. Thus we can combine equations (25) and (26) to obtain the expression for $\dot{\pi}$.

$$\dot{\pi} = \{(k - k')\dot{r} + k \sum_{i \neq j} \alpha_i \dot{J}_i - k' \sum_{i \neq j} \beta_i \dot{J}_i\} \qquad (27)$$

$$+ \{k \sum_{i \neq j} \alpha_i \dot{q}_{xi}{}^o - k' \sum_{i \neq j} \beta_i \dot{q}_{mi}{}^o\}$$

$$+ \{(1 - k) \dot{p}_x{}^o - (1 - k') \dot{p}_m{}^o\}.$$

The first bracketed term gives the influence of exchange-rate movements on the terms of trade broken into changes in the home currency price of the dollar $\dot{r}$ and the dollar prices of the other currencies $\dot{J}$. The second bracketed term gives the effects of shifts in export demand or import supply conditions in all the non-j countries. The last term gives effects of changes in domestic market conditions.

It is worth noting two properties of equation (27) for $\dot{\pi}$:

1. Pegging to the dollar, or to any other numeraire, would eliminate $\dot{r}$ from (27), but fluctuations in the dollar price of other (non-j) currencies would still move π through J.
2. For the small country, (27) reduces to

$$\dot{\pi} = \Sigma\alpha_i(\dot{J}_i + \dot{q}_{xi}{}^o) - \Sigma\beta_i(\dot{J}_i + \dot{q}_{mi}{}^o).$$

Fluctuations in the jth currency price of the numeraire disappear since $k = k'$, but π is still moved by J, $q_x{}^o$, and $q_m{}^o$.

The first bracketed term in (27) gives the effect of variations in exchange rates on the terms of trade. Choosing weights for a basket peg means selecting the weights w_i with the minimal property that $\Sigma w_i = 1$ for the formula $\dot{r} = - \Sigma w_i \dot{J}_i$, which makes $\Sigma \dot{T}_i = 0.$ 1/ Clearly from (27) the choice of a formula for $\dot{r}$ intending to minimize $\dot{\pi}$ is relevant only for countries with asymmetric market power. If $k = k'$, $\dot{r}$ falls out of the $\dot{\pi}$ equation. So the question of optimal choice of weights to minimise variations in the terms of trade arises only for countries with asymmetric market power.

1/ Note that since r is the home currency price of the numeraire and J_i is the numeraire price of the ith currency, we need the minus sign.

Two obvious possibilities for weights are export shares α_i or import shares β_i 1/. If we set $\dot{r} = -\Sigma\alpha_i \dot{J}_i$ using export weights, the first term in (27) reduces to $k' \Sigma(\alpha_i - \beta_i)\dot{J}_i$. If we set $\dot{r} = -\Sigma\beta_i \dot{J}_i$ using import weights the same term reduces to $k\Sigma(\alpha_i - \beta_i)\dot{J}_i$. Thus if $k < k'$, that is market power is greater on the export side, import weights will reduce terms-of-trade fluctuations better than would export weights, and vice versa. Market power in the form of a small value for k or k' dampens the effect of disturbances onto the terms of trade, so the weights that eliminate disturbances where market power is smallest ($k \to 1$) are more effective. In Table 1 we saw that it is the middle-income countries that manage their rates or use basket pegs. Further, in Branson-Papaefstratiou (1978) we present evidence that many of these countries have market power on the export side, and that asymmetric market power and pegging to a currency basket are positively correlated.

1/ See Black (1976 b), Crockett and Nsouli (1977), Rhomberg (1976) for discussion of choice of weights. Note that the discussion of weights for measuring changes in effective exchange rates has a different objective than ours. There the purpose is to choose the weights that translate a vector of arbitrary changes $\dot{J}_i$ into the uniform change $\dot{r}$ that would have the same effect on the balance of payments. Here we are choosing w_i to minimise the effect of $\dot{J}_i$ on the terms of trade.

We are not limited to export or import weights, however.

Assume for the moment that the $\dot{q}^o$ and $\dot{p}^o$ terms in (27) are zero.

Then for $\dot{\pi}$ we have

$$\dot{\pi} = (k-k')\ \dot{r} + k \sum_{i \neq j} \alpha_i\ \dot{J}_i - k' \sum_{i \neq j} \beta_i\ \dot{J}_i. \qquad (27')$$

Setting $\dot{r} = -\Sigma w_i\ \dot{J}_i$, with w_i to be determined, makes this expression

$$\dot{\pi} = (k'-k) \sum_{i \neq j} w_i\ \dot{J}_i + k \sum_{i \neq j} \alpha_i\ \dot{J}_i - k' \sum_{i \neq j} \beta_i\ \dot{J}_i \qquad (27'')$$

$$= \sum_{i \neq j} \{(k'-k)\, w_i + k\alpha_i - k'\beta_i\}\ \dot{J}_i.$$

Changes in the terms-of-trade now are a weighted average of $\dot{J}_i$, with weights given by the bracketed term in (27''). To eliminate the effect of changes in exchange rates on the terms of trade, choose the weights w_i that make the total weights in (27'') zero;

$$0 = \{(k'-k)w_i + k\alpha_i - k'\beta_i\}.$$

The solution is

$$w_i = \frac{k\alpha_i - k'\beta_i}{k - k'}. \text{[1/]} \qquad (28)$$

Since $\Sigma\alpha_i = \Sigma\beta_i = 1$, $\Sigma w_i = 1$. But there is no constraint that all $w_i > 0$. In a "typical" case of market power on the export side only, so $k < 1$, $k' = 1$, the weighting formula reduces to

1/ Originally we set up the choice of weight problem as minimising the variance of π, after integrating (27) to get the expression for π. In that problem the J_i were random variables. The solution, worked out by Dennis Warner, was exactly (28). It was only after we saw the solution and observed it makes variance (π) zero, that James Healy noted that the w_i solution comes by inspection from (27).

$$w_i = \frac{\beta_i - k\alpha_i}{1 - k};$$

Currencies with relatively large export shares α_i might have negative weights!

We emphasise that the weighting scheme (28) depends on three assumptions: (a) the country in question has asymmetric market power so that exchange policy can influence the terms of trade, (b) the objective of pegging is to minimize fluctuations in the terms of trade, and (c) a decision has been made to peg to a basket. Violation of any of these assumptions makes the weighting scheme (28) irrelevant.

Weights stabilising the Price of Traded Goods

An alternative weighting scheme would be one eliminating the effects of $\dot{J}_i$ on the domestic price of traded goods p_T or its ratio to the price of non-traded goods p_N. This is the weighting criterion suggested by Black (1976a) and Crockett-Nsouli (1977), among others.

Movements in the home-currency prices of traded goods are given by:

$$\dot{p}_T = z_x \dot{p}_x + z_m \dot{p}_m$$

where z_x is the proportion of exportable goods and z_m is the proportion of importables in tradeable output.1/ We are, again, searching for weights for $\dot{r}$ that eliminate the effects of $\dot{J}_i$ on p_T, not attempting to stabilise p_T in the face of shifts in world market prices or domestic market conditions. So we substitute the first two terms in equations (25) and (26) for $\dot{p}_x$ and $\dot{p}_m$ into (29) to obtain

$$\dot{p}_T = (z_x k + z_m k')\,\dot{r} + z_x k\,\Sigma\,\alpha_i \dot{J}_i + z_m k'\Sigma\beta_i\,\dot{J}_i. \qquad (30)$$

In general, we assume that the objective is to maintain $\dot{p}_T = \dot{p}_N$, with an exogenous factor moving $\dot{p}_N$. We will see that the solution for $\dot{p}_T = 0$ is a special case. Set $\dot{p}_T$ in (30) equal to the exogenous $\dot{p}_N$ and solve for $\dot{r}$:

$$\dot{r} = -\,\Sigma w_i\,\dot{J}_i + \frac{1}{z_x k + z_m k'}\,\dot{p}_N, \qquad (31)$$

where the weights w_i are given by

$$w_i = \frac{z_x\,k\alpha_i + z_m k'\beta_i}{z_x\,k + z_m\,k'}. \qquad (32)$$

These are the weights which eliminate the effect of $\dot{J}_i$ on p_T.

1/ If x is exportables and m importables, $z_x = p_x x/\,p_T\,(x + m)$, and $z_m = p_m m/p_T(x + m)$.

In the small-country case, the weights become

$$w_i = z_x \alpha_i + z_m \beta_i ,$$

and the formula for $\dot{r}$ reduces to

$$\dot{r} = - \Sigma w_i \dot{J}_i + \dot{p}_N . \tag{33}$$

This is Black's (1976a) preferred weighting scheme.

Equations (31) and (32) give the weights for a currency basket on the assumption that the objective of the choice of weights is to eliminate the effects of $\dot{J}_i$ on the relative price of traded vs. non-traded goods.

Balance of Trade Weights

The third weighting objective we consider is elimination of third-country exchange rate fluctuations $\dot{J}_i$ on the current-account balance. This will give us a set of weights similar to the IMF MERM weights[1/]

The trade balance (or, at this level of generality, the balance on current account) in home currency is given by

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1/ See Artus and Rhomberg (1974) for a discussion of the Multilateral Exchange Rate Model.

$$BT = p_x X - p_m M. \tag{34}$$

p_x

If we set $q_x = p_m = 1$ initially, differentiation of (34) yields

$$dBT = (\dot{p}_x + \dot{X})X_o - (\dot{p}_m + \dot{M})\, M_o,$$

where X_o and M_o are initial values. Substitution for $\dot{p}_x$, $\dot{X}$, $\dot{p}_m$, $\dot{M}$ from equations (10), (11), (18) and (19) yields

$$dBT = \{\frac{d_x(1+s_x)}{d_x - s_x} X_o - \frac{s_m(1 + d_m)}{s_m - d_m} M_o\}\dot{e}.$$

for the effect of a change in the exchange rate on the trade balance. The bracketed term is simply the Marshall-Lerner condition, which we will write more compactly as

$$dBT = \{k\ (1 + s_x)X_o - k'(1 + d_m)M_o\}\ \dot{e}, \tag{35}$$

where k and k' are the market-power indices developed earlier.

We now disaggregate $\dot{e}$ into the weighted averages of $\dot{T}_i$, and decompose $\dot{T}_i$ into $(\dot{J}_i + \dot{r})$. This yields the disaggregated equation for the change in the trade balance,

$$dBT = \{k(1 + s_x)X_o - k'\ (1 + d_m)M_o\}\ \dot{r} + k(1 + s_x)X_o \Sigma\alpha_i\ \dot{J}_i$$
$$- k'(1 + d_m)M_o \Sigma\ \beta_i\ \dot{J}_i. \tag{36}$$

It is worth noting that, in equation (36), movements in the exchange rate $\dot{r}$ influence the balance of trade even in the case of symmetric market power when $k = k'$. This occurs because of quantity effects, expressed by $(1 + s_x)$ and $(1 + d_m)$ in (36). If we now let $\dot{r} = -\Sigma w_i \dot{J}_i$, and solve for the weights w_i that set $dBT = 0$, we obtain for the balance of trade weights

$$w_i = \frac{X_o k(1 + s_x)\alpha_i - M_o k'(1 + d_m)\beta_i}{X_o k(1 + s_x) - M_o k'(1 + d_m)}. \qquad (37)$$

These are analogous to the MERM weights. If trade is roughly balanced so $X_o = M_o$, and quantity effects are removed by setting s_x and d_m equal to zero, the weights of equation (37) are identical to the terms-of-trade weights of equation (28). This could be the case, for example, of a developing country exporting perishable agricultural goods and importing non-substitutable intermediate goods.

Adjustment of the Basket Peg

It is important to remember the limited, if important, role of the weighting schemes just discussed. They only eliminate the effects of fluctuations of third-currency exchange rates, $\dot{J}_i$, on the relevant target variables for the home country. Simply pegging the price of the numeraire to any of these currency baskets will clearly not maintain external balance in almost all cases. Only in countries that are very open, so that movement of the nominal exchange rate does not affect the real rate, but have diversified trade, so pegging to a single currency is inappropriate, will simply pegging to a currency basket suffice for external balance.

In most countries, maintenance of external balance will require movement of the exchange rate relative to the currency basket from time to time. This adjustment could be achived by a gliding parity of the form.

$$\dot{r} = - \Sigma w_i \dot{J}_i + G(B),$$

suggested in section III. We re-emphasise this point here in order not to leave the impression that the basket pegs described here can do more than eliminate the effects of variation in J_i on the chosen policy target.

V. CHOICE OF TARGETS

In the previous sections we looked at a number of alternative targets for exchange rate policy and derived weights for basket pegs which eliminate the effects of third country exchange-rate movements (J_i) on the home country's terms of trade, on the price ratio of its non-tradeable vs. its traded goods or on its balance of trade.

Up to now attainment of each of the above targets has been considered in isolation with no regard paid to the possible trade-offs or costs associated with each policy; yet, to give an example, a policy to eliminate the effects of J_i movements on a country's terms of trade through the appropriate choice of weights for its basket peg will probably be inconsistent with stabilization of the relative price ratio of traded to non-traded goods. It is thus important to consider the possible trade-offs associated with the pursuit of each of the targets described above as well as to attempt to isolate those structural characteristics of the economy, such as the degree of openness, which will dictate the target choice.

Since relative price fluctuations contribute significantly to income instability, we can use the latter as the ultimate objective of target choice. This has also been prompted by a number of additional factors. It has been shown (Mathieson, Mc Kinnon 1974, Branson,Papaefstratiou 1978) that less-developed countries have traditionally experienced greater fluctuations in their real GNP than developed countries have, and that the properly measured welfare loss from a given degree of instability is expected to be greater the lower is the level of per capita income (Branson, Papaefstratiou 1978). In addition, terms-of-trade fluctuations have been shown to be more significant in the case of countries with low income per capita (Branson, Papaefstratiou 1978) and thus an important source of income instability.

Let us assume then that, in the simplest of cases, domestic production in the economy consists of production of exportables (X^S), importables (M^S) and non-traded goods (H^S). Then, in the absence of intermediate goods, the total value of production will be equal to consumption plus saving or,

$$p_h H^s + p_x X^s + p_m M^s = Y = C + S = p_h H^d + p_x X^d + p_m M^d + p_m M + p_x{}^X - p_m{}^M \tag{38}$$

It is assumed here that some of the domestic production of exportables is consumed domestically ($p_x X^d$) and some is exported ($p_x X$) while the demand for importables is partly satisfied through domestic production ($p_m M^d = p_m M^s$) and partly through imports ($p_m M$). It follows that total domestic consumption (C) is equal to,

$$C = p_h H^d + p_x X^d + p_m (M^d + M), \tag{39}$$

and that the consumer price index (p_c) can be defined as a weighted average of p_h, p_x and P_m. Thus

$$p_c = p_h \frac{H^d}{C} + p_x \frac{X^d}{C} + p_m \frac{M^d+M}{C}, \text{ and} \tag{40}$$

$$\dot{p}_c = w_1 \dot{p}_h + w_2 \dot{p}_x + w_3 \dot{p}_m; \ \Sigma w_i = 1. \tag{40'}$$

The weights in (40'), which represent the ratio of expenditures on each type of good to total consumption expenditures, are assumed constant in the short run.

Given equations (33) and (40), real income can be defined as the total value of production deflated by the CPI and thus is given by

$$y = \frac{Y}{p_c} = \frac{p_h}{p_c} H^s + \frac{p_x}{p_c} X^s + \frac{p_m}{p_c} M^s. \tag{41}$$

Differentiating (41) totally and making the appropriate substitutions using (40') in the process, we can express the percentage change in income as a weighted average of relative price fluctuations:

$$\dot{y} = (\dot{p}_h - \dot{p}_x)\{w_2 \cdot Eyh - w_1 \cdot Eyx\} \quad (42)$$

$$+ (\dot{p}_h - \dot{p}_m)\{w_3 \cdot Eyh - w_1 \cdot Eym\}$$

$$+ (\dot{p}_x - \dot{p}_m)\{w_3 \cdot Eyx - w_1 \cdot Eym\}$$

In (42) the terms in parentheses are elasticity weights where Eyi, i = x, m, h is the elasticity of total output (y) with respect to the relevant relative price change.

$$Eyi = \frac{dy/y}{d(p_i/p_c)/p_i/p_c}, \; Eyi \gtrless 0.$$ 1)

From (42) we can weigh and evaluate the effects of different stabilisation schemes on income instability. If the aim of exchange rate policy is to eliminate the effects of third-country exchange rate movements on the terms of trade so that in the absence of other disturbances, $p_x = p_m$, then income fluctuations can be attributed to fluctuations in the price of traded commodities relative to those of non-traded goods.

1) Here we assume that the nominal wage is rigid in the short run.

In that case,

$$\dot{y} = (\dot{p}_h - \dot{p}_T)\ \{Eyh - w_1(Eyh + Eyx + Eym)\}. \tag{43}$$

If, on the other hand, the aim of policy is to eliminate the effects of $\dot{J}_i$ on average prices of traded goods, then income fluctuations will partly depend on terms-of-trade fluctuations weighted again by different elasticities. Thus, in the absence of other disturbances, if $\dot{p}_h = \dot{p}_x$,

$$\dot{y} = (\dot{p}_x - \dot{p}_m)\{ - Eym + w_3(Eyh + Eyx + Eym)\}, \tag{44}$$

while if $\dot{p}_h = \dot{p}_m$,

$$\dot{y} = (\dot{p}_x - \dot{p}_m)\{Eyx - w_2(Eyh + Eyx + Eym)\}. \tag{45}$$

Thus policy which eliminates the effects of exchange-rate instability on one of the target variables will not eliminate income instability. The magnitude of the residual instability depends on the elasticity parameters and the effects of exchange rate instability on the other relative prices.

As far as the actual target choice is concerned, the following general observations can be made:

1. If $\tilde{p}_h$ is either small or independent of $\dot{p}_x$ and $\dot{p}_m$, then, ceteris paribus, the natural target for policy is terms-of-trade stabilisation. The same would hold true if the non-traded good sector itself is small.
2. In the case where the composition of a country's exports and imports is similar so that fluctuations in the price of exportables as a result of exchange rate instability is roughly equal to that of importables, policies that minimize the fluctuations in p_h/p_T will also tend to minimize the fluctuations in real income.
3. If, on the other hand, trade composition on the export and import sides is dissimilar, then exchange rate policy can focus on either $\frac{p_h}{p_x}$ or $\frac{p_h}{p_m}$. In that case, and if the overall objective of policy is the reduction of real income instability, the choice of target will be based on the relative magnitudes of w_2 and w_3, that is the degree of openness of the economy on the export and import side as well as the relative magnitudes of the income elasticities Eyx and Eym.

In conclusion, it is important to stress that what has been attempted in this paper is to sort out the policies that insulate an economy from random variations in third-country exchange rates. Even in the pursuit of this limited objective, one can see how important are the structural characteristics of the economy as determinants both of the target choice as well as of actual policy design. These results confirm, for us, the importance of consideration of differeing structural characteristics across countries in analysis and design of macroeconomic policy in general.

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