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ECONOMIC GROWTH CENTER

YALE UNIVERSITY

Box 1987, Yale Station
New Haven, Connecticut

CENTER DISCUSSION PAPER NO. 277

INCOME INSTABILITY, TERMS OF TRADE AND THE CHOICE OF EXCHANGE RATE REGIME

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February 1978

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LIST OF TABLES

We would like to acknowledge the extensive help received from David Bruce, Hannu Haltunnen, James Healy, Julie Nelson, Dennis Warner and Judy Oder both with regard to the analytical as well as the empirical parts of this paper. We would also like to thank Joann Young for typing this manuscript under extreme time pressure.

I. INTRODUCTION

The 1976 UNCTAD IV meetings in Nairobi and most resolutions which have been adopted since by the sponsoring countries call for an extensive reorganization of international economic relationships especially as they affect the less developed countries. Their focus has been on the need for stabilization of relative prices (and sometimes export earnings) as well as improvement in the terms of trade and real income.[1] Even though the requests are often vague and at times contradictory, the ensuing debate has prompted a reexamination of such issues as the measurement of export earning and/or income instability (Kenen, Voivodas 1972), the differential costs and benefits associated with stabilization schemes (Johnson 1976), the sources of instability (Massell 1970, Erb and Schiavo-Campo 1969, Mathieson and McKinnon 1974) and finally policies that might affect it (Heller 1976).

In this paper we move from an analysis of income instability across countries to the role of the terms of trade as a partial determinant of income instability, and then to choice of exchange rate regime as it affects variation in the terms of trade. The argument is not strictly deductive, since (a) variations in the terms of trade are only one determinant of variation in income, (b) choice of exchange-rate regime is only one of several policies that can reduce terms-of-trade variations, and (c) there are other criteria besides the latter that

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[1]For an extensive discussion see Behrman (1977).

influence the choice of exchange rate regime. But the analytical line running from income instability to terms-of-trade variation, to choice of exchange rate regime provides a coherent structure for a long paper touching on many policy choices facing less-developed countries in the area of international finance.

We begin with a measurement of income instability across countries. There is some reason to expect the properly-measured welfare loss from a given degree of instability to be greater, the lower the level of per-capita income. This is a standard result from the theory of choice under risk, generally attributed to Arrow (1965) and Pratt (1964). Consider individuals with the utility function $u(y)$, where y is income and u is (at least) concave with $u' > 0$; $u'' < 0$. If absolute risk aversion, defined as $R_a = - u''(y)/u'(y)$, is not increasing in y, a standard assumption, then the loss in expected utility from a given variance in y falls as y increases.[1]

Another way of putting this is that the lower-income person will pay more for insurance against the losses from a given expected variance in income than would the higher-income person.

If we can extend this analysis to apply across countries, it implies that lower-income countries experience a greater welfare loss from a given degree of income instability than do higher-income countries. This may be a reason to expect, on purely welfare-economic grounds, less-

[1] See, for example, Nicholson (1972), p. 154.

developed countries to push harder for international agreements to stabilize income fluctuation whatever its source might be.

In addition to the welfare loss from a given degree of income instability being greater for LDCs, we have already noted that there is a presumption in the literature that instability itself is also greater for LDCs, compounding their differential loss from international income instability. In section II of the paper we measure income instability across a sample of 41 countries and find that the measure is greater for LDCs, and probably significantly so even though a rigorous analysis is not provided. One of the implication of our results is that probably we should group countries by structural characteristics and not simply by levels of income.

In section III we analyze the sources of income instability. Two major factors potentially influencing income instability, aside from fluctuations in non-traded good production, are identified. These are supply-side openness and the terms of trade. The empirical data introduced here show no clear relation between degrees of openness and the measure of income instability, especially for LDCs vs DCs, but there is a strong, positive relationship between income and terms-of-trade fluctuations.

Variation in the terms of trade are decomposed in the theoretical model of section IV into the effects of movements in exchange rates in a floating world, shifts in world market conditions, and shifts in home market conditions. The main result is given in equation (26), p. 32. Considerations of market power are introduced here, and policies to minimize variance in the terms of trade are discussed. In particular, for countries with market power we derive a weighting scheme for a basket peg that eliminates the exchange rate as a source of terms-of-trade fluctuations.

In section V the discussion is widened to place the terms-of-trade/ exchange rate relationship into the context of choice of exchange rate regimes. Feasibility and optimality considerations are distinguished, and market power considerations are added to the usual list of factors determining choice of regimes. The decision tree of Figure 1 summarizes the hypotheses presented.

Several sets of empirical data are examined in section VI for their consistency with the story outlined in sections IV-V. A measure of the degree of market power is calculated for a sample of 41 countries, and related to the market power measure of section IV. Data on levels of income, geographic concentration of trade, and market power are related to actual exchange rate regimes. In general, the data support the hypotheses of Figure 1 . The results are strongest for market power, where countries with asymmetric power in export markets tend to follow schemes of managed flexibility or basket pegs.

II. MEASUREMENT OF INCOME INSTABILITY

Given the above discussion regarding the welfare implications of instability in per capita income it is interesting to examine if less developed countries have experienced greater fluctuations in their real-per-capita income when compared to developed countries. This is done by first computing an index of income instability over time for each country in our sample and then compare this index across countries.

Cross-country comparisons of instability indices are usually sensitive to such factors as (a) the sample of countries under consideration, (b) the measurement of the instability index and (c) the quality of data.

Time-series data for real GDP are not readily available for a number of LDC's, especially for those "least-developed" countries which one would ideally like to cover. Thus, most comparative studies include in their representative samples only the more developed among LDC's, hence biasing the results towards the reduction of estimated differences between groups. Due to this data-availability constraint, the initial sample of forty-one countries in this study was reduced to thirty-eight (data were unavailable for Barbados, Cameroon and Zambia) and subsequently to thirty seven[1] following the exclusion of Pakistan.[2]

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[1]The countries considered are listed in Table I .

[2]Pakistan was excluded due to the sharp drop in income this country experienced as a result of the Indo-Pakistani War.

The final sample consists of eighteen relatively developed and nineteen less developed countries.[1]

For each country in the sample, two separate but related measures of instability in per capita real GDP are calculated. In both cases, log-linear trends are fitted to annual data spanning the period 1960-1976. The regression run is of the following form:

$$(1) \qquad \log \frac{Y}{n} = \alpha_o + \alpha_1 t + U_t \qquad \text{where,}$$

y = real gross domestic product (in 1970 prices) or real gross national product whenever real GDP series were not available.

n = population

and

t = an index of time representing annual observations.

As in McKinnon and Mathieson (1974), the standard error of estimate of the trend equation above gives us the first and simplest measure of instability (S_i^1) for each country, i, in the sample. Thus,

$$(2) \qquad S_i^1 = \sqrt{\frac{\sum_{t=1}^{n} u_t^2}{n - 2}} \ .$$

[1]In classifying countries into DC's and LDC's we use the UNCTAD classification scheme.

In order to facilitate comparisons across distributions with widely different means, a second measure of instability has been subsequently computed by dividing the standard error of each regression given by equation (2) by the logarithm[1] of each country's real (1970 prices) GDP per capita in 1969, denominated in dollars.[2] Thus,

$$(3) \qquad S_i^2 = \frac{S_i^1}{\log\,(y/n)_{i,\ 1969}}.$$

A similar instability measure has been employed in studies measuring export-earnings instability (United Nations 1961, Massell 1964) and has been referred to by Kenen and Voivodas as a "trend-corrected analogue to the coefficient of variation" (Kenen, Voivodas 1972 , p. 793).

As we will see, the comparison of instability indices across groups of countries is partly dependent on the instability index used.

Table I presents the two instability indices for each country for the relevant periods under consideration.[3]

Looking at the first index of instability, we see that it ranges from a low of .0069 for France to a high of .0870 for Zambia. As we will see in section III, Zambia is also the country which is least diversified in its export sector and has thus been subjected to the greatest variation

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[1]Logatithm to base 10.

[2]Ideally we would like to divide S_i^1 by the log of the average real GDP per capita in the country for the period 1960-1975. This was not done due to time constraints and the mid-year was chosen instead.

[3]The years for which data were available are indicated next to each country.

Table I

Instability Indices for Real Per Capita GDP or GNP[1]

	Countries	Years	S_i^1	S_i^2
1.	Argentina	60-75	.0275	.0090
2.	Australia	60-76	.0210	.0062
3.	Austria*	60-76	.0220	.0068
4.	Barbados	n.a.	n.a.	n.a.
5.	Belgium*	60-75	.0202	.0050
6.	Bolivia	60-75	.0209	.0091
7.	Brazil	63-75	.0360	.0137
8.	Burma	60-74	.0356	.0189
9.	Cameroon	n.a.	n.a.	n.a.
10.	Canada	60-76	.0168	.0047
11.	Chile	60-75	.0644	.0211
12.	Colombia	60-75	.0249	.0098
13.	Denmark	60-76	.0308	.0088
14.	Ecuador	60-76	.0583	.0230
15.	Egypt	65-72	.0329	.0210
16.	France *	60-74	.0069	.0020
17.	Gambia	n.a.	n.a.	n.a.
18.	Germany	60-76	.0252	.0073
19.	Ghana	60-71	.0408	.0171
20.	Greece	60-76	.0399	.0132
21.	Iceland*	60-76	.0534	.0159
22.	Israel	60-76	.0419	.0129
23.	Italy	60-76	.0324	.0101
24.	Japan	60-76	.0648	.0200
25.	Malaysia	70-75	.0244	.0098
26.	Mexico	60-75	.0212	.0076
27.	Netherlands*	60-76	.0239	.0071
28.	Norway	60-76	.0079	.0023
29.	Pakistan	61-75	.1816[2]	-
30.	Peru	63-76	.0199	.0076
31.	Philippines	60-76	.0215	.0088
32.	Portugal	60-75	.0539	.0191
33.	South Korea	60-76	.0555	.0229
34.	Spain	60-76	.0371	.0125
35.	Sweden	60-76	.0246	.0068
36.	Thailand	60-76	.0206	.0092
37.	Turkey *	60-76	.0237	.0089
38.	United Kingdom	60-76	.0171	.0051
39.	United States *	60-76	.0326	.0088
40.	Uruguay	60-75	.0248	.0085
41.	Zambia	60-76	.0870	.0324

Sources: IMF, International Financial Statistics, 1976.

Notes:

1. A star indicates that the instability measure used, is instability of real GNP per capita instead of real GDP per capita.

2. The high instability of real GDP per capita in this country is the result of a sharp drop in income in 1970 following the Indo-Pakistani War.

in its terms of trade among all countries in the sample. Among developed countries, Japan has experienced the highest variability in real GDP per capita (.0648) while the corresponding figures for the United States and seven of the Common Market Countries are much lower (.0325 and .0224[1] respectively).

The ranking of countries is changed somewhat when per capita income instability is measured by S_i^2. Comparing sets of countries such as the United States and Turkey or Turkey and Thailand we see that the ranking changes depending on the instability measure used. Thus one should be extremely careful with the interpretation of results which are at the most indicative rather than conclusive.

Can we say that the less developed countries in the sample have experienced on the average greater variations in real GDP per capita than the developed countries? Table II presents average estimates for both instability indices, across the two sets of countries. Countries are grouped into relatively developed or less developed according to the classification scheme used by the UNCTAD and the World Bank. According to this classification, the Southern European countries are considered relatively developed whereas Israel is included in the LDC category, even though its per capita income exceeds $2,000.

The standard error of the mean estimate is given in parentheses. Looking now at both indices we see that the average income instability estimate for less developed countries exceeds the estimate for developed countries by 22 percent if $\bar{S}^1$ is taken as the appropriate measure and

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[1]This is an average estimate for the seven EEC countries included in the sample.

Table II

Mean Instability Indices ($\bar{S}^1$ and $\bar{S}^2$) For Real Per Capita GDP (or GNP)

		$\bar{S}^1$	$\bar{S}^2$
Less Developed Countries[1]	n = 19	.0359 (.0042)	.0143 (.0016)
Developed Countries	n = 18	.0295[2] (.0037)	.0090 (.0012)

Source: IMF, International Financial Statistics, 1976.

Notes

1. LDC's include Argentina, Bolivia, Brazil, Burma, Chile, Colombia, Ecuador, Egypt, Ghana, Israel, Malaysia, Mexico, Peru, Philippines, South Korea, Thailand, Turkey, Uruguay and Zambia. The rest are considered developed countries while Pakistan is excluded from the sample.

2. If Japan is excluded from the sample the mean instability index drops to .0274.

by 59 percent if $\bar{S}^2$ is considered. Given the standard error of the mean estimates we can say that the difference between means is statistically significant and even more so in the case of $\bar{S}^2$. This is of course only a tentative result pending a more detailed and rigorous econometric analysis.

Thus, not only is the welfare loss from a given degree of instability probably greater for LDC's (see our discussion in the introductory section), but less developed countries also seem to have experienced greater fluctuations in their per capita incomes in comparison to more developed countries, at least for the period under consideration.

We can now identify the sources of real income fluctuations $(\frac{dy}{y})$ through a simple model with two exports (x_1, x_2) one import (m) and one non-traded good (h).

Let us define real income as the value of total domestic production deflated by the price of imports (p_m). Then, in the absence of an import competing sector;

$$(5) \qquad y = \frac{Y}{p_m} = \frac{p_1}{p_m} x_1 + \frac{p_2}{p_m} x_2 + \frac{p_h}{p_m} h.$$

Differentiating totally equation (5) and using Ex_1, Ex_2 and E_h to denote the elasticities of x_1, x_2 and h with respect to changes in $\frac{p_1}{p_m}$, $\frac{p_2}{p_m}$ and $\frac{p_h}{p_m}$ respectively, we get

$$(6) \qquad \frac{dy}{y} = \frac{x}{y} \left(\frac{x_1}{x} (1 + Ex_1)\ d\left(\frac{p_1}{p_m}\right) + \frac{x_2}{x} (1 + Ex_2)\ d\left(\frac{p_2}{p_m}\right)\right) + \frac{h}{y} (1 + E_h)\ d\left(\frac{p_h}{p_m}\right).$$

where,

$\frac{x}{y}$ = exports as a fraction of national income, i.e. a measure of the supply-side openness of the economy

$\frac{x_i}{x}$, i = 1,2, exports of commodity i as a fraction of total exports i.e. the relevant export concentration ratios

E_j, $j = x_1, x_2, h$ = the relevant elasticity estimates

$\frac{h}{y}$ = production of home goods as a fraction of total income and $d(\frac{p_j}{p_m})$ $j = x_1, x_2, h$ the change in the relevant relative prices.

The first term in equation (6) describes the effect on income of terms of trade fluctuations $(d(\frac{p_x}{p_m}))$; for any given change in the terms

III. SOURCES OF INCOME INSTABILITY

Having looked at instability of real per capita income across countries, we now turn to its sources.

The openness of an economy to foreign trade, the country's size, the composition and diversification of exports and the geographic concentration of trade are only a few of the structural characteristics of economies which have figured prominently in the literature as determinants of export-earning and income instability (Massell 1964, 70; Macbean 1966, Erb and Schiavo-Campo 1969; Mathieson and McKinnon 1974). It is the purpose of this section to develop a framework which will enable us to see which of these parameters (e.g. openness of the economy) affect income variability directly and which of these (e.g. trade diversification) work themselves through the terms of trade. We then proceed with comparisons of some of these characteristics across groups of countries in order to get some preliminary indication of their relative importance as determinants of the variance in income instability across countries.

For a given population, let us define the change in real per capita income in a country as,

$$(4) \qquad d\left(\frac{y}{n}\right) = \frac{y}{n} \left(\frac{dy}{y}\right)$$

where,

y = real GDP deflated by the price of imports and

n = population.

It follows that for a given level of real per capita income (y/n), fluctuations in y/n can be analyzed in terms of fluctuations in y.

of trade the percentage change in income is larger, the greater is the openness measure $\frac{x}{y}$. As we already know from the literature (Brainard, Cooper 1968), terms of trade fluctuations *per se* become smaller the more diversified the export sector; in terms of equation (6), increasing diversification implies lower concentration ratios ($\frac{x_i}{x}$) for any one export and thus, lower overall terms of trade variation for any change in the price of an exported commodity ($d(\frac{P_j}{P_m})$, $j = x_1, x_2$); diversification also reduces the chances that the relative prices of commodities will move in unison and hence tends to reduce the variations in the overall terms of trade.

Thus, abstracting from considerations affecting the non-traded good sector, differences in income variations across countries can be partly attributed to differences in openness and/or partly to differences in terms of trade fluctuations.

Looking first at relative degrees of openness across countries (defined as the ratio of exports to GDP), we see that there exists no systematic relationship between income per capita and degrees of openness. Table III presents average openness estimates for each of six groups of countries classified according to 1974 per capita GNP levels. The openness estimates are calculated for 41 countries using 1974 data. In less-developed countries with incomes per capita under \$500, exports accounted for 23 percent of total GDP in 1974, but only 18 percent for countries in the \$1,000-\$2,000 income per capita category; most developed countries on the other hand, with per capita incomes ranging between \$4,000-\$6,000 can be identified as open economies with exports accounting approximately 35 percent of GDP. Hence, contrary to widely-held views (Mathieson, McKinnon 1974) there is no indication

Table III

Openness and Per Capita GNP ($) - 1974

Number of Countries in each sample	Per Capita GNP in Dollars (1974)	Average X/GDP (1974)
12	$ 0 - 500[1]	.2313
6	500 - 1,000[2]	.2367
5	1,000 - 2,000[3]	.1764
4	2,000 - 4,000[4]	.2138
8	4,000 - 6,000[5]	.3479
6	6,000 +[6]	.2505

Sources: World Bank Atlas, 1976 IMF; International Financial Statistics, 1976.

Notes

[1]Bolivia, Burma, Cameroon, Colombia, Ecuador, Egypt, Gambia, Ghana, Pakistan, Philippines, S. Korea, Thailand.

[2]Brazil, Chile, Malaysia, Peru, Turkey, Zambia.

[3]Argentina, Barbados, Mexico, Portugal, Uruguay.

[4]Greece, Israel, Italy, Spain.

[5]Australia, Austria, Belgium, France, Iceland, Japan, Netherlands, Norway.

[6]Canada, Denmark, Germany, Sweden, United Kingdom, United States.

that countries at low levels of income per capita are somehow more open, at least on the supply side; extending the argument one step further, there is no reason either to expect greater income instability in low income per capita countries simply on account of openness considerations.

Turning now to terms-of-trade fluctuations we see that for the period between 1960-1975 less-developed countries have exhibited much greater fluctuations in their terms of trade than developed countries. Table IV presents coefficient-of-variation estimates (V) for the terms of trade of selected groups of developed and less-developed countries.

For the period 1960-1975, the average coefficient of variation in the terms of trade for developed countries was 3.821 percent whereas the equivalent estimate for less developed countries, excluding the major petroleum exporters, was 5.463 percent. More importantly at least among LDC's, $\bar{V}$ was consistently lower for countries with higher per capita incomes; the least developed countries in 1974 experienced wider fluctuations in their terms of trade ($\bar{V} = 8.717$), as compared to countries at higher income per capita levels ($\bar{V} = 7.093$ for countries with a per capita GNP between \$200 -\$400 and $\bar{V} = 6.747$ for countries with per capita incomes higher than \$400).

For the period under examination therefore, fluctuations in the terms of trade have been much more pronounced for countries at low income per capita levels. Any policy attempt towards stabilization of per capita incomes in those countries should address itself to the question of minimization of the variance in the terms of trade; this is precisely the focus of Part IV below.

Table IV

A Comparison of Developed Market-Economy Countries (by Region) and Developing Countries (by major export and income category)

Countries	Average Terms of Trade Index: 1960-1975 1970 = 100	Standard Deviation of Terms of Trade Index Series	Coefficient of Variation(Percent)
Developed Market Economy Countries	97.000	3.706	3.821
- America[1]	97.120	3.897	4.012
- EEC[2]	97.130	3.649	3.757
- EFTA[3]	98.500	2,251	2.285
- Other Europe[4]	96.060	6.942	7.227
- Japan	95.250	8.371	8.788
- Oceania[5]	100.750	12.272	12.180
Developing Countries and Territories	105.120	18.593	17.688
- Major Petroleum Exporters[6]	133.000	76.381	57.429
- Other Developing Countries of which:	96.750	5.285	5.463
Fast Growing Exporters of Manufactures[7]	93.940	5.507	5.862
All Other Countries of which: Countries with a per capita GNP in 1974	97.380	5.427	5.573
Over $400	95.440	5.439	6.747
$200 -$400	102.250	7.253	7.093
Under- $200	96.880	8.445	8.717

Source: Table 2.5 in UNCTAD, Handbook of International Trade and Development Statistics, 1976.

Table IV (continued)

Notes

[1]Canada, United States

[2]Belgium, Denmark, France, Germany, Ireland, Italy, Luxembourg, Netherlands, U. Kingdom

[3]Austria, Faeroe Islands, Finland, Iceland, Norway, Portugal, Sweden, Switzerland

[4]Other Europe: Gibraltar, Greece, Malta, Spain, and Yugoslavia

[5]Australia, New Zealand.

[6]Defined as those countries for which petroleum and petroleum products accounted for more than 50 percent of their total exports in 1974. These countries are: Algeria, Angola, Bahrain, Brunei, Ecuador, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Oman, Qatar, Saudi Arabia, Trinidad and Tobago, United Arab E Emirates and Venezuela.

[7]Countries whose exports of manufactures amounted to more than $50 million and accounted for more than one-third of their total exports in 1972. In addition, the manufactured exports of these countries grew at an average annual rate higher than the world average of 16 percent during the period 1967-1972; they are: Hong Kong, Israel, Republic of Korea, Lebanon, Malta, Mexico and Singapore.

Before addressing this point, however, it is interesting to examine whether or not there is a negative correlation between trade diversification and terms-of-trade fluctuations as equation (6) would lead us to believe. In order to do this, a trade diversification index was computed for 40 countries using 1974 data. As a measure of relative diversification (δ_x), we took the total value of production of the four principal exports of countries in 1974[1] as a fraction of their total exports. The higher δ_x, the lower the degree of diversification. The same forty countries were then grouped according to experienced terms-of-trade fluctuations in the 1960-1975 period, measured by the coefficient of variation V; an average estimate of δ_x was then computed for each group. The results are presented in Table V . It can be readily seen that there exists a strong positive correlation between our estimate δ_x and V as one would expect.

Countries with concentrated trade (high δ_x) experienced much wider fluctuations in their terms of trade. Thus diversification of exports seems to be of paramount importance in terms of overall reduction of terms-of-trade fluctuations. Proper exchange rate policy and international stabilization agreements can also reduce substantially terms-of-trade fluctuations. It is to these considerations that we now turn.

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[1]For Peru 1971 data were the earliest available; for Barbados, Bolivia and Uruguay we have 1972 estimates and for Ecuador, Mexico and Zambia 1973 estimates were obtained.

Table V

Trade Diversification and Coefficient of Variation of the Terms of Trade for Forty Countries

Number Of Countries	V (percent)	Average δ_x for Each Group
7	0 - 5	.2752
15	5 - 10	.3956
10	10 - 15	.5865
6	15 - 20	.8040
2	20 +	.9167

Sources: UNCTAD, Handbook of International Trade and Development Statistics, 1976. United Nations, Yearbook of Trade Statistics, 1975.

IV. DECOMPOSITION OF FLUCTUATIONS IN THE TERMS OF TRADE

In the first three sections of the paper, we have shown that fluctuations in the terms of trade, measured as the ratio of export to import prices (in home currency), are an important source of income instability, especially for less-developed countries. The next step in the argument leading to policy prescription is to relate terms-of-trade fluctuations to fluctuations in (a) world market demand prices for exports and supply prices for imports, (b) home supply prices for exports and demand prices for imports, and (c) exchange rates. We do the decomposition in a log-linear supply-and-demand model for one country j in a many-country ($i = 1, \ldots, I$) 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 the model to include variations in all the exchange rates in the system. This extension yields interesting results regarding the choice of weights for a basket peg which would eliminate the effects of exchange rate fluctuations in the terms of trade. We conclude the section with a brief discussion of the implications of the decomposition for policy aimed at minimizing terms-of-trade fluctuations.

A Log-Linear Model of the Terms of Trade

The terms-of-trade π is the ratio of export prices to import prices,

p_x/p_m. We will develop separately log-linear supply and demand expressions for changes in p_x and p_m. The difference between the two, in percentage terms, is the change in π. We begin on the export side. A listing of symbols and definitions used in this section is given in Table VI.

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,

(7) $$\ln p_x = \ln p_x^{\circ} + s_x^{-1} \ln X.$$

Here p_x° 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

(8) $$\ln q_x = \ln q_x^{\circ} + d_x^{-1} \ln X.$$

q_x° is a vertical shift parameter which can represent changes in world market conditions, and d_x is the price elasticity of demand. To translate demand into home currency units, we use the relationship

(9) $$p_x = eq_x, \text{ or } \ln p_x = \ln e + \ln q_x,$$

Table VI: Symbols and Definitions on the Terms-of-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.

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 (8) gives export demand in home currency units,

$$(10)\quad \ln p_x = \ln q_x^\circ + d_x^{-1} \ln X + \ln e.$$

We can now combine the supply function (7) and the demand function (10) to solve for market equilibrium p_x and X, and then use (9) to get q. The solution could be obtained by equating (7) and (10)

$$\ln p_x^\circ + s_x^{-1} \ln X = \ln q_x^\circ + d_x^{-1} \ln X + \ln e,$$

solving for X, and substituting the solution back into (7) or (10)to obtain the value for p_x. We prefer to write the total differentials of (7) and (10) in matrix form to obtain the simultaneous solution for p_x and X. The total differentials are

$$(7')\quad \dot{p}_x - s_x^{-1} \dot{X} = \dot{p}_x^\circ, \text{ and}$$

$$(10')\quad \dot{p}_x - d_x^{-1} \dot{X} = \dot{q}_x^o + \dot{e}.$$

In matrix form we have

$$\overset{A}{\begin{bmatrix} 1 & -s_x^{-1} \\ 1 & -d_x^{-1} \end{bmatrix}} \begin{bmatrix} \dot{p}_x \\ \dot{X} \end{bmatrix} = \overset{B}{\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix}} \begin{bmatrix} \dot{p}_x^0 \\ \dot{q}_x^o \\ \dot{e} \end{bmatrix}.$$

The solution, inverting A, is given by

$$(11)\quad \begin{pmatrix} \dot{p}_x \\ \\ \dot{X} \end{pmatrix} = \frac{s_x d_x}{d_x - s_x} \begin{bmatrix} -d_x^{-1} & s_x^{-1} \\ \\ -1 & 1 \end{bmatrix} \begin{bmatrix} \\ B \\ \\ \end{bmatrix} \begin{pmatrix} \dot{p}_x^o \\ \dot{q}_x^o \\ \dot{e} \end{pmatrix}$$

Movement in the export price p_x is then

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

which we will write as

$$(12)\quad \dot{p}_x = k(\dot{q}_x^o + \dot{e}) - \frac{s_x}{d_x} k \, \dot{p}_x^o \; .$$

Here k is defined as

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

We can use k as an index of market power on the export side. In the small-country case where $d_x \rightarrow -\infty$, k approaches unity. As d_x rises from $-\infty$ (demand becomes less than perfectly elastic), k falls from unity.

If market power can be measured in the export market by decreasing elasticity of demand (in absolute value), then k is an inverse index of market power. With very inelastic demand, k approaches zero; with highly elastic demand, k approaches unity.

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

$$(13) \quad \dot{p}_x = \dot{q}_x^o + \dot{e}.$$

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.

Finally, it is useful to notice that q_x^o and e enter symmetrically in (12). Later we will expand the model to disaggregate e; from the symmetry of q_x^o and e, the same disaggregation would apply to q_x^o.

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:

$$(14) \quad \ln q_m = \ln q_m^o + s_m^{-1} \ln M.$$

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

$$(15) \quad \ln p_m = \ln q_m^o + s_m^{-1} \ln M + \ln e.$$

Import demand, in home-currency terms, is:

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

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

$$\begin{array}{c} A \\ \begin{bmatrix} 1 & -s_m^{-1} \\ 1 & -d_m^{-1} \end{bmatrix} \end{array} \begin{pmatrix} \dot{p}_m \\ \dot{M} \end{pmatrix} = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} \begin{pmatrix} \dot{p}_m^o \\ \dot{q}_m^o \\ \dot{e} \end{pmatrix}$$

The solution for $\dot{p}_m$ and $\dot{M}$ is:

$$(17) \quad \begin{pmatrix} \dot{p}_m \\ \dot{M} \end{pmatrix} = \frac{s_m d_m}{d_m - s_m} \begin{bmatrix} -d_m^{-1} & -s_m^{-1} \\ -1 & 1 \end{bmatrix} \begin{bmatrix} B \end{bmatrix} \begin{pmatrix} \dot{p}_m^o \\ \dot{q}_m^o \\ \dot{e} \end{pmatrix} .$$

Movements in the import price p_m are given by:

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

which we write as

$$(18) \quad \dot{p}_m = k' (\dot{q}_m^o + \dot{e}) - \frac{d_m}{s_m} k' \dot{p}_m^o .$$

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

$$(19) \quad \dot{p}_m = \dot{q}_m^o + \dot{e}.$$

Terms of Trade Movements.

The terms of trade π is defined as $\pi = p_x/p_m$.
Thus we can combine equation (12) for $\dot{p}_x$ and (18) for $\dot{p}_m$ to obtain the expression for $\dot{\pi}$:

$$(20) \quad \dot{\pi} = \dot{p}_x - \dot{p}_m = (k - k')\,\dot{e} + k\dot{q}_x^o - k'\,\dot{q}_m^o - \frac{s_x}{d_x}\,k\dot{p}_x^o + \frac{d_m}{s_m}\,k'\,\dot{p}_m^o \ .$$

The first term on the right-hand side of (20) gives the effect of changes in the exchange rate on the terms of trade. If market power is symmetric on the export and import sides, $k = k'$ and the exchange rate drops out of the expression for $\dot{\pi}$. One case of symmetric market power is the small-country example where $k = k' = 1$. Another case might be any of the industrial OECD countries which have market power on both sides. In that case k and k' might be less than unity, but still roughly the same. A typical case of asymmetric market power would be a developing country with concentrated exports of agricultural products or raw materials, but diversified imports of industrial products. In this case we have

$k < 1$, $k' = 1$, and $(k - k') < 0$. An increase in the exchange rate (price of foreign exchange) of that country reduces its terms of trade.

The second and third terms on the right-hand side of (20) give the effects of shifts in world market prices on the terms of trade of the home country. The last two terms give the effects of shifts in domestic market conditions. In the small-country case with $s_m = \infty$, $d_x = -\infty$, $k = k' = 1$, (20) reduces to:

$$(21)\quad \dot{\pi} = \dot{q}_x^o - \dot{q}_m^o ;$$

the terms of trade are affected only by shifts in world market prices.

Equation (20) for movements in the terms of trade provides a convenient framework for analysis of policies to reduce π fluctuations. One can look at (a) policies reducing fluctuations arising in domestic market conditions ($\dot{p}_m^o$ and $\dot{p}_x^o$), (b) policies reducing fluctuations originating in world market conditions ($\dot{q}_m^o$ and $\dot{q}_x^o$), or (c) policies reducing fluctuations from movements in exchange rates ($\dot{e}$). We will return to these policy questions after we disaggregate the model to include many countries.

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

In a world of floating exchange rates, movements in any rate can influence the terms of trade of any country with asymmetric market power. Thus to study the effects of exhange rate changes on π, we should expand the model to include many countries, each defined as a separate currency unit. The extension will allow us to look at exchange rate policies that might minimize the effects of fluctuations in exchange rates on the terms of trade. In fact, we can find the set of weights for a "basket peg" that will just eliminate these effects.

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 jth 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

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

Now in place of the single $\dot{e}$, $\dot{q}^o_x$, and $\dot{q}^o_m$ in the equations for $\dot{p}_x$, $\dot{p}_m$, and $\dot{\pi}$ (equations(12), (18), (20)), we have weighted averages of movements in all the exchange rates $\dot{T}_i$ and weighted averages in the shift factors $\dot{q}^o_{xi}$ and $\dot{q}^o_{mi}$.

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

$$(23) \quad \dot{p}_x = k \sum_{i \neq j} \alpha_i \dot{T}_i + k \sum_{i \neq j} \alpha_i \dot{q}^o_{xi} - \frac{s_x}{d_x} k \dot{p}^o_x .$$

Here α_i are export-share weights with the properties $\alpha_i \geq 0$; $\Sigma \alpha_i = 1$.

These could be simple bilateral weights or more complicated weights such as the IMF's MERM weights[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 (18) for $\dot{p}_m$ we now have

$$(24) \quad \dot{p}_m = k' \sum_{i\neq j} \beta_i \dot{T}_i + k' \sum_{i\neq j} \beta_i \dot{q}_{mi}^o - \frac{d_m}{s_m} k' \dot{p}_m^o .$$

On the import side the single $\dot{e}$ of equation (18) 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 countries. 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.

With (23) and (24) for $\dot{p}_x$ and $\dot{p}_m$, we have the disaggregated equation for $\dot{\pi}$, replacing (20):

$$(25) \quad \dot{\pi} = k \sum_{i\neq j} \alpha_i \dot{T}_i - k' \sum_{i\neq j} \beta_i \dot{T}_i + k \sum_{i\neq j} \alpha_i \dot{q}_{xi}^o$$

$$- k' \sum_{i\neq j} \beta_i \dot{q}_{mi}^o - \frac{s_x}{d_x} k \dot{p}_x^o + \frac{d_m}{s_m} k' \dot{p}_m^o .$$

So far, this is simply the weighted-average version of equation (20). The next, and more interesting, step is to break $\dot{T}$ down into $\dot{J}$ and $\dot{r}$. Replacing $\dot{T}_i$ by $\dot{J}_i + \dot{r}$ in the first two terms of (25) transforms them into

$$k \Sigma\alpha_i (\dot{J}_i + \dot{r}) - k' \Sigma\beta_i (\dot{J}_i + \dot{r}).$$

Since the α_i and β_i both sum to unity, we can remove $\dot{r}$ from the summations to

[1]See Artus and Rhomberg (1974) for a discussion on the Multilateral Exchange Rate Model.

transform the expression into

$$(k - k')\,\dot{r} + k\,\Sigma\alpha_i \dot{J}_i - k'\,\Sigma\beta_i \dot{J}_i \,.$$

Thus the complete expression for changes in the terms of trade is now

$$(26)\quad \dot{\pi} = [(k - k')\dot{r} + k \sum_{i \neq j} \alpha_i \dot{J}_i - k' \sum_{i \neq j} \beta_i \dot{J}_i]$$

$$+ [k \sum_{i \neq j} \alpha_i \dot{q}^o_{xi} - k' \sum_{i \neq j} \beta_i \dot{q}^o_{mi}]$$

$$+ [\frac{d_m}{s_m} k' \dot{p}^o_m - \frac{s_x}{d_x} k \dot{p}^o_x].$$

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 (26) for $\dot{\pi}$:

1. Pegging to the dollar, or to any other numeraire, would eliminate $\dot{r}$ from (26), but fluctuations in the dollar price of other (non-j) currencies will move π through J.

2. For the small country, (26) reduces to

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

   Fluctuations in the jth currency price of the numeraire disappear since $k = k'$, but π is still moved by J, q^o_x, and q^o_m.

With different distribution of exports and imports across countries, movements in non-j exchange rates still influence j's terms of trade even when j is small.

Some Initial Implications for Policy

To each of the bracketed terms in equation (26) corresponds a policy option to reduce fluctuations in the terms of trade. The middle term gives the effects of fluctuations in world market conditions on the terms of trade. This is in a sense the irreducible minimum instability facing any country. Action on this source of instability would require international agreement on price stabilization. As we saw earlier, less-developed countries face greater variations in their terms of trade than developed countries do. Thus it makes sense for the LDCs to apply pressure for international stabilization agreements.

The last term in (26) gives the effects of home-market disturbances on the terms of trade. This is relevant only for countries with some degree of market power. Here the indicated policy areas are stabilization of home demand for imports and supply of exports. For a typical LDC, market power is much more prevalent on the export side ($k < 1$); we see only a few cases of market power on the import side. Thus the policies that would pay off in stabilizing the terms of trade (or insulating π from home market disturbances) are export supply policies. Inventory policies, long-term marketing agreements, marketing boards all can play a role here, and do.

The first bracketed term in (26) gives the effect of variations in exchange rates on the terms of trade. We decomposed $\dot{T}_i$ into J_i and $\dot{r}$ earlier in order to look at the possibility of selecting weights for a basket peg that would minimize the contribution of exchange rate instability to terms-of-trade fluctuations. We now turn to this problem, focussing on the first bracketed term in (26).

Choice of Weights for a Basket Peg

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] If the decision has been made to peg to a basket of currencies, then the policy question becomes choice of weights. In the next section we discuss the broader question of choice of exchange rate regime; here we focus on the narrower question of choice of w_i, assuming the decision to peg to a basket is already taken. Clearly from (26) 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 minimize variations in the terms of trade arises only for countries with asymmetric market power.

[1]Note that since r is 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 (26) 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.

We are not limited to these choices, however. Assume for the moment that the $\dot{q}^o$ and $\dot{p}^o$ terms in (26) are zero. Then for $\dot{\pi}$ we have

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

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

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

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

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[1] See Black (1976c), 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 minimize the effect of J_i on the terms of trade.

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

$$(28) \qquad w_i = \frac{k\alpha_i - k'\beta_i}{k - k'}.^{1}$$

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

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

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

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[1]Originally we set up the choice of weight problem as minimizing the variance of π, after integrating (26) 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 that it makes variance (π) zero, that James Healy noted that the w_i solution comes by inspection from (26).

We emphasize 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.

V. CHOICE OF EXCHANGE RATE REGIME

In section IV we saw that a country with market power can reduce or even eliminate the effects of exchange-rate variation on its terms of trade by judicious choice of weights for a basket peg. This of course is not a general prescription for exchange rate policy; rather it is an optimal policy for one kind of country (asymmetric market power) with one particular policy objective: minimize terms-of-trade fluctuations. In this section we briefly survey the recent literature on the broader question of choice of exchange rate regimes, putting the results of section IV into perspective.

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 it is 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, and (b) the role of market power in choice of regimes.

Feasibility Considerations

The discussion of choice of regimes is illustrated by Figure 1, p. 45. This differs from a similar figure in Heller (1976, p. 24 a) in that there is not a single float vs. peg decision in our structure. Rather, we first sort out countries that must peg because floating is infeasible, and then later discuss the factors that would lend some countries to peg even though they could float.

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 McKinnon (1963), who noted that an economy can be so open that if it were to float, domestic citizens would want contracts effectively denominated in foreign exchange. Thus there would be no basis for demand for home currency in such an open economy, except for artificial legal constraints such as the requirement that taxes be paid in local currency. On the McKinnon 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 arguments run as follows. If a country has well-developed financial markets, integrated into international markets, then in the short run its exchange rate is determined by equilibrium conditions in financial 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 (1976), 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 (1978).

If, on the other hand, a country does not have well-developed capital markets which are integrated internationally, then supply and demand in the foreign exchange market are determined by current flows, and the stability conditions are the Marshall-Lerner conditions on trade elasticities. This is the model recently elaborated by Black (1976). 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. 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.[1] Thus if a country has well-integrated capital markets, it can expect a floating rate to be stable. But if the country does not have financial market integration, there is a serious question about whether a floating rate would be stable in the short run. So our second feasibility criterion is the existence of integrated financial markets.

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 countries with integrated capital markets tend to be floaters.[2] This is consistent with our argument that countries 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 well-developed 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 summarized as follows. Countries

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[1]See Black (1976), pp. 5-6.

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

(or groups of countries) which are relatively closed and have well-developed, 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 this set of feasible floaters to be the developed OECD countries. This unsurprising conclusion is supported by Heller's discriminant analysis of floating vs. pegging, and by our calculation of average per capita and total GDP for countries sorted by exchange rate regime in section VI below.[1]

Choices for Feasible Floaters

For the countries which are feasible floaters, the gains from floating are well-known and substantial; floating rates provide a fairly continuous adjustment of the domestic economy to changing international conditions. There are indications in the literature on short-run determination of exchange rates in asset markets of an "overshooting" of exchange rates in response to monetary disturbances (see Dornbusch (1976), for example), and the possibility of the existence of a "vicious circle" of feedback from the internal price level to the exchange rate and back to the price level. These phenomena argue against completely free floating, and for a "leaning against the wind" intervention policy by central banks in exchange markets.

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[1]See Heller (1976), p. 21 and Table 11. We note that Chile is among Heller's list of floaters par excellence, with a discriminant function value close to that of Germany, double that of the medium-sized European countries. We have not yet had the opportunity to look carefully at this case.

The main choices for feasible floaters then reduce to (a) independent floating, (b) joint floating, (c) basket pegging due to asymmetric market power. A group of countries with strongly interdependent trade may choose to float jointly--the obvious example is the European snake, now reduced to West Germany and its small partners. Countries with more diversified trade would be independent floaters. The exception to the rule that feasible floaters float would be an extreme case of asymmetric market power. There the objective of terms of trade stabilization could lead to a basket peg, crawling or fixed, using weights specified in section IV, equation (28), above.

Choices for Countries that Peg

The first distinguishing characteristic for infeasible floaters is geographic concentration of trade. A small country with trade heavily directed to a major currency partner will probably peg to that currency. In section VI below we see that this is by and large the case.

Heller (1976) uses discriminant analysis to allocate countries into the following categories: floaters (independent); floaters (joint); peggers to dollar, French franc, SDR, other basket. There are many anomalies, for example, Yugoslavia is an independent floater, Canada is in the snake, and Chile has disappeared from the list. The striking thing about his analysis at this point, though, is that the geographic concentration of trade is not one of the factors determining the allocation.[1]

For peggers with geographically diversified trade, in a world in which the major currencies float, the choice comes down to the choice of weights

[1] See Heller (1976, pp. 27-29).

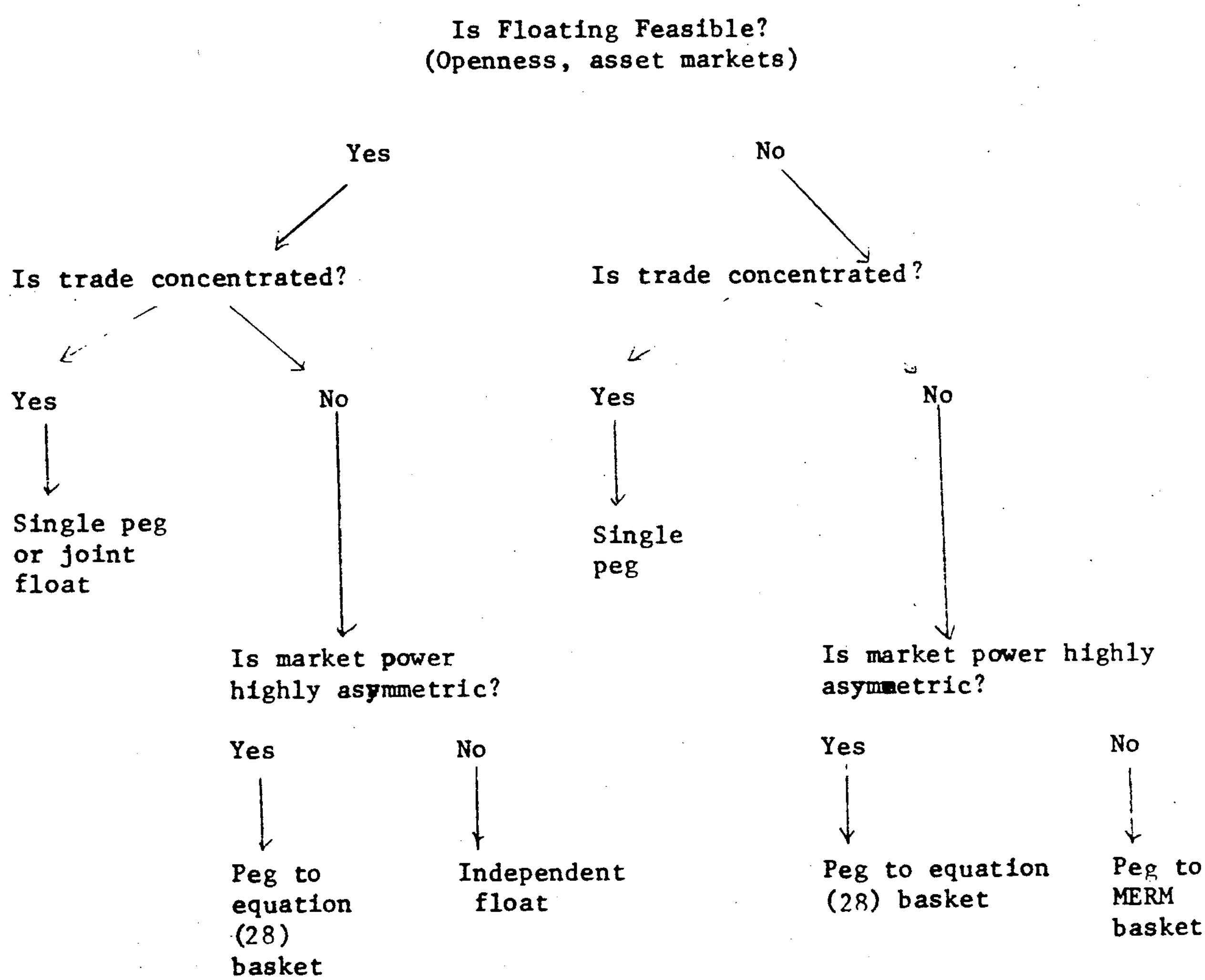
for a basket peg. The array of possibilities and their pros and cons, have been discussed by Black (1976c), who aims at stability of internal prices of tradeable goods, and Crockett and Nsouli (1977), who look at a variety of policy goals. The general outcome here is a basket peg that approximates MERM weights, to hold the effective exchange rate constant. This scheme can be combined with a crawling peg following reserve or balance-of-payments indicators. In section VI below we see a large group of medium-sized peggers following some kind of managed system.

The geographically diversified pegger with asymmetric market power, and a terms-of-trade target, could choose the weights of equation (28), minimizing the effect of exchange variability on the terms of trade. As an approximation to these "optimal" weights, the country with market power mainly on the export side could use import weights as a "second-best" alternative, and a country with market power on the import side could choose export weights. In section VI below, where we discuss measurement of market power, we see that generally the medium-sized LDCs have more market power on the export side, which would lead us to expect predominant use of import weights. These can be combined with a crawling or otherwise adjustable value for the basket peg. These arrangements do seem to dominate in the middle-income developing countries.

Summary: Country Characteristics and Exchange Rate Regimes

We can summarize roughly the likely outcomes for choice of exchange rate regimes, assuming countries follow our feasible-optimal reasoning, using the structure of Figure 1. First, we would expect the industrial countries with open asset markets to be feasible floaters, and the develop-

Figure 1 : Choice of Exchange Rate Regimes



ing countries generally not to be feasible floaters.

Going down the left branch of the tree, geographic concentration of trade will distinguish between joint and independent floaters, and it may be possible that countries with highly asymmetric market power would choose a basket peg with "optimal" weights from equation (28) or "second-best" import or export weights. The Deutschemark-denominated joint float and perhaps a Canada--U.S.--Mexico float might be indicated by trade concentration.

Going down the right branch of the tree, showing infeasible floaters, again we have concentration of trade as the distinguishing characteristic. Countries with geographically concentrated trade, mainly the smaller ex-colonial countries, will find it easiest administratively to peg to the currency toward which their trade is oriented.

The more diversified middle-income countries, are the natural basket peggers. Those with asymmetric market power on the export side, such as Ghana or Australia should be expected to choose the "optimal" weights or second-best import weights. The countries with symmetric or no market power, but diversified trade, should be expected to use MERM weights or the closest available approximation to stabilize an effective exchange rate. Finally, all the peggers can choose to manage their pegs following indicators or rules to maintain rough balance-of-payments equilibrium. We find in section VI that these classifications are roughly supported by our look at various data sets.

VI. EVIDENCE ON CHOICE OF EXCHANGE RATE REGIMES

In the first three parts of the paper, we traced income instability to term-of-trade fluctuations, and showed that this latter problem was more serious for the less developed countries. Then in section IV we showed how exchange-rate fluctuations contribute to terms-of-trade fluctuations, and in section V we widened the discussion to choice of exchange-rate regimes. There we also summarized the most recent empirical contribution (available to us) on the subject by Heller (1976). In this section we report on our initial attempts to check the theoretical assignment of countries to exchange rate regimes of Figure 1 in section V. The results here are most tentative, coming from a first cut at several non-homogeneous sets of data. Readers should particularly note that we have not yet assembled the data to perform an integrated cluster analysis, which would effectively extend Heller's (1976) work to our categorization and measurement proxies. This is the obvious next step in our research program.

Below we report initial results concerning choice of exchange-rate regimes grouped under three headings: income level, concentration of trade, and market power, following the structure of Figure 1 . If we assume that income level is an adequate proxy for feasible floating, these correspond to the principal discriminating variables of Figure 1 .

Income Level

The implications of section V for the relation of choice of exchange rate regime to level of income run roughly as follows. The high-income industrial countries are likely to be feasible floaters. In the absence of extreme asymmetry of market power these countries should float, singly or jointly. Middle-income LDCs are generally not feasible floaters due to lack of well-developed financial markets. They tend to have fairly geographically diversified trade and frequently to have market power on the export side (see below). So these countries would tend to be basket peggers with some flexibility of management in moving the peg. The low-income (and generally smaller) LDCs have more geographically concentrated trade, and would tend to be single-currency peggers.

In Appendix I (Choice of Exchange Rate Regimes by Countries) we sort countries into the categories of exchange-rate regime shown in Table VII. The sorting basically follows the IMF Yearbook (1977), modified occasionally by reference to Black (1976a) and Crockett-Nsouli (1976).

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 Appendix I. These are reported in Table VII 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-Bissao, 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.

Table VII: 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.

The mean incomes, as measured by total GDP or GDP per capita, shown in Table VII are clearly consistent with the story of section V. Not too much should be made of this in the sense of a hypothesis test, however, since the story and data were developed simultaneously. However, since the standard deviations of the estimates of the means tend to make the estimates quite significant in the usual statistical sense, at least the story and the data are consistent. We see that both GDP and GDP per capita fall as we go from floaters to managed flexibility to basket peggers to single currency peggers. Thus a first look at data on income levels is fully consistent with the story of section V.

Concentration of Trade

Once feasibility of floating is determined in Figure 1 of section V, the next question involves concentration of trade. Feasible floaters with geographically highly concentrated trade are likely to join in a joint float. Natural peggers will peg to the currency area of their trade concentration. These concentration effects may be measured by calculating the proportion of exports allocated to various currency areas by each country in a joint float or pegging to a single currency.

In a preliminary test of this hypothesis, countries were divided into groups according to the exchange rate regimes reported to the IMF in 1974. The six groups included countries pegging to the U.S. dollar, the pound sterling, or the French franc; the countries in the European Snake; countries allowing their exchange rate to float; and centrally planned countries including the Warsaw Pact region and China. Data were not available for Equatorial Guinea, the only country which pegged to the Spanish peseta.

Using 1974 data from the UN Yearbook of International Trade Statistics, 1975 it was possible to calculate the percentage of exports to each of the six currency areas for a representative sample of countries (see Table VIII). 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% of the export market for a given country were excluded from the table.

As Table VIII indicates, the trade data tend to support the hypothesis that the choice of a key currency is influenced by the concentration of trade. Countries pegged to a key currency generally exported more to members of their own currency area than to members of other single-currency areas. Countries within the European Snake also concentrated their exports 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-a-vis the dollar.

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[1] 1974 is the latest year directions of trade are available in UN statistics.

Table VIII: Percentage Export Shares by Currency Bloc in 1974

	Currency Area					
Exporter	$	£	FFR	SNAKE	FLOAT	CPE [1] & OTHER
$ PEGGERS						
Argentina	22.03	-	-	10.82	22.36	5.37
Bahamas	92.95	-	-	-	-	-
Burundi	32.49	-	-	42.77	5.47	-
Colombia	45.41	-	-	18.84	5.83	-
Costa Rica	57.35	-	-	15.44	6.63	-
Ethiopia	30.44	-	10.12	15.79	15.99	-
Guatemala	61.44	-	-	14.49	23.6	-
Haiti	68.57	-	8.26	12.50	8.69	-
Indonesia	22.89	-	-	-	62.29	-
Jordan	38.12	14.61	9.39	-	17.29	-
Kenya	10.09	11.28	-	25.60	8.02	-
Liberia	23.60	-	5.91	39.43	20.01	-
Nicaragua	40.49	-	-	19.72	13.58	-
Panama	71.26	-	-	12.24	6.56	-
Romania	-	-	-	9.70	5.31	37.53
Syrian A.R.	-	9.76	-	17.15	31.19	21.62
Thailand	12.66	-	-	10.82	45.71	-
Uganda	28.79	10.18	-	8.31	17.14	-
Venezuela	40.63	5.65	-	-	-	-
Western Samoa	19.86	5.95	-	33.03	43.54	-
U.S.	8.06	-	-	11.42	33.87	-
£ PEGGERS						
Barbados	29.99	23.77	-	-	10.09	-
Ireland	9.15	56.42	-	14.37	-	-
Mauritius	18.42	35.3	-		37.19	-
Sierra Leone	5.68	63.85	-	20.11	6.77	-
U.K.	14.2	(4.95	5.50	21.17	6.81	-

Table VIII (continued)

F. Fr. PEGGERS		$	£	FFR	SNAKE	FLOAT	CPE[1] & Oth
Central African Republic	('71)	9.98	-	58.97	16.28	7.46	
Congo	('73)	-	-	29.35	21.04	26.78	
Ivory Coast	('74)	7.05	-	30.37	27.33	13.10	
Niger		-	-	60.92	7.4	28.78	
Togo		-	-	45.69	42.78	-	
France			6.6	-	33.89	19.53	
SNAKE							
Denmark		5.80	17.11	-	38.21	8.97	
Germany		7.52	-	11.86	21.23	17.52	
Netherlands		-	9.14	9.80	48.25	8.3	
Sweden		5.34	12.23	5.23	36.32	10.12	
FLOATERS							
Austria		-	6.40	-	26.59	24.68	7.06
Finland		-	18.87	-	27.92		20.59
Iceland		29.38	9.95	-	10.23	23.49	10.94
Japan		34.25	-	-	-	9.51	
Malaysia		15.78	6.61	-	9.38	40.81	
New Zealand		24.46	20.19	-	6.76	15.63	
Singapore		23.83	-	-	-	34.21	
Spain		11.73	9.14	12.63	19.16	12.91	
Tunisia		16.28		21.73	5.11	36.7	

[1] Centrally Planned Economies and Other.

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 direct more exports to Japan alone than to 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 supported by previous export patterns. In 1974 Barbados exported more to the dollar area than to 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; by 1977 Argentina had dropped the dollar standard and was maintaining 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 Kenya and Western Samoa exported relatively little to the dollar area; by 1977 both countries had switched to a SDR peg. Although closely related to the dollar before 1971, since then the SDR exchange rate has been determined by the basket of currencies pegged to it.

As expected, the export allocation 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 Table VIII are roughly consistent with the story of Figure 1 in section V, 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. Next we turn to a more careful look at the role of market power, the last determining factor of Figure 1 .

Market Power

In the theoretical analysis of Part IV and V we concluded that both direction of trade and market power considerations are important determinants of exchange rate policy. We have argued that countries which direct most of their trade towards one currency area will probably peg their currency to that of the trading partner while countries with geographically dispersed trade should float or opt for an optimum-weighted peg depending on their relative market power.

In terms of the analysis of Part IV, exchange rate fluctuations in a country with symmetric market power on the export and import sides will not affect the country's terms of trade, as $\dot{r}$ drops out of equation (26). In that case, feasibility criteria for an optimum currency determine whether that country can float. On the other hand, if a country has market power on one side only, an optimum-weight policy can be found which will minimize the variance of the terms of trade.

Our objective here is to see whether there is in fact a systematic relationship between relative market power of countries and their respective choice of exchange rate regime.

In Part IV, market power on the export side was defined as $k = \frac{d_x}{d_x - s_x}$ with k = 1 if the country is "small", i.e. a price-taker in the export markets and $k \rightarrow 0$ as market power increases.

Similarly, market power on the import-side was defined as $k' = \frac{s_m}{s_m - d_x}$ with k' = 1 if the country is a price taker on the import-side and $k' \rightarrow 0$ as market-power increases. For a country with symmetric market power therefore, (of which "smallness" on both sides is a special case), the difference of k and k' is zero. Net export-side market power is indicated by a negative value for k-k' and net import-side market power by a positive value for k-k'.

Since price-elasticity estimates on export and import demand and supply curves are not readily available, we have developed market-power proxies for forty-one countries. Assuming that market power in any commodity is an increasing function of the country's share in world trade, we define export-side market power as,

(29) $$Z_x = \sum_i \lambda_i \delta_i,$$

where,

λ_i = the country's export share of commodity i in total world exports of i;

δ_i = commodity i as a proportion of the country's total exports, and

$\lambda_i \delta_i$ = the country's export share of commodity i weighted by the relative importance of i in the country's exports.

Similarly, market power on the import side is defined as

(30) $$Z_m = \sum_j \lambda_j \delta_j$$

where,

λ_j = the country's import share of commodity j in total world imports of j;

δ_j = commodity j as a proportion of the country's total imports, and,

$\delta_j \lambda_j$ = the country's import share of commodity j weighted by the relative importance of j in the country's imports.

Similar measures have been developed by Massell (1970) for his analysis of export earnings instability.

Given equations (29) & (30) above, the larger is the value of Z_x and Z_m, the greater is assumed to be the market power exercised by the country on the export and import sides. From our discussion above regarding k and k' we should note that our export-side market power estimate Z_x is inversely related to k while Z_m is inversely related to k'. Thus Z_x-Z_m is an increasing monotonic transformation of k' - k; positive values for Z_x - Z_m (or k'-k) indicate that the country has a net relative export-side market power whereas negative values indicate net relative import-side market power. Ideally, Z_x and Z_m should be calculated across all exports and imports. This being extremely time consuming, only each country's four most important exports and imports (in value terms) have been considered. The values obtained for Z_x and Z_m are usually good approximations for the "true" values of Z_x and Z_m even though they tend to underestimate export side market power for countries which are diversified in their export sector.[1]

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[1]High export diversification results in low values for di for any single commodity and thus a low overall concentration ratio dx = $\sum_i \delta i$ when only the four principal exports are included. This is usually the case for DC's as opposed to LDC's; even though some developed countries might have large shares of the world market for many commodities, restricting the estimate to four goods consistently underestimates their export-side market power. To give an example, whereas the four principal exports accounted for 97.94% of Zambia's total exports in 1974, the corresponding figure for the United States was only 24.57%.

This same bias does not arise on the import side as both groups of countries tend to spread their imports over a wide range of goods. The four principal imports (in value terms) in the United States accounted for 38.08% of all U.S. imports in 1974 while the equivalent percentage in Zambia is 29.27%.

So our estimates for Z_x and Z_x-Z_m tend to underestimate net export side market power for some developed countries.

Market-power indices for the forty-one countries in our sample are presented in Table IX ; data were obtained from the UN Yearbook of International Trade Statistics, 1975 and all indices were calculated using 1974 data except in the case of three countries, (Bolivia, Mexico, Peru) for which only earlier data were available. Columns 1 and 2 give estimates for Z_x and Z_m respectively while Column 3 presents an estimate of net market power, $Z_x - Z_m$.

Only in two cases, namely that of Japan and France, is $Z_x - Z_m$ negative indicating that these two countries have a relatively higher import than export side market power. Malaysia, mainly due to its exports of tin (48.88% of total world exports) and rubber (26.47% of total world exports) is the country with the highest overall net export side market power, followed by Ghana, Zambia and Chile.

How is net market power related to per capita income? Column 4 in Table IX presents 1975 per capita GNP figures in dollar terms for each country in the sample while Table X groups countries according to per capita income and presents the average value for $Z_x - Z_m$ in each category. Given our measures, countries with per capita income between \$500-1,000 have the highest average net export-side market power, countries under \$500 are next highest, and there is no clear relationship between income and market power above \$1,000.

Disaggregating net export-side market power to its components, Z_x and Z_m, we see that while import-side market power increases with per capita income, export side market power is highest for the \$500-1000 per capita income category; Z_x reaches its lowest value for countries with per capita incomes between \$2,000-\$4,000 and starts increasing again for the most

Table IX

Market Power Indices (1974[1]) and Exchange Rate Policy (1975-1976[2]) for 41 Countries

Countries	Market Power Indices on Export Side (z_x)	Market Power Indices on Import Size (z_m)	$z_x - z_m$ [3]	Y/N ($[4])	Exchange Ra Classificati 1975	197
1. Argentina	.0439	.0074	.036	1,590	FF[6]	FF
2. Australia	.0937	.0042	.090	5,640	PC	PC
3. Austria	.0070	.0033	.004	4,720	PC	PC
4. Barbados	.0019	.0001	.002	1,260	PS	PS
5. Belgium	.0279	.0091	.019	6,070	JF	JF
6. Bolivia	.0700 (72)	.0025 (72)	.068	377	n.a	n.
7. Brazil	.0815	.0139	.068	1,010	FF	FF
8. Burma	.0163	.0003	.016	110	PS	PC
9. Cameroon	.0322	.0003	.032	270	PS	PC
10. Canada	.0500	.0394	.011	6,650	F	F
11. Chile	.1240	.0044	.120	760	FF	FF
12. Colombia	.0600	.0015	.058	550	FF	FF
13. Denmark	.0386	.0039	.035	6,920	JF	JF
14. Ecuador	.0075	.0005	.007	550	PS	PS
15. Egypt	.0850	.0172	.068	310	PS	PS
16. France	.0171	.0247	-.008	4,910	JF	F
17. Gambia	.0059	.0004	.006	190	PS	PS
18. Germany	.0646	.0272	.037	6,610	JF	JF
19. Ghana	.1525	.0008	.152	460	PS	PC
20. Greece	.0091	.0027	.006	2,360	PC	FF
21. Iceland	.0313	.0019	.029	5,620	F	F
22. Israel	.0488	.0100	.039	3,580	PS	FF
23. Italy	.0318	.0266	.005	2,940	F	F
24. Japan	.1068	.1104	-.004	4,460	F	F
25. Malaysia	.1928	.0023	.190	720	PC	PC
26. Mexico	.0193 (73)	.0037 (73)	.016	1,190	PS	PS
27. Netherlands	.0393	.0115	.028	5,590	JF	JF
28. Norway	.0342	.0242	.010	6,540	JF	JF
29. Pakistan	.0402	.0032	.037	140	PS	PS
30. Peru	.0500 (71)	.0016 (71)	.048	810	PS	PS
31. Philippines	.0552	.0019	.053	370	PS	PS
32. Portugal	.0337	.0019	.032	1,610	F	F
33. South Korea	.0206	.0100	.011	551	PS	PS
34. Spain	.0144	.0140	.000	2,700	PC	PC
35. Sweden	.0374	.0105	.027	7,880	JF	JF
36. Thailand	.0529	.0018	.051	350	PS	PS
37. Turkey	.0278	.0037	.024	860	F	F
38. United Kingdom	.0324	.0303	.002	3,840	F	F
39. United States	.0881	.0825	.006	7,060	FF	FF
40. Uruguay	.0134 (72)	.0004 (72)	.013	1,330	FF	FF
41. Zambia	.1410	.0007	.140	540	PS	PS

Table IX : continued

Notes

1. Unless otherwise indicated
2. Exchange rate classifications for 1975 and 1976 are used, whereas the flexibility indices are computed for 1975.
3. Approximated to three decimal points.
4. Per capita Gross National Product in dollar terms computed for 1975
   Source: World Bank Atlas: Population, Per Capita Product and Growth Rates,
5. IMF Classification. See, IMF, "A Note on the Classification of Exchange Rate Policies", DM/77/78.
6. The following notation is being used:

   F = Independent Float; JF = Joint Float; FF = Formula Countries
   PC = Composite Peg; PS = Single Currency Peg.

Table X

GNP Per Capita ($-1975) and Net Market Power Index (Z_x - Z_m)

Y/N	Average ($\bar{Z}_x$ - $\bar{Z}_m$)	
$ 0 - 500	.0535	n = 9
$ 500 - 1,000	.0749	n = 8
$ 1,000 - 2,000	.0277	n = 6
$ 2,000 - 4,000	.0106	n = 5
$ 4,000 - 6,000	.0232	n = 6
$ 6,000 +	.0206	n = 7

Table XI

GNP Per Capita ($-1975) and Market Power on Export ($\bar{Z}_x$) or Import ($\bar{Z}_m$) Sides

Y/N	$\bar{Z}_x$	$\bar{Z}_m$
$ 0 - 500	.0567	.0032
$ 500 - 1,000	.0780	.0031
$ 1,000 - 2,000	.0323	.0046
$ 2,000 - 4,000	.0273	.0167
$ 4,000 - 6,000	.0492	.0260
$ 6,000 +	.0487	.0281

Sources: World Bank Atlas, 1976 and U.N. Yearbook of International Trade Statistics, 1975.

developed countries. This observed variation conforms to our expectations. Countries at low stages of development depend more-or-less exclusively on a few export commodities, and then, as they develop, tend to go through an import-substitution phase losing some of their export-side market power. At a later stage they start specializing according to lines of comparative advantage enhancing their market power on a new set of commodities.

Columns 5 and 6 of Table IX report the exchange rate regime of each country in 1975 and 1976 as officially described in IMF reports (Holden 1977, IMF 1977). Countries are identified as independent floaters (F), joint floaters (JF), countries which change their exchange rate parity according to formula (FF), and countries which have adopted a composite (PC) or a single peg (PS).

Between 1975 and 1976 six countries[1] changed their official classification as they opted for greater flexibility of their exchange rate.

In order to compare empirical results with the theoretical analysis of Parts IV-V, the following questions can be asked: (a) Do countries with extensive export-side market power tend to use a composite peg or formula flexibility as the theoretical analysis would predict? (b) Are independent floaters or single-peg countries usually characterized by symmetric market power and (c) in the case of those countries which decided to alter their exchange rate policies between 1975 and 1976, was the switch in the direction we would expect?

---

[1]Burma, Cameroon, France, Ghana, Greece, Israel.

In Figures 2 and 3 countries are grouped according to the Fund classification scheme along the horizontal axis. The vertical axis presents the net market-power estimates ($Z_x - Z_m$) from Table IX , and countries are identified by their respective number in Table IX .

Looking across classifications in Figure 2 we see that whereas the average net market power index is .0131 for Independent Floaters and .0211 for Joint Floaters, it rises to .0590 for countries under formula flexibility and .0580 for countries using a composite peg; it decreases to .0447 for countries which use a single peg.

The difference across groups is even more pronounced in 1976 with the average net market power for the countries using a composite peg increasing to .0654 as Ghana, Israel and Burma join the group.

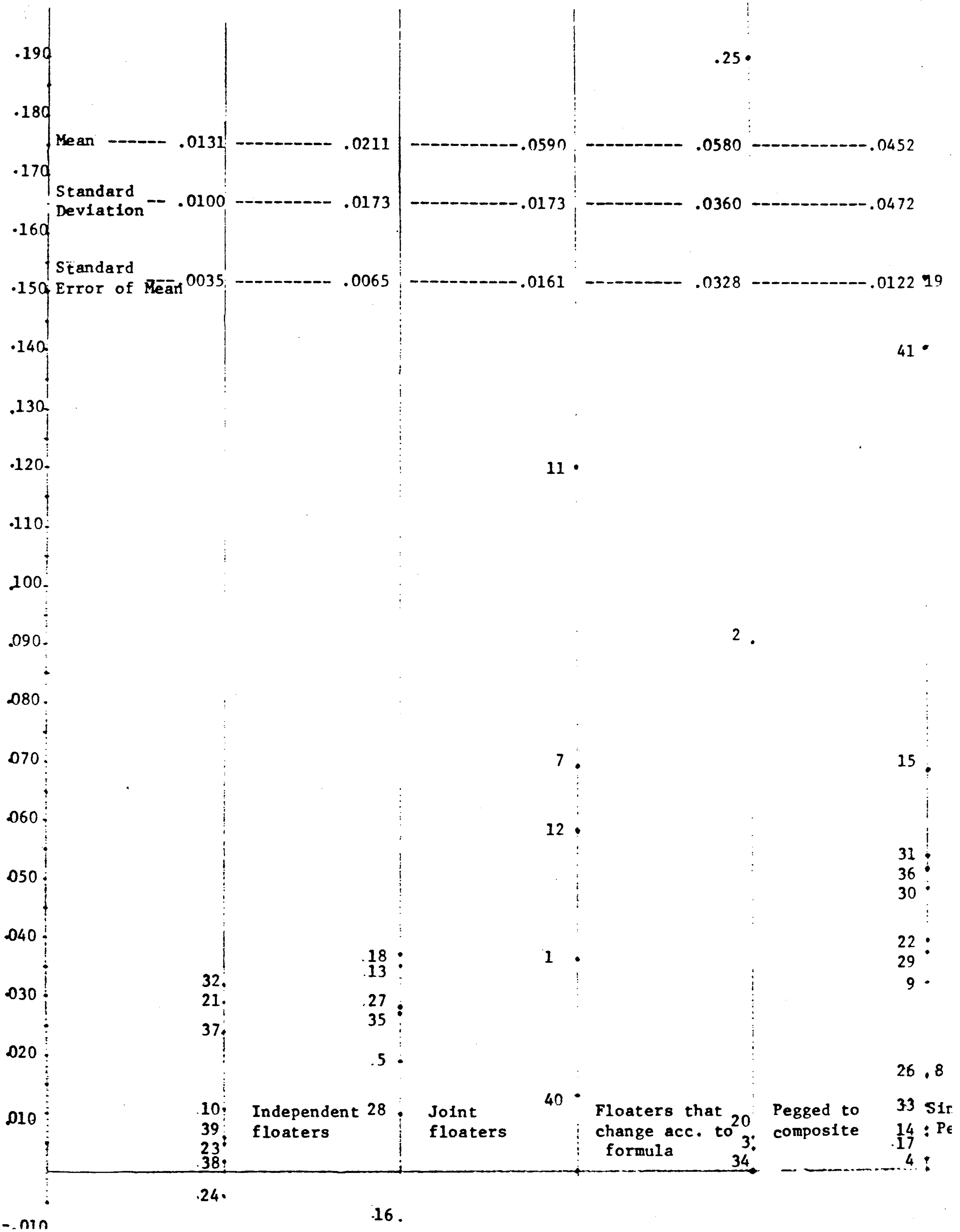
Thus it seems that it is indeed the case that countries which use formula flexibility or peg to a composite are countries which are characterized by significantly higher net export-side market power than those countries which either float or peg to a single currency.

Looking now at the countries which changed classification between 1975 and 1976 it is interesting to see that Ghana, Burma, Cameroon and Israel, all countries with net export-side market power, moved from single pegs to composite pegs as we would expect them to. The other two countries, France and Greece, moved to adjoining groups.

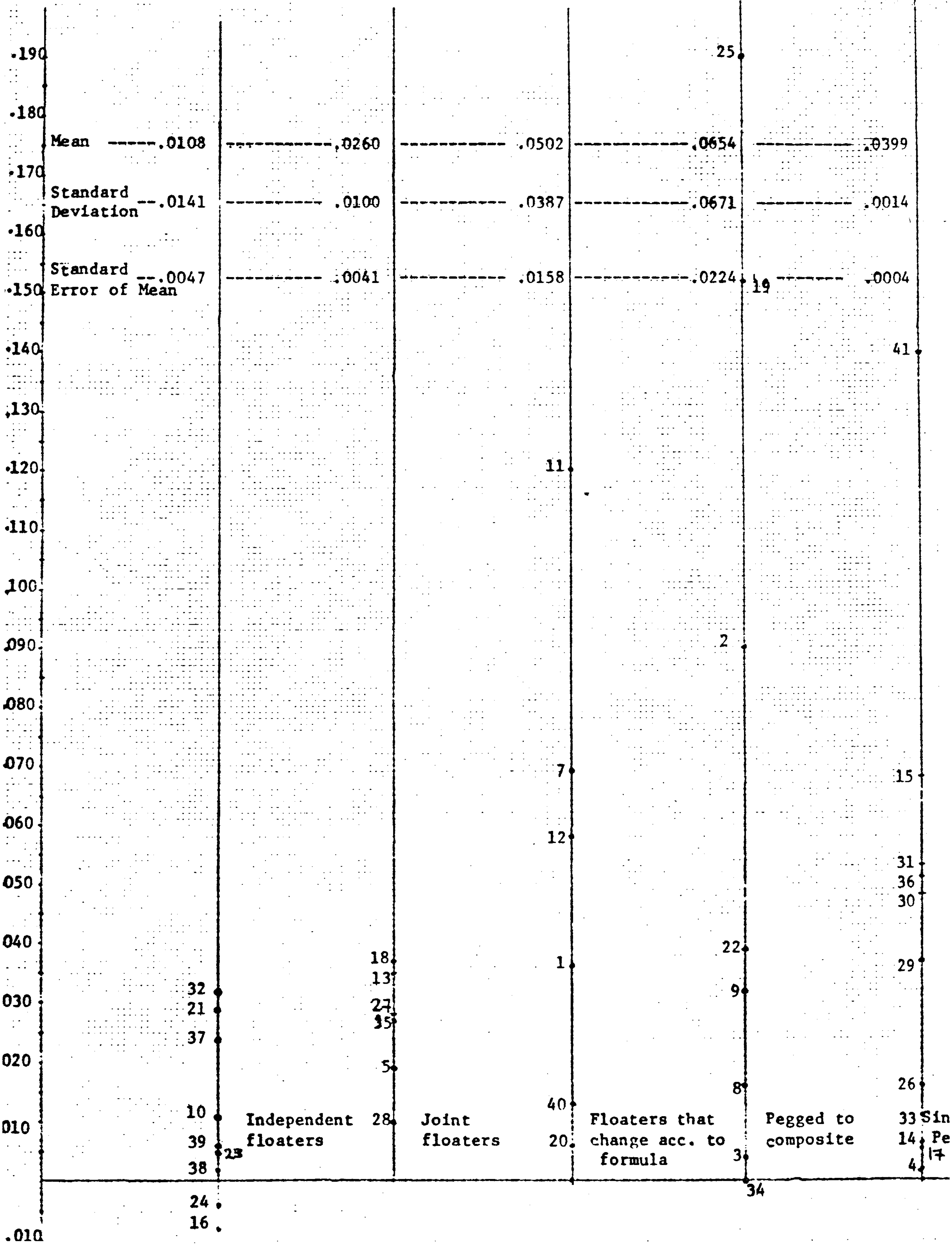
Looking back at Figures 2 and 3 it is interesting to note that some countries, such as Zambia (1975, 1976) and Malaysia (1975) have traditionally opted for a single peg even though they have considerable net export-side market power. As we have already seen, Malaysia shifted to a composite peg in 1976: for

Figure 2

MARKET POWER (1974) AND EXCHANGE RATE CLASSIFICATION (1975)



MARKET POWER (1974) AND EXCHANGE RATE CLASSIFICATION (1976)



Zambia, direction of trade considerations probably dominate over market-power considerations since copper (accounting for over 90 percent of the country's total exports) is primarily directed to the pound currency area. Our predictions as to net relative market power and exchange rate policy would be strengthened if we included in our sample the OPEC countries. At least two countries, Iran and Kuwait, used composite pegs in 1975 and 1976. (Holden, Suss 1977).

On the other hand it is hard to explain at least according to market-power criteria why Austria and Spain, both countries with symmetric market power, chose a composite peg policy.

It will be interesting to see in the next few years whether or not these countries will re-evaluate their exchange rate policies and whether or not more countries with export-side market power will opt for composite pegs; if they do so, a proper choice of weights can indeed minimize the variance of their terms-of-trade.

In this concluding section of the paper we seem to find adequate support for the hypotheses presented in Part V regarding the effects of income levels, geographic concentration of trade and market power on the choice of exchange rate regimes. Even though the results are most tentative, they seem to indicate that exchange rate policy is at least partly determined by the structural characteristics of each economy which might often, however, point to different directions. In those cases, policy-makers are left with the difficult task of ranking alternatives and assigning weights to the various options.

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