

PRINCETON STUDIES IN INTERNATIONAL FINANCE NO. 27

# The Demand for International Reserves

M. June Flanders

INTERNATIONAL FINANCE SECTION  
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IN INTERNATIONAL FINANCE

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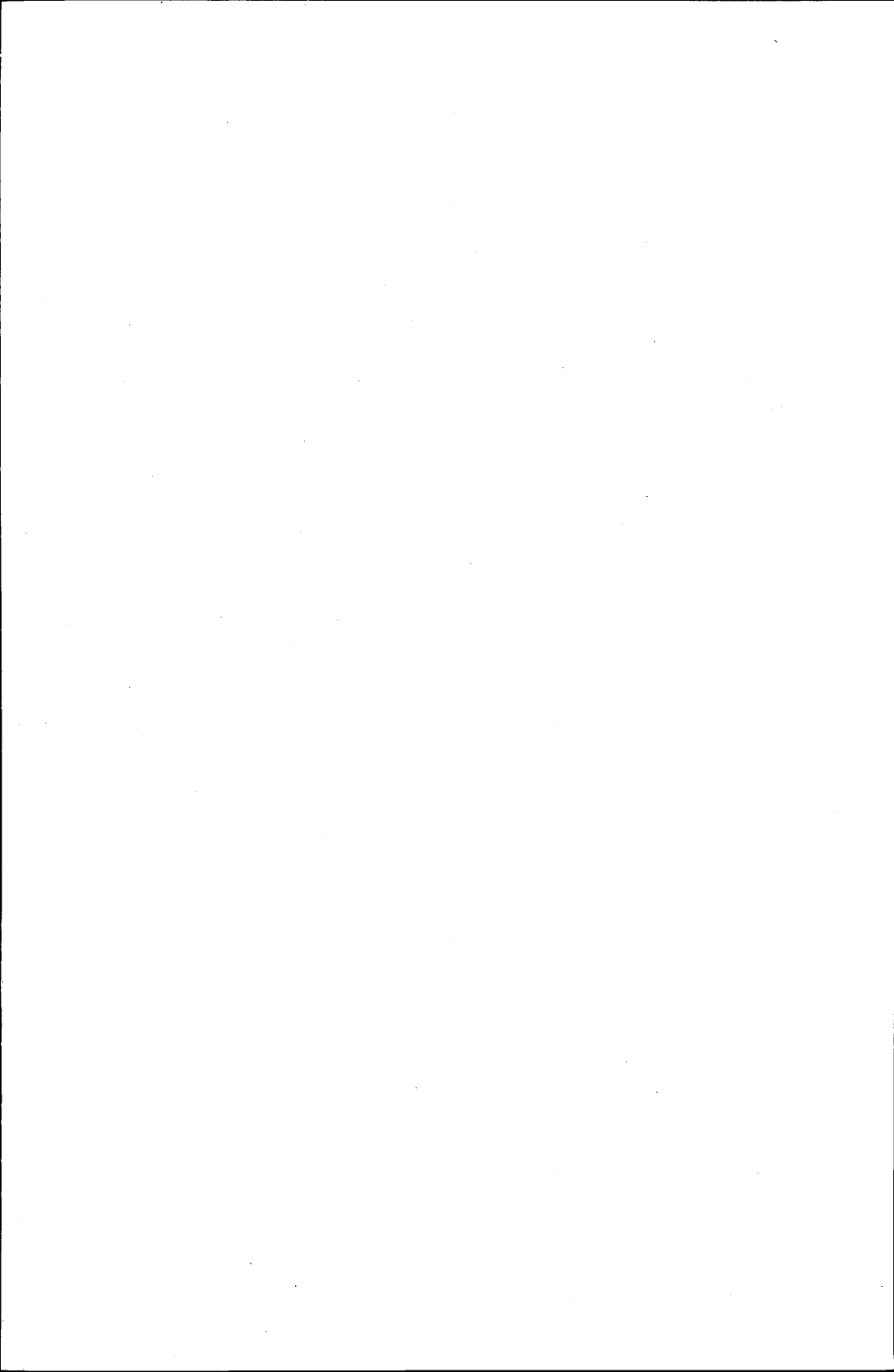
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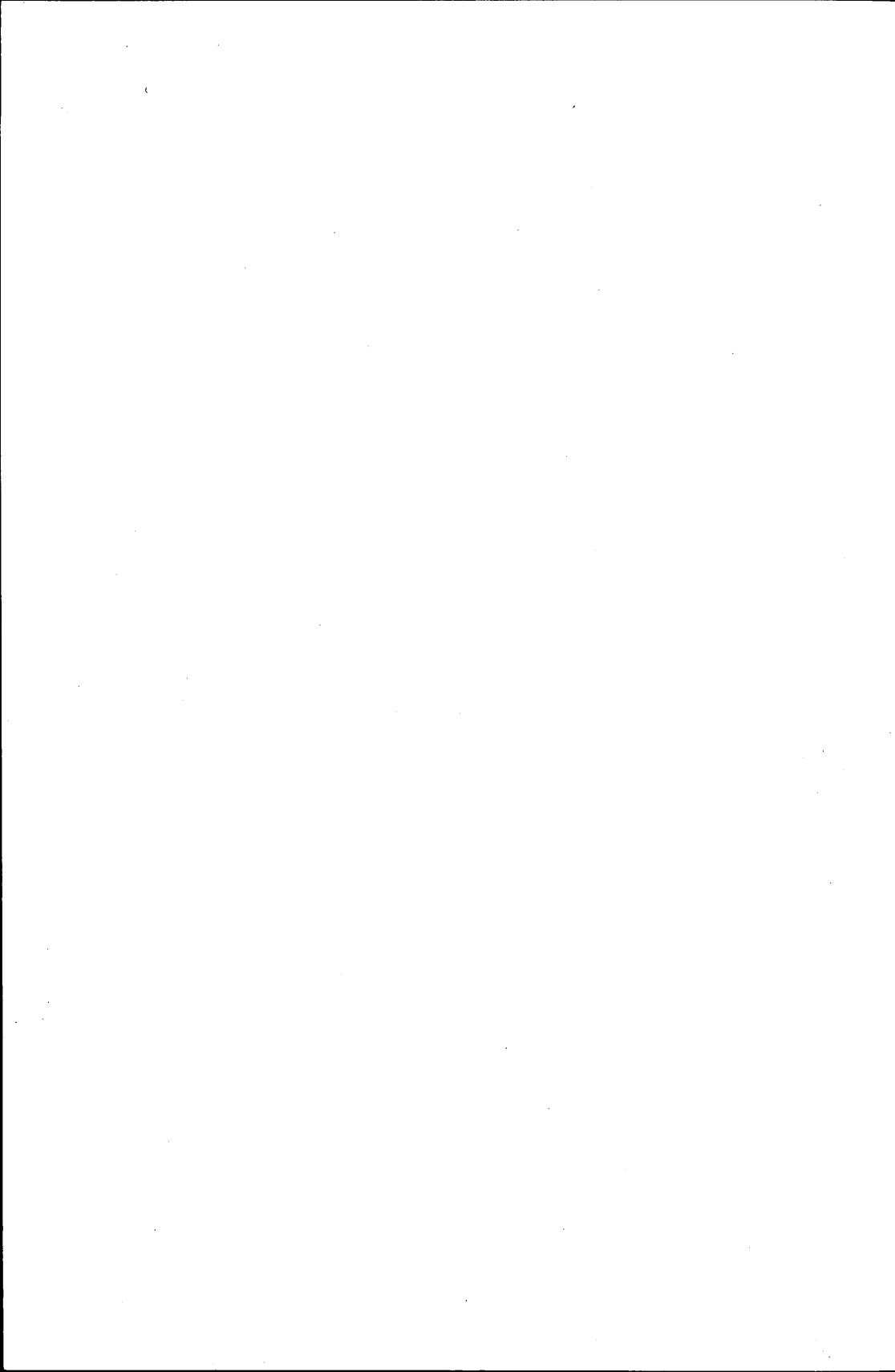
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FRITZ MACHLUP  
*Director*

*Princeton University*





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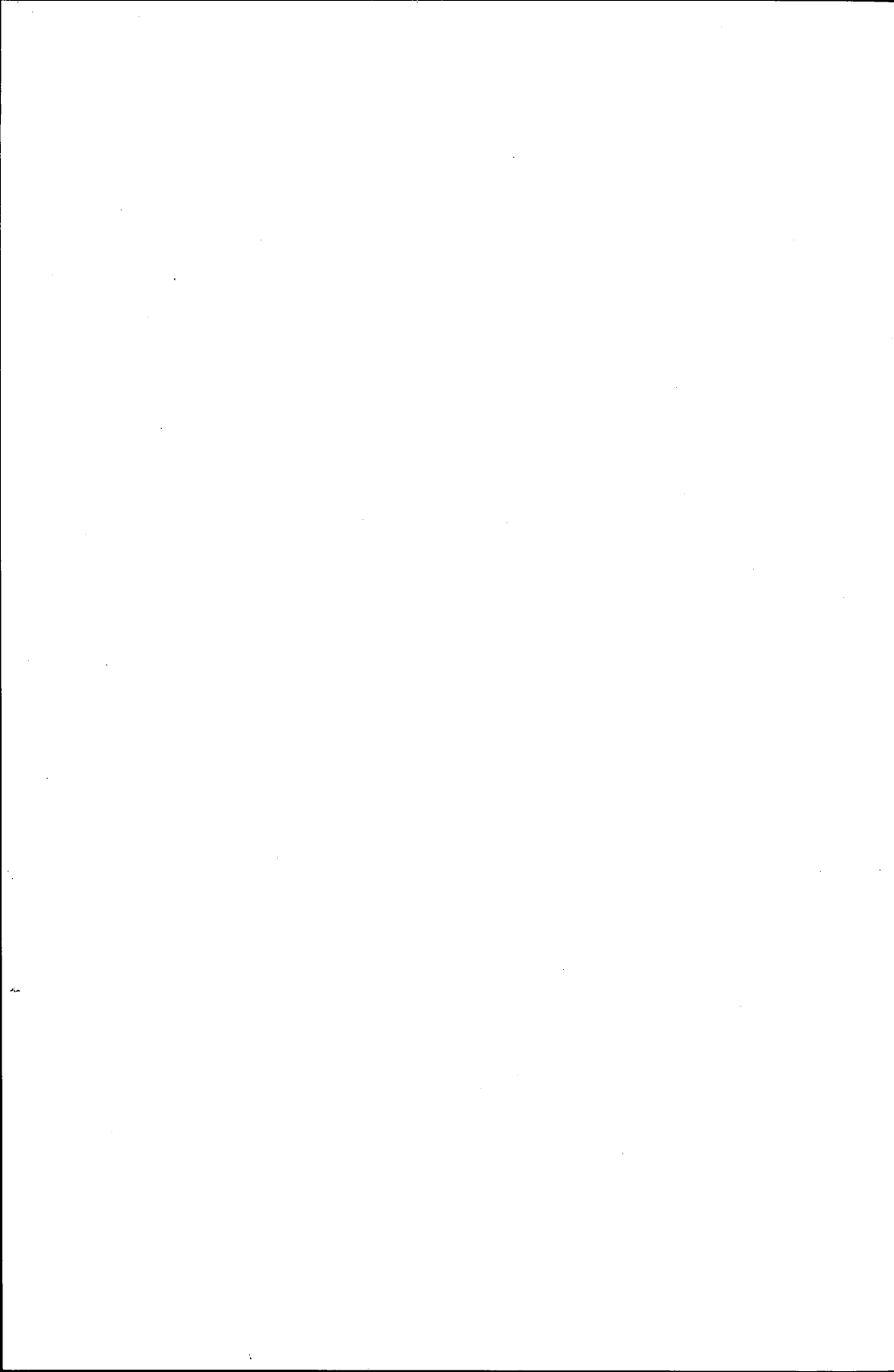
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# THE DEMAND FOR INTERNATIONAL RESERVES

## I. INTRODUCTION

The purpose of this study is to attempt to answer two questions. First, is it possible to explain the behavior of less developed countries (LDC's) in determining their holdings of international monetary reserves? Second, is it possible to make any statements regarding the adequacy of reserves of a particular (less developed) country? The reasons for concentrating this analysis on LDC's will be discussed in detail below. For the moment I note simply that there has been much written and said about the adequacy of the reserves of this particular group of countries; furthermore, there are reasons for expecting their behavior to differ from that of the developed, industrial, rich nations of the world.

First, a brief lexicon may be useful. Until recently it was common to speak of international liquidity and international reserves synonymously. Of late, however, a number of writers have offered definitions (and even measurements) of liquidity which are different from the sum of international reserves.<sup>1</sup> I therefore reluctantly eschew the use of the term liquidity, and, for variety's sake, I use the terms international reserves, reserves, and international money interchangeably.

The analysis is confined to a consideration of gross, owned, official reserves. The figures used are those reported by the IMF for the holdings by monetary authorities<sup>2</sup> of gold and foreign exchange, plus

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<sup>1</sup> See, for example, Machlup (1966), Kane, Cohen.

<sup>2</sup> There are some problems even here: Australia, for example, reports to the IMF the foreign-exchange holdings of the monetary authorities and commercial banks combined, and separate figures are not available. Panama, on the other hand, has no central bank, and all foreign exchange is held by commercial banks. Furthermore, there are differences between countries in what is included in "official

reserve positions at the Fund.<sup>3</sup> I employ this simple, gross concept of reserves for several reasons: (1) it is relatively easy and straightforward to collect data for it; (2) the figures are comparable, both over time and between countries; (3) it is conceptually unambiguous, and (4) in terms of our analysis, this is precisely the item we wish to examine. Just as studies of individual monetary behavior concentrate their attention on the cash balances (rather than the overall balance sheets) of firms and individuals, we shall be exploring the patterns of "cash holdings" of countries.<sup>4</sup>

International money is that which countries use to settle up net imbalances in their overall payments, either directly, or by entering the foreign-exchange market to support the exchange rate. If there is a tendency to imbalance in payments, the authorities have three choices: they can *adjust* by taking various actions designed directly or indirectly to affect the levels of payments and receipts; they can *borrow* by negotiating loans from foreign governments or individuals, or by adopting policies designed to encourage short-term capital inflows; and they can *finance* by drawing down their reserves.<sup>5</sup>

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holdings": some countries list holdings only of the central bank, others include exchange-equalization accounts, and still others include government holdings *in toto*. But these differences may reflect not arbitrary decisions as to what to report statistically but real institutional differences as to the ability of the monetary authorities to muster and utilize reserves held outside of the central bank. If that is the case, the lack of uniformity in reporting is appropriate. The definition of foreign exchange in the IMF's *International Financial Statistics*, which is the source of our data, is ". . . holdings by monetary authorities (central banks, currency boards, exchange stabilization funds, and Treasury holdings to the extent that treasuries perform similar functions) of bank deposits, Treasury bills, short and long-term government securities, and similar items when denominated in convertible currencies. In some cases . . . the data include holdings of government agencies other than the monetary authorities." (*IFS*, June 1967, p. 14.)

<sup>3</sup> The IMF Reserve Position is necessarily positive and represents the amount which a country may draw *unconditionally*, since it consists of the gold tranche plus the indebtedness of the IMF (generally the result of the Fund's having made use of the General Arrangements to Borrow).

<sup>4</sup> See Machlup (1966), pp. 2-3, for an excellent defense of this approach.

<sup>5</sup> These categories are analogous to, but not identical with, those established by Machlup (1965a) and Heller (1966). Machlup has three categories, real adjustment, which is the same as ours; compensatory corrections, an intermediate set of real or financial events, either happy accidents or restrictive direct controls, which eliminate the need for adjustment; and temporary financing, which is the sum of what I have labeled borrowing and financing. In our schema, there is no room for happy accidents (since we are concerned with policy measures taken to eliminate imbalances); as for direct controls, they are included in adjustment. Heller, on the other hand, has a simplified model in which there is either real adjustment or financing through the use of reserves.

## II. WHY DO COUNTRIES NEED RESERVES?

We are considering official reserves, so the word "country" is used to denote the decision-making agencies, the monetary authorities, of the several countries. Three sources of the need for (and demand for) international money come to mind. First, analogously to the conventional notion of the transactions demand, is the need for international money to settle regular, recurring imbalances, as well as ". . . systematic and random fluctuations in current account receipts and payments."<sup>6</sup> The extent to which regular, seasonal, predictable imbalances will arise is largely a function of institutional arrangements. First, the nature of a country's export and import trade in particular and its payments and receipts structure in general will determine whether and how often periodic, and seasonal, imbalances arise. Second, the degree of development of the private foreign-exchange market will determine how much of the periodic imbalances are settled in the private sector and therefore how much remains to be settled by a drawing down of official reserves. To the extent, therefore, that a country does not have an efficient and highly developed money and foreign-exchange market, the authorities may feel the need to keep larger transactions balances than otherwise. On the other hand, the more centralized the government's control over the foreign-exchange market, the more able it will be to withhold licenses, postpone payments, and generally smooth out transactions in such a way as to avoid fluctuations rather than offset them by drawing down reserves. Yugoslavia, for example, has had the lowest ratio of reserves to imports of any member country of the IMF. Probably the most difficult situation is that of a country with relatively free foreign-exchange transactions but poorly developed banking and financial institutions.<sup>7</sup>

<sup>6</sup> Clower and Lipsey, p. 587. Machlup follows essentially the same approach (1966, p. 10). Heller (1968), in discussing the transactions demand for international money, deals with day-to-day transactions, but he relates these to *commercial banks'* holdings of foreign exchange, which is quite a different story. In his 1966 paper he similarly interprets transactions demand in terms of day-to-day transactions, but again, consistently, assumes that the monetary authorities do not hold transactions balances.

<sup>7</sup> One might argue, however, that the state of development of the foreign-exchange markets of one's trading partners is also important. Thus, a country with a poorly developed foreign-exchange market may have no trouble financing its imports in the foreign-exchange and money markets of its major supplier(s). In the empirical study, no attempt has been made to estimate this "good neighbor" effect. To the extent that it exists, it may help to explain the poor performance of

Second, in addition to demand for reserves for such short-term, seasonal needs, a country may wish to hold "precautionary" balances, to meet unexpected declines in earnings, due perhaps to war (at home or elsewhere), crop failures, sudden changes in capital movements, and similar exogenous disturbances.

We say a country *may* want precautionary balances. It is possible to argue that it should not hold such balances. For example, a report published by UNCTAD states the following (p. 12): "Most countries, whether developing or developed would wish, as an ideal, that reserves were sufficient in quantity to meet such fluctuations as might normally be expected in the light of their experience, while access to credit would handle contingencies whose scale and character could not be foreseen." One could, however, argue conversely. If a country has access to borrowed funds at relatively low rates in order to meet expected fluctuations, it may be rational to borrow extensively for such purposes. At the same time, it may be necessary or desirable to finance catastrophic or episodic shortfalls by drawing down owned reserves, since borrowing may be more difficult and costly in such situations; a country's creditworthiness is more likely to be questioned at times of sudden crisis than in the normal course of economic fluctuations.

Third, and perhaps most important for less developed countries, is the systematic, but somewhat irregular, fluctuation in earnings due to shifts in the demand for exports, affecting prices or quantities, or both. Whether reserves held to meet such contingencies should be labeled precautionary or transactions balances is not obvious. The answer depends on the degree of predictability of such fluctuations and also, heavily, on the kind of adjustment process that is posited. The adjustment mechanism determines not only the name we wish to assign to such balances, which is not particularly important, but also their appropriate level, which is important.

Consider three prototypical situations:

1. If a country considers its level of earnings for the next five or ten years to be known, and if it sets its expenditures equal to average earnings, then we can view the reserves as transactions holdings, their purpose being to smooth out the effects of year-to-year changes in earnings. The time horizon is longer than the one usually thought to

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the variable representing the size of the private foreign-exchange market. My thanks to Richard Caves for drawing attention to this point.

be relevant for transactions demand, but the principle is essentially the same. The required level of reserves will depend in this case on the cumulative negative deviation of earnings from their average. This is the prevalent model in discussions of the optimum level of reserves for LDC's.

2. If the policy decision is to adjust spending fairly quickly to changes in earnings (for example, with a one-year lag, so that expenditures are always equal to last year's receipts), a much smaller level of reserves will be adequate. This is the mechanism implied by Kenen and Yudin in explaining differences between the reserve fluctuations of developed and underdeveloped countries: "One would expect—and one finds—that the changes in reserves for . . . [the less developed] countries are more nearly random than those for the [developed] countries. . . . Most of the underdeveloped countries still use strict exchange controls and have small reserves. Any enduring payments disturbance is usually met by changes in direct controls, so that the monthly changes in reserves should be regarded as the consequences of imperfect synchronization in exchange control, rather than the measure of payments disturbances."<sup>8</sup>

3. At the other extreme, if the intention is to maintain spending at the existing level for as long as possible in the hope that any downturn in earnings will reverse itself eventually, the level of (precautionary) reserves that will be required must be very large indeed (in principle, infinite). This, by the way, is the implicit model which underlies much of the current discussion of the adequacy of reserves for the world as a whole.<sup>9</sup>

In this study I have applied, alternatively, the first two hypotheses. The demand for international money is considered to be dependent, *inter alia*, on two different measures of fluctuations in earnings. In one case, fluctuations are measured in terms of deviations from trend, which is consistent with the first type of adjustment mechanism. In the other case, fluctuations are measured as percentage year-to-year changes. The implications of these methods of measuring variability will be discussed in greater detail below. I have thus far been unable

<sup>8</sup> Kenen and Yudin, p. 244, footnote.

<sup>9</sup> One of many examples of this position (Harrod, p. 55) states: "Countries should be able to allow . . . imbalances to run on for a time, until further prospects become clearer and natural forces have had time to exert themselves. Other illustrations could be given from industrial countries in recent years, where reserve shortages have led countries to adopt restrictive or deflationary measures, although the deficits were likely to be ironed out in due course."

to devise a method of testing the proposition that some countries employ the first kind of adjustment mechanism and other countries the second kind; nor have I been able to test the hypothesis that there are changes over time with respect to the basic type of adjustment mechanism used.

Note that most statements about the adequacy of the international reserves of the developing countries assume that the first mechanism either is or ought to be the adjustment process and that LDC's *ought* to have adequate reserves to permit them to adopt such a policy. This is generally based on arguments about the high cost of frequent adjustment, particularly for developing countries, for whom adjustment often involves reducing the imports of goods required for development programs.

The third hypothesis, that of nonadjustment, is not testable within the framework of our model and with the type of data and method we have used. For that matter, it is probably not testable at all. Nevertheless, it is possible that it presents an accurate picture of the world, which may be the reason our results are so poor. In fact, I have argued elsewhere that the behavior of the developed countries, at any rate, is very close to that suggested by the nonadjustment model.<sup>10</sup>

<sup>10</sup> See Flanders (1969). Paradoxically, many (if not most) arguments about the adequacy of liquidity for the whole world are based on the third adjustment mechanism, as has been noted. Since the kinds of adjustment described there are generally thought to be those involving unemployment, deflation, and retardation of growth, stemming from macroeconomic policies generally pursued by the developed countries, it is presumably these countries that the authors have in mind when they argue, in effect, that countries should never have to adjust. The inequity of the established wisdom of the profession is revealed: LDC's should have enough reserves to enable them to adjust their imports to long-term trends; developed countries, on the other hand, should have enough reserves to enable them to go on forever without adjusting.

### III. WHAT IS SPECIAL ABOUT THE LESS DEVELOPED COUNTRIES?

Alongside the discussion of the adequacy of international reserves and the need to reform the international monetary system has been the question of the adequacy of the reserves of the LDC's as a group. The arguments for increasing the reserves of the LDC's vary: some are essentially emotional arguments based on some notion of equity, others are pleas for increased reserves that are in fact based on income rather than liquidity considerations, still others stress the particular needs of the LDC's based on actual or assumed peculiarities of their trading patterns and economic structure.

Among the emotional arguments is the statement that the official plans for reform of the international monetary system are unfair in that the immediate and direct beneficiaries of these plans would be the developed, industrialized countries, that is, the rich. The usual reply to this is that increases in the stock of international money will redound to the benefit of the LDC's in the form of increased aid from rich to poor countries or increased willingness on the part of the rich to liberalize their trade as they find themselves freed of the balance-of-payments constraints imposed upon them by a worldwide shortage of reserves. This, in turn, is generally rejected by some champions of the LDC's as sophistry, analogous to the assertion of the rich man that his great wealth and income, by enabling him to give charity, benefit the poor. The issue further becomes deeply involved in a maze of political questions: if the mechanism for increasing international reserves becomes entangled with the arrangements for extending foreign aid to LDC's, will the developed countries accept the plan? If they do accept it, will there be a net increment to the total amount of aid granted to less developed countries, or will this simply substitute one form of aid-giving for another? We shall not pursue this matter here.<sup>11</sup>

<sup>11</sup> Machlup (1965b) discusses this question in considerable detail. Scitovsky 1966(a) has developed an ingenious positive-sum plan for increasing reserves by paying developed countries with unemployment and balance-of-payments deficits to produce goods which less developed countries want. Everybody gains: the developed countries get a stimulus to domestic employment plus financing of their payments deficit; the goods they give up in exchange have zero opportunity cost; the developing countries get additional resources. While the plan is not completely free of ethics, as Scitovsky claims, nevertheless it is based on an ethical proposition that is likely to be more generally acceptable than most of the other arguments. The usual ethical argument is: the rich countries should not be allowed

A number of statements on the need to relate international monetary reform to the LDC's involve the idea, as stated above, of an income transfer. Others simply take it as self-evident that LDC's need more reserves. In some cases this seems to stem from a confusion between liquidity and income problems. If a poor, underdeveloped country has a low income (and related to this, little cash), what it needs is more income, not more liquidity. The fact that over some time period imports are constrained by the level of exports—more precisely that payments are limited by receipts—is not a problem of inadequate reserves. That LDC's would like to spend more than they receive is probably true; but an explanation for the phenomenon must be sought either in the overall level of income, which is low, or in various institutional and economic phenomena which create imbalances between the propensity to import and the ability to earn foreign exchange. Lest I be accused of beating a dead horse and overstating the obvious, let me quote briefly one of many statements which fail to make this distinction clearly. The UNCTAD report of the Group of Experts states (p. 7):

The flow of long-term capital and aid to developing countries has also been inadequate and has to a large extent merely offset the adverse effects of the trends in world trade. Apart from the moderate dimensions of such assistance . . . the total value (net of capital repayments) of grants, loans and equity capital flowing annually to the developing countries has remained unchanged since 1961: . . . the real equivalent of the aid forthcoming has fallen over this period. All this has not only affected economic growth in the developing countries but subjected their monetary reserves to acute pressure.”

And again, because of the hard terms of much assistance “. . . soon after such aid is received, developing countries are confronted with serious problems of debt servicing and repayment accentuating the pressure on their balance of payments” (p. 9). I emphasize that I am attempting neither to deny the importance of these problems nor to defend the equity of the world distribution of income, but merely to separate two different issues.

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to get out of their balance-of-payments predicament without giving up something to the poor countries at the same time. Scitovsky's proposal states: in solving their payments problems, the rich countries ought to give the poor countries something which does not cost them anything anyway.



Where the income and reserves problems may merge is in a rather different arena. If it is true that the lack of adequate international reserves (for the world as a whole) is causing developed countries to have more serious balance-of-payments problems than they otherwise would, and if this in turn is leading to a reduction in the levels of development aid, then we can argue that the income problem is caused at least in part by the inadequacy of reserves. But if this is the case, increasing the reserves of the LDC's is not the answer. The appropriate remedy here, as Johnson, *inter alia*, suggests (Ch. VII) is to ease the payments problems of the developed countries by adopting a more expansionary institutional arrangement for determining the overall level of international money. In this context it is probably more important to see to it that reserves are *increasing* than that they attain any particular *level*.<sup>12</sup>

The assertion that LDC's have inadequate international reserves is usually (when not considered as simply self-evident) based on some or all of the following casually empirical statements:<sup>13</sup>

1. LDC's are in general more dependent on trade than the developed countries. They trade more, as a percentage of their gross national product (GNP), and changes in their exports have greater impact on their national income.

2. A high percentage of their exports consists of primary products. Primary products fluctuate in price more than industrial goods.

3. Their trade is more concentrated, that is, they export fewer different goods. The result of these three phenomena is that LDC's experience more severe fluctuations in trade and that these fluctuations have more serious effects on domestic income than is the case for the developed countries.

4. The imports of the LDC's are less compressible than those of the developed countries, that is, their imports are more necessary to sustain current income levels and more essential to further growth and development.

5. The LDC's have smaller reserves than the developed countries.

6. The reserves of the LDC's have been declining, or declining

<sup>12</sup> See Machlup (1966), Flanders (1969) for a discussion of the arguments leading to this conclusion.

<sup>13</sup> In many cases the statements about reserves are casual also in the sense that it is not clear whether one is talking about absolute levels of reserves or reserves in relation to some other magnitude, such as the level of trade. We shall return to this point in considerable detail.

more rapidly or rising less rapidly than those of the developed countries.

Let us consider these arguments in turn. The first three have been subjected to careful scrutiny by a number of investigators, notably MacBean, Coppock, Massell, and Michaely.

Regarding point 1, MacBean cites both Kuznets (pp. 89-107) and Michaely (Table 17) to the effect that there is no evidence that trade constitutes a higher proportion of output in underdeveloped than in developed countries. Michaely's figures indicate that the contrary may indeed be the case. He classifies countries into large and small (by population), developed and underdeveloped (by per capita annual income). For each country the average ratio of exports to GNP for the period 1950-56 is computed. Within each size classification the average ratio of exports to GNP is somewhat lower for underdeveloped than for developed countries. These differences are small, and as Michaely points out (p. 111) probably not significant, for a number of reasons. However, there is certainly no evidence from these figures that the usual presumption, of greater trade participation on the part of LDC's, is valid. Coppock (p. 85) ranks 80 countries according to their participation in trade (exports plus imports) as a percentage of GNP, and the top 30 countries include the following developed countries: Netherlands, Norway, Belgium-Luxembourg, Ireland, Denmark, Switzerland, Sweden, Austria. West Germany follows closely in thirty-third place.

Furthermore, Coppock finds a negative correlation coefficient,  $-.30$ , between foreign trade as a percentage of GNP and export instability (p. 86).

The one shred of mildly supportive evidence on this issue is a weak tendency, which Michaely finds (p. 111) for ". . . countries with a high degree of commodity concentration of exports—in distinction from underdeveloped countries . . . to have a high ratio of exports to the national product."

It is worth noting that even if proposition 1 were correct, it is not at all clear that increasing the reserves of the LDC's would remedy this situation. The argument that greater reserves would permit countries to smooth the effect on *income* of fluctuations in earnings rests on the assumption that domestic expansionary policies to counteract the multiplier effect of declining exports are constrained only by a shortage of foreign exchange. It is not difficult to adduce many other

obstacles facing LDC's in implementing the usual macroeconomic policy tools to smooth out the effects of external disturbances on domestic incomes, particularly where the foreign sector constitutes a large part of the market economy.

With respect to point 2, that a high percentage of the exports of LDC's consists of primary products, there is no doubt of the accuracy of this statement. Casual observation is supported by the data here. The inclusion of service exports would change the percentages, but the order of magnitude is so large that this is unlikely to alter the general conclusion. In 1965-66 developing countries exported in total \$37.6 billion worth of goods (f.o.b.), of which \$32.4 billion were primary products and \$5.1 billion were manufactured goods (GATT, p. 37).

As to the concentration of trade, Michaely computes the coefficients of commodity concentration of exports, for large countries and small, and for developed and underdeveloped countries. He finds significantly higher concentration indices for underdeveloped countries, both large and small, than for either group of developed countries (p. 16). This is not surprising, in the sense that it reinforces casual observation.

The conclusion that is generally drawn from statements 2 and 3 together is that countries whose exports are highly concentrated and/or whose exports are composed largely of primary products experience greater instability in export earnings than others. Investigations thus far have failed to confirm this generalization, however. Massell, for example, concludes that the relationships (a) between instability of export earnings and concentration of exports and (b) between instability and the ratio of primary products to total exports, are both highly tenuous.<sup>14</sup> Coppock, using a different measure of export instability has computed simple linear correlation coefficients between the index of instability and other variables, as follows (pp. 114-15):

Export commodity concentration index: 78 countries,  $r = .03$ ;

Percentage of exports in one commodity: 66 countries,  $r = .02$ ;

Per capita GNP, 1951-57: 30 countries,  $r = -.04$ ;

Per capita GNP, 1957: 80 countries,  $r = -.23$ ;

Foreign trade as per cent of GNP: 80 countries,  $r = -.30$ .

<sup>14</sup> However, he suggests, erroneously as we have seen, that the concern with instability of earnings of LDC's may be due to a greater participation in trade. "Also, primary-producing countries tend to depend more heavily on exports as a source of income than do industrialized countries, so that a given degree of export instability has a greater impact on the economy of a primary-producing country" (p. 62).

The most one can conclude, then, is that there is perhaps some weak tendency for poor (low-income) countries to experience more volatility in their exports than higher-income countries. The tendency is not pronounced, however, and none of the presumably underlying causes, such as a high degree of commodity concentration in exports or a high ratio of trade to GNP, seems to explain it.

Point 4, regarding the compressibility of imports, is a difficult one to assess. It surely has some merit, and probably tends to be reinforced over time as LDC's take on ever growing debt-servicing burdens and as they attempt to diminish "nonessential" and luxury imports by direct controls and by import-substituting industrialization. (One might argue, however, that imported parts for domestically produced automobiles are no more essential than imported cars.) The concept is a difficult one to formulate precisely, much less to quantify.

As for point 5, LDC's as a group certainly have smaller foreign-exchange reserves than the developed countries. In 1965, the "Industrial Nations" and "Other Developed Areas" together accounted for 84.1 per cent of the world's total holdings of gold and foreign exchange, plus reserve positions in the IMF.<sup>15</sup> This is a meaningless number, however, since the LDC's also have a relatively small share of world trade, of world income, and so on. If we consider ratios of reserves to imports, the picture changes radically. I shall not here attempt to defend the use of this particular ratio; this is a matter that will receive more detailed attention subsequently. The IMF *Annual Report* for 1966 gives ratios of reserves to imports for every year from 1951 to 1965. The figures for the beginning and end of the period, in per cents, follow:

	1951	1965
For the world as a whole	67	43
Excluding the United States	39	39
Developed countries, including the United States	68	43
Less developed countries	64	42
Less developed countries, excluding the oil countries and certain others*	41	42

\* The other countries excluded were those with initial high reserves: Ceylon, Ghana, India, Pakistan, Sudan, United Arab Republic.

The figures do not indicate, by themselves, either a great difference

<sup>15</sup> *IFS*, 1966-67 Supplement, p. iii.

between LDC's and developed countries in the level of reserves, or a great divergence in trends over time.

Since most of the empirical generalizations listed above have been found to be questionable, what are the reasons for expecting less developed countries to have different reserve needs, or demands, than developed countries?

First, as has been noted, there does seem to be some tendency for low-income countries to experience more instability in their export earnings than high-income countries. Even if the degree of volatility were the same, however, one might argue that this would affect the low-income countries more. Massell suggests that when incomes are low, even small changes in earnings can have large disutilities attached to them. The same may be true of imports. For a poor country, the need to reduce imports when exports decline may cause greater disutility than for a rich country. This can be related to the "compressibility" argument. If a high percentage of imports consists of wage goods, raw materials, and capital goods, a decline in those imports may reduce social utility more than an equivalent percentage decline in imports of luxury or nonessential goods. Furthermore, a decline in imports now may have a greater effect on the growth of income, hence on future income, for a less developed than for a developed country. This may result from a decline in imports constituting a bottleneck and preventing or postponing the completion of development programs.

In addition, if there are exchange controls and other restrictions, this implies that the exchange rate is inappropriate. The correct shadow price of foreign exchange is higher than the official or market rate. The market value of imports therefore understates their utility to the economy, and the nominal decline in imports understates the real loss.

There may also be a difference due to discontinuities in alternatives. If a less developed country produces a smaller number of goods that are close import substitutes than does a developed country, it has less flexibility in its short-run consumption pattern. For this reason, a cut in imports of the same proportion may impose a bigger burden on the developing than on the developed country.<sup>16</sup>

Second, it is frequently argued that, if LDC's do not have smaller reserves than developed countries, they should have. The reasoning

<sup>16</sup> My thanks to Richard Caves for this argument.

here is that the opportunity cost of holding reserves is higher for the developing than for the developed countries, since the marginal utility of imports, both for present consumption and for investment, is higher in the low-income, developing countries. The argument is analogous to the statement that low-income households appropriately have less money, and generally fewer assets, even in proportion to their income and expenditure, than do higher-income groups, because the marginal utility of additional consumption is higher and the opportunity cost of holding money correspondingly lower. This view is well stated in the IMF study of the adequacy of reserves:

A world-wide distribution of monetary reserves in accordance with the apparent need for them is incompatible with the yet more fundamental consideration of the distribution of the real resources of each country in accordance with the highest priority for their use. If the monetary reserves of the world were completely redistributed in accordance with apparent need, they would soon be re-redistributed, as each country would soon (quite properly) rearrange the changed amount of real resources at its disposal in accordance with its scale of preferences. In such a re-redistribution, wealthy or less dynamic countries would soon reacquire reserves which they either desired or merely accepted passively, but which, in any event, they could hold without sacrificing other deeply felt needs, while poorer or more dynamic countries would soon dispose of part of their newly acquired reserves in exchange for other types of real resources which they needed more urgently. (Pp. 217-18.)

Third, it is reasonable to suppose that the motives for holding reserves are different for developed than for less developed countries. Simplifying drastically, we pose the contrast as follows: The authorities in LDC's feel that they need reserves in order to permit some minimum level of payments to continue in the face of shortfalls in earnings. They are acutely aware of the opportunity cost of holding reserves and are anxious to get rid of reserves when they rise above the minimum required level. Furthermore, disposing of excess reserves is easy (and pleasant) since there is typically a high degree of administrative control over the rate of disbursement of foreign exchange—import controls, exchange controls, licensing, quotas, and tariffs, all of which can generally be changed fairly promptly by administrative fiat. This is another way of saying that there is typically an excess demand for foreign exchange in developing countries at pre-

vailing exchange rates. It is frequently difficult to keep this excess demand pent up, but it is almost invariably easy to let some of it loose. Furthermore, the process of getting rid of reserves (increasing foreign spending) is not likely to be inflationary; in fact, it may very well be counterinflationary, since it makes more goods available domestically.

In developed countries, in contrast, monetary authorities are typically not concerned with the opportunity cost of holding international reserves. They will thus be concerned with the level of their reserves only when these reach the critical, minimally acceptable level. When reserves increase, they will make no attempt to get rid of them. Except for persuading their legislators to vote increases in foreign aid, or to approve reductions in tariffs and quotas, which is often politically unpalatable, they have no method of reducing reserves other than applying expansionary macroeconomic policies. As a rule, they will be unwilling to do this *simply* for the purpose of adjusting their reserve positions.<sup>17</sup> A developed country with rising reserves will adopt an expansionary domestic monetary-fiscal policy only if this is desired for other reasons. The rise in the reserves is at most a permissive factor, a removal of a pre-existing constraint. That is, if a country is faced with what it considers dangerously low reserves and less than full employment, the authorities may be unwilling to adopt domestically expansionary policies; an increase in reserves in such a situation will permit them to adopt the policies previously desired.<sup>18</sup>

On the downside, the methods of adjustment are also much more direct (and in that sense easier and quicker) for the LDC's than for the developed countries. The former will, in general, increase their quotas and restrictions, that is, cut back on their imports directly. This may be painful, and in general will be, but it is relatively simple. In the developed countries, this kind of activity is regarded as poor form, and it violates various international agreements, such as the GATT. It is currently practiced by the developed countries only rarely, and then only in conjunction with other policies, to which the offending country can point as a token of its good faith and an indication of the dire seriousness of its problem. In practice, for the developed

<sup>17</sup> See, for example, Machlup (1966), Flanders (1969).

<sup>18</sup> Manipulating monetary and fiscal policy to maintain both internal and external balance may be possible in practice; it is surely very difficult, and I am arguing that authorities in developed, rich nations will be unwilling to assume the risk of failure (that is, excessive inflation) for the purpose of *reducing* their holdings of international reserves.

countries, raising the level of reserves generally involves a reduction in domestic spending induced by a tight monetary policy or a contractionary fiscal policy, or both. This may be inappropriate from the point of view of maintaining internal balance, and hence painful. Furthermore, it may be relatively slow and its effect on the balance of payments, hence on reserves, may be both weak and slow. On the other hand, if executed with vigor, it may be excessive and lead to a cumulative downturn greater than necessary to restore reserves to the desired level; and it may be difficult to reverse. Thus, since adjustment is in a sense more cumbersome and awkward for developed countries, and the cost of keeping reserves is less important in relation to income, one need be neither surprised nor outraged to find that they have, on the average, higher reserves than the developing countries.

In suggesting that direct controls of various types and macroeconomic policies regarding changes in spending are alternative means of adjustment to payments imbalances, we have consciously violated one of the canons of contemporary economic orthodoxy. Certainly most discussions of alternative methods of adjustment do not view controls and restrictions as an acceptable form of adjustment, except in the case of *reductions* in controls on the part of surplus countries, reductions which are presumably intended to be irreversible.<sup>19</sup> The IMF study on the adequacy of reserves goes so far as to say that the concept of adequacy cannot even be defined for a country whose foreign trade and payments are subject to such controls (p. 185). This is not to say that controls and licensing constitute a desirable method of achieving payments balance for developing (or any other) countries; and in an important sense payments which are equated by such devices cannot be said to be truly balanced; certainly such a situation cannot be labeled equilibrium. Nevertheless, it would be unrealistic to study the actual *behavior* of developing countries with respect to their reserves without recognizing that they do in fact employ such devices liberally (or illiberally). An important and interesting subject for another study is the question of what levels and distributions of reserve holdings would be appropriate in a world in which the use of such measures was universally eschewed. Related to this would be the question of the optimality of a system of fixed exchange rates and/or the optimum frequency of change in the exchange-rate peg. To repeat, then, I propose in this study to take the

<sup>19</sup> But, for a cogent and unorthodox argument to the contrary, see Scitovsky (1966b).



behavior of countries with respect to direct controls as given. This does not imply that I bestow my blessings upon it, or that I necessarily expect such behavior to continue indefinitely into the future.

Finally, there is an argument, mentioned previously, for expecting LDC's to hold larger, rather than smaller, reserves than developed countries. It involves the imperfect functioning of their private exchange and financial markets and, related to this, the probability that both private and official borrowing are more difficult, more costly, and subject to greater restriction, for the LDC's than for the developed countries.

At this point, note, I am not asserting that the two types of country necessarily evidence different behavior with respect to their holding and management of international money, but only that there are valid reasons for singling out the LDC's for separate study.

#### IV. THE NATURE OF THE STUDY

A number of studies have related international reserves to payments imbalances, or to fluctuations in reserves.<sup>20</sup> These are the same, if the balance of payments is defined as the algebraic sum of all transactions other than changes in reserves. The studies differ widely with respect to methods, assumptions, and even purposes, since some are intended to establish criteria for determining the optimal reserves of individual countries (as, for example, Heller), others have attempted to discern a behavior pattern in the actual reserve holdings of various countries (Machlup, Kenen and Yudin), while still others have been concerned with the adequacy of reserves (or rate of growth of reserves) for the world as a whole (Rhombert). What they all have in common, however, is the implicit "neutrality" of this measure with respect to the extent of adjustment and borrowing. Differences between countries in the average ratio of imbalances and reserve fluctuations to the level of reserves may reflect differences in the success of the authorities in executing their plans. That is, they may simply reflect differences in the ability of various authorities to achieve desired or intended level of reserves. The studies cited assume that this is not the case; my own investigation is likewise based on this assumption.

If the authorities are indeed able to do what they intend and wish to do, it may be that intercountry differences in the volatility of reserves, or in the relationship of the level of reserves to fluctuations in reserves (payments imbalances) are due to differences in the willingness to "use" reserves. These in turn may result from the personality quirks of the decision-makers, from institutional constraints (such as legal requirements that tie the domestic money supply to gold and foreign-exchange reserves), or from rational economic considerations which affect the decision rules of the several authorities. When one expresses the need for reserves in terms of net payments imbalances or fluctuations in reserves, however, one is assuming that all entries in the balance of payments are autonomous, that accumulation or decumulation in reserves is the sole balancing item, or that the extent of adjustment and borrowing is optimal. This is probably most useful when applied, as by Archibald and Richmond, and

<sup>20</sup> Some of these are Machlup (1966), Brown, Archibald and Richmond, Kenen and Yudin, Rhombert, Heller (1966); see also the discussions in Caves, Clower and Lipsey, and Fleming and Lovasy.

Clower and Lipsey, to a discussion of the need for reserves to smooth out very short-term fluctuations (and even then, probably, most useful in the case of the developed countries, for reasons already discussed). But as a method of establishing criteria for reserve adequacy, either for individual countries or the world as a whole, or as a method of arriving at generalizations to explain observed reserve-holding behavior, it seems to me unsatisfactory.<sup>21</sup>

If we adopt the first model of adjustment discussed above, we assume that countries want (and need) reserves that are adequate to smooth out and offset exogenous disturbances to their payments. What we really need to know is the extent of imbalance in autonomous payments. The data for the basic balance of payments would be an improvement (over the overall balance, which measures simply the change in reserves) if we could obtain data that were consistent and comparable over time and between countries. Even with this measure it would be impossible to identify adjustment. If a reduction in earnings caused the authorities to institute direct controls or effect a contractionary monetary-fiscal policy, the resulting reduction in imports (and/or increase in exports) would not be identifiable as adjustment to exogenous disturbances on the basis of examination of the balance-of-payments data. The degree of financing, however, through changes in short-term capital movements on public or private account, would appear as a need for reserves. This, of course, assumes that all short-term capital movements are of an accommodating or financing type, which is clearly a debatable point. But any measure of the balance of payments incorporates some assumption about the distinction between disturbing and accommodating items.

Let us rephrase the problem as follows, in terms designed to suit the generally held view of a less developed country. Consider the receipts from exports, from private foreign investment, and from autonomous government capital inflows (essentially foreign aid other

<sup>21</sup> A number of the writers cited are explicit about this assumption. Kenen and Yudin, for example, recognize the problem (pp. 246-47). Rhomberg states very clearly his assumption that the extent of adjustment and borrowing is a datum for each country, even from the normative point of view, since he says that countries need more reserves the greater the disturbances to which they are subject and ". . . the less inclined are the authorities to modify domestic objectives or accustomed economic policy designs in order to adjust the balance of payments" (p. 371). Cooper, on the other hand, argues as I do that ". . . the *ex post* deficit is not typically the best measure of the size of the problem, since other objectives may have been sacrificed to reduce an even larger prospective deficit" (p. 627).

than that induced by balance-of-payments crises). Now suppose that the level of expenditures (including some capital repatriation and other contractual obligations) is determined by the domestic authorities. The authorities decide to set annual expenditures equal to the annual average of the receipts enumerated above. The question in the first instance is, what size reserves will they need in order to finance imports at that level, year in and year out, without having to borrow (privately or officially)? The next question is whether the cost of keeping reserves at that level and the ability to borrow periodically will induce the authorities to keep reserves less than that "necessary" level.

Unfortunately, balance-of-payments data are not available in a form that lends itself to this kind of computation. At best, one would have to make heroic guesses all along the way, in any case. The most difficult problem would be to decide whether and to what extent foreign aid can be considered autonomous rather than financing. The extent to which private capital flows are influenced by the balance-of-payments position of the host country (and its reserve position) is another uncertainty. For these reasons I have compromised, unhappily, and consider the variations, not in total receipts, but in earnings from exports of goods and services.

I then proceeded as follows: I chose as independent variable (initially as the only independent variable) an index of fluctuations, or instability, in exports, computed separately for each country. To have related such an index (which, however computed, is always a measure of *relative* volatility of exports) to the absolute level of reserves would have made no sense at all. Reserves had to be normalized on something. Population would have been one possibility, as an index of the size of the country. A better one would have been gross national product, as an index of the "economic size" of a country. However, this would still presumably leave the difference in openness of an economy unaccounted for. Given two countries with the same population and per capita income, one might expect the country which exports 30 per cent of its GNP to have larger reserves than the one which exports 5 per cent of its GNP. I therefore chose to normalize reserves by dividing by imports. Though it appears to be a not unreasonable choice from this point of view, there were indeed other reasons, and these warrant some discussion.

## V. THE RELATIONSHIP BETWEEN RESERVES AND IMPORTS: A DIGRESSION

In the statistical investigations, the ratio of reserves to imports, rather than the absolute level of reserves, has been chosen as the dependent variable. This ratio is treated as a function of a number of independent variables, to be discussed in detail below. At this point, some defense is required of the procedure of starting with the notion of a reserve ratio, and of using imports as the denominator of this ratio.

1. "Everybody does it." The study originated from a request to supply a quick-and-ready method for evaluating the appropriateness of an individual country's reserve holdings and changes in reserves. In everyday parlance, in the press, and in semi-public discussion, reserve figures are frequently cited in terms of  $x$  months' worth of imports. It is interesting, in and of itself, to determine whether there is any merit in this approach and in this way of describing reserve positions. If the reader wonders at the researcher's bias, let me hasten to point out that my initial tentative answer to this question was in the negative.

2. The procedure *can* be defended as plausible (which does not, of course, mean that it is correct). When one thinks of the need to hold reserves because reserves are used to finance trade, this is clearly inappropriate. But the ratio can be interpreted as a measure of the ability of a country to continue importing *in extremis*. Brown (pp. 7-8) has expressed eloquently the shortcomings of such a notion. I agree with him, but while the notion is "... hardly appropriate to the situation of modern advanced economies," it might make a very small amount of sense when applied to less developed countries, whose imports are generally regarded as being somehow more necessary and essential than those of the developed countries. I agree further with Brown that a comparison between reserves and the country's net foreign balance is more appropriate, but at the moment I know of no way to define this concept in such a manner that it is readily measurable in numbers that can be used for intertemporal or international comparisons. The only really clear notion of the foreign balance that generally exists is the balance on official transactions, that is, the change in reserves, but the use of this number begs too many questions in which we are interested.

3. Though by no means enchanted with the folkloric relationship between reserves and imports, I do feel that it has not yet been

fairly tested. Here some brief comments are in order regarding some studies that have been made. The results have in most cases been bad; in the one instance where they appeared to be good, there was an error in specification.

(i) Courchène and Youssef performed linear regressions of time series, for nine developed countries, with quarterly data. Their equations were

$$R_t = a + b_1 X_t + b_2 r_t + e'$$

and  $R_t = a + b X_t + e,$

where reserves were gold, foreign exchange and gold-tranche position with the IMF, and  $r$  was the long-term government-bond rate. When  $X$  was imports (they also performed estimates for  $X$  equal to the money supply) they got low values for  $b_1$  and  $b$  respectively, and lower  $t$ -values than when  $X$  was the money supply. On this basis, they rejected the hypothesis that reserves are related to imports. But in my view these estimates indicate nothing at all. To suggest that quarterly changes in imports should be associated with quarterly changes in the demand for reserves, which can be measured by the level of reserves actually held, is inappropriate. Clearly if imports were the only independent variable, reserves should move inversely with imports on a quarterly basis. The hypothesis that countries wish to hold reserves on the average equal to some proportion of imports has not been tested.

(ii) Machlup (1966, pp. 6-11) computed ratios of reserves to imports for 14 developed countries, and found that these ratios varied significantly between countries, and, for each country, over time. He therefore rejected the hypothesis that there exists a systematic relationship between reserves and imports. The question here is whether the differences between countries can be explained.

(iii) Coppock (p. 113) computed the instability index for the ratio of reserves to imports, and correlated this with the instability index of exports. He was surprised to find a low correlation coefficient between these two indices. This low correlation simply reveals, however, either that (a) there are other important influences on the *variability* of reserves besides export variability, or (b) that countries differ in their desire or ability to adjust quickly to changes in export earnings or to finance imbalances by means other than drawing down reserves. In any case, relating export instability with reserve instability

has nothing to do with the hypothesis we are examining, which relates the *level* of reserves (as a percentage of imports) to export instability.

(iv) Thorn attempted to defend the reserves-import ratio, specifically in response to the attack on it by Kenen and Yudin. He examined the ratio of reserves to imports of 14 developed countries (the same as those studied by Kenen and Yudin) in 1960. He then fitted a cross-sectional equation for each of four years, 1954, 1957, 1962, and 1964. The equation fitted was

$$\log R_{it} = a_0 + a_1 \log I_{it} + a_2 \log r_{i 1960}$$

where the  $R_i$  are reserves,  $I_i$  are imports, and  $r_i$  the ratio of reserves to imports. This is the logarithmic form of his behavior equation

$$R_{it} = I_{it} r_{i 1960} e^{a_0}.$$

Kenen and Yudin retorted that this was a "virtual tautology," though I see no *a priori* reason why Thorn should have found as good a fit as he did. Kenen and Yudin are right, however, in pointing out that the fact that the coefficient of  $a_0$  was not significantly different from zero was not a test of the behavior relationship but simply a reflection of the fact that in the period covered reserves and imports tended to change at roughly the same rate. I do not wish to explore the debate in detail here. I agree with Kenen and Yudin that the interesting problem is to "... account for differences in countries' 'target ratios'" (p. 626). This is precisely what I am attempting here, although frankly sharing Kenen and Yudin's pessimism regarding the possibility of success.

My aim, then, is to give a fair hearing to the frequently stated proposition that countries do indeed attempt to hold reserves equal to some proportion of their average imports. A further refinement of this proposition states (a) that the desired or target ratio of reserves to imports differs between countries, and (b) that this ratio is a function of a number of variables, including the volatility of earnings. I further argue, on the basis of *a priori* plausibility, that this type of behavior pattern is likely to be more pronounced among the developing than among the developed countries, primarily because less developed countries will be more interested than developed countries in drawing down reserves when they rise above the target ratio.

## VI. THE VARIABLES IN THE DEMAND FUNCTION

I have attempted to estimate empirically a single reserve function (having resisted the temptation to call it a liquidity-preference function). The dependent variable is the ratio of reserves to annual imports, hereafter called the reserve ratio and written  $L/M$ . Candidates for independent variables are listed herewith and will be discussed individually:

1. Some measure of the instability of exports.
2. The existence of "near-moneys."
3. The opportunity cost of holding reserves.
4. The rate of return on reserves.
5. The variability of reserves.
6. The willingness to devalue the currency, that is, to adjust rather than finance imbalances.
7. The cost of adjustment (other than by changing the exchange rate).
8. The level, or changes in the level, of inventories of traded goods.
9. The cost of borrowing.
10. Income.

1. *The instability of export earnings.* This was the first variable considered; in fact, as we shall note shortly, in a preliminary study made this was the sole independent variable. Many of the casually analytical discussions of the reserve "problem" of the less developed countries suggest that the reserve ratio is (or ought to be) primarily a function of the volatility of earnings. This study began, in fact, as an attempt to discover whether there exists a simple, neat relationship between volatility of earnings and reserve holdings. A more serious reason for including this variable is that the volatility of earnings is a major determinant of the frequency and size of autonomous imbalances, and it is for the purpose of settling these that countries should—and do—hold reserves of international money.

There are two distinct types of measures of volatility of earnings: those which measure average annual percentage change, and those which measure deviations from trend. There is a third type, which measures annual differences, with some correction for trend. However, these prove to be highly correlated with the second kind.<sup>22</sup>

<sup>22</sup> Massell computed both an index of deviation from trend and an index of



The reasons for adjusting for trend are obvious. Given two countries, one with identical exports every year, the other with a constant annual percentage increase, we should feel uncomfortable in labeling the second country's exports more unstable or variable than the first, particularly if we then proceeded to associate this greater instability with the need for, or demand for, higher international reserves. Furthermore, a measure of year-to-year fluctuations ignores the effect of the duration of a peak or trough. If export earnings fall in one year and then remain for three or four years at the lower level, this might reasonably be thought to create a greater demand for international reserves than an equal decline followed by a recovery in the following year to the previous level. On the other hand, a measure based on deviations from trend is, *ipso facto*, sensitive to a poor fit of the trend.<sup>23</sup> Furthermore, even if the trend fit is good, it clearly has different implications from the measure of year-to-year changes. The trend-corrected measures take more account of movements which are counter to trend than the first-differences measure. Thus, when the trend is rising (or horizontal), a decline which persists more than one year will have more weight in such a measure than in a first-differences measure. The converse is true if the trend is downward: here an actual decline may, of course, appear as an increase if the value is above the trend value albeit lower than the value of the previous year.

The importance one attaches to these differences depends on the type of adjustment mechanism posited. If it is assumed that imports respond closely to changes in exports, but with a lag of, say, one year, then it is precisely the annual fluctuations that are important. If, on the other hand, it is assumed that countries try to smooth out longer fluctuations in earnings and maintain constant, or constantly increasing or decreasing, imports over the period, then the duration of the swings as well as their amplitude is important. Furthermore, the trend value, and deviations therefrom, are the important variables in this instance.

Note that none of the indices used in any way distinguishes between

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annual variation with a trend correction. He found a rank correlation of .718 between them. Similarly, the Coppock index, which purports to be a measure of first differences corrected for a constant percentage trend, is highly correlated with MacBean's index, measuring deviations from a five-year moving average centered on the middle year. We found a Spearman coefficient of rank correlation of .80 between these two indices.

<sup>23</sup> See Massell, p. 52.

amplitude and frequency of fluctuations (although, as has been argued, different types of indices weight these differently). Two countries could have the same index (within any one of the measures) if one had frequent, small fluctuations, and the other had occasional, large fluctuations. Yet the implications of these differences for the need for reserves might be quite different.

In this study I have used all three types of instability index, the percentage annual changes, the deviations from trend, and the intermediate type—the trend-corrected first differences. I also used a very simple measure, the coefficient of variation, which is the standard deviation divided by the mean of earnings.

2. *Near-money* in this context means the existence of an efficient private market in foreign exchange and foreign credit.<sup>24</sup> The argument, quite simply, is that if there are large foreign-exchange holdings and transactions in the private sector, the monetary authorities will be called upon to do less financing than otherwise. Furthermore, foreign-exchange holdings of the private sector may be available to the authorities in periods of emergency, through severe credit contraction, or expropriation, or forced sale. Brown objects to the inclusion of these holdings in the measure of reserves specifically on the grounds that such restrictive measures and regulations would conflict with his “. . . basic general decision to study the liquidity problem with special reference to advanced countries maintaining a high degree of convertibility.”<sup>25</sup> Nevertheless, it is plausible to argue that some countries decide to hold smaller reserves than they otherwise would, because they feel that they can mobilize privately-owned foreign exchange by direct control when necessary. On the other hand, there may be a countervailing effect of the existence of a large private foreign-exchange market, namely that this raises the likelihood of destabilizing capital movements. This variable, then, is to be viewed with considerable agnosticism.

In my multivariate studies I have the term *B/L*, the ratio of bank holdings of foreign exchange to total official holdings. In principle, it might be argued that all private holdings should be included here, those of nonbanks as well as of banks. The availability of nonbank

<sup>24</sup> Brown, pp. 5-6, states a number of excellent reasons for excluding private holdings of foreign exchange or of assets denominated in foreign currencies, from a measure of reserves. I agree with him completely. The question here, however, is not whether to include unofficial holdings in the *measure* of reserves but whether to add them as a *determinant* of the level of official reserves.

<sup>25</sup> *Ibid.*

holdings for financing purposes, however, is even more questionable than that of bank holdings. In LDC's, in particular, it is probable that a large part of such foreign exchange is held by foreign firms and subsidiaries. Alternatively, the privately-held foreign exchange may be in the hands of residents (exporters) who do not wish to sell it to importers but prefer to keep it (perhaps as inflation hedge) and who do not lend it because the capital markets are thin and poorly developed. Furthermore, data on nonbank holdings, even legal ones, are difficult, if not impossible, to obtain. Even bank holdings are not reported for many countries, and this variable is used in only a few supplementary regression estimations. The data were too sparse to be included in the main program.

3. *The opportunity cost of holding reserves.* This is the marginal utility of the imports or the consumption of domestic exportables forgone. From the point of view of our problem and of our interest in LDC's, it is useful to think of the cost of forgone imports in terms of forgone investment. In principle we could measure this cost by the rate of return on investment, and perhaps even more specifically by the rate of return on investment of foreign resources. (This latter measure would recognize the bottleneck argument, which states that it is precisely imported capital goods that are scarce in developing countries. More generally, the argument that the rate of return on domestic investment is different from that on investment of foreign resources rests on an assumption, often valid, that the exchange rate is inappropriate in the sense that the correct shadow price of foreign exchange is higher than the nominal price.)

Measuring the cost of forgone imports by the marginal productivity of capital does not imply the assumption that all imports consist of capital goods. Imports may include consumer goods, the importation of which releases domestic resources for investment. Nor does the argument in principle apply only to LDC's. An excess of imports over exports constitutes a true capital import in principle as well as in terms of the standard balance-of-payments terminology, regardless of whether the imports consist of capital goods or consumer goods.

Unfortunately, I know of no data for a large group of countries which indicate the marginal return on investment. Average capital-output ratios are not relevant here and incremental capital-output ratios (if meaningful) are not generally available. Interest rates, especially in LDC's, are generally totally unrealistic. As a rough proxy for this variable, therefore, I have used the compound real growth

rate of GNP over the period. It is assumed that countries which have been growing rapidly in the recent past have a higher productivity of investment than stagnant or more slowly growing economies.<sup>26</sup>

4. *The rate of return on reserves.* Unlike domestic money, some international money is interest-earning. Official foreign-exchange holdings consist primarily of time and savings deposits and government securities. I have not examined here the problem of the composition of total reserves with respect to gold and the IMF position, on the one hand, and interest-earning foreign exchange, on the other. The assumption is that this decision is made exogenously to our model. But this allocation does determine the profitability of holding reserves, so that countries with higher earnings from reserves ought to be willing to keep higher reserve ratios than those that earn less. The rate of earnings on reserves is  $rF/L$ , where  $F/L$  is the proportion of reserves held as foreign exchange and  $r$  is the interest rate on short-term government securities in one of the major financial centers. This rate could be that in the financial center (New York, London, Zurich, Paris) in which the authorities of any given country typically hold most of their foreign exchange, or the average of all of these, or the highest one of these. The choice would depend on whether one assumed that the authorities can and do shift their foreign-exchange holdings from one center to another in response to changes in these several interest rates. It is probably more realistic to assume that they do not. The fact that many authorities hold large amounts of Eurodollars is an additional complication.

We are interested not in the levels of return on reserves, but rather in intercountry differences. Since differences between short-term interest rates in the major markets are probably smaller than errors in the data on reserve and foreign-exchange holdings, I have simplified the variable, assumed  $r$  to be the same for all countries, and used  $F/L$ , the ratio of foreign exchange to total official reserves, as a proxy for the rate of return on reserves.<sup>27</sup>

<sup>26</sup> Kenen and Yudin (1965) tried a similar computation, with poor results. They, however, used the level of per capita income, on the assumption "... that the 'social marginal product' of capital varies inversely with per capita income" (p. 248). This appears to be an even more questionable assumption than the one I have made.

<sup>27</sup> Heller (1966) combines these last two variables and makes, as he says, the heroic assumption that the net opportunity cost (the cost of forgone imports minus the return on reserves) of holding reserves is 5 per cent for all countries.

5. *The variability of reserves.* The IMF (1953, p. 11) made the point that, as reserves are drawn down, people lose confidence in their adequacy. This may lead to stockpiling of goods, postponement of receipts, and acceleration of payments, so that the reserves prove to be inadequate after all. The IMF study concludes, therefore, that reserves should always be larger than their maximum use, by a margin which probably depends on past experience.

Similarly, Williamson (p. 428) argues that there is “. . . some minimum reserve level at which capital flight would become cumulative and so force the authorities to take restrictive actions. One may expect . . . [this minimum level] to depend upon the reputation of the country's Finance Minister, the size of its contingent liabilities arising from trade, and many other factors that may be taken as given for a particular country at a particular time. Of special importance, however, is the dependence of . . . [this minimum level] on the size of the country's short-term liabilities.”

Kenen and Yudin conclude that the major determinant of the level of reserves is the variance of reserves. The problem with this is that countries with absolutely higher reserves are likely, *ceteris paribus*, to have the higher variances, as both are measured in absolute amounts. Furthermore, the larger countries, *ceteris paribus*, are likely to have the larger reserves.

These problems have been avoided by normalizing reserves by imports and the variability measure (the standard deviation) by the mean level of reserves. The hypothesis, then, is that there is a relationship between the variability (the standard deviation divided by the mean) of reserves and the reserve ratio. Countries with greater fluctuations in their reserves will, it is posited, tend to hold higher reserves.

This hypothesis is approached with a good deal of *a priori* skepticism. In the preliminary investigation (Flanders, 1967) several developing countries were examined individually with respect to the behavior over time of their reserve ratios. Very large differences were found between countries in the maximum drawing-down of reserves that had ever occurred. There would seem, therefore, to be two kinds of countries: reserve-users and reserve-holders. Internal institutional differences may have much to do with this; there may also be traditional levels of acceptable variability, and these may differ between countries. Such differences may well extend to developed countries as well. It is probable, for example, that if the Netherlands

had experienced variations in reserves comparable to those of the United Kingdom there would have been even more serious capital flights and speculative movements than in the various sterling crises.

On the other hand, in assessing the needs of individual countries for reserves, it is tempting to conclude that a country with relatively small fluctuations has *enough* reserves. Given the volatility of earnings, the smaller the fluctuations in reserves, the greater the extent of adjustment and/or borrowing. If the steadiness of the reserves is due primarily to frequent resort to borrowing, the country in question may indeed not *need* more reserves; it may simply have decided to use borrowing frequently and regularly as a substitute for more adjustment or for holding higher reserves. On the other hand, if the reserves are relatively steady because the country makes frequent adjustments (by varying total expenditure or by tightening direct controls), we should be more reluctant to say that such a country does not need more reserves. Again we encounter the difficulty of defining the concept of need for reserves independently of a decision as to the optimum extent of adjustment.<sup>28</sup> Alternatively, one can be totally neutral in this respect, and take as given the adjusting and borrowing; but then one must remember always that the word "need" takes on a very special and unusual meaning in this context.

6. *The willingness to change the exchange rate.* This is viewed as an alternative to other means of adjustment, or to borrowing, or to financing. In a world of freely fluctuating exchange rates there would be no need for official reserves. In a world of crawling pegs, or frequently adjusted pegs, authorities would require reserves only in order to carry out small and temporary smoothing operations. Under the arrangements now prevailing, a country that is willing to undertake frequent changes in the exchange rate will presumably need—and want—smaller reserves to finance imbalances than one that resorts to exchange-rate changes seldom, or never at all.

To take this into account, I have included a term involving the percentage change in the price of the U.S. dollar, corrected (by

<sup>28</sup> The same issue differentiates the work of Peter B. Clark from the present study. In his theoretical model (1970), the demand for reserves is a function of the disturbances to the balance of payments and the speed of adjustment. In the empirical study based on this model, he measures the disturbance by the standard deviation of the residual from the estimated time trend of reserves. This implies that the fluctuations in reserves are measures of the disturbance in the balance of payments. My contention is that this ignores all the financing and borrowing of a compensating nature, both private and official.

subtraction) for the change in each country's cost-of-living index. The reasoning here is as follows. If the  $i$ th country experienced precisely the same rate of price-level change as its trading partners (approximated by a world price index) and kept its exchange rate constant, then it would be undertaking a zero level of adjustment by means of changing the exchange rate; and a change in the exchange rate which was less than the rate of inflation (relative to that in the rest of the world) would constitute a negative use of the exchange rate. The country in question would need larger reserves than otherwise, simply to compensate for the disequilibrating effect of the rise in relative prices (or, to state it differently, of the relative appreciation of the currency). For ease of computation, I have preferred not to deflate the figures for the change in the world price level. Deflating would involve subtracting a small constant from the value of the variable, leaving the intercountry relationships virtually unaffected. In a preliminary computation, I tried both versions and found a correlation coefficient of .99 between them.

7. *The cost of adjustment.* Heller (1966) considers the cost of adjustment to be the level of unemployment required to correct any given imbalance. More generally, the cost of adjustment is the welfare cost of any method (or mix of methods) of adjustment plus borrowing. (We include borrowing here, because we are interested primarily in the total cost of not having reserves when needed.) These costs would include the costs of unemployment, the welfare costs of growth forgone because of higher interest rates (and unemployment), the costs due to distortions of the market caused by the imposition of direct controls, quotas, tariffs, and interference with foreign investment. No attempt was made to include this variable. However, for developing countries, to the extent that they respond to imbalance by tightening up on import controls, the cost of adjustment is fundamentally the same as the cost of holding reserves, namely the marginal productivity of investment. Thus, the effect of this variable, if significant, would be to offset the effect of the variable involving the rate of growth of GNP (the proxy for the marginal productivity of investment and hence of the opportunity cost of holding reserves).

8. *The level, or changes in the level, of inventories of traded goods.* If a country has sizable inventories of traded goods (both imports and exports) these are substitutes for reserves of foreign exchange and reduce the need for reserves. On the other hand, there may be

variations in foreign-exchange holdings which are explainable in terms of the stockpiling of traded goods. Such variations may be cyclical in nature, or they may be shorter-term fluctuations, particularly responses to changes in expectation regarding exchange rates. That is, holding excess inventories of traded goods may be a substitute for speculative increases in the holding of foreign currencies. I have not attempted to include this variable, for the following reasons: (1) This consideration is probably primarily important in relation to the time pattern of behavior of reserves, and this is a cross-sectional study. (2) The problem of finding appropriate data is in this instance overwhelming. (3) It is uncertain how one would handle the data (if available) for less developed countries. If we think of reserves as something that protects the importing ability of a country, inventories of import goods are clearly a substitute (though not perfect) for reserves. It is more difficult to say *a priori* how one should treat inventories of exportables, especially for developing countries that export primary products, and particularly for those among them that have a large share in the world market for their exports. Since the prices of primary products are presumably subject to sharp and frequent fluctuations, it is difficult to know at what prices one ought to evaluate stockpiles of such goods. When the inventories are owned by a major exporting country, the problem becomes more difficult still. For example, if Brazil tried to convert its large stocks of coffee quickly into foreign exchange, we should expect a very sharp drop in the price of coffee.

9. *The cost of borrowing.* An alternative to holding reserves is to rely (at least in part) on borrowed funds when the need arises. In principle, then, the demand for reserves should be treated as a function of the cost of borrowing. This is not a one-dimensional variable, however, but a vector of interest cost, the ease with which the credit can be obtained, the maturities available, and the terms of repayments.

In addition, the existence of a banking sector with foreign-exchange holdings may be in part a substitute for official reserve holdings, in the sense that the government may be able to borrow from the private sector; or the private sector may be able to borrow from foreigners when necessary. If there is an active money market and dealings in foreign assets, it may be easier for the authorities to induce capital inflows (or backflows) than to borrow directly.

Another dimension to the cost of borrowing is the stringency of the terms attached to the credit. This may be particularly important when



the loan is made by the IMF or by a foreign government. The UNCTAD report (p. 13) suggests that the failure of a number of developing countries to borrow from the IMF indicates an unwillingness to comply with what are felt to be excessively onerous conditions laid down by the Fund in negotiating drawings beyond the first or second tranche.

The considerations mentioned above complicate the problems involved in introducing the cost of borrowing as an argument in the reserve function. I decided finally against it, however, on the basis of perhaps the most serious problem of all, that of simultaneity. The ability of a country to borrow and the rate at which it can obtain loans depend on the size of its reserves; loans are easier to obtain, from both private and official lenders, if the borrower appears to be in a sound reserve position.<sup>29</sup>

10. *Income*. In modern monetary theory, it is often argued that income is a determinant of the demand for money over and above the effect of the volume of transactions on the demand for cash balances. This is essentially the argument that was discussed in 3 above, in which it was argued that the demand for reserves might vary with the value of the forgone consumption of internationally traded goods. This is measured by the growth rate of the economy. Critics of earlier versions of this study, however, have argued that income should be entered directly as an argument in the demand function. This has been tried, with per capita GNP included as an independent variable.

<sup>29</sup> UNCTAD, *loc. cit.*, p. 20. "But the ability of developing countries to secure credits is itself dependent on the strength of their reserve positions, because foreign banks often require that reserves in the form of investments in foreign securities be pledged as collateral against credit facilities."

## VII. THE ESTIMATIONS

The first, preliminary, study involved estimation of the equation

$$L/M = a_0 + a_1X,$$

where  $L/M$  is the average ratio of reserves to imports (for each country) over the period 1951-62 and  $X$  is an index of instability of exports. The computation was performed with five different indices of instability: one computed by Coppock, one by Massell, one by Fleming and Lovasy, and two by MacBean (for different groups of countries and different periods). One of these indices is based on annual percentage change (Fleming and Lovasy), three on deviations from trend (Massell, MacBean) and one on annual differences corrected for trend (Coppock). Data for  $L/M$  was from the IMF (1966), so that in each case the number of observations was determined by the availability of both the indices and the IMF figures. For this reason, some equations were estimated on the basis of very few observations.

The equations were estimated for five groups of countries: all countries; all less developed countries; all LDC's minus "special cases";<sup>30</sup> LDC's which drew heavily from the IMF; LDC's which did not draw heavily from the IMF.

There were thus a total of 25 possible groups, of which two were empty. Twenty-three equations were estimated, and of these only five had coefficients which were significant at the five per cent confidence level. The highest  $R^2$  (adjusted for degrees of freedom) was .398; most were negative when adjusted for degrees of freedom.

The next step was to estimate a number of multivariate equations, involving the variables discussed in the previous section. Indices and reserve ratios were computed anew, so as to have a larger set of observations. The period covered was 1950-65 and the computations were carried out for this period and four overlapping subperiods, chosen arbitrarily. We have then, five periods:

1950-65

1950-60

1955-60

1955-65

1960-65

<sup>30</sup> The "special cases" were those with reserves at the end of the period either twice as high or half as much as at the beginning.

The reason for examining the shorter periods was to explore the possibility that there might have been shifts in some or all of the parameters of the function over the longer period.

The countries included were all those for which data were available for the whole time period (plus Jamaica, Morocco, Nigeria, and Tunisia, for which data were available only for the period 1960-65). The countries were arranged in six groups:

- All countries (57),
- All minus the United Kingdom and the United States,
- All developed countries (20),
- All developed countries minus the United Kingdom and the United States,
- All less developed countries (37),
- All less developed countries minus the "special cases" (26).

Lists of the countries will be found in the Appendix.

The data were obtained primarily from the IMF *International Financial Statistics*. The export figures are from the *Balance of Payments Yearbooks*.

The variables and their methods of computation are listed below. I repeat that the study is cross-sectional, so that the values of the variables are the averages (or similar statistics) over the relevant time period, one for each country.

- $L/M$  The *average ratio*, not the ratio of the averages, of liquidity to imports.
- $\bar{L}$  The mean, over the period, of liquidity.  $L$  is the sum of foreign exchange, gold, and the reserve position in the IMF.
- $\bar{M}$  The mean, over the period, of commodity imports, in U.S. dollars.
- $B/L$   $B$  is the amount of foreign exchange held by private banks.  $B/L$  is the average of the annual ratios of  $B$  to  $L$ . Unfortunately, almost half of the countries in the study do not report the figures for  $B$ , so that most of the estimations exclude this variable.
- $F/L$   $F$  is official holdings of foreign exchange.  $F/L$  is the average, over the period, of the annual ratios of  $F$  to  $L$ .
- $\sigma L$  The coefficient of variation of  $L$ , the ratio of the standard deviation to the mean.

*GR* The annual percentage rate of growth of GNP, where the GNP figures are deflated by cost-of-living indices. I have been unable to compute this for each time period, because of data problems. Thus, the equations for 1955-60 use the growth rate for 1950-60. And the equations for 1955-65 use the growth rate for 1950-65.

*D* The formula for computing this is  $\frac{R_{T2} - R_{T1}}{R_{T1}} - \frac{CL_{T2} - CL_{T1}}{CL_{T1}}$

where  $R$  is the price of a U.S. dollar in terms of domestic currency and  $CL$  is the cost-of-living index. Preliminary studies showed that adjusting this statistic for a 1.25 per cent change per year in the world price index made virtually no difference to the rankings, and so I decided not to make that correction. As in the case of the growth rate, data problems prevented computing  $D$  for every time period, and equations for 1955-60 use the  $D$  for 1950-60.

*Y* Per capita GNP as a percentage of the per capita GNP of the United States. This is one number for each country, which is the same for every time period.

$\sigma X$  The coefficient of variation of exports of goods and services.

*DIF* This is the absolute value of the average percentage annual changes in exports. The formula for computing it is

$$\frac{1}{T-1} \sum_{t=1}^{T-1} \left| \frac{X_{t+1} - X_t}{X_t} \right|$$

*FC* This is a modification of the Coppock index, which is reported in Coppock and MacBean.<sup>31</sup> The Coppock index, by using logarithms for its computation, cancels out the intermediate years in computing the trend adjustment. This makes the index highly sensitive to the choice of the beginning and end years. I have simply computed directly what Coppock claimed he wished to compute, the standard annual percentage change, adjusted for the average annual percentage change, that is, for the trend. The formula is

<sup>31</sup> Coppock, p. 24; MacBean p. 36, fn. 1.

$$\left\{ \frac{1}{T-2} \sum_{t=1}^{T-1} \left[ \frac{X_{t+1} - X_t}{X_t} - \left( \frac{1}{T-1} \sum_{t=1}^{T-1} \frac{X_{t+1} - X_t}{X_t} \right) \right]^2 \right\}^{\frac{1}{2}},$$

which can be shown<sup>32</sup> to be identical to a literal interpretation of what Coppock was trying to compute, which is

$$\left\{ \frac{1}{T-2} \sum_{t=1}^{T-1} \left[ \frac{X_{t+1}}{X_t} - \left( \frac{1}{T-1} \sum_{t=1}^{T-1} \frac{X_{t+1}}{X_t} \right) \right]^2 \right\}^{\frac{1}{2}}.$$

*TR* This is the  $R^2$  of the estimated regression of exports on time, for each country. It was inspired by Massell's measure of instability, which is the standard error of such an estimate. This is easier to compute, since the standard error would have to be normalized by something, involving an additional computation. In fact, the  $R^2$  is precisely the measure wanted, since a perfect fit of exports on time would indicate zero deviation from trend. The sign of the coefficient, of course, should be opposite to that for the other measures of export variability.

The following sets of equations were computed. First, for each period for each group, and for each different type of export-variability index,  $V$ , I computed

$$L/M = a_0 + a_1F/L + a_2\sigma L + a_3GR + a_4D + a_5Y + a_6V.$$

Subsequently, I recomputed most of these dropping the  $Y$  variable. (It performed extremely badly and since I had never really wanted to include it in the first place, I removed it, thereby gaining an additional degree of freedom.)

Second, a similar set of equations was computed including  $B/L$  as a variable. Since the number of countries for which data on this variable are available is relatively small, these were computed only for the groups All Countries minus the United States and the United Kingdom and All Less Developed Countries.

<sup>32</sup> I am grateful to Claude Colantoni for helpful discussions on this point.

The group Less Developed minus Specials is quite small, and so, in order to increase the degrees of freedom, a number of equations were computed with small subsets of variables, three or four at a time.

Finally, all the computations were carried out with one export-variability index ( $\sigma X$ ), and  $\bar{L}$  rather than  $L/M$  used as the dependent variable, with  $\bar{M}$  as one of the independent variables. This was done for a number of reasons. Friendly critics of early accounts of the work had warned that assuming homogeneity with respect to imports put too much strain on the analytical model. Others had assured me that the puzzling negative relationship between  $L/M$  and  $\sigma L$  would disappear if  $L$  and  $M$  were pulled apart.

The results are almost uniformly bad and are not presented here. A few examples are displayed in the appendix, and the full results are available on request. The results, or rather the *non*-results, are summarized below.

Except where the dependent variable is average liquidity,  $\bar{L}$ , there is no  $R^2$  greater than .49. Only twice is the  $R^2$  as high as .4 and rarely as high as .3. Furthermore, all these "high"  $R^2$  values occur in the group All Developed Countries, a small group clearly dominated by the United States. Thus, for example, the equation which gives an  $R^2$  of .491 for All Developed Countries has an  $R^2$  of only .231 for the group Developed minus United States and United Kingdom. Similarly, the relatively strong association between  $Y$  and  $L/M$  disappears when the United States and the United Kingdom are eliminated. In general, the  $R^2$  values are extremely low, and often are shown as negative, since the program used adjusts for degrees of freedom.

When  $\bar{M}$  is one of the independent variables and  $\bar{L}$  the dependent variable,  $R^2$  is very high indeed in most cases, clustering around .65 for All Countries, .8 for All Developed minus the United States and the United Kingdom, somewhat lower for All Developed, around .5 for All Less Developed, and around .35 for Less Developed minus Specials. In all cases the coefficient of  $\bar{M}$  is massively significant. (The coefficient, by the way, is not noticeably higher for Developed minus the United States and United Kingdom than for All Less Developed but it is higher for both than for Less Developed minus Specials. Thus, whether less developed countries have lower reserves in relation to imports than do the developed countries depends on which group of less developed countries we are talking about.) For the other coefficients, the results are roughly the same as in the

regressions in which  $L/M$  was the dependent variable. That is, separating  $L$  from  $M$  did not lead to any new insights or improve any of the relationships. It is not possible therefore, to argue that the reason for the poor results of the other estimations is the restrictive and constraining effect of assuming that reserves are a homogeneous function of imports. On the contrary, the high  $R^2$  and the significance of the coefficients justify the choice of imports as the normalizing variable.

So much for the  $R^2$ . What can we say about the significance of the coefficients of the individual variables? Not much more. Most of the  $t$ -values are less than one, and hardly any rise above 2 (the constant terms and the coefficient of  $\bar{M}$  being the only, and obvious, exceptions). A brief discussion of each of the variables follows.

*B/L.* This has the predicted sign (negative) except in the most recent period, 1960-65. The  $t$ -values are very low, seldom rising above 1 and never as high as 2. Unfortunately, however, there were so many countries for which data were not available, that grouping into all the subsets of countries seemed inappropriate. We therefore have estimates only for All minus United States and United Kingdom, and for All Less Developed Countries, both groups which in general give very poor results. More information, therefore, might conceivably yield improved results for this variable.

*F/L.* For All Countries, and All minus United States and United Kingdom this almost invariably has the wrong sign. Since less developed countries tend on the whole to have small gold holdings, this is probably a proxy variable for level of development in this aggregate grouping. However, for the Developed Countries (both including and excluding the United States and United Kingdom) the  $t$ -values are much higher and the sign is persistently wrong, that is, negative. For the Less Developed Countries, the sign is generally correct, but the coefficient is much less significant. For the Developed Countries, it would appear that there is a difference in the level of "conservatism." It seems that conservative countries (ants) hold more reserves *and* more gold than their less cautious neighbors (grasshoppers). When the dependent variable is  $\bar{L}$ , the sign remains negative except in one instance, and the  $t$ -value declines.

$\sigma L$ . This is the most surprising variable of all. When  $L/M$  is the dependent variable,  $\sigma L$  comes in with a positive sign only once in all the equations. The others are all negative, often with a relatively high  $t$ -value. I have been unable to explain this behavior and find the consistency and persistency with which it occurs frankly puzzling. This was one important reason for having carried out the computations with  $\bar{L}$  as the dependent variable. The  $t$ -values for the  $\sigma L$  term are smaller in these equations, but the negative sign persists with only a few exceptions. For the Less Developed Countries the sign remains negative throughout. The only conclusion I can draw is to repeat that stated above: the world is made up of ants and grasshoppers. The former keep high reserves and maintain them at a relatively steady level through time; the latter keep lower reserves and permit them to fluctuate more.

$GR$  For All Countries and All minus United States and United Kingdom the sign of the coefficient of this variable keeps changing and it is impossible to draw any generalizations. For the Developed Countries the sign is wrong (positive), and when the United States and the United Kingdom are excluded the sign is almost always wrong. For the Less Developed Countries minus Specials, the sign is always correct but the  $t$ -values are extremely low. Nevertheless, for this group of countries, this variable gives one of the most consistent sign patterns.

$D$  For All Countries the sign is always wrong (positive) when the dependent variable is  $L/M$ . When the United States and the United Kingdom are excluded, the sign pattern remains the same and the  $t$ -values rise slightly. For the Developed Countries, both with and without the United States and the United Kingdom, the signs are unstable and the  $t$ -values very low. This is not surprising, given the erratic nature of post-war devaluations and the relative conformity of price-level movements within the group of countries, as well as the frequency of resort to controls as an alternative to devaluation. For the Less Developed Countries, on the other hand, the sign is fairly consistent and almost always wrong. The  $t$ -values are very low, however, particularly when the sign is correct.



Y Per capita GNP yields the wrong sign consistently and has very low  $t$ -values for All Countries. When the United States and United Kingdom are removed, the sign remains perverse and the  $t$ -values rise somewhat. For the Developed Countries the sign is correct and the  $t$ -values relatively high, but this is clearly the effect of the United States, with its high income and high reserves, because when the United States and the United Kingdom are excluded the sign becomes generally negative and the  $t$ -values minuscule. For the Less Developed Countries the signs are unstable and the  $t$ -values small. This variable was dropped from the computations after the first set of estimations.

$\sigma X, DIF, FC, TR$  The signs of the coefficients of these indices are usually (but not always) correct for All Countries, but the  $t$ -values are low. When the United States and the United Kingdom are removed, the sign patterns begin to waver. For the Developed Countries, the signs are for the most part wrong, with and without the United States and the United Kingdom (though the instability is evidently generally low for these countries). For the Less Developed Countries, the sign pattern is inconsistent. In the case of the Less Developed Countries minus Specials the sign pattern is fairly uniform and mostly wrong. For  $TR$  the signs are wrong (positive) throughout this group, but the  $t$ -values are low. This, it should be recalled, is the group of countries for which the whole analysis was originally designed and for whom export instability is supposed to be the major determinant of the need and the demand for international reserves.

For the group Less Developed Countries minus Specials a number of estimations were computed involving fewer variables, in the hope that by increasing the degrees of freedom results with greater statistical significance might be obtained. On the whole, however, this exercise accomplished nothing.

I may add a brief note on intercorrelations. As a general statement, we can say that there are no problems of colinearity, since the correlations are very low between independent variables which appear together in the same equations. That is, the only high intercorrelations are between variables used as substitutes or alternatives in various

equations. Particularly, this refers to correlations between the several indices of export instability (which in some cases is surprisingly low), and to the substantial correlation between  $\bar{L}$  and  $L/M$ . This, again, presents no statistical problems, since they never appear in the same regressions, but the phenomenon is somewhat startling, and I can find no simple explanation for it. For All Developed Countries the correlation coefficient is .8; with the United States and the United Kingdom removed, however, it remains as high as .46. For the Less Developed Countries there is also a high correlation, while there is a very small negative correlation between  $L/M$  and  $\bar{M}$ . Again, a difference between the degree of conservatism between countries seems to be operative here.

## VIII. CONCLUDING REMARKS

A few observations on the objectives and methods of my research are in order. Admittedly, I expected poor results from the start; nevertheless it can be said in good conscience that I tried. I constructed a model based on a broad interpretation of contemporary monetary theory, a model which readily incorporates a number of currently popular notions about the "correct" or "required" level of international reserves. When I attempted to estimate the parameters of this model, the results were a dismal failure.

Unfortunately, of course, all one can say with certainty is that this particular model does not work. One can guess that no simple model will be satisfactory, but that is only a guess, not a testable proposition. It is conceivable that a system of simultaneous equations would give good results. Perhaps the countries were divided into groups inappropriately; maybe there are certain types of demand functions among countries but the differences are not correlated with the level of development. All or any of these may be possible explanations of the poor quality of the results. All I can say is that I do not think that any of them is, in fact, the correct explanation.

Does it follow that reserves and the determination of their amount are a wholly noneconomic phenomenon? Not necessarily. I did, however, come close to arguing this (Flanders, 1969) when I wrote that central bankers, at least in developed countries, had so many problems (that is, so many policy goals) that they could not worry about reserves as well, as long as reserves were above some minimum critical level.

There remains, of course, the question, what determines that minimum critical level? Related to this, one might wonder why the ratio of reserves to imports is as similar among countries as it is. True, it ranges from about 5 to 180 per cent. But if it were purely random it could range from zero (or very near zero) to several thousand per cent. And the majority of countries have reserve ratios clustered within a very much narrower range, between 30 and 60 per cent roughly. This suggests that there is something here not wholly random.

A further point is that there is no problem in economics (to my knowledge) in which one is attempting to construct a model, and to test it statistically, for so few decision-making units. There are 57 countries in the study, which means 57 decision-makers. This is not a

question of a small *sample*; the whole universe, which I would have included had data been available, consists of about 100 units. Thus it is possible that all (or most) of the central bankers and monetary authorities have in mind considerations such as those implied by the model, but that individual differences may be great enough to rob the functions of any discernible shape. Such differences could inhere in the weight given by various central bankers to the several variables; in the time horizons for balance-of-payments adjustment; in legal and political constraints (not to mention changes in these constraints, or changes in the persons of the central bankers, within the period studied); in the choice of different measures of export variability; and in levels of success in carrying out intended policies.

On the last point, however, I reject the hypothesis that the poor results reflect simply the fact that countries are not "on their demand functions" and that we have perpetual and universal disequilibrium. In the short run this is an important consideration, especially since one does not know the length of lags and the speed of adjustment. This was, indeed, one major reason for performing a cross-sectional rather than a time-series analysis. But to say that most or all countries over a 16-year period are unable to maintain the amount of reserves they demand is like saying that I do not have the size of wardrobe that I demand. I cannot speak for Mrs. Machlup, but I for one have fewer clothes than I want to have, or feel I need. Always. Yet as an economist I should be hard put to saying that I am "off my demand curve" for clothes.

In conclusion, I am still tempted by the relatively agnostic view with which I began. The persistent negative relationship between the value of the reserve ratio and the coefficient of variation of reserves, coupled with the very low coefficients of determination for the over-all regressions, lead one to suspect that in fact the world is made up of ants and grasshoppers: that the ants have relatively high reserve ratios and keep them from varying much and the grasshoppers are both less frugal and less particular about keeping their reserves at a steady level.

APPENDIX

COUNTRY GROUPINGS

All Countries	57
United States	20 Developed
United Kingdom	
Australia	18 Developed minus United States and United Kingdom
Austria	
Belgium	
Canada	
Denmark	
Finland	
France	
Germany	
Iceland	
Ireland	
Italy	
Japan	
New Zealand	
Netherlands	
Norway	
South Africa	
Sweden	
Switzerland	
<hr/>	
Argentina	26 Less Developed minus Specials
Bolivia	
Brazil	
Burma	
Chile	
China	
Colombia	
Dominican Republic	
Ecuador	
Greece	
Iraq	
Korea	
Malaysia	
Mexico	
Morocco	
Peru	
Portugal	
Spain	
Syria	
Thailand	
Tunisia	
Turkey	
Uruguay	
Venezuela	
Yugoslavia	
Jamaica	
<hr/>	

COUNTRY GROUPINGS *continued*

Ceylon  
Egypt  
Ghana  
India  
Iran

Israel  
Nigeria  
Pakistan  
Panama  
Philippines  
Sudan

11 Specials

(These plus the 25 preceding together  
make up the group Less Developed)

SOME SAMPLE REGRESSION EQUATIONS

All Countries,

$$1950-65: L/M = .79 - .09 F/L - .099 \sigma L - 1.18 GR + .003 D - .001 Y$$

$$(4.0) \quad (.48) \quad (1.3) \quad (.48) \quad (1.2) \quad (.23)$$

$$+ .064 FC \quad R^2 = -.006$$

$$(4.1)$$

All Countries,

$$1950-60: \bar{L} = -445 - 207 F/L - 516 \sigma L + 15,553 GR - 8.50 D$$

$$(.45) \quad (.18) \quad (.95) \quad (1.2) \quad (.69)$$

$$- 387 \sigma X + .982 \bar{M} \quad R^2 = .604$$

$$(.48) \quad (8.0)$$

Less Developed

$$\text{Countries: } L/M = .49 + .200 B/L + .029 F/L - .153 \sigma L + .377 GR$$

$$(2.2) \quad (1.3) \quad (.12) \quad (1.0) \quad (.30)$$

(32 Countries)

$$1960-65: \quad + .022 D - .041 \sigma X \quad R^2 = -.118$$

$$(.02) \quad (.48)$$

Less Developed

Countries

$$1955-65: L/M = .67 + .120 F/L - .094 \sigma L - 2.41 GR$$

$$(3.0) \quad (.49) \quad (.88) \quad (.95)$$

$$+ .021 D - .000 Y - .082 DIF \quad R^2 = .060$$

$$(1.9) \quad (.04) \quad (.26)$$

Less Developed

Countries minus

Specials

$$1955-60: L/M = .81 - .033 F/L - .494 \sigma L - .527 GR$$

$$(3.3) \quad (.10) \quad (2.5) \quad (.16)$$

$$+ .059 D + .029 TR \quad R^2 = .171$$

$$(1.4) \quad (.14)$$

All Developed

Countries

$$1955-65: L/M = -.00 - .375 F/L - .199 \sigma L + 2.33 GR + .032 D$$

$$(.01) \quad (2.0) \quad (1.2) \quad (.71) \quad (.13)$$

$$+ .007 Y + .466 \sigma X \quad R^2 = .365$$

$$(2.1) \quad (1.9)$$

Developed minus

United States

and United

Kingdom

$$1955-65: L/M = .54 - .353 F/L - .211 \sigma L + 2.12 GR + .092 D$$

$$(1.2) \quad (1.8) \quad (1.4) \quad (.67) \quad (.38)$$

$$+ .001 Y + 1.11 DIF \quad R^2 = -.016$$

$$(.13) \quad (.92)$$

(numbers in parentheses are *t*-values)

## REFERENCES

- Archibald, G. C. and J. Richmond, "The Theory of Foreign Exchange Reserves: A Probabilistic Approach," University of Essex discussion paper (mimeo).
- Brown, Weir M., "The External Liquidity of an Advanced Country," Princeton Studies in International Finance, No. 14 (Princeton: International Finance Section, 1964).
- Caves, Richard E., "International Liquidity: Toward a Home Repair Manual," *The Review of Economics and Statistics*, Vol. XLVI (May 1964), pp. 173-80.
- Clark, Peter B. (1969), "Demand for International Reserves: A Cross-Country Analysis" (mimeo).
- Clark, Peter B. (1970), "Optimum International Reserves and the Speed of Adjustment," *Journal of Political Economy*, Vol. 78 (March/April), pp. 356-76.
- Clower, Robert and Richard Lipsey, "The Present State of International Liquidity Theory," *American Economic Review*, Vol. LVIII (May 1968), pp. 586-95.
- Cohen, Benjamin J., "A Note on the Definition of International Liquidity," *Economia Internazionale*, Vol. XVII (August 1964), pp. 3-13.
- Coppock, Joseph D., *International Economic Instability* (New York: McGraw-Hill, 1962).
- Courchène, T. J. and G. M. Youssef, "The Demand for International Reserves," *The Journal of Political Economy*, Vol. 75 (August 1967), pp. 404-13.
- Flanders, M. June (1967), "Developing Countries' Needs for International Liquidity," prepared for, and circulated by, United States Agency for International Development, Office of Program and Policy Coordination (mimeo).
- Flanders, M. June (1969), "International Liquidity is Always Inadequate," *Kyklos*, Vol. XXII (Fasc. 3, 1969), pp. 519-29.
- Fleming, J. Marcus, and Gertrud Lovasy, "Fund Policy and Procedure in Relation to the Compensatory Financing of Commodity Fluctuations," *IMF Staff Papers*, Vol. VIII (November 1960), pp. 1-76.
- GATT, *International Trade, 1966* (Geneva: 1967).
- Harrod, Sir Roy, "The Dollar Problem and the Gold Question," in Seymour E. Harris, Ed., *The Dollar in Crisis* (New York and Burlingame: Harcourt, Brace and World, 1961).
- Heller, H. Robert (1966), "Optimal International Reserves," *The Economic Journal*, Vol. LXXVI (June 1966), pp. 296-311.
- Heller, H. Robert (1968), "The Transactions Demand for International Means of Payments," *The Journal of Political Economy*, Vol. 76 (January/February 1968), pp. 141-45.
- International Monetary Fund (1953), "The Adequacy of Monetary Reserves," *IMF Staff Papers*, Vol. 3 (October 1953), pp. 181-227. Prepared under the supervision of Mr. Henry Murphy.
- International Monetary Fund (1958), *International Reserves and Liquidity* (Washington, D.C.: 1958).
- International Monetary Fund (1966), *Annual Report, 1966* (Washington, D.C.).
- International Monetary Fund, *International Financial Statistics*, Various Issues.
- Johnson, Harry G., *Economic Policies Toward Less Developed Countries* (Washington: Brookings Institution, 1967).
- Kane, Edward J., "International Liquidity: A Probabilistic Approach," *Kyklos*, Vol. XVIII (Fasc. 1, 1965), pp. 27-48.
- Kenen, Peter and Elinor Yudin, "The Demand for International Reserves," *The Review of Economics and Statistics*, Vol. 47 (August 1965), pp. 242-50.
- Kuznets, Simon, *Six Lectures on Economic Growth* (Glencoe, Ill.: The Free Press, 1959).



- MacBean, Alasdair I., *Export Instability and Economic Development* (Cambridge, Mass.: Harvard University Press, 1966).
- Machlup, Fritz (1965a), "Adjustment, Compensatory Correction, and Financing of Imbalances in International Payments," in *Trade, Growth, and the Balance of Payments*, R. Baldwin, et al. (Chicago and Amsterdam: Rand McNally and North Holland Publishing Company, 1965). Reprinted by International Finance Section, Princeton University, Reprints in International Finance No. 2 (Princeton: 1965).
- Machlup, Fritz (1965b), "The Cloakroom Rule of International Reserves: Reserve Creation and Resources Transfer," *The Quarterly Journal of Economics*, Vol. LXXIX (August 1965), pp. 337-55. Reprinted by the International Finance Section, Princeton University, Reprints in International Finance, No. 1 (Princeton: 1965).
- Machlup, Fritz (1966), "The Need for Monetary Reserves," *The Banca Nazionale del Lavoro Quarterly Review*, No. 78 (September 1966). Reprinted by the International Finance Section, Princeton University, Reprints in International Finance, No. 5 (Princeton: 1966).
- Massell, Benton F., "Export Concentration and Export Earnings," *American Economic Review*, Vol. LIV (March 1964), pp. 47-63.
- Michaely, Michael, *Concentration in International Trade* (Amsterdam: North Holland Publishing Company, 1962).
- Rhomberg, Rudolf, "Trends in Payments Imbalances, 1962-64," *IMF Staff Papers*, Vol. 13 (November 1966), pp. 371-95.
- Scitovsky, Tibor (1966a), "A New Approach to International Liquidity," *American Economic Review*, Vol. LVI (December 1966), pp. 1212-19.
- Scitovsky, Tibor (1966b), "Alternative Methods of Restoring Balance," Ch. 15 in William Fellner, Fritz Machlup, Robert Triffin and Eleven Others, *Maintaining and Restoring Balance in International Payments* (Princeton: Princeton University Press, 1966), pp. 197-200.
- Thorn, Richard S., "The Demand for International Reserves. A Note in Behalf of the Rejected Hypothesis," and Kenen and Yudin, "Demand for International Reserves: A Reply," *The Review of Economics and Statistics*, Vol. 49 (November 1967), pp. 623-27.
- United Nations Conference on Trade and Development, UNCTAD, *International Monetary Issues and the Developing Countries*, Report of the Group of Experts (New York: 1965).
- Williamson, John, "Liquidity and the Multiple Key-Currency Proposal," *American Economic Review*, Vol. LIII (June 1963), pp. 427-33.
- Yudin, Elinor Barry, "The Demand for Reserves" (mimeo.), International Economics Workshop, Columbia University (New York: 1964).

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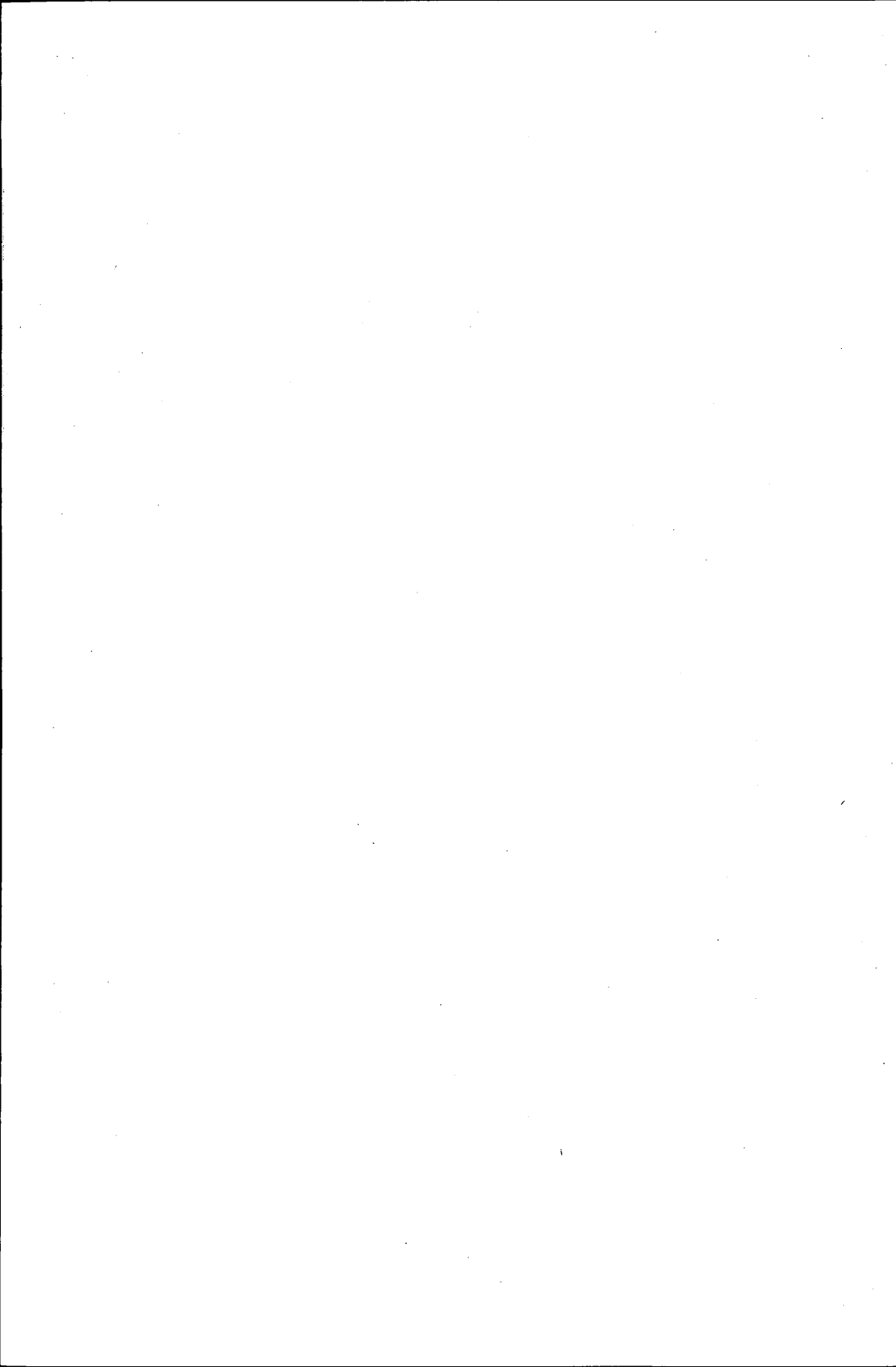
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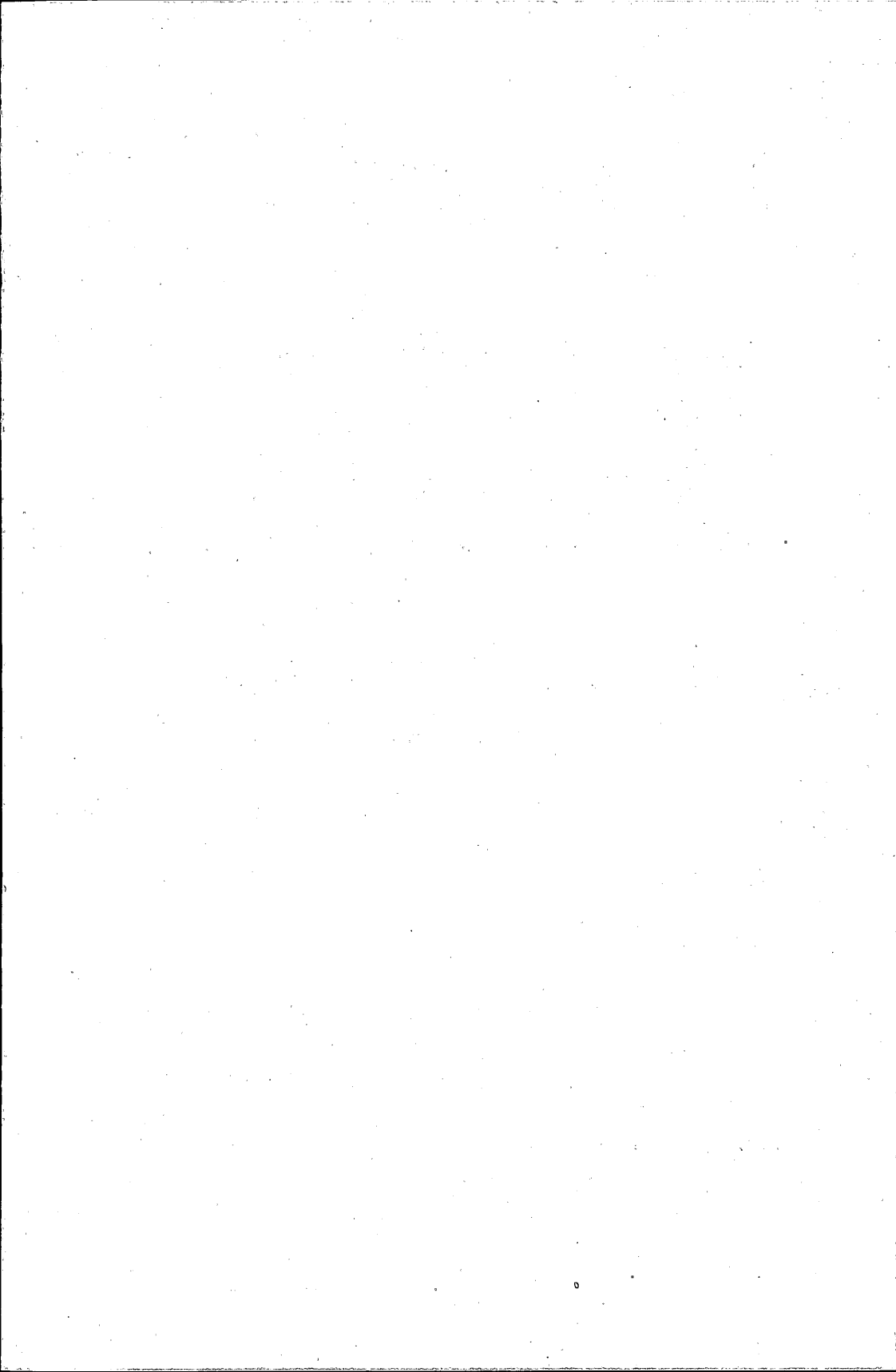
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