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## Demand for International Reserves and Effects of Reserve Increases on the World Economy: An Annotated Bibliography

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The attached annotated Bibliography surveys the recent literature on two topics: (1) the effects of an increase in international reserves (or an SDR allocation) on the world economy; and (2) the demand for international reserves with emphasis on studies containing empirical results. This note briefly describes some of the conclusions that have emerged from the theoretical and empirical studies in these two areas. Some of the more comprehensive studies are also identified. 1/

### 1. Reserve creation and the world economy

The analysis of the effects of an increase in international reserves (or an SDR allocation) on inflation, growth, the adjustment process, and the composition of reserves has been an integral part of the literature on the functioning of the international monetary system. Since the mid-1960s, analyses of these topics have evolved in a manner reflecting changes in the exchange rate regime and the degree of capital mobility in the international financial system. Around the time of the first allocation of SDRs, the macroeconomic effects of reserve growth were analyzed in the context of an international monetary system based on stable par values and limited capital mobility. In such a system, the stock of international reserves could be increased through gold production, SDR allocations, and balance of payments deficits of the reserve currency countries. Growth in the supply of international reserves that was too rapid (slow) relative to the growth in the demand for reserves at stable prices and exchange rates would have an expansionary (deflationary) effect on the world economy. These conclusions are evident in much of the literature described in Section I.1 of the Bibliography. In particular, the relative importance of different sources of reserve growth was examined extensively in Fleming (1970b, I.2). 2/ The general macroeconomic

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1/ Where possible, the annotations in the Bibliography have made use of the authors' summaries contained in the papers themselves or the Journal of Economic Literature.

2/ References are cited by year of publication and the section of the Bibliography in which they appear. When an author has two or more citations in a given year, these are differentiated by the presence of a small arabic letter after the year of publication (e.g., 1970a).

effects of reserve growth, and the implication for SDR allocations, are discussed in papers prepared for the Executive Board (e.g., IMF (1969a, I.1) and IMF (1970, I.1)) as well as by Fleming (1970a, I.1), Johnson (1973, I.1), and Rhomberg (1970, I.1).

During the 1970s and 1980s, discussions of the effects of reserve growth attempted to incorporate such factors as the changing nature of exchange rate relationships, the growing size and importance of international financial markets, the linkages between reserve accumulation and domestic stabilization policies, and the contribution of expectations regarding inflation. The exchange rate system evolved from a system based on fixed par values to one that encompasses independent floating and "joint floats" of groups of industrial countries, as well as a variety of exchange rate arrangements (including fixed but adjustable rates) for the developing countries. The presence of fixed, managed, and floating exchange rate arrangements has increased the complexities involved in analyzing the general macroeconomic effects of reserve increases. These alternative exchange rate regimes not only affect the demand for international reserves but also allow countries to exercise control over their domestic money supplies, which enable them to pursue domestic price objectives provided they are willing to accept the implied exchange rate movements. This potential monetary independence makes the analysis of the inflationary effect of reserve growth more difficult, because linkages between reserve growth and domestic monetary growth are weaker than in a fixed exchange rate system. Since many of the analyses given in Section I.2 of the Bibliography reflect different assumptions regarding the exchange rate regime, it is not surprising that there are diverse views on the strength of the linkages between reserve growth and inflation. Studies by Fleming (1975, I.2), Haberler (1977, I.2), and Williamson (1976a, I.2) give special attention to the implications of these changes in the exchange rate system. The relationship between reserve growth and inflation under these new conditions has been examined in a number of papers prepared for the Executive Board--IMF (1977, I.2; 1980, I.2; 1981, I.2; and 1983, I.2)--as well as in studies by Heller (1976, I.2 and 1981, I.2), Khan (1979, I.2), Willett (1980, I.2) and Williamson (1982, I.2).

The 1970s also witnessed the rapid growth of the Eurocurrency markets and a significant increase in the degree of capital mobility. The ability of countries to borrow in international capital markets implied that changes in the foreign exchange component of international reserves were not necessarily tied to the balance of payments deficits or surpluses of reserve currency countries. While some components of reserves remained clearly exogenous to the operations of the international monetary system (e.g., the SDR), the total stock of international reserves became more endogenous. As a result, an increase in one of the exogenous components of reserves (e.g., the SDR) might merely lead to the eventual displacement of one component of reserves with another component while leaving the overall stock of reserves unchanged. This possibility raised the question of the degree of substitutability between different types of reserve assets. Since there has not been general agreement about the extent of reserve assets substitutability in the literature given in

Section I.2 of the Bibliography, there is not yet a consensus regarding the implications of the increase in the degree of capital mobility for the inflationary potential of reserve growth. Some of the implications of the increased capital mobility for both the composition and growth of international reserves are addressed in the works by Corden (1983, I.2), Crockett (1978, I.2), the Group of Thirty (1982a, I.2 and 1982c, I.2), and Swoboda (1978, I.2), as well as in the papers prepared for the Executive Board on SDR allocations.

## 2. The demand for international reserves

The key empirical question dealt with in the literature listed in Section II of the Bibliography is whether the demand for international reserves is likely to show a stable relation to its principal determinants. While some theoretical studies have expressed doubt about the existence of a stable demand for international reserves (e.g., Niehans (1970, II.2)), most empirical studies have found well defined and quite stable demand functions at least for the period through the late 1970s. The country's level of income, the average income propensity to import, and the variability of imports have been identified as the principal empirical determinants of the demand for reserves. The estimated demand functions showed some signs of instability during the period 1972-73, especially for the industrial countries. It is too early to determine how stable those demand functions were during the disturbances in financial markets in 1981 and 1982. The empirical results on the demand for reserves are given in section II.2 of the Bibliography. Results based on relatively recent data include the papers by Frenkel (1983, II.2), Heller and Khan (1978, II.2), and von Furstenberg (1982, II.2).

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#### I. The Effects of a Reserve Increase (or SDR Allocations) on the World Economy

1. Discussions during the period of the first allocation of SDRs

Cooper, R. N. (1970), "International Liquidity and Balance of Payments Adjustment" in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970), pp. 125-45.

The author focuses on the relationship between liquidity and adjustment. He concludes that whether or not payments adjustment is facilitated by additional reserves depends on the nature of the adjustment process, the state of global reserve demand relative to supply, the source and pattern and magnitude of payments imbalances, and the extent to which national views about reserve changes are asymmetrical as between increases and declines.

Fleming, J. M. (1967), "Toward Assessing the Need for International Reserves," Essays in International Finance, No. 58, (Princeton University Press, 1967).

The study looks into the need for international reserves. The approach taken does not ask what amount of reserves each country would like to have, or what it would require in order to be able to follow desirable policies. Instead, it asks what would be the effects on world economic welfare, given the probable reactions of governments, central banks, and individuals, of increasing total reserves. On this approach the world's need for reserves is determined at the point where the effects of further reserve increments on world economic welfare cease to be positive.

\_\_\_\_\_ (1970a), "Reserve Creation and Real Reserves," in International Reserves Needs and Availability, International Monetary Fund (Washington, 1970), pp. 521-52.

A theoretical model is developed to study the effects that an increase in the rate of expansion of nominal reserves and an increase in the rate of interest paid on reserve holding have on the rate of inflation, on real reserves and on trade liberalization. Several results are possible depending on certain parameters of the model.

\_\_\_\_\_ (1970b), "The Bearing of the Supply of Other Reserves on the Need for Special Drawing Rights," in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970b), pp. 321-49.

This analysis examines some of the issues that arise in assessing and evaluating the supply of reserve assets other than SDRs when discussing the needs for allocations of SDRs. It presents a statistical classification of factors that give rise to reserve changes organized by types of reserves. It considers the various sources of reserve growth in the years preceding the calculation underlying the Managing Director's Proposal on the Allocation of Special Drawing Rights for the First Basic Period, what assumptions were contained in these calculations, and how the various factors have evolved since that time.

\_\_\_\_\_ (1971), "The SDR: Some Problems and Possibilities," International Monetary Fund, Staff Papers, Vol. 18 (March 1971), pp. 25-47.

The article describes the events that led to the creation of the SDRs, reviews the experience of the first year, and discusses some questions pertaining to future developments. The topics considered include: how should the SDR interest rate be set, how should the creation of SDRs be related to economic developments, should currencies be convertible into SDRs, and should private individuals be allowed to hold and use SDRs?

International Monetary Fund (1969a), "Allocation of Special Drawing Rights for the First Basic Period - An Assessment of the Quantitative Elements Involved," SM/69/101, July 3, 1969.

This paper discusses a growing inadequacy of reserves as evidenced by declining reserve-to-import ratios, and growing recourse to protectionist measures, payments restrictions, and borrowed reserves. An increase in reserves or an SDR allocation would promote a more acceptable adjustment behavior in keeping with Fund objectives, without aggravating inflation that was being brought under control through restrictive demand management policies in the United States and other major deficit countries.

\_\_\_\_\_ (1969b), "Relationships Between Conditional and Unconditional Liquidity," SM/69/98, June 30, 1969.

A distinction is made between the particular functions of conditional liquidity--to contribute to an optimal adjustment of payments disequilibrium--and the particular function of unconditional liquidity--to provide financial resources to all countries for meeting balance of payments needs. It argues that conditional and unconditional liquidity are imperfect substitutes and that the quality of the adjustment process is enhanced by having an appropriate balance between these two forms of liquidity.

\_\_\_\_\_ (1970), "The Need for Reserves: An Exploratory Paper," "Reserves and Reserve Creation: Issues to be Considered," "Reserve Developments, 1951-68: An Analytical Review," "Reserves and the Adjustment Process," and "Quantitative Criteria for Assessment of Reserves Needs," in International Reserves: Needs and Availability (Washington, 1970), pp. 369-490.

These are papers prepared by the staff of the Fund between January 1966 and June 1969 as background for the discussion and decisions of the Executive Directors regarding the creation of international reserves by the Fund. In measuring reserve need, the important factors mentioned are the stock of reserves, the rate of growth of payments disequilibrium, and the presence of excessive or deficient monetary demand. The effects of reserve increases, and hence their desirability at any particular time, will vary to some extent according to the manner in which they are carried out and according to the initial distribution of reserves among the various countries. The determination of the adequate size of allocations of SDRs has to take into account the expected growth in other forms of reserves. There is an analysis of reserve developments during approximately two decades, which examines the growth, reserve distribution among countries, reserve composition and reserve sources of reserves. Projections of reserve needs for a period of five years based on a sample of sixty countries are also presented.

Johnson, H. G. (1973), "Secular Inflation and the International Monetary System," Journal of Money, Credit and Banking, Vol. 5, No. 1 (November 1973), pp. 509-19.

In a financial system with fixed exchange rates it is important to keep the supply of international liquidity under control in order to avoid inflation.

Makin, J. H. (1972), "The Problem of Coexistence of SDRs and a Reserve Currency," Journal of Money, Credit and Banking, Vol. 4 (August 1972), pp. 509-28.

This study argues that a multi-asset reserve system is likely to be difficult to sustain. The potential instability of such a system reflects a Gresham's Law problem involving the coexistence of a number of reserve assets especially when the relative prices of the assets are fixed. The SDR may be able to play a role in stabilizing the system only if it is made sufficiently attractive. A greater degree of exchange rate flexibility might also be a means of reducing instability.

Marquez, J. (1970), "Reserves, Liquidity, and the Developing Countries," in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970), pp. 97-111.

Among other subjects this paper discusses the needs of reserves of industrial and developing countries. It argues that developing countries need relatively higher reserves owing to the structure of their imports, exports, and foreign debt; the problems of confidence in their currencies; the need to pursue active development policies; the need for flexible economic policies; and the restrictions in the access of these countries to world capital markets.

Polak, J. J. (1970), "Money: National and International" in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970), pp. 510-20.

This paper presents a systematic exposition of some of the similarities and dissimilarities between domestic and international money. It mentions that, while monetary policy within a country would be effective in influencing aggregate demand, the effects of the supply of reserves on aggregate world demand are less certain. Therefore, it is doubtful that the adequacy or inadequacy of reserves could be inferred from the prevailing world demand situation. In view of the existent uncertainty regarding the policy response of governments to changes in the availability of reserves, international reserve policy should be focused on the trend rather than cyclical factors.

Rhomberg, R. R. (1970), "Estimation of Effects of Changes in International Reserves," in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970), pp. 157-92.

This analysis discusses and evaluates possible research methods to estimate the effects of allocations of special drawing rights on the world economy. It examines the mechanism through which reserve changes affect the world economy and identifies some of the problems facing any attempt at quantitative estimation. Then, it sets out a simple model of

the world economy from which it follows that an autonomous increase in the rate of growth of nominal reserves may have, over a medium-term period, one of the following three consequences or a combination of them:

(i) a reduction in the rate of growth of other reserves or reserve substitutes; (ii) an increase in the target rate of growth of real reserves; (iii) a reduction in the purchasing power of existing reserve assets. Then, it analyses the choice among different instruments that can be used for balance of payments policy. Finally, it discusses the possibilities for estimation of the effects of changes in reserves.

Salant, W. S. (1970), "Practical Techniques for Assessing the Need for World Reserves," in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970), pp. 269-306.

This analysis considers some questions arising in connection with efforts to estimate the need for aggregate international reserves, reviews some of the methods that have been used, and suggests some alternative methods.

Sohmen, E., (1970), "General Reserve Supplementation: Some Central Issues," in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970), pp. 12-31.

The author is very sceptical about the possibility of quantifying the need for reserves. He argues that a reserve need for transactions purposes does not exist for the major industrial countries with easy access to mobile international funds. These countries can bridge any incipient deficits in their autonomous international payments by appropriate monetary and fiscal policies, intervention on forward exchange markets, or direct borrowing abroad by their central banks or government. A genuine need for official reserves or for easy access to officially negotiated international liquidity exists only for less developed, politically more unstable countries in which private capital is reluctant to enter. Need for international liquidity on a large scale arises only in situations of crises. For those cases, a quantitative evaluation is impossible.

## 2. More recent analyses

Corden, W. M. (1983), "Is There an Important Role for an International Reserve Asset such as the SDR?" in International Money and Credit: The Policy Roles, G. M. von Furstenberg, ed., International Monetary Fund (Washington, 1983), pp. 213-59.

The analysis considers some inadequacies of the present monetary system (the instability of exchange rates, the tendency for the system to give rise to inflation or recession, and problems in the international capital market) and examines whether a large-scale creation of an inter-

national reserve asset, such as the SDR, could overcome these inadequacies. It concludes that, within the present system, new creation of SDRs would be justified only to compensate for a possible tendency of the international capital market to overreact to recent events and underlend to developing countries. The same objective, however, could be achieved better through increases in quotas or the expansion of the direct resources of the Fund.

Crockett, A. D. (1978), "Control Over International Reserves," International Monetary Fund, Staff Papers, Vol. 25 (March 1978), pp. 1-24.

The author discusses whether the objective of international control over reserve creation should be reconsidered in the light of recent developments in the international monetary system. It deals with the effect of exchange rate flexibility and the growth of international capital markets on the shape and stability of the supply and demand functions for international reserves and considers some alternative proposals for exercising a greater degree of reserve control. Because of the theoretical objections and practical difficulties involved, it suggests as a more fruitful means of improving the international adjustment process the effective implementation of the Fund's surveillance procedures.

Fawzi, S. I. (1982), "Has the SDR Been Used as the First Line Reserve Asset?" International Monetary Fund, DM/82/4 (January 1982).

This paper attempts a statistical analysis of SDR uses with a view to ascertaining whether participants have tended to use SDRs in greater proportion than other reserve assets when drawing down reserves. The general conclusion that emerges from the analysis is that most members did not appear to have used SDRs as their first line of reserves, preferring instead to use foreign exchange. Furthermore, the specific factors that could be expected to influence the use of SDRs did not show explanatory power in that context.

Fleming, J. M. (1975), "Floating Exchange Rates, Asymmetric Intervention, and the Management of International Liquidity," International Monetary Fund, Staff Papers, Vol. 22 (July 1975), p. 263-83.

It is argued that, even in a system with managed floating exchange rates, the problems of asymmetry of adjustment between the issuers of the principal intervention currencies and other countries and the problem of ensuring an effective international management of reserves remain to be solved. The best solutions for these problems involve a combination of three elements: organized multicurrency intervention, asset settlement, and an SDR substitution account. A development of the system of SDR designation would also be required.

Girton, L. (1974), "SDR Creation and the Real-Bills Doctrine," Southern Economic Journal, Vol. 41, No. 1 (July 1974), pp. 57-61.

The author argues that the real-bills doctrine is widely understood to be fallacious as a guide to the proper management of a domestic monetary system. Supplying money to meet the needs of trade will exacerbate price movements if prices respond to demand pressures. Creating SDRs at the rate needed to keep the ratio of reserves to international trade at an "acceptable" level is the international analogue of the domestic real-bills doctrine and suffers from the same logical defect, that of using one nominal magnitude as a guide for controlling the supply of another nominal magnitude.

Group of Thirty, Reserves Assets Study Group (1982a), "How Central Banks Manage Their Reserves" (New York, 1982).

This study examines reserve asset diversification. The original impetus to diversification came from the collapse of the Bretton Woods System and the floating exchange rates. This motivated many countries to try to maintain the real value of the foreign exchange assets or at least to increase the return on them. The desire to spread the exchange risk on the large accrual of reserves to raw material producers after the commodities boom of 1972/73 and to oil producers after 1973 and 1979 contributed to reserve asset diversification. Euromarkets provided the preferred channel for diversification. Diversification is expected to continue but at a slower pace because very few countries have markets of a breadth and depth that would make their currencies suitable as foreign official assets on any significant scale.

\_\_\_\_\_, Reserves Assets Study Group (1982b), "Towards a Less Unstable International Monetary System" (New York, 1982).

There is a clear tendency of many central banks to diversify the composition of their reserves. This diversification could be a potential destabilizing element in foreign exchange markets. The establishment of a Substitution Account in the IMF could be a first step toward meeting the challenge. The study also suggests that a form of cooperation between central banks is needed which would guide their policies to a less destabilizing pattern.

\_\_\_\_\_, Multiple Reserve Currency Study Group (1982c), "Reserve Currencies in Transition" (New York, 1982).

Contrary to expectations, flexible exchange rates have led to the development of a system of multiple reserve currencies. In such a system, the growth of reserves (including Eurocurrencies) may become excessive and promote a vicious circle of inflation, with higher prices leading to higher commercial needs and in turn to larger uses of credit and related money and reserve creation.

Grubel, H. G. (1977), "How Important is Control Over International Reserves?" in The New International Monetary System, R. A. Mundell and J. J. Polak, eds. (Columbia University Press, 1977), pp. 133-61.

A theoretical model is presented that suggests that international reserves have a positive social productivity and that the world would benefit from having the IMF supply aggregate reserves in the form of SDRs in optimal quantity and with an optimal yield. While the analysis is mainly theoretical, the author indicates two policy implications. First, the yield on SDRs must be raised. Second, in view of the difficulties encountered in measuring reserve demand directly, the determination of aggregate reserve growth should be approached very pragmatically. He suggests that the IMF should increase SDR supplies at a steady constant rate for a number of years, say five. The rate may be made initially equal to the rate of growth in the nominal value of international trade in the preceding ten years.

Haberler, G. (1977), "How Important is Control over International Reserves?" in The New International Monetary System, R. A. Mundell and J.J. Polak, eds. (Columbia University Press, 1977), pp. 109-32.

It is argued that generalized floating and other developments have rendered obsolete any attempt to define an optimum level of international reserves; similarly, control of international reserves is no longer an important business for the IMF. It is the adjustment and not the liquidity problem that is of paramount importance. Although additional allocations of SDRs may have a marginal effect on world inflation, under the present system of floating, inflation has its roots in national monetary, fiscal and exchange rate policies. The primary responsibility for fighting inflation falls on the leading industrial countries.

Heller, H. R. (1976), "International Reserves and World-Wide Inflation," International Monetary Fund, Staff Papers, Vol. 23 (March 1976), pp. 61-88.

The study analyzes the relationship between increases in international reserves and inflation from a global perspective. It argues that the increase in reserves helped to precipitate worldwide monetary expansion that was an important causal factor in the worldwide inflation of the early 1970s.

\_\_\_\_ (1981), "International Reserves and World-Wide Inflation - Further Analysis," International Monetary Fund, Staff Papers, Vol. 28, No. 1 (March 1981), pp. 230-33.

The four-page note provides further evidence on the linkage between global reserve changes and worldwide inflation. The evidence confirms the hypothesis that there is indeed a relationship between increases in

global reserves and worldwide inflation. The conclusion is that greater control over global reserve increases would be helpful in slowing down global monetary increases and worldwide inflation.

Howle, E. S. (1974), "Real Reserves, Nominal Reserves and Balance of Payments Adjustments," Journal of International Economics, Vol. 4, No. 1 (February 1974), pp. 1-14.

The multicountry theoretical model of the international monetary system presented in this paper allows for using several alternative assumptions regarding balance of payments adjustment. The author explores how the rate of creation of nominal reserves affects (1) the quantity and growth of real reserves, and (2) the division of the adjustment burden between deficit and surplus countries.

International Monetary Fund (1977a), "The Adequacy of International Liquidity," SM/77/62, March 21, 1977.

This analysis argues for an early resumption of SDR allocations so as to promote its long-term role but without exacerbating the problem of inflation. It notes that the impact of an SDR allocation may differ because of major changes in the system. While an SDR allocation was initially viewed as providing a needed increase in the supply of reserves to offset a reserve shortage, an allocation is now viewed as a means to affect the composition of reserves in more desirable directions. The control of world inflation requires appropriate national monetary and fiscal policies and allowances by national authorities for the amount of SDR creation in determining the non-inflationary expansion in monetary aggregates.

\_\_\_\_ (1977b), "The Question of a Further Allocation of Special Drawing Rights," SM/77/269, November 10, 1977.

The paper undertakes a fairly detailed assessment of some of the costs and benefits of an SDR allocation taking note of the major changes in the international environment since the initial decision to allocate SDRs. It argues, on the basis of past data, that only 10 percent of an SDR allocation might be spent directly and that the bulk of the allocation would in any event accrue to major countries with a lower international spending propensity; and that the effects are likely to be very small and easily contained by minor changes in policy. Furthermore, the allocation would not interfere with the international adjustment process, given its potentially small size relative to quotas and other sources. One benefit of such an allocation would be to alleviate problems encountered by countries with limited access to capital markets. By raising the ratio of net to gross (including borrowed funds) reserves, the paper argues that the allocation makes the world economy more resistant to financial disruptions. One of the longer-term benefits would be that the value (in

terms of goods and services) of the bulk of reserve assets of countries would not be primarily dependent on the economic policy of only one country.

\_\_\_\_\_ (1978), "Draft Report of the Executive Directors to the Interim Committee on the Characteristics and Uses of the SDR," SM/78/85, March 21, 1978.

This paper discusses steps for promoting more effectively the use of SDRs with the focus on the rate of interest on this asset. The argument is presented that to lower the rate of interest would encourage the use of the SDR in financing a balance of payments deficit, while to raise the rate would discourage surplus countries from adjustment. The rate of interest on SDRs also has a bearing on the desired composition of reserves and thus the promotion of the SDR as the principal reserve asset. In effect, an appropriate rate of interest would render the SDR allocation less expansionary than it otherwise would be.

\_\_\_\_\_ (1980), "Considerations Relating to the Size of SDR Allocations," SM/80/189, with Cor. 1, July 25, 1980.

A number of considerations are discussed in connection with the remainder of the third basic period and the prospective fourth basic period. The argument is presented that "unexpected" developments involving a major and possibly permanent deterioration in the terms of trade of non-oil developing countries will result in sizable prospective imbalances, thereby adding to the need for reserves. In addition, a supplemental SDR allocation would contribute to the diversification of reserves by type of asset. With regard to the possibility of aggravating the rate of inflation, it is argued that the connections between the allocation of SDRs and the growth of global reserves, and between the latter and national inflation rates, are quite tenuous. Moreover, a large part of the price increases that had occurred could be viewed as irreversible, which in turn would support an SDR allocation to maintain its share in total reserves.

\_\_\_\_\_ (1981a), "Considerations Relating to the Size of the SDR Allocations in the Fourth Basic Period," SM/81/4, and Cor. 1, January 7, 1981.

In proposing an SDR allocation, the paper does not, on the basis of past evidence, find compelling the argument that the allocations would convey an inflationary signal and affect expectations adversely. Nor would the allocation lead to the entire amount being monetized and spent. In any event, the expansionary impact would be small given the limited size of allocations envisaged. A detailed discussion of possible channels of influence of an SDR allocation is provided emphasizing the monetary base implications. The argument is also presented that the reserve needs of many non-oil developing countries were not being adequately met through the capital markets and an SDR allocation would help avoid ensuing deleterious consequences.

\_\_\_\_\_ (1981b), "Further Considerations Relating to the Size of SDR Allocations in the Fourth Basic Period," SM/81/74, and Sup. 1, April 1, 1981.

The paper argues for an SDR allocation in step with the increase in the demand for non-gold reserves on the assumption of zero inflation. Hence, even though some actual inflation is likely to occur, the contribution of new SDR allocations would not be inflationary and would not be so regarded.

\_\_\_\_\_ (1983a), "Considerations Relating to a Possible Proposal for an Allocation of SDRs in the Current Basic Period," SM/83/157, July 11, 1983.

In this paper a historical review is provided of the circumstances surrounding the decisions with regard to SDR allocations in each of the basic periods. In the first basic period, the allocation was justified on the grounds of meeting a long-term reserve need that could not be achieved through continued U.S. deficits. However, the unanticipated explosion in reserves at the onset of the second basic period counselled against any allocations. For the third basic period modest allocations were made, not to meet a global need for reserves but to improve the quality of holdings. The pursuit of anti-inflationary policies in the early 1980s disposed against a further SDR allocation. However, the paper argues for an SDR allocation on the basis of more recent developments involving a sharp decline in inflation, the emergence of excess capacity, and the inability of many non-oil developing countries to maintain access to the international capital markets. Some statistical evidence is presented to demonstrate that, for the non-oil developing countries, the decline in reserve holdings exceeded the amount attributable to demand factors indicating some supply constraints. The effects of an SDR allocation are regarded as being on balance beneficial.

\_\_\_\_\_ (1983b), "Considerations Relating to the Long-Term Global Need to Supplement Existing Reserve Assets," SM/83/196, August 26, 1983.

This analysis examines whether there is a long-term global need for reserve supplementation as it is laid down in the Articles of Agreement. There are projections of the medium-term demand for the period 1983-86 on the basis of forecasts in the World Economic Outlook. In addition, the likely sources of reserve supply growth are identified. It is argued that SDR allocations can play a role in meeting the long-term global need for reserve supplementation and help to diversify the composition of reserve assets.

\_\_\_\_\_ (1983c), "The Evolving Role of the SDR in the International Monetary System," in International Money and Credit: The Policy Roles, G. M. von Furstenberg, ed. (Washington, 1983), pp. 475-535.

This paper discusses various actual and potential roles of the SDR in the international financial system. The first part deals with past developments and their implications of the SDR; the second considers how the role of SDRs and SDR-denominated claims could usefully be broadened under the existing international monetary system and under a conceivable future system that is characterized by greater stability of exchange rates and national price levels.

Kelly, M. G. (1970), "The Demand for International Reserves," American Economic Review, Vol. 60 (September 1970), pp. 655-67.

A model is provided in which governments hold reserves in order to reduce income fluctuations induced by exogenous changes in external demand. Utility is a function of the level of income net of reserves and of fluctuations in that income. Maximizing utility gives optimum reserve holdings as a function of the variance in exogenous disturbances in the balance of payments, the domestic response to these disturbances, and the opportunity cost of reserves. The model is tested on reserve holdings of 46 countries in the postwar period. Implications are drawn for reserve supply policy of the International Monetary Fund.

Kenen, P. B. (1983), "Use of the SDR to Supplement or Substitute for Other Means of Finance," in International Money and Credit: The Policy Roles, G. M. von Furstenberg, ed., International Monetary Fund (Washington, 1983), pp. 327-60.

The author argues that international reserves will play a larger role in the 1980s than they did in the 1970s and more attention should be paid to their supply. An attempt should be made to stabilize the stock or growth rate of reserves by altering the supplies of SDRs to offset unanticipated changes in the supply of other reserves assets, especially to offset decreases brought about by abrupt withdrawals of borrowed reserves. Ways to make the SDR a more important reserve asset are suggested.

Khan, M. S. (1979), "Inflation and International Reserves: A Time-Series Analysis," International Monetary Fund, Staff Papers, Vol. 26 (December 1979), pp. 699-724.

This analysis examines whether the growth in international reserves during the period 1957-77 could be considered a cause of global inflation. In addition, an attempt is made to consider separately the empirical relationship between the two variables during the more recent floating exchange rate period. Tests for three separate country groups--the world, industrial countries, and developing countries--indicated that for the period as a whole causation was, in the main, unidirectional, running from international reserves to inflation. However, since 1973, the pattern of causation has become somewhat ambiguous.

Leipziger, D.M. (1975), "Determinants of Use of Special Drawing Rights by Developing Nations," Journal of Development Studies, Vol. 11, No. 4 (July 1975), pp. 316-24.

The paper examines the determinants of the use of SDRs by developing countries. The general model characterizes the demand for SDRs as dependent on balance of payments requirements, changes in reserve asset levels, and portfolio considerations.

McKinnon, R. (1982), "Currency Substitution and Instability in the World Dollar Standard," American Economic Review, Vol. 72 (June 1982), pp. 320-33.

It is argued that the demands for the (convertible) moneys of the industrial countries are highly sensitive to expected exchange rate changes or other international economic disturbances and therefore foreign exchange considerations should influence American monetary policy. For the United States, fluctuations in the "world" money supply explain the two great inflations of the 1970s, and the great deflation of 1981-82, better than any American monetary aggregate. Hence, the Federal Reserve System should replace its domestic monetary rule with a carefully defined international one.

Murphy, R. J. and G. M. von Furstenberg (1981), "An Analysis of Factors Influencing the Level of SDR Holdings in the Non-Oil Developing Countries," International Monetary Fund, Staff Papers, Vol. 28 (June 1981), pp. 310-37.

The paper considers various influences on SDR holdings of non-oil developing countries. It finds that for 1974-78, SDR holdings expressed as percentages of allocations were systematically affected by portfolio balance and cost considerations. Analysis of external debt factors showed no clear relationship between debt burdens and SDR use.

Rhomberg, R. R. (1983), "Balance of Payments Financing and Reserve Creation," International Monetary Fund, DM/83/76 (November 1983).

This paper examines the processes by which international reserves are, or could be, generated and discusses the effects of alternative reserve systems on macroeconomic performance and balance of payments adjustment.

Swoboda, A. K. (1978), "Gold, Dollars, Euro-Dollars and the World Money Stock Under Fixed Exchange Rates," American Economic Review, Vol. 68 (September 1978), pp. 625-42.

A two-country model of the world money stock under fixed rates which integrates balance of payments with money-multiplier analysis is presented. Given asset-preference ratios, domestic credit, and outside international reserves (gold), the model determines endogenously: (1) the world money stock; (2) national money stocks; (3) Euro-dollar deposits; (4) European official dollar reserves; and (5) the distribution of total international reserves. The paper investigates the asymmetries introduced by European official dollar holdings, which sharply reduce the effectiveness of European monetary policy and the effect of asset-preference changes on the world money stock and world prices.

Willett, T. D. (1980), "International Liquidity Issues," Washington: American Enterprise Institute for Public Policy Research (Washington, 1980).

This study presents an analytic history of major international liquidity developments and analyzes a number of recent policy issues. Some of the main conclusions of the study are the following. There is not a sufficiently strong and systematic relationship between reserve changes and national economic behavior to use the behavior of international reserves aggregates as a guide to international liquidity policies in the way that the behavior of national monetary aggregates can be used as a guide to national monetary policy. Although the international liquidity explosion of 1970-72 did have a significant impact on the acceleration of worldwide inflation, the effect was not nearly as large as other authors have argued. A modest rate of SDR creation should be continued, but greater emphasis should be placed on strengthening the resources of the IMF for discretionary lending.

Williamson, J. (1973), "International Liquidity: A Survey," Economic Journal, Vol. 83 (September 1973), pp. 685-746.

This survey article of the literature on international liquidity, interpreted as that part of international monetary economics concerned with the behavior of the international monetary system rather than the balances of payments of individual countries, primarily covers the period since 1959. The first half covers positive theory: the demand for reserves, reserve composition, the supply of reserves, and the effects of reserves on adjustment. The second half is concerned with the normative theory of how the system should be managed. It surveys alternative ways in which liquidity could be provided, the grounds for choosing between these alternatives (analyzed in terms of confidence, stabilization, and seigniorage), the aid link, the normative theory of reserve supply, and the adequacy of reserves.

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(1976a), "Exchange Rate Flexibility and Reserve Use," Scandinavian Journal of Economics, Vol. 78, No. 2 (1976), pp. 327-39.

This paper examines whether there is a trade-off between the degree of flexibility in exchange rates and the extent of reserve use. The first section of the paper constructs a measure of reserve use in order to examine changes in the extent of reserve use since the advent of generalized floating. It is found that reserve use initially tended to increase following the move to floating, and that, despite some subsequent decline, it has remained substantial. The second section constructs and partially solves a formal model designed to illuminate the determinants of reserve use. It is shown that there need not necessarily be a trade-off between exchange rate flexibility and the extent of reserve use.

\_\_\_\_ (1976b), "Generalized Floating and the Reserve Needs of Developing Countries," in The International Monetary System and the Developing Nations, D. M. Leipziger, ed. (Washington: Agency for International Development, 1976), pp. 75-86.

This paper discusses whether the reserve needs of developing countries that have continued to peg their currency to a reserve-intervention currency have been increased by the adoption of generalized floating by a large number of other countries. Although the theoretical analysis implies an increase in the needs for reserves, the empirical evidence drawn from five developing countries indicates that the quantitative effects are not significant.

\_\_\_\_ (1982), "The Growth of Official Reserves and the Issue of World Monetary Control," in The International Monetary System: A Time of Turbulence, J. S. Dreyer, G. Haberler, and T. D. Willett, eds. (Washington: American Enterprise Institute for Public Policy Research, 1982), pp. 277-91.

This paper discusses whether the rapid expansion of international reserves during the 1970s has caused the global inflation witnessed during that period. It argues that there is neither theoretical nor empirical evidence linking global reserves to world inflation, especially under present arrangements. It draws the conclusion that a coherent world monetary policy, in the sense of an assurance that the world money supply will expand at an appropriate rate, cannot be achieved by establishing and exercising collective control of the volume of world reserves.

## II. The Demand for International Reserves

### 1. Theoretical studies

Claassen, E. M. (1975), "Demand for International Reserves and the Optimum Mix and Speed of Adjustment Policies," American Economic Review, Vol. 65, No. 3 (June 1975), pp. 446-53.

The paper builds a model of the demand for reserves that is based on the government welfare maximizing behavior under uncertainty. The basic assumption is that there is an "objective" trade-off between reserves and adjustment policies on the one hand and a "subjective" trade-off between the opportunity cost of reserves holdings and the variability of internal variables caused by adjustment policy on the other hand. There are many similarities between the demand function for precautionary balances by individuals and the demand function for international reserves by central banks. The main difference is the use of a notion of internal adjustment cost in the demand for reserves as opposed to the idea of cost of portfolio shifts in the precautionary demand for money.

Clark, P. B. (1970), "Optimum International Reserves and the Speed of Adjustment," Journal of Political Economy, Vol. 78 (April 1970), pp. 356-76.

This paper argues that the optimum level of reserves and the optimum speed of adjustment are interdependent. It provides a model based on the assumption that a country wishes to maintain a given probability of running out of international reserves, and that it can do this with different combinations of reserve levels and rates of adjustment. Slower adjustment is permitted by holding a larger average reserve stock, but this alternative involves a loss in income due to foregone investment. The main results of the paper show how the optimum reserve stock and speed of adjustment depend on the underlying parameters.

Clower, R. and R. Lipsey (1968), "The Present State of International Liquidity Theory," American Economic Review, Vol. 58, No. 2 (May 1968), pp. 586-95.

This discussion examines the reasons for holding official reserves. The reasons are the following: (1) need to accommodate systematic and random fluctuations in current account receipts and payments; (2) need to allow for temporary non-speculative variations in capital account items; (3) need to buy time when facing a fundamental disequilibrium; and (4) need to be able to weather speculative storms.

Heller, H. R. (1968), "The Transaction Demand for International Means of Payment," Journal of Political Economy, Vol. 67 (January 1968), pp. 141-45.

International reserves held by the monetary authorities are not used to finance international transactions but to intervene in the foreign exchange market. The demand for reserves therefore primarily depends on the magnitude of the imbalances in the balance of payments. The paper, however, admits that there also exists a transactions motive for holding international reserves.

Kemp, M. C. (1970), "World Reserve Supplementation: Long-Run Needs for Short-Run Purposes," in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970), pp. 3-11.

After formulating the problem of the determination of reserve needs in abstract terms, this paper discusses an alternative approach that allows for a numerical solution. It concludes that the optimal path of reserve supplements can be calculated only if either the optimal time path of exchange rates, tariffs, and quantitative restrictions over trade and payments are simultaneously calculated or specific assumptions about the policy determination of these variables by individual countries are introduced.

Niehans, J. (1970), "The Need for Reserves of a Single Country," in International Reserves: Needs and Availability, International Monetary Fund (Washington, 1970), pp. 49-85.

The analysis first considers the level and growth of reserves of a single country from a theoretical point of view. The demand for reserves is derived as a result of equating the marginal utility of reserves and their marginal cost. It concludes, however, that the practical assessment of national reserves needs may be both difficult and unnecessary. International monetary authorities could formulate workable guidelines for the aggregate supply of reserves without considering the reserve needs of individual countries.

Olivera, J. H. G. (1969), "A Note on the Optimal Rate of Growth of International Reserves," Journal of Political Economy, Vol. 77, No. 2 (March/April 1969), pp. 245-48.

This paper assumes that the long-run excess demand for foreign exchange is normally distributed with zero mean, and that the monetary authority maintains the risk of reserve depletion at a fixed level. It shows that, even under these simplified hypotheses, there is no general relation between the amount of reserves and the volume of transactions. A precise relation only results if the composition of exchange transactions is kept rigidly constant. Then the long-run need for reserves is connected with the volume of transactions by a square-root law.

## 2. Empirical studies

Archibald, G. C. and J. Richmond (1971), "On the Theory of Foreign Exchange Reserve Requirements," Review of Economic Studies, Vol. 38, No. 114 (April 1971), pp. 245-63.

The study is an empirical investigation of the time-series characteristics of the stock of reserves in 14 countries. The focus is on the notion of "required reserve levels." Security is the main reason behind the demand for reserves.

Ben-Bassat, A. (1980), "The Optimal Composition of Foreign Exchange Reserves," Journal of International Economics, Vol. 10, No. 2 (May 1980), pp. 285-95.

The paper presents a model for selecting an optimal foreign exchange reserves portfolio for semi-industrial and developing countries. The focus is on the relationship between the composition of reserves on one side and the composition of imports and the reserve and risk of the investment in each currency on the other.

Bilson, J. and J. Frenkel (1979), "International Reserves: Adjustment Dynamics," Economic Letters, Vol. 4 (June 1979), pp. 267-70.

The paper presents evidence suggesting that central banks have a target level of international reserves and that the dynamics of adjustment is rapid. The target level for reserves is a function of income, the average propensity to import and the ratio of the standard error of the trend-adjusted change in the stock of reserves to the level of imports. On average, 50 percent of the discrepancy between the desired and the actual stock is made up within a year.

Chrystal, K. A. (1977), "Demand for International Media of Exchange," American Economic Review, Vol. 67, No. 5 (December 1977), pp. 840-50.

It is argued that there is a demand for internationally acceptable moneys to circulate in the world economy. Four currencies are assumed to compete in this role. The composition of a portfolio comprising foreign held balances of these currencies is shown to be dependent upon the relative rates of return and transactions services of each. Transactions services are proxied by the size of the issuing country in world trade. All currencies respond to interest rate changes. Trade structure affects sterling and deutsche mark. The dollar is influenced by the aggregate level of world trade rather than by its composition, but the French franc shows no response to trade at all.

Chrystal, K. A., N. D. Wilson, and P. Quinn (1983), "Demand for International Money, 1962-1977," European Economic Review, Vol. 21, No. 3 (May 1983), pp. 287-98.

One of the authors has previously argued that there is a well-established pattern of substitution between external holdings of major currencies (Chrystal [1977]). The present paper extends the earlier results through a period of major perturbations in the international monetary system. Such substitutions continue to be well defined, although the present results indicate the presence of dynamic instability in the system as specified.

Clark (1970), "Demand for International Reserves: A Cross-Country Analysis," Canadian Journal of Economics, Vol. 3 (November 1970), pp. 577-94.

This study provides an empirical test of a stock-adjustment model of reserve-holding behavior. This model postulates that there is a trade-off between reserves and the speed of adjustment in maintaining a given probability of running out of reserves, and these two policy instruments are shown to be functions of the marginal propensity to import, income per capita, and the standard deviation of the payments disturbance. Using estimates of these parameters for 38 countries, cross-country regressions show that the payments disturbance and income per capita are important explanatory variables.

Daub, M. (1979), "The Statistical Nature of International Reserves Behavior," Canadian Journal of Economics, Vol. 12, No. 3 (August 1979), pp. 450-56.

The conclusion is reached that different models are needed for different countries and that models should be specified in percentage changes (not levels or absolute changes). The main result is that the explanation for reserve holdings should concentrate more on explanation of the "trend" than on short-run period fluctuations. There also appear to be breaks in the data during the 1968-71 period and in the post-1974 period.

Edwards, S. (1980), "A Note on the Dynamic Adjustment of the Demand for International Reserves by LDC's," Economic Letters, Vol. 5 (1980), pp. 71-74.

The dynamics of the adjustment of the demand for international reserves by developing countries is examined. It is found that 95 percent of the adjustment is completed within 12 months. The demand for reserves is a function of income, a measure of openness (average propensity to import) and a variability measure (variance of the trend adjusted changes in the stock of international reserves deflated by the level of imports). All the variables are significant.

Flanders, M. J. (1971), "The Demand for International Reserves," Studies in International Finance, No. 27, Princeton University (1971), pp. 1-50.

The study attempts to answer the question whether it is possible to explain the behavior of less developed countries in determining their holdings of international monetary reserves. The sample period is 1950-65. The estimated demand function has the average ratio of reserves to imports on the left-hand side; on the right-hand side we find the ratio of official holdings of foreign exchange to total reserves, the coefficient of variation of reserves, GNP growth, real exchange rate changes, per capita GNP

as a percentage of per capita GNP of the United States, and the amount of foreign exchange held by private banks. The author concludes that "the results are almost uniformly bad."

Frenkel, J. A. (1983), "International Liquidity and Monetary Control," in International Money and Credit: The Policy Roles, G. M. von Furstenberg, ed., International Monetary Fund (Washington, 1983), pp. 65-109.

Among other topics, this paper reports the results of an empirical study of the demand for international reserves during 1963-79. The main findings are that a country's holding of international reserves can be characterized as a stable function of three variables (income, average propensity to import, and variability of international receipts and payments), and that the move to greater flexibility of exchange rates has not fundamentally changed the general patterns of reserve holdings.

\_\_\_\_\_ and B. Jovanovic (1981), "Optimal International Reserves: A Stochastic Framework," Economic Journal, Vol. 91 (June 1981), pp. 507-14.

A stochastic model is developed for determining the optimal stock of international reserve holdings as a function of the rate of interest, the variance of the stochastic process governing international payments and receipts, and the mean rate of net payments. The model is tested empirically using data on reserve holdings for 22 developed countries. The empirical results are shown to be highly consistent with the predications of the theoretical model.

Grubel, H. G. (1971), "The Demand for International Reserves: A Critical Review of the Literature," Journal of Economic Literature, Vol. 9 (December 1971), pp. 1148-66.

This is a survey of the literature on the demand for reserves. The conclusion is that demand is an increasing function of the level of income, imports, and the instability in the international payments. The elasticity with respect to income is close to one, that with respect to trade considerably less than one.

Heller, H. R. (1966), "Optimal International Reserves," Economic Journal, Vol. 67 (June 1966), pp. 296-311.

A theoretical model is used to analyze the welfare effects of an adjustment to an external disequilibrium. It determines the optimal level of international reserves as a function of the cost of adjustment, the cost of holding liquid international reserves and the probability that there will be a need for reserve use of a given magnitude. Then it calculates for several countries the optimal reserve levels implied by the model. Finally, it compares the ratio of optimal reserves to actual

reserves and the ratio of actual reserves to imports against a set of thorough country studies or reserve adequacy. It concludes that the ratio of optimal reserves to actual reserves is a more reliable index of reserve adequacy than the ratio of actual reserves to imports.

\_\_\_\_\_ and M. S. Khan (1978), "The Demand for International Reserves Under Fixed and Floating Exchange Rates," International Monetary Fund, Staff Papers, Vol. 25 (December 1978), pp. 623-49.

The authors examine whether the change in the international monetary system in 1973 from fixed par values to managed floating resulted in a shift in the demand for international reserves, and also whether one could identify a stable function in the period of floating. Tests performed for various country groups covering the period 1964-76 shows what appears to be a once-and-for-all structural change in 1973 in the demand for reserves by industrial countries, but no indication of change in the basic relationship explaining reserve holdings of the developing countries.

\_\_\_\_\_ and M. Knight (1978), "Reserve-Currency Preferences of Central Banks," Essays in International Finance, No. 131 (Princeton University, 1978).

Two factors are found to be important in a central bank's selection of its foreign exchange portfolio: the country's exchange rate regime and the pattern of its international trade. Countries hold a significantly greater proportion of their exchange reserves in the currency to which they peg. The study also finds that central bankers as a group are sensitive to interest differentials between the markets for U.S. Treasury bills and Eurodollars. Compared with industrial countries, the developing countries tend to deposit a higher proportion of reserve accruals in the Eurodollar market regardless of the size of the interest differentials.

Hipple, F. S. (1974), "The Disturbance Approach to the Demand for International Reserves," Studies in International Finance, No. 35 (Princeton University, 1974).

The study finds that variations in reserve holdings among industrial countries are almost fully explained by wealth, the size of disturbances, external vulnerability, and exchange rate flexibility. Variations in reserves holdings among developing countries are partially explained by the size of disturbances, wealth, and the cost of adjustment under expenditure switching policies.

\_\_\_\_\_ (1975), "The Adequacy of International Reserve Stocks - An Empirical Study," Southern Economic Journal, Vol. 41, No. 4 (April 1975), pp. 627-34.

Several changes and extensions are made in Heller's 1966 model for estimating optimum stocks of international reserves. Then optimum reserve stocks are calculated for 65 countries for the period 1960-1970. Actual reserves seem to have been generally inadequate over the decade, with advanced countries typically holding 75 percent of optimum reserves and developing countries holding 50 percent.

Makin, J. H. (1971), "The Composition of International Reserve Holding: A Problem of Choice Involving Risk," American Economic Review, Vol. 61 (December 1971), pp. 818-32.

Portfolio theory is applied to the analysis of the choice by central banks between interest-bearing dollar assets and gold. Dollars and gold are both viewed as non-sterile assets with a certain return on dollars and an expected return on gold. A model is specified and tested for major central banks in the time period running from June 1961 to March 1968. The results do not permit rejection of the hypothesis that some part of the dollar assets held by central banks on 9 of the 13 cases examined were managed as a part of a portfolio including gold.

Officer, L. H. (1976), "The Demand for International Liquidity: A Test of the Square-Root Law," Journal of Money, Credit and Banking, Vol. 8, No. 3 (August 1976), pp. 325-37.

A comprehensive measure of the volume of international transactions is used to test the hypothesis that the transactions elasticity of the demand for international liquidity is governed by the square-root law. The evidence provided by estimated demand equations indicates that this law is applicable to precautionary balances (official reserves), but not to transactions balances (commercial banks' foreign exchange).

Ripley, D. M. (1974), "Some Factors Affecting Reserve Needs in Developing Countries," International Monetary Fund, DM/74/110 (November 1974).

This paper reviews a number of determinants of reserve need that are likely to be of particular importance for many developing countries, including the characteristics of the present exchange rate system, payment fluctuations and the availability for external financing for imbalances. The analysis suggests that the reserves needs of developing countries may be high relative to those of developed countries for a given level of trade, and that these needs may have been increased by some developments in exchange and commodity markets.

\_\_\_\_\_ and E. C. Suss (1974), "An Approach to the Estimation of Inequality in Reserve Distribution," International Monetary Fund, Staff Papers, Vol. 21 (November 1974), pp. 789-99.

This study examines the distribution of reserve holdings relative to reserve needs for a sample of 104 countries for 1968, a year in which reserves were considered generally adequate, and for 1973. Several sample measures of maldistribution indicate a greater inequality between the distribution of reserve needs and the distribution of reserve holdings in 1973 than in 1968.

Suss, E. C. (1976), "A Note on Reserve Use Under Alternative Exchange Rate Regimes," International Monetary Fund, Staff Papers, Vol. 23 (July 1976), pp. 387-94.

This paper examines the reserve use of 14 industrial countries during a period of relatively fixed exchange rates, and during a period of managed floating. Reserve use is calculated in three different ways. The overall conclusion is that, generally, reserve use may have declined slightly under the period of managed floating exchange rates.

von Furstenberg, G. M. (1982), "New Estimates of the Demand for Non-Gold Reserves Under Floating," Journal of International Money and Finance, Vol. 1, (April 1982), pp. 81-95.

This is an empirical study of the demand for non-gold reserves for the period 1973:II - 1981:I for the following country groups: industrial countries excluding the United States; oil exporting countries; non-oil exporting countries; and all groups combined. It finds that the demand for non-gold reserves is a function of the level of imports, changes in the terms of trade, changes in exchange rates, the market value of gold reserve, the difference between the rates of growth of the money supply in the United States and all other industrial countries, and the U.S. unemployment rate.