The Analytics of a Substitution Account *

Introduction

In 1979 and 1980, the Interim Committee of the International Monetary Fund considered a series of reports from the Executive Board of the Fund concerned with the creation of a substitution account, a facility in which member countries might deposit some of their foreign-currency reserves in exchange for claims denominated in Special Drawing Rights (SDR). These new claims would be transferable on the books of the account and would thus function as reserves. The account was intended to advance the long-term objective enshrined in the Articles of Agreement of the Fund — to make the SDR "the principal reserve asset in the international monetary system" (Art. VIII, Sec. 7), but it was also meant to serve immediate objectives. Member countries could diversify their reserve holdings without disturbing foreign-exchange markets, and the availability of this opportunity could help to arrest the drift toward a multiple reserve-currency system — a movement that was gathering momentum with the weakness of the U.S. dollar and the growth of reserve balances in Deutschemark, Swiss Franc, and Yen.

In October 1979, at its meeting in Belgrade, the Interim Committee concluded that "such an account, if properly designed, could contribute to an improvement of the international monetary system" and set out some principles to guide the Executive Board in its attempt to design an account:

> In order for the account to achieve widespread participation on a voluntary basis and on a large scale, among other things, it should satisfy the needs of depositing members, both developed and developing, its costs and benefits

* I am grateful to Charles Averill and Olga Jonas, who wrote the computer programs used for the simulations in this paper, to the Research Department of the International Monetary Fund, for supplying some of the interest-rate and exchange-rate data, and to the International Finance Section, Princeton University, for research support. The views expressed in this paper are my own and should not be ascribed to the International Finance Section or to any other institution.

> should be fairly shared among all parties concerned, and it should contain satisfactory provisions with respect to the liquidity of the claims, their rate of interest, and the preservation of their capital value.

The Executive Board made progess in resolving a number of issues but was unable to reach agreement on the way to preserve the capital value of the SDR claim, and it referred the matter back to the Interim Committee, which met at Hamburg in April 1980. There has been no official account of the discussion at that meeting, but the communiqué suggests that the question of capital value, rechristened as the question of financial balance, was the main obstacle to agreement:

> The Committee commended the Executive Board for the progress it had made in designing a plan for a substitution account along the lines requested by the Committee in its communiqué issued in Belgrade. The Committee noted that the Board had reached ... provisional agreement on a wide range of features of such an account. The Committee also noted that some issues remained to be solved, including arrangements for the maintenance of financial balance in the account. The Committee, after a discussion of these issues, expressed its intention to continue its work on this subject.

The matter was not referred again to the Executive Board. It was set aside.

There is no way to know when the subject will come up again or the form in which it will arise. But the problem of financial balance will have to be solved by any successful proposal, and that is the problem examined in this paper. It presents a series of simulations showing that the problem of financial balance derives from the way that exchange rates interact with interest rates during the life of an account, defining the size of the problem under various plans, and measuring the costs of various solutions.The simulations pretend that a substitution account was set up at the beginning of 1964 and examine the balance sheet of the account in each of the next fifteen years. They are thus based on actual exchange rates and interest rates in 1964-1978.

I started to conduct these simulations in 1979, when discussions of various plans got under way, and repeated them several times, as new plans were brought forward. The simulations reproduced in this paper deal with the small group of proposals that survived discussions in the Fund and with some variants that should perhaps have been discussed. All of these simulations have been rerun for publication, to make them fully comparable. While most of the plans considered in this paper resemble in general design those that were discussed in the Fund, they are not faithful reproductions of their official counterparts. As a

participant in several groups that examined the case for a substitution account, including a study group on reserve assets established by the Group of Thirty,[1] I made the acquaintance of the proposals that had been examined in the Fund, but the documents containing the details were not available to me when I designed my simulations.

This paper has three main parts. In the first, I make a brief excursion into history, recalling that the first plan for a substitution account was advanced in the *Report* of the Committee of Twenty,[2] and that the discussions of that plan raised many of the issues considered in 1979-1980. I point out, however, that the plans advanced in 1979-1980 addressed themselves to different aims and go on to list the main problems involved in designing a substitution account along the lines laid down in the Belgrade communiqué. In the second part, I present my simulations, which deal with a subset of those problems, and show how various interest-rate arrangements, interacting with exchange-rate behavior, would have affected the financial balance of an account created in 1964. I look at ways of solving the problem of financial balance, including a guarantee by the United States, a guarantee provided jointly by the United States and the depositors, and the use of gold held by the IMF to make good an imbalance in the account. These arrangements are compared by measuring their impact on financial benefits and costs, viewed first from the standpoint of the depositors and then from the standpoint of the United States. Finally, in the third part, I comment briefly on some plans that have been put forth recently and offer some suggestions of my own.

Origins and Issues

The Committee of Twenty was established in 1972 to consider and report on proposals for reform of the international monetary system.[3] It sought to design a monetary system based on stable but adjustable par values and to make the new system more "symmetrical" than the earlier

---

[1] For the findings of this group, see *Towards a Less Unstable International Monetary System: Report of the Reserve Asset Study Group of the Group of Thirty,* Consultative Group on International Economic and Monetary Affairs, New York, 1980.

[2] COMMITTEE ON REFORM OF THE INTERNATIONAL MONETARY SYSTEM AND RELATED ISSUES, *International Monetary Reform: Documents of the Committee of Twenty,* International Monetary Fund, Washington, 1974, Outline of Reform, Annex 7.

[3] This discussion of the work of the Committee draws on ROBERT SOLOMON, *The International Monetary System, 1945-1976,* New York, 1977, JOHN WILLIAMSON, *The Failure of World Monetary Reform, 1971-1974,* New York, 1977, and my "Convertibility and Consolidation", reprinted in PETER B. KENEN, *Essays in International Economics,* Princeton, 1980, pt. III.

Bretton Woods System. It soon became apparent, however, that the leading governments disagreed about the meaning of symmetry. Europeans emphasized the need to reduce or eliminate the special role of the U.S. dollar, because that role permitted the United States to escape the "discipline" of reserve losses. They favored a new system of convertibility, based on mandatory asset settlement. The United States emphasized the need for surplus countries to take more responsibility for the functioning of the adjustment process and the need for ready recourse to exchange-rate changes. It proposed the use of an "objective indicator" to signal the need for policy changes in deficit and surplus countries alike.

The concerns of the two sides were complementary, in that the United States could accept European views about convertibility only if there were improvements in the adjustment process. It had to be sure that it would be able to eliminate the persistent deficit in the U.S. balance of payments. But another condition had to be fulfilled before the United States could contemplate mandatory asset settlement. Something had to be done about the large dollar balances already held by foreign official institutions. The United States had to be sure that these could not be presented for conversion into "primary" reserve assets, because they were several times larger than U.S. reserves.

Two ways of handling this "dollar overhang" were suggested in the course of the Committee's work: 1) Consolidation of the dollar balances into long-term U.S. government obligations. 2) Creation of a substitution account to exchange dollar balances for SDR. These proposals differed in two important ways. The consolidation of dollar balances into long-term U.S. debt would have removed them from reserves, reducing the total stock of reserves, whereas the substitution of SDR for dollars would have replaced the dollars with another reserve asset, leaving the stock of reserves unchanged. The consolidation of the balances, moreover, would impose on the United States, explicitly or implicitly, the task of amortizing its obligations, whereas the proposal for a substitution account left this question open.

This first plan for a substitution account left other questions open too.[4] Would substitution take place once, or could it be repeated? Would substitution go one way, or could it be reversed? Would substitution be mandatory or voluntary? This last question worried the

[4] Some of these questions are raised in COMMITTEE ON REFORM, *Documents,* Report of Technical Group on Global Liquidity and Consolidation, especially pp. 169-176.

developing countries, because they insist on complete freedom of choice in the management of their reserves. They were concerned, moreover, by the possibility that substitution would become the main way of issuing new SDR. They wanted SDR creation to increase the supply of reserves, not merely to alter the composition (and they hoped at that time to forge a "link" between SDR creation and development assistance).

The first proposal for a substitution account died with the Committee of Twenty itself, a victim of the economic ailments rampant at the time that made it impossible to contemplate an early return to par values. The proposal itself could not survive the move to floating exchange rates, because it was connected logically to the plan for mandatory asset settlement, and asset settlement has no clear-cut role to play under a floating-rate regime.

Yet floating rates had much to do with the revival of interest in a substitution account. They were the chief cause of the movement toward a multiple reserve-currency system that produced so much concern in 1978-1980. The diversification of reserves that began in earnest after 1976 was inspired by the expectation of exchange-rate fluctuations, exacerbated by the weakness of the U.S. dollar.

At the end of 1976, U.S. dollars accounted for 86.6 per cent of official foreign-exchange holdings; at the end of 1978, they accounted for only 82.1 per cent.[5] There is one sense in which these numbers overstate the shift from dollars into other reserve currencies; some part of the decline in the share of the dollar was due to the decline in its value. But there is another, more important sense in which the numbers understate the size of the shift; some of the dollars sold for other national currencies entered the reserves of the countries whose currencies were being bought. The full extent of diversification should therefore be measured by removing the currency reserves of the main reserve-currency countries.[6] Once this is done, the share of the dollar works out at about 80 per cent in 1976 and falls to only 70 per cent in 1978.

[5] INTERNATIONAL MONETARY FUND, *Annual Report 1980,* p. 64. The numbers for 1979 are harder to interpret, because that was the first year in which ECU were issued. If ECU are excluded (by treating those issued for dollars as though they were dollars and removing entirely those issued for gold), the share of the dollar works out at 77.8 per cent, substantially lower than in 1978. If ECU are included, by treating all of them as new foreign-currency reserves, the share of the dollar works out at 65.1 per cent.

[6] By subtracting the foreign-currency reserves of Germany, Japan, Switzerland, and the United Kingdom from global foreign-currency reserves and, on the limiting but plausible assumption that those reserves were dollars, subtracting them from global dollar reserves. This calculation cannot be repeated for 1979 without adjusting for the presence of ECU in German and U.K. reserves. Treating all ECU as foreign-currency reserves, one can subtract the foreign-currency reserves of the four major countries from global foreign-currency reserves, but one cannot subtract them from global dollar reserves without first removing ECU held by Germany and the United Kingdom. When this is done (approximately), the share of the dollar works out in the neighborhood of 53 per cent.

This trend was worrisome from several points of view. The United States, for example, was increasingly concerned to halt the depreciation of the dollar. On November 1, 1978, it undertook to intervene heavily in support of the dollar. Diversification interfered directly with this effort. Sales of dollars for Deutschemark and other strong currencies amounted to perverse intervention on the part of the central banks involved. And the indirect effects of diversification may have been bigger than its direct effects. Expectations of official sales may have caused private holders of dollars to step up their own sales, adding to the downward pressure on the dollar. Countries with strong currencies had symmetrical concerns. Diversification was making their currencies stronger, and it was also undermining their monetary policies, insofar as it was forcing them and the United States to intervene on a larger scale. But those countries had another worry. They were reluctant to become major reserve centers. Some, indeed, had tried to limit or discourage foreign official holdings of their currencies.[7]

There was the widespread belief, moreover, that a multiple reserve-currency system, the logical outcome of large-scale diversification, would prove to be "inherently" unstable. This view was defended by historical analogies. The bimetallic standard of the Nineteenth Century, based on gold and silver, was a multiple reserve-asset system, and it broke down eventually. The gold-exchange standards of the interwar and postwar periods, based on sterling and the dollar, were unstable too. But most analogies are imperfect, and so are these. The "inherent" instability of earlier reserve regimes derived from the authorities' attempts to peg the prices of the reserve assets despite changes in their relative scarcities. Those attempts invited self-aggravating speculation whenever it seemed possible that the authorities would exhaust their holdings of the scarce asset. Present arrangements may not invite this form of speculation, because the authorities do not try to peg the prices of the reserve assets. Exchange rates connecting the dollar, Deutschemark and other reserve currencies are managed, but management is very different from pegging in its implications for the stability of the reserve system. It does not invite self-aggravating speculation.

[7] These efforts were not successful, because they served merely to divert diversification into the Eurocurrency markets; much of the recent growth in official holdings of Deutschemark, Swiss Franc, and Yen, took place in those markets. For this reason, among others, the German and Swiss authorities altered their attitudes in 1980, and the Germans began to sell DM-denominated debt directly to Saudi Arabia when the German trade balance deteriorated. Countries' doubts about reserve-currency status usually give way when the need for balance-of-payments financing makes the short-term benefit seem large compared to the long-term cost.

Nevertheless, fears of instability were held widely, and they animated a new interest in reform of the reserve system. This interest turned quickly to consideration of a substitution account based on the SDR, because it could accommodate the demand for reserve diversification in a manner that would not compound the problems of the United States and other reserve-currency countries.

Because the SDR is a "basket" of currencies, a claim denominated in SDR is by itself a diversified asset, offering protection against exchange-rate fluctuations. Because claims denominated in SDR would be issued directly to official institutions, diversification through a substitution account would not affect the foreign-exchange markets and could relieve the pressure on Germany and other countries to permit wider use of their currencies as reserve assets.

Participation in a substitution account would be voluntary. That was understood early on and was stated as a premise, not a principle, in the Belgrade communiqué. Furthermore, the new account would be managed by the IMF but would have to be segregated from the books of the Fund.[8] This was also understood, because any other approach would require an amendment to the Articles of Agreement, a time-consuming process, and many observers recommended rapid action to divert diversification from foreign-exchange markets and block the development of a multiple reserve-currency system.

The creation of a separate substitution account, however, posed special problems, and the solution of those problems was greatly complicated by the need to attract participation on a voluntary basis and on a scale large enough to make the exercise worthwile. The account would be able to issue claims denominated in SDR, but it could not issue the SDR defined in the Articles of Agreement. In consequence, those claims would not assume automatically the attributes of the SDR. The transferability (liquidity) of the SDR is guaranteed within limits, because the Fund can "designate" a member to receive SDR in exchange for that member's own currency (Art. XIX, Sec. 5). The redemption of the SDR is guaranteed by the provisions of the Articles pertaining to the liquidation of the SDR Department (Art. XXV and Sched. I). The transferability of the new asset, its interest rate, and ways

[8] The present Articles allow the Fund to manage an account of this sort if participation by members is voluntary. Under Art. V, Sec. 2 (b).

> If requested, the Fund may decide to perform financial and technical services, including the administration of resources contributed by members, that are consistent with the purposes of the Fund. Operations involved in the performance of such financial services shall not be on the account of the Fund. Services under this subsection shall not impose any obligation on a member without its consent.

to guarantee its value in the event of liquidation — the problem of financial balance — had to be negotiated, and these issues were connected in complicated ways.

Holders of claims on the account would be able to transfer them freely among themselves. But potential holders wanted to be sure that they would find buyers whenever necessary. It was therefore suggested that holders should have the right to cash in their claims (i.e., that the account itself should serve as buyer of last resort). Some said that this right should be unconditional, but others said that it should be circumscribed, to be exercised only as a last resort, and that penalties should be imposed to make the option costly.[9]

There were, of course, proposals for "designation" patterned on the plan adopted for the SDR itself. But reliance on this mechanism, it was said, might discourage participation in the substitution account. Countries with strong currencies and large reserves, whose participation would be important for success, might be unwilling to make big deposits, because these would expose them lo large-scale "designation" (i.e., the obligation to grant large amounts of credit to countries in balance-of-payments need). There was some discussion of marketability as the ultimate solution to the problem of liquidity, but marketability looked to be a long way off. It would be necessary first to foster private use of the SDR claim and to develop active markets in which official sellers could count on finding private buyers.[10]

What rate of interest should the new claim pay? There had to be a sensible relationship between liquidity and yield, but two other relationships had to be considered — the relationship between the interest rate on the new claim and the rate paid on the SDR itself, and the relationship between the rate on the new claim and the rate that would be paid by the United States on the dollar holdings of the account.

In 1979-1980, when the matter was examined, the interest rate on the SDR was set at 80 per cent of the so-called full combined rate, a weighted average of five national interest rates, including most importantly the U.S. Treasury Bill rate, which was the rate that many countries earned on their dollars. If the interest rate on the new claim was to be no higher than the SDR rate, it would be lower than most market rates, including those available on dollar, Deutschemark, and other currency

[9] There are no encashments in my simulations; once SDR claims are created, they remain in existence until liquidation of the substitution account.

[10] Marketability is discussed extensively in the report of the study group established by the GROUP OF THIRTY, *Towards a Less Unstable International Monetary System*.

reserves. This could discourage participation in the account. Furthermore, a low rate on the SDR claim would make it less attractive to private purchasers if and when it was decided to permit private holdings and thus to foster marketability as the long-run solution to the problem of liquidity. If the interest rate were higher than the SDR rate, however, the SDR would be less attractive as a reserve asset, and some feared that this would diminish enthusiasm for new allocations of SDR, a matter of continuing concern to the less-developed countries. This issue was not resolved completely, but it is not especially important now, because the Executive Board has unified the relevant interest rates; the rate on the SDR has been raised to 100 per cent of the full combined rate. (It is for this reason that all of my simulations use the full combined rate as the one at which depositors earn interest on their SDR claims.)

The relationship between the rate on the new claim and the rate to be paid by the United States was important for the problem of financial balance. That problem has two dimensions. There is first the problem of flow balance, by which I mean the relationship between the interest income of the account and its interest payments to depositors. If all interest payments were made in U.S. dollars, one of the possibilities examined in the Fund and in my simulations, dollars would leak out of the account when its interest income from the United States was larger than its interest payments to depositors. This could happen if the interest rate paid by the United States was lower than the interest rate paid to depositors. It could also happen, however, if the dollar depreciated against the SDR, because of the manner in which interest payments would be calculated. Interest payments by the United States would normally be calculated in U.S. dollars, being payments made on the dollars held by the account. Interest payments to depositors would normally be calculated in SDR, being payments made on the SDR claims issued by the account. A depreciation of the dollar against the SDR would raise the dollar value of the interest payments calculated in SDR and would thus raise the dollar payments made by the account without also raising its receipts.

The problem of flow balance translates itself eventually into a problem of stock balance. If large numbers of dollars leak out of the account, those that remain may not suffice to pay off the depositors in the event of liquidation. But a depreciation of the dollar can jeopardize stock balance or solvency even if there is no problem of flow balance. This is made quite clear by my simulations, and it leads in turn to a consideration of the ways in which financial balance can be secured – by guarantees, by deficiency payments, or by using gold held by the IMF.

Rather than examining these problems abstractly, I have tried to quantify them and to measure the costs of solving them. That is the main aim of my simulations.[11]

The Simulations

All of my simulations start at the beginning of 1964 and close at the end of 1978. There was no SDR in 1964, however, which posed the first question that had to be answered before I could run my simulations: What numbers should be used to represent the dollar value of the SDR?

In the First Amendment to the Articles of Agreement, creating the SDR, the value of the SDR was tied to gold, at SDR 35 per ounce, so that one SDR was worth $ 1.00. (With the devaluations of the dollar in 1971 and 1973, the dollar value of the SDR rose automatically to $ 1.0857, then to $ 1.0263.) In mid-1974, however, the valuation of the SDR was redefined in terms of a "basket" of sixteen currencies and thus came to fluctuate vis-à-vis the dollar. In some of my early simulations (and some done elsewhere), these were the valuations used (with the old parity in terms of the dollar carried back to 1964). Here, by contrast, I carry back the "basket" valuation. At the beginning of each simulation, then, the value of the SDR is $ 1.1016, and it rises to $ 1.3028 at the end. In other words, the dollar depreciates by 18.3 per cent in terms of the SDR. Had I carried back the old dollar parity, the depreciation would have been much bigger, at 30.3 per cent. But the one obtained by my method is large historically, because of the period covered by my

[11] In a world of the sort that economists like to contemplate, populated by risk-neutral speculators with "rational" expectations, the problems of flow and stock balance would be solved automatically. Expectations of currency depreciation would be accurate over time and would be reflected accurately by interest-rate differences. Therefore, a depreciation of the dollar in terms of the other currencies entering the SDR "basket" would be matched by an increase of U.S. interest rates relative to interest rates on assets denominated in those currencies. There would be an increase in U.S. interest payments large enough to offset the flow and stock effects of the depreciation. This does not happen in my simulations, and there are two explanations. First, the SDR "basket" contained the currencies of sixteen countries, but the full combined rate was based on a five-country average. Second and much more important, interest-rate differences did not reflect accurately the changes in exchange rates affecting the dollar value of the SDR in 1964-1978. The discrepancies were large, and there were many causes. Exchange rates were not freely flexible, even after 1973. Interest rates were not freely flexible either, but were influenced heavily by monetary policies. And the world is not populated by risk-neutral speculators with "rational" expectations.

simulations. At the end of 1980, for example, the dollar value of the SDR was $ 1.2754, and depreciation of the dollar was reduced to 15.8 per cent. Therefore, my simulations produce pessimistic measures of the problem of financial balance and of the costs of dealing with it.

Some of the other questions raised in this paper had also to be answered. Should substitution take place once, or should the account remain open to new deposits? What interest rates should be paid by the account and by the United States? How should the interest payments be made?

The first of these questions came up in connection with the proposal by the Committee of Twenty and again in 1979-1980. My simulations answer it by opening the account at the start of 1964 and holding it open for five years. At the start of each year, depositors acquire SDR 10 billion of new claims, so that the stock of claims rises to SDR 50 billion at the beginning of 1968 and remains at that level thereafter (unless interest payments are made in additional SDR claims). Each year's claims are issued, of course, at the then-current dollar price of the SDR, so that the number of dollars deposited varies from year to year.

What interest rate is paid on the new claims and what form do the payments take? The full combined rate is employed in all my simulations, for the reason given earlier, but the form of payment varies. In some simulations, payments are made in U.S. dollars; in others, they are made in additional SDR claims.[12]

What interest rate is paid on dollars held by the account, and what form do these payments take? I work with five interest rates:

(1) The ninety-day U.S. Treasury Bill rate.

(2) A floating fifteen-year U.S. Government Bond rate (which is an average of the ten-year and twenty-year rates).

(3) A fixed fifteen-year U.S. Government Bond rate (which is the average level of the floating rate for 1964-1978).

[12] One other possibility was discussed and was examined by my simulations. Interest payments might be made in SDR. For this to be done, however, the United States would have to make its interest payments in SDR, and this might not be possible. In one of my simulations, the United States was given SDR 4 billion initially (an amount roughly equal to actual allocations through 1980) and received an additional SDR 750 million per year through new allocations (slightly less than its actual allocation in 1980). It made only half of its interest payments in SDR. Nevertheless, it ran out of SDR long before the end of the fifteen-year simulation. Accordingly, the simulations present in this paper deal only with the options mentioned in the text — payments in U.S. dollars and payments in new SDR claims created by the account.

(4) The full combined rate.

(5) The full combined rate plus a premium of one percentage point.

All payments, however, are made in U.S. dollars.

Annual results for one simulation are shown in Table 1. This is the one in which depositors earn interest in U.S. dollars, and the United States pays the Treasury Bill rate. At the start of 1964, depositors acquire SDR 10 billion of claims on the account by turning in $ 11.016 billion of U.S. dollars. (Recall that the dollar value of the SDR was $ 1.1016 under my method of valuation.) At the end of 1964, however, the account holds only $ 10.899 billion of U.S. dollars, because the problem of flow balance arises right away. The account pays $0.508 billion to the depositors (an amount obtained by applying the full combined rate to the SDR 10 billion of depositors' claims and converting the result into U.S. dollars). But the account earns only $ 0.391 billion from the United States (an amount obtained by applying the U.S. Treasury Bill rate to

TABLE 1

U.S. PAYS TREASURY BILL RATE: ALL INTEREST PAID IN U.S. DOLLARS

End Year	SDR Claims Outstanding	Dollar Holdings	SDR Value of (3)	Interest Earned		Interest Paid by U.S. in $
				SDR Claims	$	
1964	10.000	10.899	9.885	0.000	0.508	0.391
1965	20.000	21.746	19.739	0.000	1.044	0.866
1966	30.000	32.571	29.621	0.000	1.791	1.599
1967	40.000	43.397	40.182	0.000	2.056	1.886
1968	50.000	54.060	50.111	0.000	3.037	2.900
1969	50.000	53.909	50.013	0.000	3.767	3.617
1970	50.000	53.327	49.194	0.000	4.054	3.472
1971	50.000	52.594	46.347	0.000	3.047	2.314
1972	50.000	52.069	45.715	0.000	2.665	2.141
1973	50.000	50.712	42.543	0.000	5.018	3.660
1974	50.000	48.746	39.812	0.000	5.957	3.991
1975	50.000	47.538	40.607	0.000	4.045	2.837
1976	50.000	46.309	39.859	0.000	3.602	2.372
1977	50.000	45.172	37.188	0.000	3.577	2.440
1978	50.000	44.303	34.006	0.000	4.130	3.261

Status at liquidation: shortfall of 15.994 billion SDR (20.837 billion dollars)

Total interest paid by the United States: 37.748 billion dollars

Total interest earned by participants : 48.299 billion dollars

the $ 11.016 billion of U.S. dollars held by the account before the completion of interest payments). There is thus a shortfall of $ 0.117 billion (which equals the difference between the initial deposits of $ 11.016 billion and the balance of $ 10.899 billion at the end of the year). The problem of stock balance arises too, because the SDR value of the dollars dips below SDR 10 billion.

The problem of flow balance does not go away. In fact, the account loses dollars year after year, with the loss reaching a peak of $ 1.966 billion in 1974 and totalling $ 10.551 billion at the close of the fifteen-year period. (Interest payments to depositors total $ 48.299 billion, and interest payments by the United States total only $ 37.748 billion.) The problem of stock balance is resolved temporarily in 1967, when the devaluation of the pound causes the dollar to appreciate in terms of the SDR, but reappears in 1970 and grows thereafter. At the end of the simulation, the shortfall is SDR 15.994 billion, which translates into $ 20.837 billion and is twice as large as the loss of dollars resulting from the problem of flow balance.

There is a simple way to solve the problem of flow balance. The account can pay interest in additional SDR claims and thus store up all of the dollars received from the United States. That is what happens in Table 2, which shows that this solution to the problem of flow balance greatly exacerbates the problem of stock balance. Claims on the account grow to SDR 112.469 billion by the end of 1978, and dollar holding grow to $ 112.553 billion, but the latter are worth only SDR 86.393 billion, leaving a shortfall of SDR 26.077 billion, equivalent to $ 33.973 billion. The crediting of interest in SDR claims defers the problem of financial balance, but the size of the problem rises with the size of the account.

To compare these simulations more systematically, I have discounted back to 1964 all of the relevant payments and receipts. In this and every other instance, I use the U.S. Treasury Bill rate as the discount rate. I assume, in effect, that this is the rate at which the U.S. Government can borrow, and that it is the rate that foreign central banks and governments earn on their dollar balances.

The discounted values for the simulations are shown in Table 3. If the account were liquidated after fifteen years and the whole cost of liquidation (making good shortfall) were borne by the United States, depositors would get back the full dollar value of their claims on the account (SDR 50 billion or $ 65.140 billion in the first simulation, and SDR 112.469 billion or $ 146.526 billion in the second simulation). The discounted values of these payments are listed on the first line of

TABLE 2

U.S. PAYS TREASURY BILL RATE: ALL INTEREST PAID IN SDR CLAIMS

End Year	SDR Claims Outstanding	Dollar Holdings	SDR Value of (3)	Interest Earned		Interest Paid by U.S. in $
				SDR Claims	$	
1964	10.461	11.407	10.346	0.461	0.000	0.391
1965	21.431	23.319	21.167	0.970	0.000	0.886
1966	33.138	36.012	32.750	1.707	0.000	1.676
1967	45.191	49.043	45.410	2.053	0.000	2.035
1968	58.298	63.045	58.440	3.107	0.000	3.202
1969	62.373	67.262	62.401	4.075	0.000	4.218
1970	67.039	71.594	66.046	4.666	0.000	4.332
1971	70.639	74.701	65.828	3.600	0.000	3.107
1972	73.944	77.742	68.254	3.306	0.000	3.040
1973	80.171	83.207	69.804	6.226	0.000	5.465
1974	87.971	89.755	73.305	7.801	0.000	6.548
1975	94.050	94.979	81.130	6.079	0.000	5.224
1976	99.881	99.718	85.831	5.831	0.000	4.739
1977	105.764	104.974	86.419	5.883	0.000	5.255
1978	112.469	112.553	86.393	6.705	0.000	7.579

Status at liquidation: shortfall of 26.077 billion SDR (33.973 billion dollars)
Total interest paid by the United States: 57.698 billion dollars
Total interest earned by participants : 73.069 billion dollars

Table 3. When all interest income accumulates inside the account, as in the second simulation, this number measures the gross benefit of participation. When interest income is paid out in dollars, as in the first simulation, it is an understatement of the gross benefit. One must add in the discounted value of the interest income (and of interest earned on that interest income, because that income is added to the depositors' dollar reserves and, therefore, invested at the Treasury Bill rate). This is the number listed on the second line of Table 3, and the sum of the two numbers is the measure of gross benefit. It is, of course, larger in the second simulation, because interest income inside the account is valued in SDR, whereas interest income outside the account is valued in U.S. dollars, and the dollar depreciates in terms of the SDR during the period I examine.

The benefits of one arrangement, however, must always be compared with those of an alternative, and that done on the fourth line of Table 3. The alternative that I select may not be the one that some countries would have chosen, but is the one whose benefits are easiest to

TABLE 3

DISCOUNTED VALUES FOR SIMULATIONS IN WHICH U.S. PAYS TREASURY BILL RATE
(All Values in Billions of U.S. Dollars)

Item	Interest Paid in	
	Dollars	SDR Claims
I. United States Pays Whole Cost of Liquidation:		
Value of depositors claims on account	29.406	66.145
Value of interest earned in dollars	30.809	—
Gross benefit of participation	60.215	66.145
Value of dollars reserves in account	50.809	50.809
Net benefit of participation	9.406	15.336
Cost of interest payment	35.572	35.572
Cost of liquidation payments	9.406	15.336
Gross cost of obligation	44.978	50.908
Cost of interest on dollar reserves	35.572	35.572
Net cost of obligation	9.406	15.336
II. United States Pays Half of Cost of Liquidation:		
Gross benefit of participation	55.512	58.477
Net benefit of participation	4.703	7.668
Gross cost of obligation	40.275	43.240
Net cost of obligation	4.703	7.668

calculate. If there had been support in 1964 for the creation of a substitution account, there might also have been interest on the part of some countries in diversifying their currency reserves, and they might have put together "baskets" of their currencies with rates of return higher than the one on the U.S. dollar (or, for that matter, higher than the one on the claim issued by the substitution account). Throughout this paper, however, I assume that all reserves are held in dollars if they are not deposited with the account, and they earn interest at the Treasury Bill rate. Therefore, I calculate the discounted value of the dollars put into the account (and of the interest income that would have been earned on those dollars), and I use it to compute the *net* benefit of participation in the account. Net benefit is positive in every single simulation, which says that participation would have been advantageous from the depositors' standpoint, compared with the retention of dollar reserves, even though it was not necessarily the most advantageous course of action.

The next five lines of Table 3 examine the costs of the obligation borne by the United States. The first line measures the discounted stream of interest payments made by the United States, including interest payments made directly to depositors when they invest their interest income from the account in additional dollar balances. The second line discounts back to 1964 the total shortfall at the time of liquidation, because I am assuming temporarily that the United States makes good the whole shortfall. The third line is the sum of the first two, and it measures the gross cost of the obligation borne by the United States. Finally, I invoke the assumption made above, that the alternative to participation was the retention of dollar reserves, and calculate the interest payments on those reserves. The discounted value of those payments is, of course, the saving conferred on the United States by the creation of the account, and it is therefore subtracted from the gross cost to measure the *net* cost of the obligation borne by the United States.

In the two simulations summarized by Table 3, the net benefit to the depositors equals exactly the net cost of the obligation borne by the United States. This is because the Treasury Bill rate has been used to calculate interest payments on the dollars held by the depositors and on the dollars held by the account itself. Total interest payments made by the United States are the same in the two simulations. Furthermore, the total interest payments made by the United States equal exactly the interest payments saved by the reduction in dollar reserves. Putting the point in different terms, the use of the Treasury Bill rate to calculate all interest payments made by the United States has the effect of isolating the liquidation payment as the only net benefit to the depositors and the only net cost to the United States. The account serves merely to confer an SDR guarantee on the depositors' dollar reserves. In subsequent simulations, where other interest rates are used to calculate interest payments by the United States, net benefits and costs will differ, and it will not be possible to identify net benefit or costs with the size of the liquidation payment.

At the start of this paper, I quoted the communiqué issued by the Interim Committee at its Belgrade meeting. It said that "costs and benefits should be fairly shared among all parties concerned ..." The calculations in the first part of Table 3 violate that principle, because the whole cost of liquidation is borne by the United States. We do not know how this principle would have been implemented, but I have applied it by splitting the liquidation costs evenly between the United States and

the depositors. In the lower part of Table 3, half of the discounted cost of liquidation is transferred from the United States to the depositors, reducing the gross and net benefits of participation and reducing by the same amounts the gross and net costs of the obligation borne by the United States. In the first simulation, the benefits and costs are cut by half of $ 9.406 billion, and in the second simulation, they are cut by half of $ 15.336 billion. Note that the net benefit is still positive, and this is true in every simulation.

Before moving on to other interest-rate arrangements and other ways of dealing with the problem of financial balance, one more point should be made about my calculations. All of them assume that liquidation takes place at the end of fifteen years, so that the costs of liquidation are certain costs, just like the costs of interest payments. If liquidation were a possibility rather than a certainty, one would want to use the expected cost of liquidation in the fifteenth year (i.e., to multiply the cost of liquidation by the probability). But this procedure would be wrong if done for only one year. It would be necessary to construct a distribution of probabilities, one for each year in which liquidation might take place, and compute the benefits and costs of the account using the whole distribution.

Simulations were conducted using other interest rates. The United States was made to pay the floating bond rate, the fixed bond rate, the full combined rate, and the full combined rate plus a premium of one percentage point. The effects of these interest-rate arrangements are summarized in Table 4.

When the United States pays the long-term bond rate, the problem of flow balance is virtually solved. When the United States pays the full combined rate, the size of the problem is reduced substantially but not as dramatically. (Although the same interest rate is used to calculate the interest payments made by the account and by the United States, the depreciation of the dollar raises the dollar payments made by the account.) Because the problem of flow balance is reduced by all of these new arrangements, the shortfalls are smaller when the account is liquidated. When the United States paid the Treasury Bill rate, the shortfall was $ 20.837 billion; when it pays a floating fifteen-year U.S. Government Bond rate, the shortfall is cut to $ 11.386 billion; and when it pays the full combined rate plus a premium of one percentage point, the shortfall is cut to $ 1.501 billion. But these reductions in the shortfall do not reduce the net costs of the obligation borne by the United States — not when it bears the whole cost of liquidation nor when that cost is

TABLE 4

SUMMARY STATISTICS FOR SIMULATIONS IN WHICH ALL INTEREST IS PAID IN U.S. DOLLARS, WITH VARIOUS INTEREST RATES PAID BY THE UNITED STATES
(All Entries in Billions of U.S. Dollars)

Item	Interest Rate Paid by United States				
	Treasury Bill	Floating Bond	Fixed Bond	Full Combined	Full Combined Plus Premium [a]
Shortfall (−) at liquidation [b] ...	−20.837	−11.386	−11.667	−13.105	− 1.501
I. United States Pays Whole Cost of Liquidation:					
Cost of interest payments	35.572	40.962	41.873	40.370	47.563
Cost of liquidation payment ..	9.406	5.140	5.267	5.916	0.678
Gross cost of obligation	44.978	46.102	47.140	46.286	48.241
Net cost of obligation	9.406	10.530	11.568	10.714	12.669
II. United States Pays Half of Cost of Liquidation:					
Net benefit of participation ..	4.703	6.886	6.773	6.448	9.067
Net cost of obligation	4.703	7.960	8.934	7.756	12.330

[a] Premium set at one percentage point.

[b] This entry is measured in current dollars at the end of 1978; all other entries are discounted back to the start of 1964.

shared with the depositors. The increase in the cost of interest payments is always larger than the decrease in the cost of the liquidation payment. (This result reflects the fact that interest payments are made yearly, whereas the liquidation payment is made at the end, so that the liquidation payment is discounted more heavily.)

When the United States pays the whole cost of liquidation, interest-rate arrangements do not affect the gross or net benefits of participation, because depositors receive the full value of their claims. When liquidation costs are shared, however, gross and net benefits are affected by the size of the shortfall. The effect is shown in the second part of Table 4, where net benefits are higher under all of the new interest-rate arrangements. When, in fact, the shortfall is reduced to $ 1.501 billion, the net benefit of participation is almost as high as it is when the United States is made to bear the whole cost of liquidation; the cost of the depositors' share of the liquidation payment falls to only $ 0.339 billion.

There is no way to say that one of these arrangements is better than the rest. It depends on your point of view. Suppose that the United

States were pledged to pay the whole cost of liquidation and that the depositors were sure that it would do so, regardless of the size of the shortfall. The net benefit to the depositors would not be affected by the interest-rate arrangements, and they would have no reason to be worried about large dollar losses or large gaps on the books of the account. Accordingly, they would have no reason to insist that the United States pay a high interest rate. The United States, of course, would want to pay a low rate, such as the Treasury Bill rate, in order to replace (current) interest costs with (deferred) liquidation costs. In two other circumstances, however, the depositors might insist that the United States pay a high interest rate — if they had doubts about the willingness of the United States to honor its commitment or had themselves to bear some of the liquidation cost. They would then want to minimize the size of the shortfall in the account, because a shortfall would reduce the net benefit expected from participation. In these same circumstances, moreover, high interest rates have the largest effects on the costs of the account viewed from the standpoint of the United States. Look at the last two lines of Table 4, which deal with the case in which liquidation costs are shared, and concentrate on the effect of adding one percentage point to the full combined rate paid by the United States. The net benefit to the depositors rises by $ 2.619 billion, but the net cost to the United States rises by $ 4.574 billion. When the depositors have the strongest reasons for favoring the use of a high interest rate, the United States has the strongest reasons for resisting a high rate.

No one has suggested that the United States would default on its obligation to the account, but some countries were concerned at the prospect of large gaps on the books of the accounts. Their concerns produced two more proposals:

(1) That the parties make maintenance-of-value payments to limit the gaps (i.e., that they pay currently some fraction of their share of the liquidation payment implied by any gap).

(2) That some of the gold held by the IMF be sold for the benefit of the account.[13]

[13] There were two variants of the gold proposal: (a) that gold be sold at the outset and the net proceeds invested in dollars, giving the account some "equity" and additional interest income; (b) that gold be sold when necessary to make good an imbalance in the account. In both cases, the account would receive the net proceeds or profits from gold sales, defined as the difference between the market price of gold and the bookkeeping price used by the IMF. I do not deal with the first variant, because it is difficult to simulate historically. Had gold been sold at the start of 1964, there would have been no profit for the use of the account. The market price of gold was about the same as the relevant bookkeeping price.

To show how these schemes would work in the context of my simulations, I call for a "deficiency payment" or gold sale at the end of any year in which claims on the account exceed by more than five percent the value of the dollars held by the account. The payment or sale brings the gap back down to five per cent rather than closing it completely. The results are illustrated by Table 5, and additional results are summarized by Table 6. (If the "deficiency payments" shown in these tables had been made by the United States or shared by the depositors, one would want to discount them back to 1964 and use them in the benefit and cost calculations. I have not done so in Table 6, because the call for "deficiency payments" was replaced quite speedily by the plan to use the profits from gold sales, and I treat them as gold sales in the discussion that follows.)

TABLE 5

U.S. PAYS TREASURY BILL RATE: ALL INTEREST PAID IN U.S. DOLLARS
EFFECTS OF PROVISION FOR DEFICIENCY (GOLD) PAYMENTS

End Year	SDR Claims Outstanding	Dollar Holdings	SDR Value of (3)	Interest Earned		Interest Paid by U.S. in $	Deficiency Payment
				SDR Claims	$		
1964	10.000	10.899	9.885	0.000	0.508	0.391	0.000
1965	20.000	21.746	19.739	0.000	1.044	0.866	0.000
1966	30.000	32.571	29.621	0.000	1.791	1.599	0.000
1967	40.000	43.397	40.182	0.000	2.056	1.886	0.000
1968	50.000	54.060	50.111	0.000	3.037	2.900	0.000
1969	50.000	53.909	50.013	0.000	3.767	3.617	0.000
1970	50.000	53.327	49.194	0.000	4.054	3.472	0.000
1971	50.000	53.903	47.500	0.000	3.047	2.314	1.309
1972	50.000	54.102	47.500	0.000	2.665	2.194	0.671
1973	50.000	56.620	47.500	0.000	5.018	3.803	3.732
1974	50.000	58.159	47.500	0.000	5.957	4.456	3.040
1975	50.000	57.499	49.115	0.000	4.045	3.385	0.000
1976	50.000	56.767	48.861	0.000	3.602	2.869	0.000
1977	50.000	57.698	47.500	0.000	3.577	2.992	1.517
1978	50.000	61.883	47.500	0.000	4.130	4.166	4.149

Status at liquidation: shortfall of 2.500 billion SDR (3.257 billion dollars)
Total interest paid by the United States: 40.909 billion dollars
Total interest earned by participants: 48.299 billion dollars
Total deficiency (gold) payment: 14.418 billion dollars

When the United States is made to bear all of the liquidation cost, the addition of gold sales to the simulations has no effect on gross or net benefits of participation. The depositors receive the full value of their claims, and the benefits remain at the levels given in Table 3. The costs to the United States are reduced, however, and the reductions are quite large in the simulation that uses the Treasury Bill rate. There is, of course, some increase in the interest cost, because the United States has to pay interest on all dollars held by the account, including those obtained from gold sales, but this increase is smaller than the decrease in the cost of liquidation resulting from the cut in the size of the shortfall. When the liquidation costs are shared, the addition of gold

TABLE 6

EFFECTS OF PROVISION FOR DEFICIENCY (GOLD) PAYMENTS
SUMMARY STATISTICS FOR SELECTED SIMULATIONS IN WHICH
ALL INTEREST IS PAID IN U.S. DOLLARS
(All Entries in Billions of U.S. Dollars, Except as Noted)

Item	Interest Rate Paid by United States		
	Treasury Bill	Floating Bond	Full Combined
Shortfall (−) at liquidation [a]	−3.257	−3.257	−3.257
I. United States Pays Whole Cost of Liquidation:			
Cost of interest payments	37.179	42.108	41.077
Cost of liquidation payment	1.470	1.470	1.470
Gross cost of obligation	38.649	43.578	42.547
Net cost of obligation	3.077	8.006	6.975
II. United States Pays Half of Cost of Liquidation:			
Net benefit of participation	8.671	8.761	8.671
Net cost of obligation	2.342	7.271	6.240
Sum of deficiency payments	14.418	5.830	8.446
Gold sales implied by payments (millions of ounces) [b]	471	59	68

[a] This entry is measured in current dollars at the end of 1978; all entries in Parts I and II are discounted back to the start of 1964.

[b] Obtained by dividing an end-year profit rate on gold sales into the deficiency payment for that year. The profit rate is the difference between the dollar price of gold in London and the dollar equivalent of the official price (SDR 35 per ounce). The dollar equivalent is calculated with the "basket" valuation of the SDR used throughout these simulations.

sales adds to the benefits of participation, because it reduces the liquidation cost borne by the depositors. This effect is shown in the second part of Table 6, and it is largest when, without the sales, there was a large shortfall at liquidation. But the final section of the table is the most important, because it shows the sizes of the sales needed to make the requisite deficiency payments.[14]

The plan to use Fund gold in support of the account was flawed for three reasons. First, it antagonized less-developed countries, who argued that the Fund's gold should be used for their benefit.[15] Second, it attracted too much support from countries that wanted to limit their own obligations and argued that gold sales could substitute for governmental guarantees. Third and most important, gold sales could exhaust the Fund's gold holdings. In one of my simulations, the Fund has to sell 471 million ounces, more than the Fund held at any point in time.[16] In the other simulations, it must sell some 60-70 million ounces, which is more than half of what it held when the gold proposal was being considered.

Conclusion

The simulations summarized in this paper dealt with years in which the dollar depreciated sharply in terms of the SDR. There were thus substantial benefits to the depositors and large costs to the United States under all of the interest-rate arrangements examined, even when the liquidation costs were "fairly shared" between the depositors and the United States. The use of gold held by the IMF reduced the liquidation costs but ate up a large fraction of that gold. If the simulations had been run for another period, the benefits and costs would have been different. If they had started, for example, at the end of 1971, following

[14] To calculate the number of ounces sold, I have divided each year's deficiency payment by a "profit rate" (the London gold price at the end of the year in question *less* the dollar equivalent of the bookkeeping price used by the IMF).

[15] The Fund sold off some 50 million ounces of gold in 1976-1980. Half of this gold was sold directly to Fund members, at the old official price; the rest was sold at public auction, with the profits going to a Trust Fund established for the benefit of the less-developed countries. (Profits were defined in the manner described by the previous footnote.)

[16] The large gold sales in this simulation reflect the need to make gold sales in 1971 and 1972, when the "profit rates" on sales were quite low (market prices were not far from the old official price). But the sales required in subsequent years, when "profit rates" were higher, total about 100 million ounces.

the first devaluation of the dollar, and ended in 1980, after the dollar began to appreciate in terms of the SDR, the benefits and costs would have been somewhat smaller. To look ahead, moreover, one would have to take account of the recent changes in the attributes of the SDR — the reduction from sixteen to five in the number of currencies entering the valuation "basket" and the change in the definition of the full combined rate. These might have mixed effects on costs and benefits.[17]

The decision to create a substitution account, however, should not be based primarily on financial benefits and costs, even if one could calculate them accurately. Much weight should be given to the implications for the monetary system. I have argued that a multiple reserve-currency system is not "inherently" unstable, but it can add to the instability of exchange rates and can complicate the task of monetary management in countries whose currencies are used as reserves. One should give some weight, moreover, to the way that an account might widen the role of the SDR and enhance the role of the IMF itself. There are, in brief, important systemic effects that cannot be quantified.

There is never a good time to negotiate major changes in the international monetary system. One U.S. official put it well. When the dollar is weak, he suggested, the United States cannot obtain acceptable terms. When the dollar is strong, no one else is interested. This is all the more reason, however, to start talking soon again about a substitution account. To wait until cyclical forces weaken the dollar may be worse than trying to reach agreement at a time when holders of dollars have no wish to part with them.

New suggestions have been made, and they need to be considered. One participant in the last round of discussions has suggested that the next round should look at the integration of a substitution account with the IMF itself.[18] This would require an amendment to the Articles of Agreement, and that would take time, but there was perhaps excessive emphasis on haste in 1979-1980. An amendment would permit the exchange of currencies for SDR, not for a claim designed expressly for the purpose, which means that the problems of liquidity and yield could be solved by making appropriate changes in the attributes of the SDR, and the problem of financial balance might figure less prominently in

[17] Some of these effects have been studied in the Fund; see GEORGE M. VON FURSTENBERG, "Simulated Reserve Currency Performance Indicates Investment Qualities of the SDR", *IMF Survey*, January 26, 1981.

[18] See the remarks of J.J. POLAK at the Georgetown University Bankers Forum, summarized in the *IMF Survey*, October 27, 1980.

the negotiations. Governments might want to change some of the relevant Articles, and there would no doubt be bargaining on other issues too, but this process might serve to raise the numbers of countries and dollars involved in substitution.

Some participants in the last round have suggested a connection between substitution and recycling.[19] This is an interesting possibility, but it raises difficult issues. Substitution is intended to replace one reserve asset with another. The nature and success of the enterprise could perhaps be jeopardized by attempting to engage simultaneously in large-scale maturity transformation. Furthermore, the quality of the new reserve asset might be seen to depend on the creditworthiness of long-term borrowers, and this could limit the demand for the new asset. Finally, an attempt to connect the two endeavors might raise questions concerning the locus of control over Fund policies regarding the use of its resources — policies relating to eligibility and conditionality.

The role of gold in substitution and in the monetary system presents an interesting challenge. It was not wrong in principle but was perhaps unwise in practice to propose the use of IMF gold holdings as "backing" for the substitution account. If gold is to have a role in substitution, it should be quite different. Participants in a substitution account might be asked to deposit gold along with reserve currencies, and the United States might be asked to do so too. Valuation gains due to an increase in the market price of gold could be "monetized" in part, as in the European Monetary System, or used entirely to protect the financial balance of the substitution account.[20]

The first attempt to reach agreement, in 1979-1980, was inspired by belief that the system was in trouble — that it was moving rapidly in the wrong direction and had to be deflected. The next attempt, I have suggested, should be more leisurely, inspired by the need for a better reserve system rather than the fear of a worse one. But the need to take a long look at the problem is the strongest reason for starting right away.

Princeton

PETER B. KENEN

---

[19] See, for example, the address by H. Johannes Witteveen at the Second International Monetary Conference in Philadelphia, November 13, 1980.

[20] Interest in this way of using gold was, of course, awakened by the creation of the EMS, but the idea has been around for many years. In 1969, for example, I recommended that "all central banks deposit all their gold, dollars and other reserve assets with the IMF, obtaining in exchange a new composite reserve asset backed by all the gold and other assets that had been held separately". ("The International Position of the Dollar in a Changing World", reprinted in KENEN, *Essays*, pt. III, p. 332).