Reserve Pooling in Asia and the Far East

by

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One of the forms of payments arrangements among the developing countries recognized by the Group of Experts appointed by United Nations Conference on Trade and Development (UNCTAD) [6] is the establishment of a reserve fund by pooling the reserves of the interested countries. The Committee on Invisibles and Financing Related to Trade of UNCTAD recommended that "the pooling of the reserves of the developing countries in particular regions should be considered" [7, Annex I, p. 9]. While a great deal of talk about other forms of payments arrangements has been going on in the region defined by the United Nations Economic Commission for Asia and the Far East (to be called Asia and the Far East region in the paper)[1], not much has yet been thought about the possibilities of the formation of reserve funds on regional or subregional basis as a possible measure toward the cherished goal of regional economic co-operation unanimously adopted at the Ministerial Conference on Asian Economic Cooperation held in Manila [9]. The purpose of this paper is to theoretically examine the rationale for reserve pooling among a group of countries and then to apply this theory to explore the possibilities of gains from reserve pooling on both regional and subregional basis in Asia and the Far East region.

I. THE CASE FOR RESERVE POOLING[2]

The rationale for regional reserve funding, specially among the developing countries, is primarily based on three arguments.

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[1] *See* [6].

[2] The theoretical rationale for reserve pooling among a group of countries has been examined by Richard N. Cooper [1 ; 2]. This paper attempts to improve upon Cooper's work in some ways.

First, reserve pooling can help in substantial conservation of the foreign-exchange reserves. It is well known that the rate of economic growth of many developing countries is constrained by the availability of foreign exchange so that this rationale for reserve pooling makes a special appeal in the context of the developing economies. It is based on taking advantage of the variability in the prevailing time pattern of international payments of these countries with the *world* arising from either seasonal or cyclical or other factors. Assuming that countries hold international reserves primarily to finance occasional deficits in their balance of payments and that the amount of required reserves to meet such contingencies is related directly to the expected variability of such contingencies, *i.e.*, to the expected standard deviation of disturbances to the balance of payments, as reflected in the reserves changes per period of specified time, then to the extent that the pooling of reserves of a group of countries helps to reduce the pooled standard deviation of the size of disturbances to the balance of payments and to the extent that these are less than perfectly positively correlated with those of other countries, some of the reserves held *individually* by the countries of a region for precautionary motive can be safely saved *collectively* by each member drawing on the pool when it has to pay to others and depositing with the pool when it receives payments from others, thus keeping the pool solvent. The amount of reserves thus conserved by reserve funding can be used either as a source of intraregional development finance or put in higher-yielding investments in the extraregional countries.

The above reasoning may be formulated in terms of the application of the probability theory. If it is assumed that the year-to-year reserves changes are, as a first approximation, independently normally distributed random variable with means and standard deviations (σ) equal to those empirically observed during a specified time period, then probability theory tells us that each country acting individually will require to hold 3σ (*i.e.*, three times the standard deviation) of its annual reserves changes to avoid exhaustion of reserves not exceeding one year with a probability of 99.9 per cent. A reserve fund will enable its member countries to hold lesser reserves *collectively* if the pooled standard deviation of the reserves changes of all the members of the fund is smaller than the unpooled standard deviation (*i.e.*, the sum of individual standard deviations). The standard deviation of the combined reserves changes of n countries (σ_n) is given by the following expression :

$$\sigma_n = \left(\sum_{i=1}^{n} (\sigma_i^2) + 2 \sum_{j>i} \sum_{i} \rho_{ij} \sigma_i \sigma_j \right)^{\frac{1}{2}}$$

where ρ_{ij} denotes the correlation coefficient between the reserves changes of the i-*th* and j-*th* countries.

The condition for the *pooled* standard deviation (σ_n) to be less than the *unpooled* standard deviation $\left(\sum_{i=1}^{n} \sigma_i\right)$ can be written as follows :

$$\sigma_n < \sum_{i=1}^{n} \sigma_i \text{ iff}$$

$$\sum_{i=1}^{n} \sum_{j>i} \rho_{ij} < \frac{n(n-1)}{2}$$

It is important to point out in this connection that it is not at all necessary for the *pooled* standard deviation to be less than the unpooled standard deviation that either all or a majority of the covariances be negative; all that is necessary is the condition immediately written above. Some gains will be derived by the pooling of reserves even among the countries whose correlation coefficients of reserves changes are positive but less than perfectly positively correlated. However, it is true that the larger the size of pairwise negative covariances among a group of countries, the larger would be the expected gains from reserves pooling for this group.

There are some serious theoretical problems involved in applying the above-stated probability model to the *ex post* data of reserves changes of a group of countries since the *ex post* reserves changes are heavily influenced by the balance-of-payments policies of the monetary authorities. Ideally, what we would like to have is the data on the *ex ante* disturbances in the balance of payments. But unfortunately the data are available only on *ex post* basis and there is no easy way of extracting *ex ante* information out of it. Presumably the standard deviation of the *ex ante* disturbances to the balance of payments is likely to be larger than revealed by the *ex post* disturbances which are influenced by the policies of the authorities but it is not at all clear *a priori* as to what would be the nature of the pairwise covariances of the *ex ante* reserves changes of a group of countries as compared to the pairwise covariances of the *ex post* reserves changes of these countries. Thus, we cannot resolve this problem of *ex ante* vs. *ex post* reserves changes in an easy way; what can be done within the constraints of the availability of *ex post* data of reserves changes is to concentrate on a more meaningful economic measure of the balance-of-payments deficits than changes in the gross reserves of the countries would indicate. This can be found in the concept of the *official reserves changes* which is the analogue of the well-known concept of the "official settlements balance" of the countries. But even when the data on the official reserves changes are used in the application of the probability model of reserve pooling formulated above, there exist the problems of testing the hypotheses of the normality and independence of the assumed distribution of the year-to-year changes in the official reserves of a group of countries. Of the two, the non-independence of the year-to-year variations in the official reserves of a

country is probably a more serious problem. If it turns out that the distributions of year-to-year variations in the official reserves of the countries of a reserve fund are not normally distributed but have a *skewed* distribution, other appropriate tests will have to be devised than described above for measuring the magnitude of the likely conservation of reserves by the pooling of reserves. On the other hand, if there exists a positive *autocorrelation* in the distribution of the year-to-year variations in the official reserves of the countries participating in reserve funding, the estimate of the likely conservation of reserves based on the probability model described above will overstate the gains from pooling of reserves and vice versa. Thus, a very careful handling of the empirical application of the above probability model is needed. And the estimates of the probable conservation of reserves by reserve pooling in a group of countries, as far as they go, need to be cautiously interpreted.

Secondly, the direct benefits from reserve pooling come from increased bargaining strength of the regional reserve fund as compared to the bargaining strength of the member countries individually, in matters of more sound and profitable avenues of investment, thus permitting the member countries to earn higher rates of interest collectively than they could have earned individually. Moreover, the existence of a sound regional reserve fund would naturally give a strengthened position to the regional currencies collectively than ever before and tend to lead to their fuller convertibility and lesser degree of risk regarding exchange-rate depreciations.

Thirdly, besides some of the direct advantages of the reserve pooling among the developing countries considered above, there are many, perhaps equally important, indirect advantages of such arrangements. These indirect advantages are derived from "the pooling of information, the exchange of ideas and the cooperative decision-making which necessarily accompany an exercise in multi-national monetary cooperation...." [2]. These cooperative acts are likely to increase the propensity to cooperate and "facilitate thereby the negotiation and practical implementation of more ambitious programmes of regional cooperation and integration" [5, p. 136], such as the regional organization of trade, *etc.*, perhaps finally culminating in the establishment of a full-fledged *economic* union with joint decision-making regarding all economic policies.

It may be pointed out here that whereas regional organization of trade in the form of establishment of a free-trade area or a customs union *etc.*, is discriminatory and regional payments unions can be discriminatory when credits are granted to finance only the intraregional deficits of the member countries, reserve pooling is a non-discriminatory measure since it is meant for taking advantage of the existing misalignments in the pattern of payments of the member countries with the *world* at large.

II. QUANTIFICATION OF GAINS FROM RESERVE POOLING IN ASIA AND THE FAR EAST

This section attempts to quantify only the expected conservation of international reserves from reserve pooling among a specified group of countries on regional and subregional basis in Asia and the Far East. With due regard to the limitations mentioned in Section I of this paper on the application of the probability model of gains from reserve pooling to empirical data, the empirical analysis of this part of the paper is based on the existing trends in the movements of international reserves of the countries of Asia and the Far East (as defined by ECAFE) during the period 1958-1965/66. Subsection A below provides a rough idea of the likely conservation of reserves from seasonal variations in the pattern of international payments of these countries while subsection B below presents estimates of expected conservation of reserves from year-to-year variations in the international reserves of these countries.

A. Conservation of Reserves from Seasonal Variations

The existence of inter-country differentials in the pattern of seasonal fluctuations affords an important source for mutual offsetting of reserves losses of some countries of Asia and the Far East with some other countries of the region, thus conserving reserves by the establishment of reserve funds in the region. Table I shows, in very rough terms, *quarterly* seasonal variations in the gross reserves (consisting of gold, foreign exchange and I.M.F. gold tranche positions) of countries of the region based on the data of 1959-66 period. This table also analyses the seasonal patterns in the reserves movements of the regional and subregional groupings of countries of the region which have been chosen for this study.

It is clear from Table I that the seasonal patterns in reserve movements of the various countries of Asia and the Far East do vary substantially from quarter to quarter. As an example of the possibilities of pairwise compensations of seasonal fluctuations among various combinations, the case of China (Taiwan) and Republic of Korea may be illustrated from the table. Whereas in the first and second quarter of the year, the Republic of China is always gaining reserves to acquire excess reserves over required reserves for meeting seasonal needs of financing international transactions, the Republic of Korea tends to lose reserves during these quarters, its requirements for seasonal finance exceeding its receipts from abroad; the situation is exactly reversed in the fourth quarter. Thus, these two countries can mutually extend interest-bearing credit facilities to tide over their seasonal requirements of reserves. The existence of such pairs which reverse the seasonal pattern of their reserves changes is most conducive to successful reserve pooling for the conservation of reserves. However, the offsetting possibility described above is purely on a *bilateral* basis and can be enlarged by multilateralization of compensations of seasonal fluctuations of the

TABLE I

QUARTERLY SEASONAL PATTERNS IN RESERVE MOVEMENT IN 1959-66 IN ASIA AND THE FAR EAST

(in millions of U.S. dollars)

Country/region	I	II	III	IV	Range
1. Burma	**—17.0**	**+12.6**	+7.4	—2.8	29.6
2. Ceylon	**+2.5**	+0.4	**—3.1**	+0.1	5.6
3. China (Taiwan)	**+9.0**	+4.8	+0.1	**—13.9**	22.9
4. India	+21.6	—23.0	**—28.4**	**+29.5**	57.9
5. Iran	**+16.6**	**—14.3**	+3.7	—6.0	30.9
6. Korea (Rep.)	—4.2	**—7.8**	+2.1	**+9.8**	17.6
7. Malaysia	+3.5	—5.6	**—5.9**	**+8.0**	13.9
8. Pakistan	**+22.8**	—6.1	**—18.1**	+1.4	40.9
9. Philippines	—0.3	**—2.5**	**+5.5**	**—2.5**	8.0
10. Thailand	**+13.7**	—2.2	**—7.5**	—4.1	21.2
11. Viet Nam (Rep.)	**—6.2**	+2.2	**+3.9**	+0.0	10.1
12. Japan	+1.6	**—17.2**	—13.4	+29.1	46.3
13. Australia	—26.6	**+55.0**	**—55.2**	+27.1	110.2
14. New Zealand	+19.0	**+36.4**	—11.5	**—43.9**	80.3
Asia and the Far East	**+56.0**	+32.7	**—120.4**	+31.8	176.4
Developing Subregion	**+62.0**	**—41.5**	—40.3	+19.5	103.5
Developed Subregion	—6.6	**+74.2**	**—80.1**	+12.3	154.3
A. S. A.	**+16.9**	**—10.3**	—7.9	+1.4	27.2
Iran and Pakistan	**+39.4**	**—20.4**	—14.4	—4.6	59.8

Source: Calculated from *International Financial Statistics.*

Notes: 1. Entries in bold type indicate quarterly maxima and minima.
2. Seasonal patterns are calculated by comparing each quarter's average reserve changes with typical quarterly average for each year.
3. Asia and the Far East: Countries 1 to 14; Developing subregion: Countries 1 to 11; Developed subregion: Countries 12 to 14; Association of Southeast Asia (A. S. A.) : Countries 7, 9 and 10.

countries by the establishment of regional reserve fund, since the fund will be able to offset the reserves gains of *any* member country with the reserves losses of *any* other member country and thus increase the scope for conservation of reserves.

An attempt is made in Table II to estimate the gains to be derived by pooling of reserves for the regional and subregional groups from the existing seasonal patterns, as recorded in Table I. For this purpose, the *range*—the difference between the largest reserves gain and largest reserves loss — is calculated for each country individually and for the hypothetical regional and subregional groupings as if they had existed. The *unpooled range* of region is the arithmetic sum of range of member countries *individually* (as given in Table I)

whereas *pooled range* of a region is the range based on the quarterly seasonal patterns of the combined reserves changes of the hypothetical region as a country as if it had actually existed. Since each country must have reserves (or assured lines of credit) to cover the seasonal ranges, a reduction in the range of seasonal variations implies that member countries of the fund will be required to have lesser reserves to that extent to cover the seasonal ranges. Table II gives estimates of percentage reduction in range achieved by pooling of reserves in Asia and the Far East.

TABLE II

ANALYSIS OF RANGE OF SEASONAL PATTERNS IN RESERVES MOVEMENTS IN ASIA AND THE FAR EAST ON REGIONAL AND SUBREGIONAL BASIS

(*in millions of U.S. dollars*)

Region	Range without pooling	Range with pooling	% reduction range by pooling
Asia and the Far East	495.4	176.4	64.4
Developing subregion	258.6	103.5	59.9
Developed subregion	236.8	154.3	34.8
A. S. A.	43.1	27.2	36.9
Iran and Pakistan	71.8	59.8	16.7

Source : Based on Table I.

The following observation can be made on the possibilities of conservation of reserves from Table II.

Reserve Fund in Asia and the Far East: The unpooled range for seasonal pattern in reserves movements in Asia and the Far East region is 495.4 million dollars whereas the pooled range is only 176.4 million dollars. Reserves pooling in the case of Asia and the Far East Reserve Fund leads to a reduction in the range for seasonal movements by 64.4 per cent. With pooling, reserves requirements to cover the seasonal needs would, therefore, be only 36 per cent of the reserves requirements for the countries operating individually. This is indeed substantial amount of savings of reserves (319 million dollars) which could be used either as a source for financing intraregional development or for earning more foreign exchange by investment at higher rates of interest in foreign markets.

Reserve Fund in Developing Asia and the Far East: The pooled range of seasonal reserves movements for Developing Asia and the Far East gets reduced from 258.6 million to just 103.5 million dollars which is a reduction in range

by as much as 155.1 million dollars (or 59 per cent). The Developing Asia and Far East region will, therefore, require only 40 per cent of its reserves through the operations of Developing Asia and Far East Reserve Fund to cover its normal seasonal reserves requirements than without such a Fund. Thus, even without developed countries of the region, the developing subregion has enormous potential to help tide over seasonal fluctuations in the reserve requirements of member countries.

Reserve Fund in Developed Asia and the Far East: The range of seasonal reserves movements for Developed Asia and the Far East without pooling is 236.8 million dollars, and with reserve pooling it goes down to 154.3 million dollars so that the possible reduction in the range achieved by pooling reserves through Developed Asia and the Far East Reserve Fund is 82.5 million dollars (or 34.8 per cent). Thus, as compared to the developed countries of the region operating separately, they will require only 65 per cent of reserves to cover their normal seasonal reserves needs.

A.S.A. Reserve Fund: For the Association of Southeast Asia, the unpooled range of seasonal reserve movements is 43.1 million dollars whereas the pooled range is 27.2 million dollars which means a reduction of 15.9 million dollars (or 37 per cent). Thus, A.S.A. Reserve Fund will help A.S.A. to get by with 63 per cent of reserves to cover its normal seasonal reserve movements without pooling.

Iran and Pakistan Reserve Fund: The range of seasonal reserves movements by pooling the reserves of Iran and Pakistan is reduced only by 12 million dollars or (17 per cent) — the lowest figure among subregional groupings. This implies that Iran and Pakistan will jointly need to hold 83 per cent of the reserves to meet their seasonal requirements of reserves.

The results obtained above in connection with conservation of reserves from existing patterns of seasonal variations in reserves during 1959-66 clearly indicate that total Asia and Far East offers the greatest potential proportional reduction (64 per cent) in the required reserves for meeting seasonal requirements of finance in terms of conservation of reserves. However, it is remarkable that Developing Asia and Far East also does quite well in this respect (making for 60 per cent of reduction in pooled range of variations in reserves) to justify the case for establishment of Developing Asia and the Far East Reserve Fund. Other subregional groupings do not yield substantial benefits.

This conservation of reserves for seasonal requirements by reserve pooling is indeed impressive when calculated on the quarterly basis. It needs to be mentioned that in all likelihood, the conservation of reserves for seasonal requirements is likely to be enhanced if seasonal patterns were calculated on smaller period than a quarter, *e.g.*, on the basis of monthly, weekly or daily calculation.

However, the important point is that the possibilities for conservation of reserves based on seasonal patterns is only a part of the story, and rather a smaller part, because the reserves requirements to cover seasonal movements are only a small portion of the *total* requirements of reserves to finance *all* international transactions over time. Hence, we now proceed to analyse the scope for conservation of reserves in Asia and the Far East from the existing pattern of year-to-year variations in the reserves of the countries of this region.

B. Year-to-Year Variations in Reserves and the Scope for Conservation of Reserves

In order to estimate the conservation of reserves from year-to-year variations in the reserves of the countries of Asia and the Far East, use will be made of the probability model discussed in Section I. It may be recalled from the discussion of that probability model that we assumed that countries hold reserves to meet occasional deficits in their balance of payments. What we would ideally like to have for estimating the possible conservation of reserves while applying that probability model is the data on *ex ante* disturbances in the balance of payments since the *ex post* data are influenced by various kinds of policy changes. But unfortunately, all the information that is available is on the basis of *ex post* data and it is not possible to extract *ex ante* information out of it. Within the constrains of the availability of data on the balance of payments, a more meaningful method for estimating the conservation of reserves from the year-to-year variations in the reserves of a group of countries which would be particularly relevant in the context of possibilities of financial cooperation among the central banks is to look at the distribution of year-to-year changes in the official reserves of these countries, *i.e.*, the year-to-year balances of the monetary authorities of these countries and not the year-to-year changes in the gross reserves of these countries. Even the reliance on the data for official monetary balances has to be qualified by examining the nature of balances of the commercial banks as the "deficits" may be covered not by drawing down of the reserves of the monetary authorities but by the borrowing abroad undertaken by the commercial banks. However, what follows still relies on the comparison of year-to-year variations in the balance of monetary authorities.

Before turning to the application of the sophisticated probability model to the data of balances of monetary authorities of the countries of Asia and the Far East for estimating the possible conservation of reserves, it would be worthwhile examining the nature of the data and year-to-year possible mutual offsettings that could be undertaken by the establishment of the regional and subregional reserve funds.

Table III shows the annual reserves changes of the monetary authorities of the countries of Asia and the Far East and of the hypothetical regional and subregional reserve funds as if they were in existence over the period 1958-65.

TABLE III

ANNUAL RESERVES CHANGES OF MONETARY AUTHORITIES IN ASIA AND THE FAR EAST, 1958-65

(in millions of U.S. dollars)

Country or group	1958	1959	1960	1961	1962	1963	1964	1965	Average change over 1958 to 1965
Burma	27	25	—4	—7	52	23	—3	—27	10.8
Cambodia	17	9	—2	33	—11	—1	2	5	2.8
Ceylon	—32	—20	—40	—22	—15	—18	—1	34	—14.3
China (Taiwan)	20	—5	23	—57	1	51	103	8	18.0
India	—249	97	—67	—59	—136	23	21	—103	—59.1
Indonesia	198	110	68	—231	—46	—124	24	32	3.9
Iran	—46	—25	—57	59	46	12	104	62	19.4
Korea (Rep.)	38	3	1	47	—52	—49	—2	4	—1.3
Malaysia*	—27	28	114	49	15	—6	—37	21	19.6
Pakistan	—48	89	27	—60	7	41	—58	—67	—8.6
Philippines	—	43	26	—90	36	55	—4	—15	6.4
Thailand	—15	10	49	83	69	52	84	79	51.4
Viet Nam (Rep.)	33	24	46	—40	—22	22	—39	36	7.5
Japan	338	487	498	—404	230	243	—56	123	182.4
Australia**	—4	57	—104	217	140	493	—339	59	64.9
New Zealand	36	49	—39	—51	43	—24	22	—99	—7.9
Asia and the Far East	286	981	539	—563	357	793	—179	152	295.8
Developing subregion	—84	388	184	—325	—56	81	194	69	56.4
Developed subregion	370	593	355	—238	413	712	—373	83	239.4
A. S. A.	—42	81	189	42	120	101	43	85	77.4
Iran and Pakistan	—94	64	—30	—1	53	53	46	—5	10.8

Source : Calculated from [3 ; 4].

*The data up to 1961 are for Malaya or Malaya Federation and for Malaysia from 1962 onward.

**The data are for fiscal years.

A cursory glance at Table III will reveal that there are substantial variations in year-to-year reserves changes of the monetary authorities in the countries of Asia and the Far East. A statistical measure of such variations can be found by comparing the standard deviations of these reserves changes for each country which is given in Table X. The dispersion of reserves changes around its average value as measured by the standard deviation over the period 1958-65 is the smallest (7.7) for Cambodia and the largest (279.9) for Japan in units of millions of dollars.

A careful study of Table III also shows the existence of inter-country differences in annual reserves changes of the monetary authorities of the countries in Asia and the Far East which provide the scope for mutual offsetting of reserves losses of one member of a Reserve Fund with the reserves gains of another member of the Fund in any year. It may be noted that considering the (official) reserves changes of each country *separately*, the cumulative reserves gains of most of the countries of Asia and the Far East have exceeded their cumulative reserves losses over the period 1958-65 — the exceptions being Ceylon, India, Korea (Rep.), Pakistan and New Zealand. For the period under consideration, the cumulative (official) reserves gains of Ceylon covered 23 per cent of its cumulative (official) reserves losses; similar percentages for India, Korea (Rep.), Pakistan and New Zealand were 23 per cent, 90 per cent, 70 per cent and 70 per cent, respectively. Considering the reserves changes of the monetary authorities of the countries of Asia and the Far East on *pooled* basis, the extent of mutually possible offsettings over *space* which could be undertaken annually by the hypothetical regional and subregional reserve funds in Asia and the Far East is shown in Tables IV to VIII.

TABLE IV

ESTIMATION OF MUTUAL OFFSETTING OF OFFICIAL RESERVES CHANGES OVER SPACE IN EACH YEAR BY ASIA AND THE FAR EAST RESERVE FUND FOR 1958-65

(*in millions of U.S. dollars*)

Year	Reserves gains of members	Reserves losses of members	Reserves change of fund	Mutually compensable
1958	707	421	286	421
1959	1031	50	981	50
1960	852	313	539	313
1961	458	1021	—563	458
1962	639	282	357	282
1963	1015	222	793	222
1964	360	539	—179	360
1965	463	311	152	311
Average 1958-65	691	395	296	302

Source : Based on Table III.

TABLE V

ESTIMATION OF MUTUAL OFFSETTING OF OFFICIAL RESERVES CHANGES OVER SPACE IN EACH YEAR BY DEVELOPING ASIA AND THE FAR EAST RESERVE FUND FOR 1958-65

(*in millions of U.S. dollars*)

Year	Reserves gains of members	Reserves losses of members	Reserves change of fund	Multually compensable
1958	333	417	—84	333
1959	438	50	388	50
1960	354	170	184	170
1961	241	566	—325	241
1962	226	282	—56	226
1963	279	198	81	198
1964	338	144	194	144
1965	281	212	69	212
Average 1958-65	311	255	56	197

Source : Based on Table III.

TABLE VI

ESTIMATION OF MUTUAL OFFSETTING OF OFFICIAL RESERVES CHANGES OVER SPACE IN EACH YEAR BY DEVELOPED ASIA AND THE FAR EAST RESERVE FUND FOR 1958-65

(*in millions of U.S. dollars*)

Year	Reserves gains of members	Reserves losses of members	Reserves change of fund	Multually compensable
1958	374	4	370	4
1959	593	0	593	0
1960	498	143	355	143
1961	217	455	—238	217
1962	413	0	413	0
1963	736	24	712	24
1964	22	395	—373	22
1965	182	99	83	99
Average 1958-65	379	140	239	64

Source : Based on Table III.

TABLE VII

ESTIMATION OF MUTUAL OFFSETTING OF OFFICIAL RESERVES CHANGES OVER SPACE IN EACH YEAR BY A. S. A. RESERVE FUND FOR 1958-65

(in millions of U.S. dollars)

Year	Reserves gains of members	Reserves losses of members	Reserves change of fund	Mutually compensable
1958	0	42	— 42	0
1959	81	0	81	0
1960	189	0	189	0
1961	132	90	42	90
1962	120	0	120	0
1963	107	6	101	6
1964	84	41	43	41
1965	100	15	85	15
Average 1958-65	102	24	77	19

Source : Based on Table III.

TABLE VIII

ESTIMATION OF MUTUAL OFFSETTING OF OFFICIAL RESERVES CHANGES OVER SPACE IN EACH YEAR BY IRAN AND PAKISTAN RESERVE FUND FOR 1958-65

(in millions of U.S. dollars)

Year	Reserves gains of members	Reserves losses of members	Reserves change of fund	Mutually compensable
1958	0	94	—94	0
1959	89	25	64	25
1960	27	57	—30	27
1961	59	60	—1	59
1962	53	0	53	0
1963	53	0	53	0
1964	104	58	46	58
1965	62	67	—5	62
Average 1958-65	56	45	11	29

Source : Based on Table III.

It can be seen from Tables III to VIII that over the period 1958-65, on the average, each of the regional or subregional reserve fund gained reserves. The Asia and the Far East Reserve Fund would have lost reserves only in 1961 and 1964 out of the 8 years period under consideration; the Developing Asia and the Far East Reserve Fund would have been a loser of reserves in only 1961 and 1962; the Developed Asia and the Far East Reserve Fund would have lost reserves only in 1961 and 1964; the A. S. A. Reserve Fund would have lost reserves in only one year, *i.e.*, 1958; and Iran and Pakistan Reserve Fund would have been a loser of reserves in the years 1958, 1960, 1961, and 1965 in the ever, in each case, the possible reserves losses could have been met from the period 1958-65. How cumulative reserve gains of the previous years and each Fund would be expected to be solvent over time.

Tables IV to VIII clearly reveal that substantial mutual compensations over space could be undertaken by the regional or subregional reserve funds in Asia and the Far East for year-to-year changes in the (official) reserves thus conserving reserves for the region (or subregion) as a whole. Size-wise as well as proportion-wise, the largest scope for mutual offsetting of reserves changes appears to be for the entire Asia and the Far East region and the second largest for the Developing subregion while further subregionalization substantially reduces the scope for such compensations. However, it must be emphasized in this connection that these compensations over space calculated on an annual basis cannot be negotiated without negotiating the compensations over time for each country separately in the form of agreements on lines and sizes of the availability of credits.

We can now turn to the econometric analysis of the existence of inter-country differentials in the existing pattern of official reserves changes of countries of Asia and the Far East region, shown in Table III, to quantify the possible conservation of reserves using the probability model described in Section I. Table IX presents the correlation coefficient matrix of the reserves changes of the monetary authorities of the countries of Asia and the Far East based on the data of Table III. It can be seen from Table IX that the pair-wise movements of reserves changes of many groupings of the countries of the region show opposite patterns thus helping to reduce the pooled standard deviation of such reserves changes for all the regional and subregional groupings considered in this study compared to the unpooled standard deviation (*i.e.*, the arithmetic sum of standard deviations of each of the members separately) thereby promising the potentialities of conservation of reserves. Larger amount of reserves can be conserved if the policy authorities of the reserve funds are prepared to adopt more liberal probability hypotheses than the rigid requirement of 0.1 per cent probability of exhaustion of reserves on one-year basis for any country, as illustrated in Section I. Since year-to-year reserves changes have been, as a first approximation, assumed to be independently normally distributed random variables with mean and standard deviations equal to those actually observed during

TABLE IX

CORRELATION COEFFICIENT MATRIX OF OFFICIAL RESERVES CHANGES OF COUNTRIES OF ASIA AND THE FAR EAST FOR THE PERIOD 1958-65

(rounded to one place of decimal)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Burma	1.0	—0.2	—0.5	—0.0	—0.1	0.1	—0.3	—0.5	—0.3	0.5	0.6	—0.5	—0.1	0.4	0.3	0.8
2. Cambodia	—	1.0	—0.0	—0.1	—0.2	0.5	—0.3	0.7	—0.3	—0.2	—0.2	—0.7	0.4	0.1	—0.2	0.1
3. Ceylon	—	—	1.0	0.1	0.1	—0.1	0.7	—0.1	—0.3	—0.4	—0.2	0.5	—0.1	—0.3	—0.1	—0.5
4. China (Taiwan)	—	—	—	1.0	0.2	0.3	0.2	—0.4	—0.5	—0.0	0.5	0.1	0.0	0.2	—0.4	0.2
5. India	—	—	—	—	1.0	—0.3	0.2	—0.3	0.1	0.5	0.2	0.2	—0.2	0.0	0.1	0.0
6. Indonesia	—	—	—	—	—	1.0	—0.5	0.2	—0.1	0.1	0.4	—0.7	0.6	0.7	—0.6	0.4
7. Iran	—	—	—	—	—	—	1.0	—0.1	—0.4	—0.6	—0.4	0.8	—0.8	—0.8	—0.1	—0.2
8. Korea (Rep.)	—	—	—	—	—	—	—	1.0	0.1	—0.5	—0.8	—0.2	—0.0	—0.3	—0.3	—0.2
9. Malaysia	—	—	—	—	—	—	—	—	1.0	0.3	—0.1	0.1	0.3	0.2	0.0	—0.4
10. Pakistan	—	—	—	—	—	—	—	—	—	1.0	0.8	—0.4	0.4	0.7	0.3	0.4
11. Philippines	—	—	—	—	—	—	—	—	—	—	1.0	—0.4	0.5	0.8	0.1	0.4
12. Thailand	—	—	—	—	—	—	—	—	—	—	—	1.0	—0.6	—0.7	—0.0	—0.5
13. Viet Nam (Rep.)	—	—	—	—	—	—	—	—	—	—	—	—	1.0	0.8	0.1	—0.2
14. Japan	—	—	—	—	—	—	—	—	—	—	—	—	—	1.0	—0.1	0.4
15. Australia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.0	—0.2
16. New Zealand	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.0

Source: Based on Table III.

the period 1958-65 and since the reserves requirements on the basis of some hypothesis regarding the probability of exhaustion of reserves at a specified level (to be jointly decided by the members of Reserve Fund) can be calculated using the table of normal probability distribution, a rough estimate of the conservation of reserves by the establishment of a Reserve Fund (in so far as pooling of reserves helps to reduce the pooled standard deviation of reserves changes of members as compared to the unpooled sum of individual standard deviations of the members) can easily be made. The following two different hypotheses regarding the specification of the probability of exhaustion are chosen for the purpose of illustration:

HYPOTHESIS 1. Each country and each fund requires to hold reserves sufficiently large to avoid exhaustion of reserves not exceeding a period of 2 years with a probability of 95 per cent. This will require each country and Fund to hold reserves equal to 2.33 times the appropriate standard deviation.

HYPOTHESIS 2. Each country and each fund requires to hold reserves large enough to avoid exhaustion of reserves not exceeding a period of 5 years with a probability of 95 per cent. This necessitates the holding of reserves equal to 3.68 times the appropriate standard deviation.

Comparatively speaking, Hypothesis 1 is more liberal than Hypothesis 2 in terms of the risk functions underlying the decisions of these various hypotheses. The estimated conservation of reserves on the basis of each of these two hypotheses is shown in Tables X and XI.

It can be seen from Tables X and XI that a very strong case can be made for regional reserve pooling in Asia and the Far East on the basis of the probability model presented above; the expected conservation of reserves on both regional and subregional basis is indeed enormous both percentage-wise and in terms of absolute amount in dollars. As far as the proportionate conservation of reserves, likely to be achieved on the basis of the recent historical pattern of the official reserves changes by the establishment of the regional and subregional reserve funds, is concerned, it is as follows : Asia and the Far East Reserve Fund (60 per cent); Developing Asia and the Far East Reserve Fund (68 per cent); Developed Asia and the Far East Reserve Fund (35 per cent); A. S. A. Reserve Fund (48 per cent); and Iran and Pakistan Reserve Fund (53 per cent). Surprisingly enough, at least proportionately, the Developing Subregion affords even greater possibilities of conservation of reserves based on the intercountry differentials in the time pattern of official reserves changes of the member countries than either the Developed Subregion or the entire Asia and the Far East region. However, what is more important is not the proportion but the absolute magnitude of the likely conservation of reserves. In terms of the absolute amount, for example, the expected conservation on the basis of Hypothesis 1 is the largest for Asia and the Far East region *i.e.*, about 1,644.3 million dollars

TABLE X

RESERVES REQUIREMENTS WITH AND WITHOUT POOLING IN ASIA AND THE FAR EAST BASED ON THE MONETARY OFFICIAL BALANCES FOR 1958-65

(in millions of U. S. dollars)

Country/region	Standard deviation of official balance	Required by Hypothesis 1	Required by Hypothesis 2	Average annual gross reserves actually held
Burma	23.6	55.0	86.8	154.9
Cambodia	7.7	17.9	28.3	106.5
Ceylon	21.2	49.4	78.0	99.3
China (Taiwan)	43.1	100.4	158.6	179.3
India	100.9	235.1	371.3	635.8
Indonesia	126.6	295.0	465.9	198.8[a]
Iran	54.1	126.1	199.0	221.0
Kores (Rep.)	33.1	77.1	124.8	155.0
Malaysia	44.6	103.9	164.1	791.3[b]
Pakistan	54.2	126.3	199.5	269.8
Philippines	43.1	100.4	158.6	108.0
Thailand	34.0	79.2	125.1	493.9
Viet Nam (Rep.)	33.0	76.9	121.4	171.1
Japan	279.9	652.2	1030.0	1796.8
Australia	226.0	526.6	831.7	1400.1
New Zealand	50.0	116.5	184.0	163.4
Asia and the Far East	469.4	1093.7	1727.3	6639.7
Developing Asia and the Far East	201.2	468.8	740.4	3279.4
Developed Asia and the Far East	359.9	838.6	1324.4	3360.3
A. S. A.	62.8	146.3	231.1	1393.2
Iran and Pakistan	50.8	118.4	186.9	490.8

[a]Based on annual average for 1958-63 period.

[b]Based on annual average for 1958-64 period.

TABLE XI

ANALYSIS OF ESTIMATED CONSERVATION OF RESERVES BY RESERVE POOLING IN ASIA AND THE FAR EAST

(in millions of U. S. dollars)

Region of reserve fund	Hypothesis 1		Hypothesis 2		% conservation of reserves by pooling (by either hypothesis)
	unpooled required reserves	pooled required reserves	unpooled required reserves	pooled required reserves	
Asia and the Far East	2738.0	1093.7	4327.1	1727.3	60.0
Developing Subregion	1442.7	468.8	2281.4	740.4	67.5
Developed Subregion	1295.3	838.6	2045.7	1324.4	35.3
A. S. A.	283.5	146.3	447.8	231.1	48.4
Iran and Pakistan	252.4	118.4	398.5	186.9	53.1

Source : Calculated from Table X.

and is the second largest for the Developing Subregion, *i.e.*, about 973.9 million dollars. It is much smaller for the other subregions. It may be noted that bulk of this conservation of reserves would be in the form of foreign exchange as all the countries of this region keep most of their international reserves in the form of foreign exchange. Thus, for example, if the conserved reserves on the basis of Hypothesis 1 were invested by the reserve funds in securities in the foreign markets at a rate of interest just 2 per cent higher than what individual countries now get for their investments, this could provide an additional annual income of approximately 33 million dollars for the entire Asia and the Far East region and about 19 million dollars for the Developing Subregion alone. Alternatively the conserved reserves may be invested for intra-regional economic development.

The last column of Table X provides information on the average annual gross reserves actually held by the countries of Asia and the Far East during 1958-65 period for comparison with the required reserves derived from the probability model. These figures are reassuring as to the sound workability of regional and subregional reserve pooling in the region as these hypothetical regions and subregions have been holding much larger reserves than even the stricter of the two hypotheses postulated here (*i.e.*, Hypothesis 2) would require. Even though a much more cautious approach is to be recommended initially for establishing and operating regional reserve funds, if confidence can be placed in the probability calculus presented above, such regional reserve funds should be viable units in Asia and the Far East.

Qualifications to the Probability Analysis of Estimates of Conservation of Reserves

The hypothetical figures of estimated conservation of reserves through pooling of reserves need to be very cautiously interpreted. In this connection, the limitations of the probability model for empirically estimating the possible conservation of reserves mentioned in Section I need to be very well borne in mind. The case for regional reserve pooling in Asia and the Far East presented here needs to be further examined. In this connection, the trend factor in reserves movements for all groupings needs to be isolated for further study. The nature of the probability distribution of annual reserves changes needs to be more rigorously tested and if it turns out, as I suspect, to be *skewed* rather than *normal* as assumed in the present study as a first approximation, other appropriate statistical tests have to be devised to calculate the gains to be derived by the establishment of the regional reserve funds. As was stated in Section I, a more serious problem can be the non-independence of the year-to-year reserves changes. The data presented in Table III on the year-to-year official reserves changes of the countries of Asia and the Far East was tested for the existence of autocorrelation and the results are summarized in Table XII.

TABLE XII

AUTOCORRELATION COEFFICIENTS FOR OFFICIAL RESERVES CHANGES OF COUNTRIES OF ASIA AND THE FAR EAST FOR THE PERIOD 1958-65

Country	Autocorrelation coefficient	Significant at 0.05 level or not
Burma	0.14	No
Cambodia	0.31	No
Ceylon	0.68	Yes
China (Taiwan)	0.14	No
India	—0.62	No
Indonesia	0.27	No
Iran	0.38	No
Korea (Rep.)	0.03	No
Malaysia	0·31	No
Pakistan	—0.10	No
Philippines	—0.21	No
Thailand	0.76	Yes
Viet Nam (Rep.)	—0.24	No
Japan	—0.11	No
Australia	—0.37	No
New Zealand	—0.26	No

Source : Calculated from Table III.

The evidence presented in Table XII on the basis of very limited number of observation does not refute the hypothesis of independence of the year-to-year official reserves changes of the countries of Asia and the Far East assumed in this study at the 5-per-cent level of confidence. Of all the autocorrelation coefficients of Table XII, only two are significant at the 5-per-cent level of confidence, namely, those of Ceylon which has been a persistent reserve loser and Thailand which has been a persistent reserve gainer over the period 1958-65. Of the remaining insignificant autocorrelation coefficients, almost one half have the positive sign and the other half have negative sign. Thus, the estimates of possible conservation of reserves presented in this part may not be either exaggerating or understating the gains from reserve pooling in Asia and the Far East.

However, the most serious limitation of this applied analysis of the possible conservation of reserves in Asia and the Far East, as mentioned in Section I, is that it is based on *ex post* figures of annual changes in the reserves of the monetary authorities which are clearly influenced by the availability of external borrowings (such as from the International Monetary Fund), the exogenous factors such as the escalation of military operations in Viet Nam by the United States and deliberate government policies regarding permissible variations in the official reserves and other factors which conceal the true nature of the actual changes in the balance of payments of any country. These factors will modify the basic figures of "true" nature of disturbances in the balance of payments and hence also the estimates of probable conservation of reserves by reserve pooling.

The very fact that the countries of Asia and the Far East are holding reserves consistently much larger than required by either of the two hypotheses chosen here (*see* Table X) casts doubt on the validity of the assumption of our model which postulates that countries hold reserves to cover occasional deficits in their balance of payments or else that the standard deviation of the "true" disturbances in the balance of payments is much larger than shown here in Table X. The former raises other theoretical problems as to what explains the demand for reserves by the monetary authorities of the countries of Asia and the Far East. Since these problems require a separate study in itself, I will not go into them in this paper.

Finally, the estimates of probable conservation of reserves using the probability model of Section I are based on the assumption that existing pattern of official reserves changes will be similar in the near future as well. To be complete and more accurate in projecting the likely conservation of reserves, the analysis must take into account not only the existing pattern but also *potential* behaviour of the balance-of-payments disturbances likely to prevail in the future, which is indeed a very hard nut to crack.

CONCLUSION

The attempt in this paper, to quantify the expected conservation of international reserves by regional reserve pooling in Asia and the Far East, points out that in terms of the magnitude of conservation of reserves both on *seasonal* and *annual* basis, the entire Asia and the Far East region affords the possibilities of the largest conservation of reserves. However, the expected conservation of reserves for developing subregion is still substantial to justify the case for establishment of Developing Asia and the Far East Reserve Fund in case the Asia and the Far East Reserve Fund cannot be established for some reasons. Within the developing subregion, the importance of the participation of the countries gaining reserves like Malaysia, Philippines and Thailand cannot be exaggerated for viability of the Developing Asia and the Far East Reserve Fund over time.

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