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RICE -- THE HISTORICAL RECORD

By Virach Arromdee
Kasetsart University, Bangkok

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RICE -- THE HISTORICAL RECORD

By Virach Arromdee

GENERAL RICE PRODUCTION AND TRADE

The facts are that:

1. Rice is the staple food of one third of the world's population.
2. Rice is important to the economy of many Asian countries, especially Thailand, and the rest of Southeast Asia.

It has, and will continue to play a vital role in the world food situation. Agriculture, in the majority of Asian countries, especially Southeast Asia, is the major economic activity of a large share of the population. In addition to providing employment it is an important source of foreign exchange earning for several countries in the region. The ratio of rice exports to total exports in an average year for the countries in Southeast Asia is: 75 per cent for Burma, 35 per cent for Thailand, 30 per cent for the Republic of Vietnam and 30 per cent for Cambodia.[1]

In spite of the importance of rice as a source of export earnings for these countries, international trade accounts for only about 4 per cent of the total rice production. Most of the rice produced in the developing countries, especially Asia, is consumed domestically. The small ratio of exports to production leads to an unstable volume of trade. Furthermore, a small percentage of change in domestic

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[1] U.S. Department of Agriculture, *Agriculture in South East Asia, Asian Rice Bowl and its Relation to U.S. Farm Exports*, ERS-Foreign Agricultural Economic Report No. 28, June 1965, p. 30.

production or consumption can significantly affect international trade volume and the price of rice in international markets.

The following data show the world rice production and trade during 1951 to 1966:

	WORLD RICE PRODUCTION 1,000 M.T. milled (conversion rate 66%)	WORLD RICE TRADE 1,000 M.T. milled
1951	110,484	4,978
1952	119,064	5,253
1953	129,426	4,805
1954	126,720	4,966
1955	136,950	5,668
1956	144,210	6,874
1957	140,976	6,666
1958	151,140	6,596
1959	151,140	7,073
1960	159,456	7,374
1961	161,898	6,209
1962	163,944	6,210
1963	167,025	6,559
1964	173,376	7,388
1965	167,769	7,390
1966		7,540

The milled rice production increased from 119.658,000 metric tons in 1951-53 average to 169,390,000 metric tons on 1963-65 average or only 42 per cent increase. The world milled rice trade increased during the same period was

5,012,000 metric tons to 7,112,000 metric tons or also 42 per cent.

Burma and Thailand are the world's leading rice exporting countries. Figure 1 shows the combined milled rice production and exports of the two countries from 1951 to 1966.

After 1966, because of a shortage of supply from the world's major exporting countries, the world's rice price greatly increased. The f.o.b. Bangkok 100 per cent rice price per metric ton was £55-16 in April 1966, £66-8 in April 1967, £92-0 in April 1968. (U.K. devaluation in November 18, 1967 was 14.28 per cent or the equivalent of $2.80 to $2.40 per pound sterling).[2] In 1966-67, production in Burma declined by one-fifth. Burma's exports in 1967 were expected to decline sharply to only 500,000 metric tons as against the annual export in preceding years of approximately 1.4 million metric tons. South Vietnam, in the early 1960s exported 300,000 to 400,000 metric tons annually, but now imports are approximately 700,000 metric tons per year. The reduction in exports from these two sources accounted for about two million metric tons. This led to a sharp rise in price. It also contributed to an expansion of production and exports from other Asian and non-Asian countries.

This flourishing rice trade, however, has declined since 1968, mainly because of the high competition in rice export market. The Philippines, normally a rice importer, has become a rice exporter; many importing countries are moving toward self-sufficiency in rice. The world situation has thus changed from the

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[2] Thailand, Ministry of Economic Affairs, *Report of Rice Exports*, No. 4/2511, January 1968, p. 5.

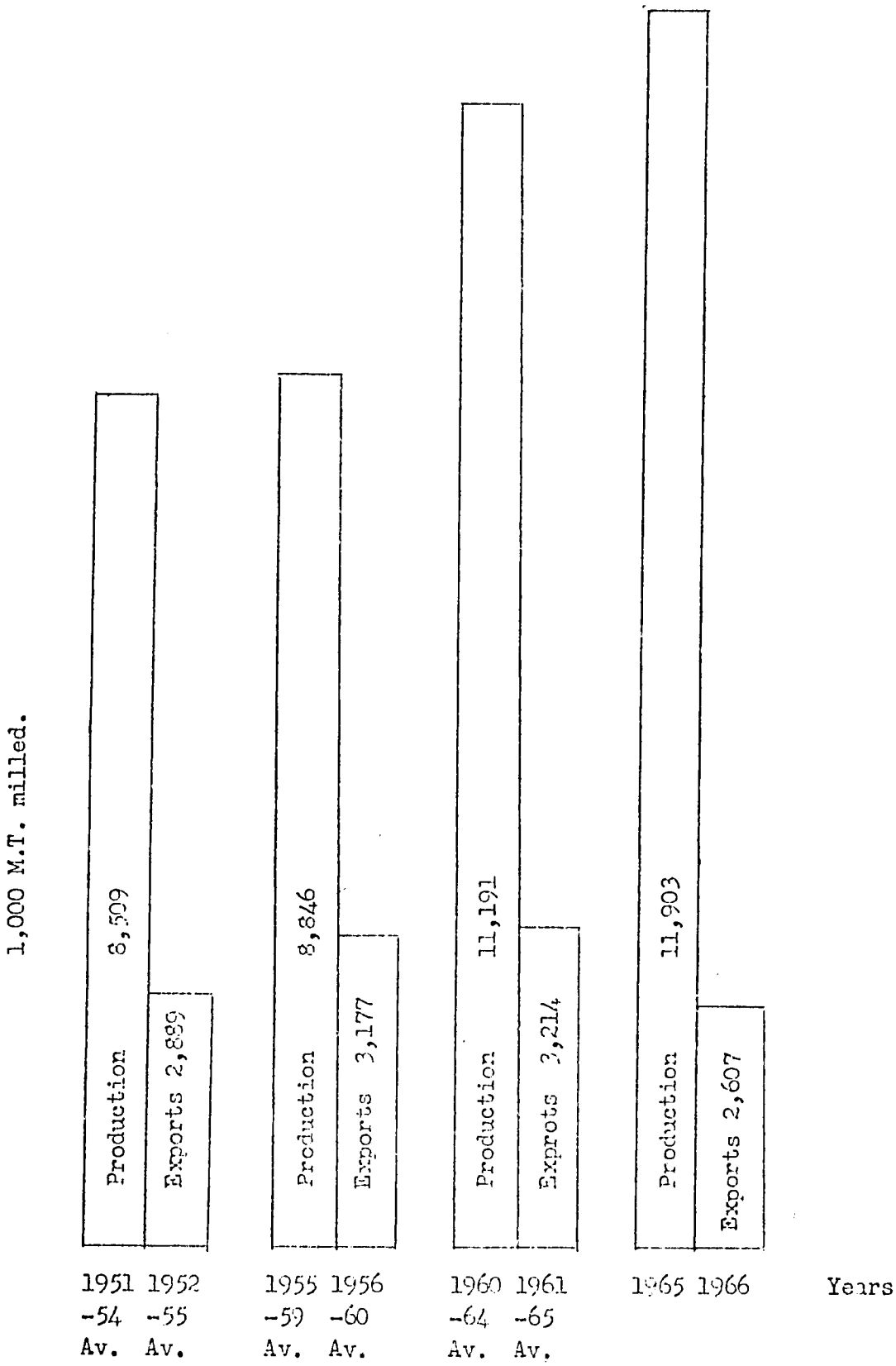

Figure 1. Combined milled rice production and exports of Burma and Thailand.

seller's market to a buyer's market, and the export price has a declining trend. The 100 per cent rice price per ton was £96 f.o.b. Bangkok in January 1968, £92 in April, and sharply fell to £77 in June.[3] Despite the declining price, the rice price is still considered to be comparatively high. The world's rice trade pattern has changed through time. Trade increased from 4,978 thousand metric tons in 1951 to 7,390 thousand metric tons in 1965. In 1967, trade declined to 6,640 thousand metric tons.

Table 1 shows the changes in trade pattern of various regions, and exports of the countries in Southeast Asia from 1951-1965.[4] The share of the Southeast Asian rice exports relative to total world trade declined from 63.5 per cent in 1951 to 49.8 per cent in 1965. During the same period exports from United States rose from 10 to 20.6 per cent and exports from Communist Asia rose from 3 to 12.4 per cent. Even in Burma and Thailand, until 1966 the world's leading exporters of rice, exports declined from 58.2 per cent of the world total trade in 1951 to 45 per cent in 1965. Exports from the United States, however, accelerated to about 1.75 million tons in 1967. Thus, in 1967, the United States became the world's largest rice exporter, Thailand ranked second, Mainland China third, and Burma fourth.

RICE TRADE PATTERN

The trade relationship can be viewed as individual countries and as regions. The regions in this paper are grouped as follows:

1. *Southeast Asia* includes Thailand, Burma, Cambodia, Laos, and the Republic of

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[3] Bangkok Bank Limited, *Monthly Review*, Bangkok, Thailand, January 1969, p.10.

[4] Southeast Asian region in this paper includes Burma, Cambodia, Laos, South Vietnam and Thailand.

Table 1.--Comparisons of amount and percent of milled rice exported from individual regions and countries in South East Asia to total six Asian regions and total world trade between 1951 and 1965

Export / Import	Total six Asian regions		Percent of six Asian regions		Total world trade		Percent of total world trade	
	1951	1965	1951	1965	1951	1965	1951	1965
	(1,000 M.T.)							
Total world trade	3,575	4,683	100.00	100.00	4,978	7,390	100.00	100.00
South Asia	186	48	5.20	1.03	215	146	4.32	1.98
South East Asia	2,774	2,843	77.59	60.71	3,159	3,681	63.46	49.81
Other East Asia	73	280	2.04	5.97	74	281	1.49	3.80
Far East and Oceania	-	9	-	0.19	16	21	0.32	0.28
Japan	-	-	-	-	-	-	-	-
Communist Asia	127	634	3.55	13.54	142	917	2.85	12.41
United States	163	832	4.56	17.77	487	1,523	9.78	20.61
Rest of the World	252	37	7.06	0.79	885	821	17.78	11.11
Total Export of:								
South East Asia	2,774	2,843	77.59	60.71	3,159	3,681	63.46	49.81
Burma	1,137	1,081	31.80	23.08	1,269	1,362	25.49	18.43
Cambodia	56	220	1.57	4.70	56	359	1.13	4.86
Laos	-	-	-	-	-	-	-	-
South Vietnam	13	2	0.36	0.04	208	2	4.18	0.03
Thailand	1,568	1,540	43.86	32.89	1,626	1,958	32.66	26.49

Vietnam. These countries provide the main sources of rice exports to the six Asian regions and the rest of the world as well, and possess the common characteristics of low population density which, in Asia, is an important factor affecting potential increases in rice production and consumption. Their economies, except for Laos, are competitive with each other for rice exports.

2. *South Asia* includes Ceylon, India, Pakistan, Bhutan, Nepal, and Afghanistan. They are situated close together, have a similar ethnic composition, are primarily rice deficit countries (except for some years in Pakistan), and their trade patterns have both a commercial and non-commercial basis. Their commercial rice imports are directly affected by concessional rice imports and are indirectly affected by other concessional grains.[5] These countries are important markets for the region of Southeast Asia. In the year ahead, increase in rice production in Pakistan may make this country a regular rice exporter.

3. *Other East Asia* includes Hong Kong, the Republic of Korea (South), the Philippines, Taiwan, Macao, Ryukyu Isl, and Port Asia. Most of these countries trade on a commercial basis and are important markets for Southeast Asian exporters, especially for Thailand. The region as a whole is the food deficit region, and Taiwan is the only country that has a net rice export. Hong Kong is a regular commercial rice importer. South Korea and the Philippines are occasional but not regular importers.

4. *The Far East and Oceania* includes Indonesia, West Malaysia, Singapore, New Guinea, Papua, Sarawak, Brunei, Guam, Sabah, Fiji, Australian New Guinea, West Samoa, New Caledonia, Polynesia, and Oceania not elsewhere specified. This

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5 Concessional trade is trade which does not have a purely commercial basis, but rather is a privilege agreement such as trade under Public Law 480.

region also is a big market for Southeast Asia, especially for Thailand and Burma. It is composed of the countries in the same location.

5. *Japan,* which has represented a large export market for rice from Thailand in some years, is treated separately mainly because Japan is a highly developed country in contrast to the rest of the countries in Asia. Rice still plays a very vital role for the countries in the foregoing four regions, and affects the economy and daily lives of their population. Japan, as a developed country imports rice not because of its inability to produce enough to meet domestic demands, but because it has more productive alternatives for the employment of its resources.

6. *Communist Asia* is composed of Mainland China, Mongolia, North Korea, and North Vietnam. This area is treated separately because the countries' economies are administered by central authorities. Therefore, the bahavior of the rice trade pattern between Communist Asia and the rest of the regions is, to a certain degree, relatively responsive to both economic and non-economic considerations that are reflected in government policy. Mainland China is particularly competitive with Thailand in the Hong Kong market.

7. *The United States* is also treated separately from the rest of the world because its share of exports to the free world countries in the five Asian regions (which are also the major markets for Thailand) is large and has been steadily increasing. Most of this trade has been on a concessional basis.

8. *The Rest of the World* is considered in order to obtain a complete picture of the rice trade of the six Asian regions in relation to total world trade.

The data reported in this section were derived from the tables of rice trade which have been combined according to the previously mentioned criteria. The discussion of the pattern will be made in two parts: (1) general pattern and (2) origin and destinations. General pattern deals with world rice exports.

Origin and destinations deal with the pattern of a major individual Asian country's trade and that of the United States.

General Trade Pattern

From 1951 to 1965, the volume of world rice exports increased greatly. It increased from 4,978,000 metric tons of milled rice in 1951 to 7,390,000 metric tons in 1965, a 48.5 per cent increase. The relative importance of exporting nations also changed. Figure 2 and 3 show the pattern of trade of major exporting countries. In 1951 the contribution of the major supplying countries to the total world rice trade was 25.5 per cent from Burma, 32.7 per cent from Thailand, 2.9 per cent from Mainland China, 9.8 per cent from the United States and 29.1 per cent from other countries. By 1965, the contribution changed noticeably among the contributors: Burma supplied 18.4 per cent, Thailand 26.5 per cent, Mainland China 11.8 per cent, the United States 20.6 per cent and others 22.7 per cent. Mainland China and the United States significantly increased their exports, relatively as well as absolutely. While exports of Mainland China were unstable/ fluctuating from year to year, U.S. exports were stable and had a steadily increasing trend. In 1959, Mainland China was the world's largest rice exporter. In 1965, the runner-up of world rice exports was not Burma but the United States, and it was expected that the U.S. would surpass the world's largest exporter very shortly. In 1965 Thailand exported 1,958,000 metric ton, the United States 1,523,000 metric tons, and Burma only 1,362,000 metric tons.

Origin and Destination

Only selected major rice trade countries: Thailand, Burma, West Malaysia, Japan, Mainland China, and the United States are discussed with respect to the flows and changes in the pattern of trade.

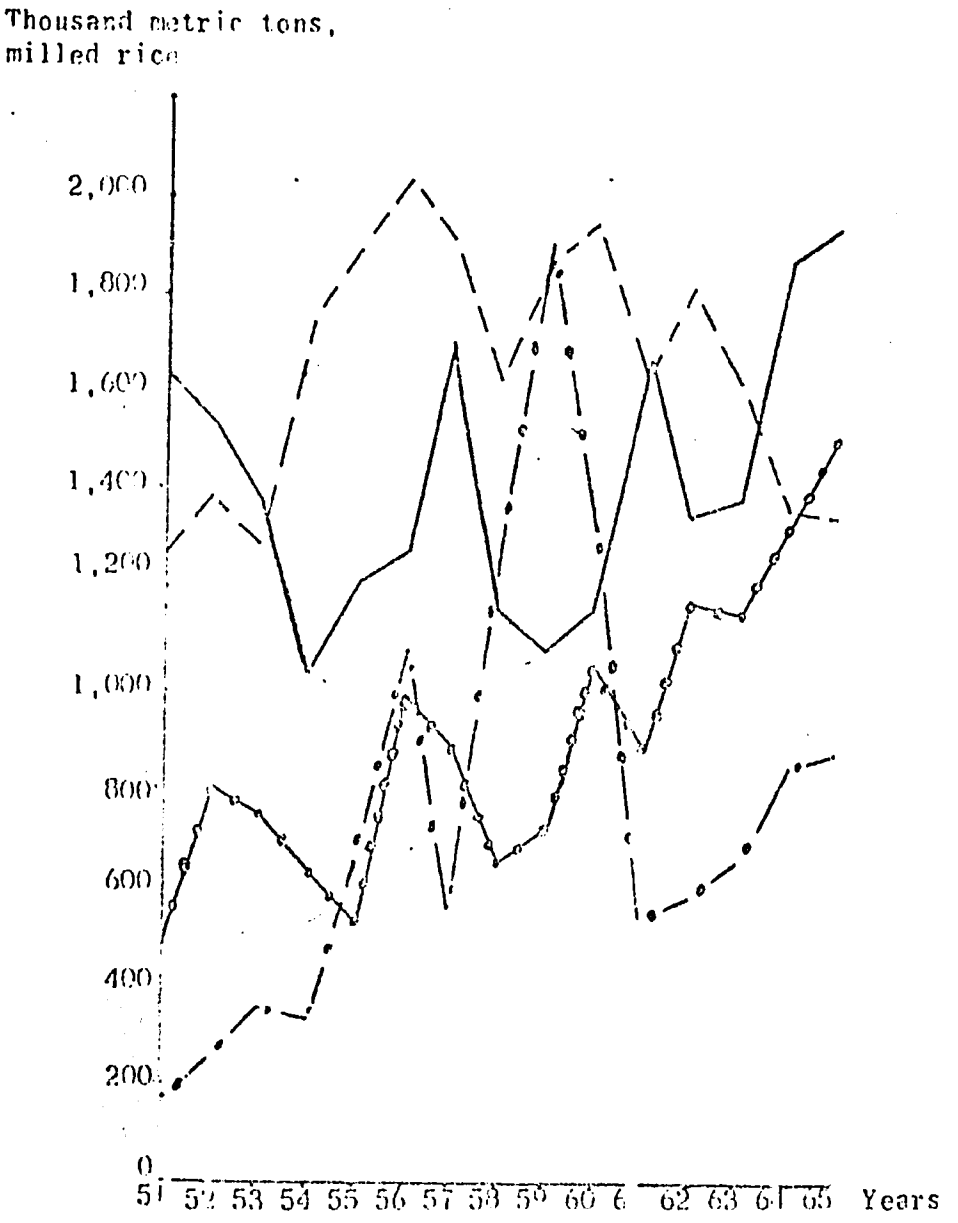

Figure 2.--Leading rice exporting countries.

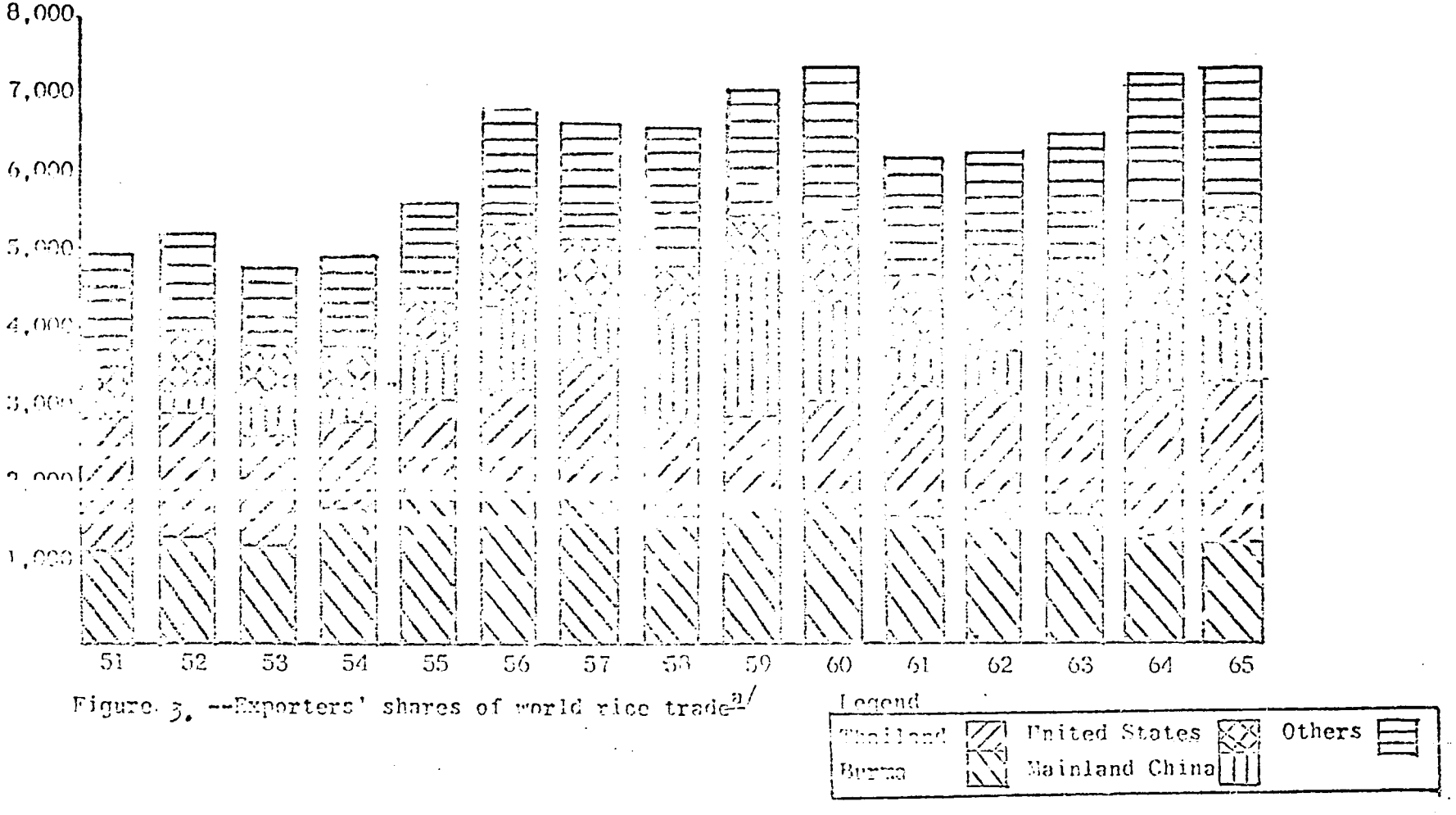

Figure 3. --Exporters' shares of world rice trade[a/]

Thailand. Thailand was a major exporting country, and during the period 1951-1965 the trend was slightly upward. During the first three years of the 1950s, while Burma's exports were at a low ebb, Thai exports were at a higher level than those of Burma, even though it was the declining phase of Thailand's rice exports. From 1951 to 1954, Thai's rice exports decreasing steadily, then increased in 1955. The amounts shipped by Thailand from 1951 to 1954 were as follows:

1951 - 1,626,000 metric tons

1952 - 1,556,000 metric tons

1953 - 1,389,000 metric tons

1954 - 1,039,000 metric tons

After Thai's exports reached their trough in 1954--the lowest during the 1951-1965 period--they steadily increased for three years:

1955 - 1,223,000 metric tons

1956 - 1,288,000 metric tons

1957 - 1,724,000 metric tons

A slacking of exports was again noted during 1958, 1959, and 1960 and a trough was again reached in 1959, to 1,089,000 metric tons.

During 1961, Thai's exports again increased to 1,660,000 metric tons and surpassed those of Burma, at this time the world's largest exporter. Another decline occurred in the year 1962 followed by a slight recovering in 1963:

1962 - 1,345,000 metric tons

1963 - 1,390,000 metric tons

However, after 1963, Thai exports sharply increased and exceeded those of Burma by more than 500,000 metric tons each year. The exports were 1,879,000 metric tons in 1964 and 1,958,000 metric tons in 1965. Thailand's peak share in 1951 was equivalent to 32.7 per cent of the world's rice exports; in 1957 it was 25.6 per cent; 1961, 26.7 per cent and in 1965, 26.5 per cent. Thailand's share of exports to the six Asian regions for the corresponding period was as follows:

1951 - 43.9 per cent

1957 - 33.6 per cent

1961 - 34.4 per cent

1965 - 32.9 per cent

Thailand concentrated its trade with Other East Asia and the Far East and Oceania rather than on South Asia. It is noteworthy that the trade of these regions was usually done on a commercial basis (except Indonesia--a country member in the Far East and Oceania), while trade in South Asian regions had an element of concessional basis. Figure 4 shows the pattern of total milled rice exports and some dominant importers during 1951-1965. Table 2 shows the volume and per cent of exports to various countries.

Burma. During the first three years of the analysis, 1951-1953, exports from Burma were low relative to the following years. They were as follows:

1951 - 1,269,000 metric tons

1952 - 1,394,000 metric tons

1953 - 1,303,000 metric tons

After 1953 Burma's rice exports stayed at a very high level and at no time during the period 1953-1963 did they fall below 1,600,000 metric tons. The peak was reached in 1956, that year Burma exported a total of 2,036,000 metric tons. Then

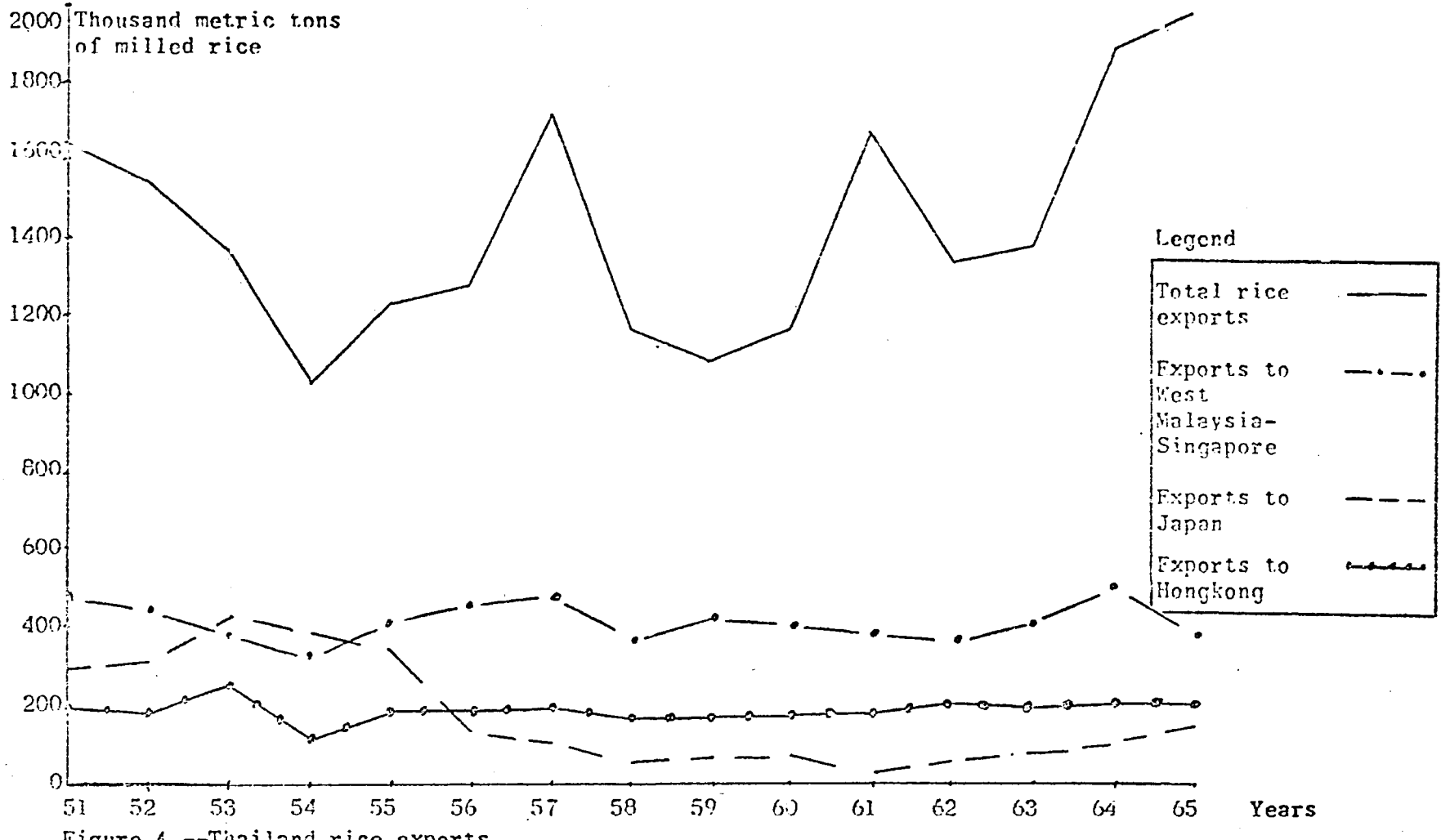

Figure 4.--Thailand rice exports.

Table 2.--Thailand - Rice exports

Year	Ceylon		India		Hongkong		South Korea		Philippines		Indonesia	
	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent
	(in 1,000 M. T., milled rice)											
1951	45	2.77	217	13.34	197	12.12	26	1.60	104	6.40	180	11.07
1952	17	1.09	187	12.02	184	11.83	31	1.99	30	1.93	226	14.52
1953	-	-	4	0.29	250	18.00	152	10.94	-	-	55	3.96
1954	-	-	3	0.29	116	11.17	-	-	17	1.64	78	7.50
1955	12	0.98	2	0.16	181	14.80	-	-	56	4.58	66	5.40
1956	-	-	6	0.46	186	14.44	39	3.03	31	2.41	167	12.97
1957	50	2.90	5	0.29	197	11.42	43	2.49	105	6.09	179	10.38
1958	7	0.60	31	2.65	171	14.61	3	0.27	47	4.02	132	11.28
1959	-	-	-	-	173	15.89	-	-	-	-	75	6.89
1960	26	2.19	-	-	178	15.02	-	-	-	-	187	15.78
1961	62	3.73	-	-	195	11.75	1	0.06	141	8.49	376	22.65
1962	35	2.60	-	-	218	16.21	-	-	-	-	271	20.15
1963	19	1.37	-	-	196	14.10	10	0.72	71	5.11	340	24.46
1964	30	1.60	35	1.86	205	10.91	-	-	115	6.12	463	24.64
1965	166	8.48	215	10.98	201	10.26	-	-	130	6.64	108	5.52

(continued)

Table 2. -(continued)

Year	West Malaysia-Singapore		Japan		Others in six Asian regions		U. S. and the Rest of the world		Total	
	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent
	(in 1,000 M. T., milled rice)									
1951	463	28.47	316	19.43	20	1.23	58	3.57	1,626	100
1952	444	28.54	317	20.37	56	3.60	64	4.11	1,556	100
1953	396	28.51	424	30.52	43	3.10	65	4.68	1,389	100
1954	333	32.05	380	36.57	16	1.54	96	9.24	1,039	100
1955	401	32.79	341	27.88	69	5.64	95	7.77	1,223	100
1956	451	35.02	130	10.09	143	11.10	135	10.48	1,288	100
1957	462	26.80	116	6.73	281	16.30	286	16.60	1,724	100
1958	375	32.05	45	3.84	103	8.80	256	21.88	1,170	100
1959	428	39.30	71	6.52	89	8.17	253	23.23	1,089	100
1960	402	33.92	65	5.49	129	10.89	198	16.71	1,185	100
1961	387	23.31	34	2.05	148	8.92	316	19.04	1,660	100
1962	377	28.03	63	4.68	132	9.81	249	18.52	1,345	100
1963	407	29.28	94	6.76	98	7.05	155	11.15	1,390	100
1964	501	26.66	117	6.23	150	7.98	263	14.00	1.879	100
1965	397	20.28	145	7.40	178	9.09	418	21.35	1,958	100

beginning in 1962, the volume of exports steadily declined as follows:

1962 - 1,823,000 metric tons

1963 - 1,625,000 metric tons

1964 - 1,378,000 metric tons

1965 - 1,362,000 metric tons

1966 - 1,100,000 metric tons

A further decrease was anticipated in 1967 to 600,000 metric tons.[6] This may be the result of stepping up centralization in rice production and trade by the government. Burma's most important rice markets were Ceylon, India, Pakistan, Malaya-Singapore, and Indonesia. Figure 5 shows the pattern of total milled rice exports and some dominant imports during 1951 to 1965.

West Malaysia-Singapore. From 1951 to 1965 the annual average imports of this area amounted to 644,000 metric tons, accounting for the annual average of 10.4 per cent of the world rice trade. Out of these annual average imports, 415,000 metric tons were received from Thailand. Imports from Thailand averaged annually about 65.4 per cent, and from Burma 19.6 per cent. Burma was the second largest regular supplier to Malaya-Singapore, with annual average imports during the 15-year analysis period of 128,000 metric tons. The other suppliers to this region were Cambodia, Mainland China, South Vietnam, and a very small amount from the United States and other countries. The annual pattern of imports of the area did not change much from year-to-year and ranged from 528,000 metric tons to 836,000 metric tons. This area had two high importation peaks during the study period, 811,000 metric tons in 1958, and 836,000 metric tons in 1963. Out of the 1958 peak imports from Thailand amounted to 375,000 metric tons, and 304,000

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6 U.S. Department of Agriculture, FRS, *The Far East and Oceania Agricultural Situation,* Foreign 197, September 1967, p. 4.

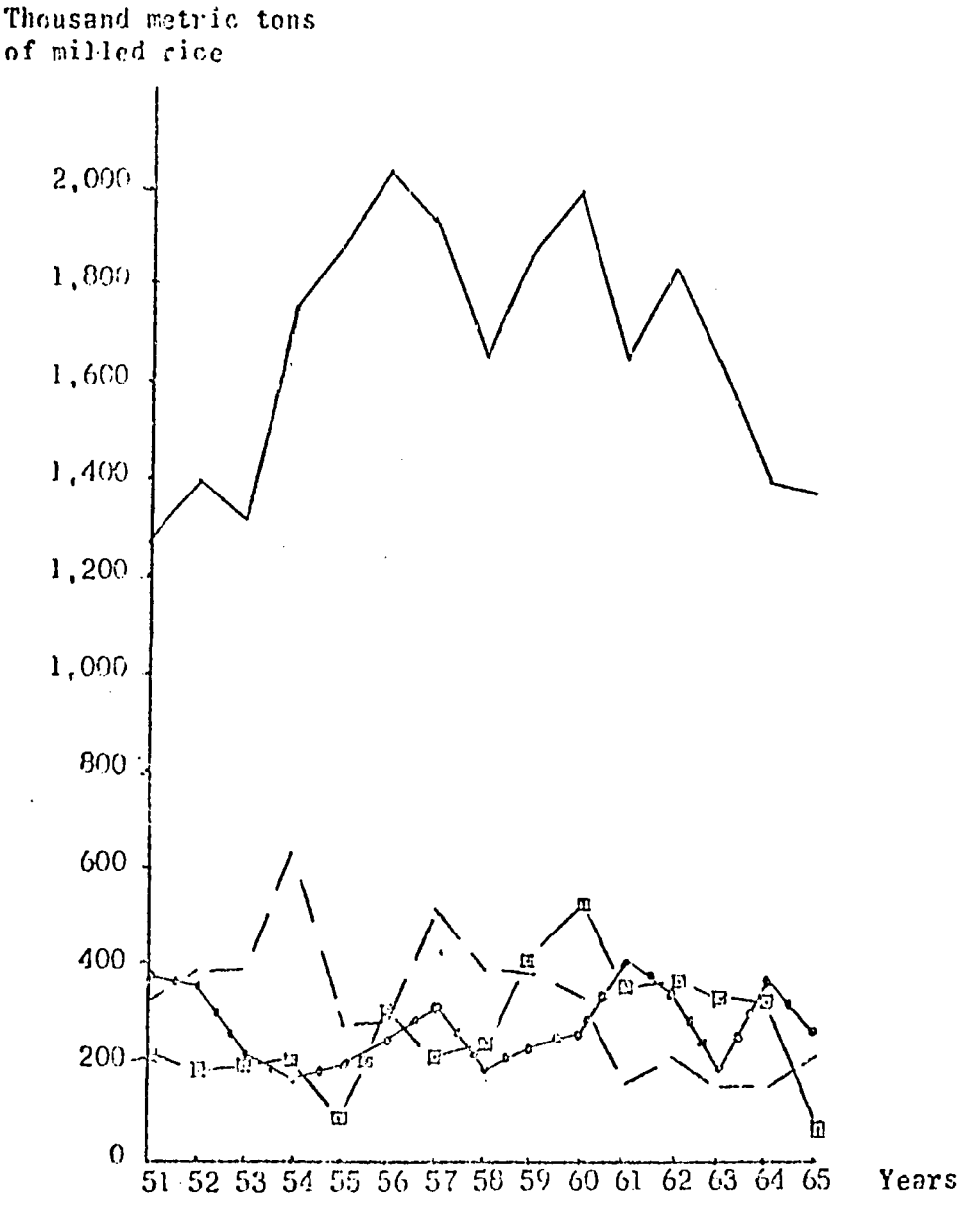

Figure 5.--Burma rice exports.

Legend

Total rice exports	———
Exports to Ceylon	—•—•—
Exports to India	— — —
Exports to Indonesia	—□—▽—□—

metric tons came from Burma, accounting for a total of 679,000 metric tons. Out of the 1963 peak of 836,000 metric tons imports from Thailand amounted to 407,000 metric tons and from Burma 147,000 metric tons. The yearly import from Thailand ranged from 333,000 metric tons to 501,000 metric tons. This pattern of imports from Thailand was rather stable during the entire analysis period. The range of imports from Burma was from 30,000 metric tons to 304,000 metric tons and, the shape of the imports from Burma when illustrated graphically looked "bell-shaped". It was high in the middle period of the analysis and low at both ends. Figure 6 shows the pattern of total rice imports and dominant exporters to Malaya-Singapore. Table 3 shows the volume and per cent of imports by Malaya-Singapore from the various countries.

Japan. Japan has been treated separately from other East Asia the Far East and Oceania regions because its economic and technological advances are so very different from those of other developing countries. Japan is a highly developed nation and can manipulate policy in such a way that it affects the volume of rice imported. It is still a rice deficit nation even though part of the later period of the analysis indicated Japan was much less dependent on rice imports; however, the pattern of imports changed drastically during 1951-1965. The annual rate of rice imports to the annual world rice trade varied from 2 per cent to 28.9 per cent. In the period 1951-1954 the volume of rice imports was quite high, increasing from 1951 when the imports totaled 799,000 metric tons to a peak volume of 1,433,000 metric tons in 1954, accounting for 28.9 per cent of the total world rice trade in that year. After 1954, a sharp drop occurred every year for the next three year period, being only 347,000 metric tons in 1957. There was, however, a slight increase in 1958, followed by a decline. Imports

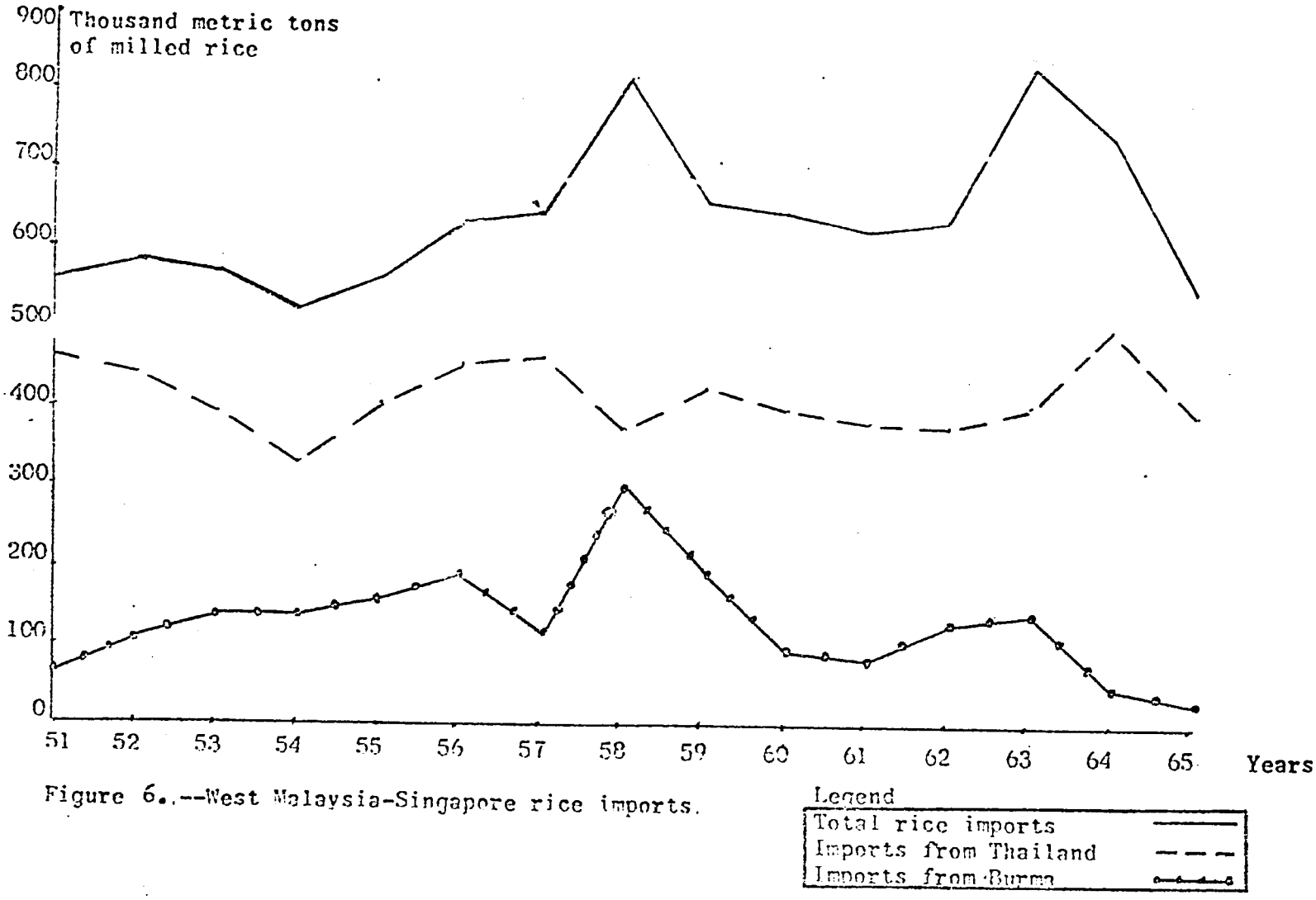

Figure 6.--West Malaysia-Singapore rice imports.

Table 3.--West Malaysia-Singapore - Rice imports

Year	Pakistan		Burma		Cambodia		South Vietnam		Thailand		Taiwan	
	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent
	(in 1,000 M. T., milled rice)											
1951	-	-	62	11.05	36	6.42	-	-	463	82.53	-	-
1952	-	-	104	17.81	31	5.31	5	0.86	444	76.02	-	-
1953	1	0.17	137	23.66	43	7.43	-	-	396	68.39	-	-
1954	-	-	137	25.94	36	6.82	21	3.98	333	63.07	-	-
1955	-	-	155	27.43	2	0.36	6	1.06	401	70.97	-	-
1956	-	-	179	27.92	-	-	-	-	451	70.36	-	-
1957	-	-	111	17.00	50	7.69	-	-	462	71.08	-	-
1958	-	-	304	37.49	59	7.27	-	-	375	46.24	-	-
1959	-	-	189	28.29	20	2.99	-	-	428	64.07	-	-
1960	-	-	96	14.70	74	11.33	-	-	402	61.56	-	-
1961	-	-	84	13.19	31	4.87	-	-	387	60.75	-	-
1962	10	1.56	129	20.09	24	3.74	14	2.18	377	58.72	-	-
1963	17	2.03	147	17.58	26	3.11	73	8.73	407	48.69	-	-
1964	13	1.74	52	6.93	56	7.47	22	2.93	501	66.80	-	-
1965	-	-	30	3.36	21	3.76	1	0.18	397	71.02	-	-

(continued)

Table 3.--(continued)

Year	Mainland China		United States		Others		Total		Total world Trade	
	Volume	Percent	Volume	Percent	Volume	Percent	Volume	percent	Volume	Percent
	(in 1,000 M.T., milled rice)									
1951	-	-	-	-	-	-	561	100	4,978	11.27
1952	-	-	-	-	-	-	584	100	5,253	11.12
1953	-	-	-	-	2	0.35	579	100	4,805	12.05
1954	-	-	-	-	1	0.19	528	100	4,966	10.63
1955	1	0.18	-	-	-	-	565	100	5,668	9.97
1956	11	1.72	-	-	-	-	641	100	6,874	9.33
1957	26	4.00	-	-	1	0.15	650	100	6,666	9.75
1958	25	3.08	-	-	45	5.92	811	100	6,596	12.30
1959	15	2.25	-	-	16	2.40	668	100	7,073	9.44
1960	45	6.89	8	1.23	28	4.29	653	100	7,374	8.86
1961	76	11.93	5	0.79	54	8.47	637	100	6,209	10.26
1962	75	11.68	13	2.03	-	-	642	100	6,210	10.34
1963	160	19.14	6	0.72	-	-	836	100	6,559	12.75
1964	106	14.13	-	-	-	-	750	100	7,388	10.15
1965	108	19.32	1	0.18	1	0.18	559	100	7,390	7.56

in 1958 were 506,000 metric tons, but a trough was noted during 1961 when the imports dropped to 126,000 metric tons, or only 2 per cent of the total world rice trade. After 1961, imports rose and continued on the upgrade through 1965, as evidenced by the following figures;

1964 - 416,000 metric tons

1965 - 969,000 metric tons

It was interesting to note the various nations contributing to Japan's share of imports. In the early 1950s, during Japan's high import period between 1951 and 1956, Burma contributed an annual average per cent of Japanese total rice import of 21.4 per cent, Thailand 30.4 per cent, Taiwan 8.3 per cent, Mainland China 7.2 per cent, the United States 17 per cent, and the rest was filled by others. During the period following 1956, when Japan's imports were low, shipments from Burma declined; Mainland China and the United States were even zero. In fact, during 1957, 1959 and 1963, no rice was imported from either of the last two mentioned countries. During this time Thailand's percentage of contribution did not change much, and imports from Taiwan rose significantly both in absolute and percentage terms. In 1956, Taiwan's share of imports to Japan was 89,000 metric tons or 11.7 per cent of Japanese rice imports for that year. This figure rose to 153,000 metric tons in 1959 or a percentage figure of 54.6 per cent. It is interesting to note that during 1965 the ratio of Burma's and Thailand's exports to Japanese total imports dropped drastically to 4.8 per cent and 15 per cent, respectively, while the share from Taiwan increased from 24.5 per cent from the previous year to 28.3 per cent. Mainland China again resumed trade and this amounted to 17.3 per cent. At the same period Japan received from the United States the largest share of its imports or 30 per cent of total imports. Figure 7 shows the pattern of total rice imports and the two exporting countries during the years 1951 to 1965. Table 4 shows the volume and per cent of rice imported by Japan

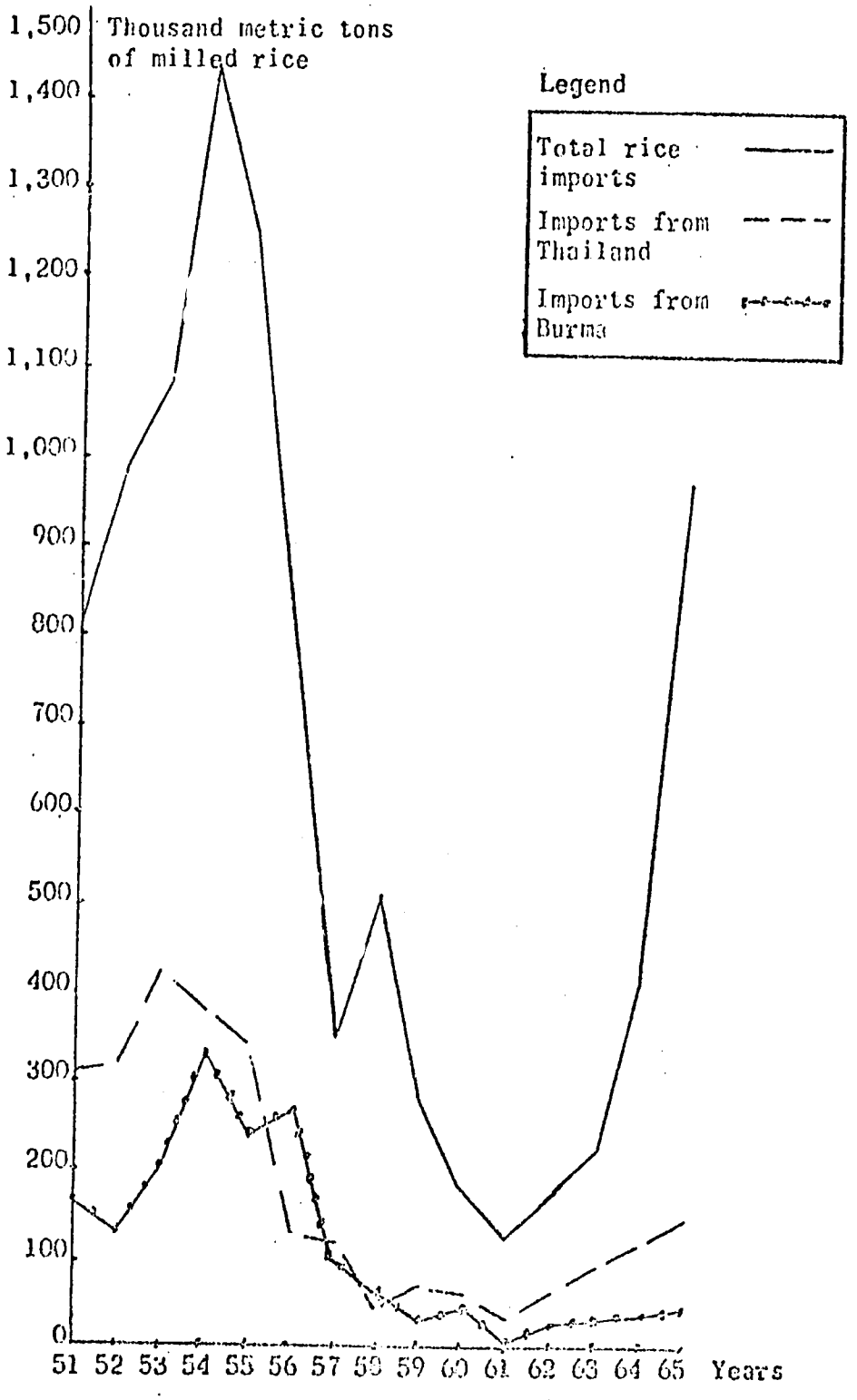

Figure 7.--Japan rice imports.

Table 4.--Japan - Rice imports

Year	Pakistan		Burma		Cambodia		South Vietnam		Thailand		Taiwan	
	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent
						(in 1,000 M. T., milled rice)						
1951	-	-	162	20.26	-	-	-	-	[illegible]	[illegible]	73	9.13
1952	-	-	126	12.07	-	-	-	-	[illegible]	[illegible]	61	[illegible]
1953	-	-	200	18.53	-	-	-	-	424	39.30	54	5.00
1954	24	1.67	327	22.32	-	-	6	3.21	380	26.52	43	3.00
1955	-	-	236	16.98	-	-	-	-	341	27.35	183	14.67
1956	-	-	267	35.13	-	-	-	-	130	17.11	89	11.71
1957	-	-	186	30.55	-	-	6	1.73	116	33.43	115	33.14
1958	-	-	51	10.08	4	0.79	-	-	45	8.89	191	37.75
1959	-	-	27	9.64	3	1.07	5	1.79	71	25.36	153	54.64
1960	-	-	47	26.40	4	2.25	6	3.37	65	36.52	34	19.10
1961	-	-	6	4.76	-	-	-	-	34	26.98	70	55.56
1962	-	-	21	11.80	-	-	-	-	63	35.39	52	29.21
1963	-	-	29	13.00	5	2.24	10	4.49	94	42.15	85	38.12
1964	-	-	36	8.65	5	1.20	5	1.20	117	28.13	102	24.52
1965	-	-	46	4.75	10	1.03	-	-	145	14.96	274	28.28

(continued)

Table 4.--(continued)

Year	Mainland China		United States		Others		Total		Total World Trade	
	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent	Volume	Percent
1951	7	0.88	41	5.13	200	25.03	799	100	4,978	16.05
1952	44	4.50	276	28.19	155	15.83	979	100	5,253	18.64
1953	78	7.23	239	22.15	84	7.79	1,079	100	4,805	22.46
1954	75	5.23	346	24.15	192	13.40	1,433	100	4,966	28.86
1955	133	10.66	243	19.49	111	8.90	1,247	100	5,668	22.00
1956	113	14.87	20	2.63	141	18.55	769	100	6,874	11.06
1957	-	-	-	-	4	1.15	347	100	6,666	5.21
1958	86	17.00	1	0.20	128	25.29	506	100	6,596	7.67
1959	-	-	-	-	21	7.50	280	100	7,073	3.96
1960	-	-	-	-	22	12.36	178	100	7,374	2.41
1961	-	-	-	-	16	12.70	126	100	6,209	2.03
1962	-	-	-	-	42	23.60	178	100	6,210	2.87
1963	-	-	-	-	-	-	223	100	6,559	3.40
1964	-	-	107	25.72	44	10.58	416	100	7,388	5.63
1965	168	17.34	290	29.93	36	3.71	969	100	7,390	13.11

from the various countries.

Mainland China. During the analysis period this area was a rice exporting country showing an upward trend. Exports fluctuated, however, as indicated by the fact that one year Mainland China exported close to 2 million metric tons to 2 million tons and another year approximately one-half million metric tons. The ranges of net exports was from 122,000 metric tons in 1951 to 1,824,000 metric tons in 1958. The annual average per cent of exports to total world rice exports during 1951 to 1965 was 11.6, and to the six Asian regions, was 10.4, with almost half of its total exports going to areas outside the six Asian regions. Its annual average exports to the six Asian regions amounted to 428,000 metric tons and to outside this area 333,000 metric tons. The major customers in the six Asian regions were Ceylon, Hong Kong, Indonesia, Malaya-Singapore, and Japan. Ceylon was a regular customer importing 168,000 metric tons as a yearly average between the years 1951-1965. Shipments to Ceylon ranged from 28,000 metric tons in 1961 to 280,000 in 1959. Hong Kong however, did not import from Mainland China in the early 1950s but started regularly after 1955, and this amount remained high--over 100,000 metric tons from 1961 to 1965. The range was from zero in 1951 and 1954 to 144,000 metric tons in 1962. Indonesia was not a regular customer, and no imports from Mainland China were made between 1951-1956, 1963 and 1965. Indonesia's peak imports of 318,000 metric tons from Mainland China were reached in 1959. No exports were made to Malaya-Singapore during 1951-1954, and a small portion, 1,000 metric tons, were exported in 1955. However, after 1955 the trend of exportation to Malaya-Singapore increased reaching a figure of 108,000 metric tons in 1965. During the high volume of imports by Japan during 1951-1956, the annual average from Mainland China was 75,000 metric tons. This figure increased

in the year 1955 to 133,000 metric tons. After that no exports were made to Japan until 1964, with the exception of 1958 when 86,000 metric tons were exported. In the following year, 1965, exports to Japan were sizable, amounting to 168,000 metric tons. Figure 8 shows the pattern of milled rice exports and some dominant importers during 1951 to 1965. Table 5 shows Mainland China's exports and imports during the period 1951 to 1965.

The United States. As the United States is one of the most important suppliers to the six Asian regions, this area has been classified separately. United States rice exports have steadily increased since 1951. Their annual average per cent of the total world rice exports between 1951 and 1965 was 14.3, and the annual average per cent contribution to the six Asian regions was 11.7. The major customers of the United States in the six Asian regions were India, Pakistan, Indonesia, and Japan.

Exports to India were irregular during 1951-1959, but between 1960-1965 these stayed at a high level and ranged from 194,000 metric tons in 1961 to 368,000 metric tons in 1962.

Substantial amounts were shipped to Pakistan during the 1956-1961 period, and these ranged from 57,000 metric tons to 251,000 metric tons.

Significant amounts of rice were shipped to Indonesia during the period 1956-1964. Graphically, exports to this country during 1956-1963 took on the appearance of a "U" shape, being as high as 239,000 metric tons in 1956 and down to 122,000 metric tons in 1957. However, a trough was reached in 1959-91,000 metric tons--but

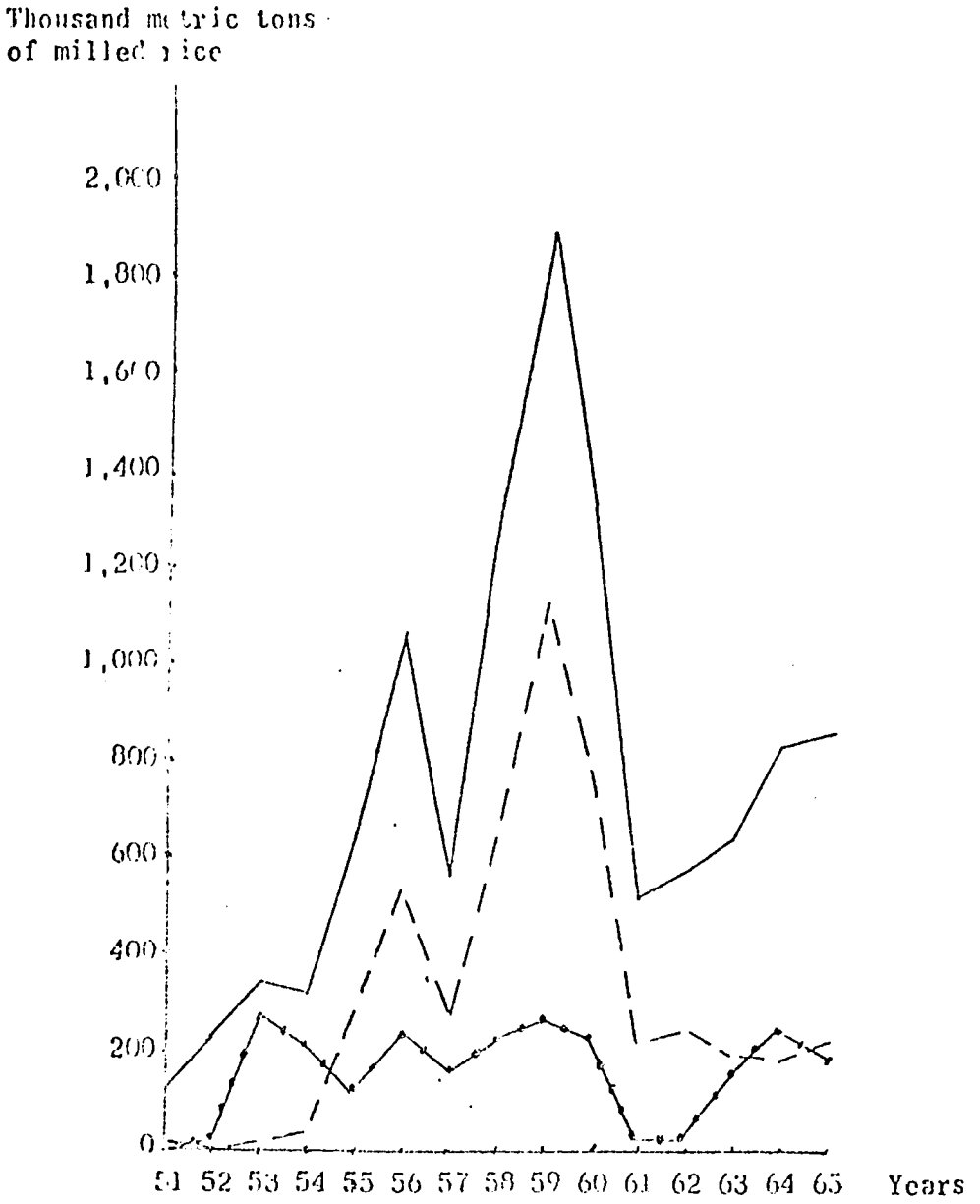

Figure 8.--Mainland China rice exports.

Table 5.--Mainland China - Rice exports - imports

Year	Exports								
	Ceylon	India	Pakistan	Hongkong	Indonesia	Malaya Singapore	Japan	Other six Asian regions	Total
	(in 1,000 M.T., milled rice)								
1951	-	120	-	-	-	-	7	-	127
1952	36	150	-	6	-	-	44	-	236
1953	265	-	-	3	-	-	78	-	346
1954	218	-	-	-	-	-	75	-	293
1955	122	-	-	37	-	1	133	8	301
1956	246	47	64	52	-	11	113	-	533
1957	163	14	-	65	2	26	-	14	284
1958	249	-	68	143	89	25	86	24	684
1959	280	-	49	63	318	15	-	24	749
1960	246	-	4	76	104	45	-	27	502
1961	28	-	-	126	6	76	-	55	291
1962	29	-	-	144	40	75	-	46	334
1963	165	-	-	111	-	160	-	16	452
1964	265	-	-	141	100	106	-	46	658
1965	200	-	-	111	-	108	168	44	631

(continued)

Table 5. -(continued)

Year	EXPORTS				IMPORTS					
	Rest of World	Export total	Percent of world trade	Percent of six Asian regions	Burma	Thailand	Cambodia	Others	Total	Net export
					(in 1,000 M. T., milled rice)					
1951	15	142	2.85	3.55	-	20	-	-	20	122
1952	8	244	4.65	5.74	-	16	-	-	16	228
1953	13	359	7.47	9.68	-	5	-	-	5	354
1954	40	333	6.70	7.97	-	-	-	1	1	332
1955	352	653	11.52	8.98	157	-	-	-	157	496
1956	547	1,080	15.71	11.82	86	-	-	6	92	988
1957	295	579	8.68	6.63	106	-	-	-	106	491
1958	646	1,330	20.16	16.22	12	-	-	-	12	1,318
1959	1,136	1,885	26.65	19.16	10	-	51	-	61	1,824
1960	822	1,324	17.96	11.26	18	-	10	1	29	1,295
1961	237	528	8.50	7.45	55	-	-	12	67	461
1962	250	584	9.40	9.03	5	-	-	-	5	579
1963	200	652	9.94	10.44	35	-	-	62	97	555
1964	187	845	11.44	14.03	-	-	46	-	46	799
1965	239	870	11.77	13.48	61	-	38	3	102	768

exports increased in 1962 to 223,000 metric tons and 220,000 metric tons in 1963.

During the years Japan was importing heavily, significant amounts were exported from the United States. The figures ranged between 243,000 metric tons during 1952-1955. The picture changed, however, in 1955 and continued through 1963 when exports from the United States to Japan were negligible. Japan resumed importation of rice from the United States during 1964-1965 and the amounts were 107,000 metric tons and 290,000 metric tons, respectively. Table 6 shows the volume of U.S. rice exported to the various countries.

The Trade Pattern Measured by Matrix Apprcach

The pattern of rice trade may be considered from the viewpoint of elasticity-like by matrix approach (see model attached).

The paper deals with Southeast Asia region and four leading rice exporting countries: Thailand, Burma, Mainland China, and the United States.

Southeast Asia. The average rice export elasticity of Southeast Asia during 1951 to 1965 with respect to the average previous year's trade was 1.0079. It means that for a one per cent increase in trade of all regions including Southeast Asian region it decreases exports of Southeast Asian regions by 1 - 1.00795=.0079 per cent. This result indicates that rice trade of Southeast Asia is stable.

Thailand. The average export elasticity for the period 1951-1965 with respect to Thailand's average export of the previous year is 1.06. This implies that if

Table 6.--United States - Rice exports

Year	Ceylon	India	Pakistan	So. Vietnam	Hongkong	So. Korea	Philippines	Indonesia
				(in 1,000 M.T., milled rice)				
1951	-	-	-	-	-	64	-	58
1952	63	-	-	-	8	104	3	40
1953	2	-	-	-	-	111	7	51
1954	-	-	-	-	-	-	-	-
1955	-	9	-	-	-	-	2	-
1956	-	48	251	-	-	-	1	239
1957	-	197	127	-	-	135	16	122
1958	23	-	98	5	1	2	60	68
1959	55	1	57	3	2	2	1	91
1960	19	336	83	13	14	-	6	104
1961	10	194	64	2	-	11	-	121
1962	-	368	-	42	-	-	-	223
1963	-	334	1	-	-	1	-	220
1964	-	276	-	1	-	-	75	38
1965	-	220	-	186	-	-	67	-

(continued)

Table 6.--(continued)

Year	Malaya Singapore	Japan	Others	Total	Rest of World	Grand total	Percent of world trade	Percent of six Asian regions
1951	-	41	-	163	324	487	9.78	4.56
1952	-	276	-	494	294	788	15.00	12.02
1953	-	239	-	410	342	752	15.65	11.47
1954	-	346	-	346	291	637	12.83	9.41
1955	-	243	26	280	256	536	9.46	8.35
1956	-	20	103	662	334	996	14.49	14.68
1957	-	-	3	602	296	898	13.47	14.06
1958	-	1	25	299	358	657	9.96	7.09
1959	-	-	2	215	501	716	10.12	5.50
1960	8	-	26	643	419	1,062	14.40	14.42
1961	5	-	32	439	427	866	13.95	11.24
1962	13	-	30	676	517	1,193	19.21	18.29
1963	6	-	92	654	509	1,163	17.73	15.10
1964	-	107	69	566	767	1,333	18.04	12.07
1965	1	290	68	832	691	1,523	20.61	17.77

every country increases its trade by one per cent including Thailand's, it affects the rice trade of Thailand to decrease 1 - 1.06=0.06 per cent.

Burma. The average export elasticity for the period 1951-1965 with respect to Burma's average export of the previous year is 0.12. This implies that if every country increases its trade by one per cent, including Burma, it would affect the pattern of trade of Burma to increase by 1 - 0.12=0.88 per cent.

Mainland China. The average export elasticity for the period 1951-1965 with respect to this country's average export of the previous year is 0.91. This implies that if every country increases its trade by one per cent, including Mainland China, it affects the rice trade of Mainland China to increase by 1 - 0.91=0.09 per cent.

The United States. The average export elasticity for the period 1951-1965 with respect to the United States is 1.61. This implies that if every country, including the United States, increases its trade by one per cent, it affects the rice trade of the United States to decrease by 1 - 1.61=-0.61 per cent.

FACTORS AFFECTING THE HISTORICAL CHANGES IN PRODUCTION AND TRADE

The volume of production and trade depend on the production strategy, price policy, trade policy, and others of each individual rice producing and consuming country. To limit the discussion, only three countries will be briefly discussed: Thailand, a world leading rice exporter; West Malaysia, a rice deficit country; and Japan, a big rice producing country and close to self-sufficiency.

Thailand

Rice Production Yield and Area 1951-1965. Rice production rose from 7,389,000 metric tons of paddy in 1951-1953 average to 9,793,000 metric tons of paddy in 1963-1965 average. This represents an annual rate of change for the same period of 2.4 per cent, with annual level of increase approximately 226,000 tons of paddy per year. During this same period, the area rose from 5,599,000 hectares to 6,274,000 hectares, representing an annual rate of increase close to one per cent, and the yield rose from 1,320 kilograms per hectares to 1,563 kilograms per hectare, representing an annual rate of increase of 1.4 per cent. The rate of increase in area is less than the rate of increase in yield per hectare, and both growth rates are slow.

The total area in Thailand is about 200,000 square miles or 514,000 square kilometers or 321 million.[7]

In 1965 total farm land occupied 21.3 per cent of the total area; rice alone made up about 13 per cent of the total area or 6,440,000 hectares (cr 40.25 million rai). Of this total 6,440,000 hectares were claimed during 1962 by the Royal Irrigation Department with slightly more than one-fourth, 1,872,000 hectares (11.7 million rai),[8] already irrigated. It should be pointed out here that several big projects are still under construction, many of which provide only supplementary irrigation during the wet season. The actual area which can really benefit from

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7 One square kilometer is equal to 100 hectares, one hectare is equal to approximately 6.25 rai or 2.47 acres.

8 Thailand, Ministry of Agriculture, Division of Agricultural Economics, *Rice Economy of Thailand,* December 1964, p. 3.

the irrigation in terms of regulating the water, both by pumping and draining out when desired, could be far less than irrigated areas claimed.

Factors Underlying Rice Production. The following discussion concerning the main factors affecting rice production in Thailand during 1951-65 are also expected to play an important role in the future. The discussion will center on two major factors affecting price received and the shift variables.

Price received. Two main factors influencing the supply price are export tax and marketing costs. An export tax is levied on rice and is called "rice premium." It has been effective since 1954; before that period an export tax was imposed in a different fashion. The premium was a large percentage of the farm price. In 1965, a premium of 950 baht (one U.S. dollar equals approximately 20 baht) amounting to 62 per cent of the total price of 1,509 baht for 100 per cent rice. Actually this amounted to about 140 per cent of the farm price received by farmers of 680 for paddy price.[9] This export tax levied on exporters obviously was the reason for the lower farm price received.

Since the estimate of price elasticity of hectarage response which is the proxy of price elasticity of supply of rice is about 0.30, the rice premium or export tax caused the farmers to produce less. Low farm price is one of the important factors affecting the application of fertilizer and insecticide, as these are applied only when it is economically profitable. In 1964, the ratio of the cost of a kilogram of nitrogen was equal to 5.2 kilograms of paddy. In countries

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9 EA/TECH, Agricultural and Rural Development Division, U.S. Department of State, *Rice in South East Asia,* March 21, 1968, p. 1.

where application of fertilizer and insecticide has been successful in rice production, such as Japan and South Korea, the ratio for the same year was 1.5 in Japan and 1.06 in South Korea.[10]

Marketing costs are another important factor directly affecting farm price received. This includes the cost of all marketing channels from producers to consumers, e.g., assembling, processing, grading and transportation. The marketing conditions since 1951 have improved significantly, especially in transportation. According to the Economic Farm Survey of 1953, the farmers sold 42 per cent of the rice they produced and kept the rest for home consumption. The process of assembling rice in the villages, shipment from the villages to mills, processing at the mills and shipment to ports, and eventually the arrangements for exports, are done by separate groups of middlemen. There are some farmers' cooperative associations handling the marketing functions, but these are few. There is still much room for improvement in marketing functions. One of the big functions to be improved is the transportation of rice from villages to ports by river, rail, and highways. Even though the river is the most important means of rice transportation, highways are gaining in importance: many have been constructed, but more are needed in areas where water transportation is not directly accessible. These newly constructed highways have facilitated faster delivery to various ports.

Other factors affecting supply. Technology, in the broad sense, includes irrigation and drainage facilities, labor-saving devices, good seeds, fertilizers and plant protection meansures. As mentioned earlier the total rice irrigated

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10 *Ibid.*

land was claimed to be about one-fourth or 1,872 thousand hectares of the total rice cultivated land; even less than this area can be irrigated when desired. Therefore, the state of technology in irrigation and drainage can be improved. At the present time most of the rice cultivated is on the rainfed fields, and the method is implemented in two ways, i.e., by broadcasting and transplanting, Most of the cropping system work is done under traditional farming techniques. The field work is largely done by human labor. Heavy work such as plowing, harrowing, and hauling is done by animals, either buffalo or other cattle. In 1964, use of fertilizer was very low, and the average was 3.2 kilograms per hectare as contrasted to Japan and Taiwan using 304.4 and 237.1 kilograms respectively.

Therefore, improved technology for rice cultivation is needed in Thailand. Changes in technology may be classified in two categories: biological or chemical type and mechanical or engineering type. For a developing agricultural country like Thailand, the immediate task is to improve technology through research. It is the government of the country which will have to do this research because it cannot be done by small individual farmers. The problem of developing mechanical technology is how to adopt the existing mechanical equipment to suit the Thai rice farm. As one sees the situation at the present time improvement in productivity seems to be an immediate solution not the expansion of the production area. The introduction of new varieties which will give the higher yields seems to be the most effective solution to the Thai rice situation. The Rice Department has been conducting research

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11 EA/TECH, *op. cit.*, p. 1.

programs for better seeds and has been demonstrating the increased use of fertilizer and insecticide to farmers. Some degree of success has been met for the varieties that are resistant to diseases and higher yielding, but there is no variety that responds to the application of fertilizer such as IRRI varieties developed in the Philippines. The IRRI varieties were introduced into Thailand in 1966 and have been tested with the same results achieved by IRRI in the Philippines. A national program to replace the old varieties has not yet been launched. For application of the new varieties the prerequisite of effective water control must first be accomplished. To be completely successful the efficient farm management and appropriate application of fertilizers are required; therefore, all these problems must be solved simultaneously. The lack of any elements, e.g., proper insecticide, weed control, fertilizer, and regulated water supply would be abortive for applying the new varieties.

Other variables include land tenure problems and the level of education for development, production credit, group action by farmers, improving, and expanding rice cultivated land. Land tenure in Thailand is not as yet a serious problem. For the whole country about 13 per cent of all farm land is tenant-operated and many of them are partowners. A special type of education which will provide farmers with the desired knowledge, especially for farm management, skill, and ability to adapt the new technologies both in biological, chemical, and mechanical application so far has been limited in scope and efficiency. This type of ecucation wil play an important role for the application of new varieties such as IRRI. Production credit rendered to the needed Thai farmers has been emphasized in Thailand for a long time, but the extent is still

limited. Most of the sources of credit come mainly from relatives, traders, and private lenders. Money from these sources often does not meet the demand of farmers either in terms of high rate of interest, duration, proper timing, and adequate amounts. Therefore, proper credit institutions will help the farmers to produce greater quantities. The action by farmers of improving and expanding rice cultivated land have been promoted by the government but as yet have not shown much impact on rice production.

Domestic Demand. The total domestic milled rice availability or consumption of Thailand is derived as the difference of the past year's production of rice minus the exports of the following year. The per capita availability or consumption is derived from total availability divided by the population of that year. The total domestic availability or consumption is composed of demand for food use and nonfood uses. The major nonfood uses in any year are change in inventory, for feed and for seed. Due to lack of reliable data for nonfood uses and the small percentage of total domestic consumption, the analysis of demand for consumption will also include nonfood uses. The total rice consumed in Thailand during 1963-65 was 4,649,000 metric tons and per capita consumption during the same period was 152.27 kilograms.

The total domestic demand depends on population and per capita consumption. The total demand or per capita demand is a function of the price of rice and shift variables as well as price for other substitute goods, taste, preferences, and the level of income.

The population of Thailand in 1965 was 31.45 million with the annual rate of growth about 3.00 per cent, and it is expected the population will reach 42.27

million in 1975.

The estimate of price elasticity of rice demanded is about 0.5. Due to the low significance level of the coefficient, the estimate does not give a high degree of reliability even though it is believed to be negative in sign. Unfortunately, there is no other source of the estimate of price elasticity in Thailand available for comparison. The estimate would be very small even though it is negative, because of the marked consumers' preference and price change which would leave little room for substitution. In comparison with Japan, the price elasticity of rice in Japan has been varied from source to source and time to time. It was -1.249 in 1951-55 and -0.034 in 1955-60.[12] Another source is that the price elasticity in Japan was zero in 1958-64.[13]

The domestic price of rice in Thailand has been kept low due to the export tax (rice premium). The farm price received is at least 50 per cent[14] lower than it would have been had the export tax not been levied. The absolute amount of rice demanded would be much less than the present level even the estimate of the price elasticity is believed to be small if there was no

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12 Department of Agricultural Economics, University of Tokyo, Japan *Japanese Import Requirement: Projections of Agricultural Supply and Demand for 1965, 1970 and 1975,* Tokyo, Japan, March 1964, p.74.

13 FAO Commodity Bulletin Series 36, *The World Rice Trade Economy,* Vol. 2, *Trends and Forces,* Rome, 1963, p. 55.

14 Chaiyong Chuchart and Sopin Tongpan, *The Determination and Analysis Policies to Support and Stabilize Agricultural Prices and Income of the Thai Farmers.* Department of Agricultural Economics, Kasetsart University, Thailand, May 1965, p. 74.

export tax and the domestic price was allowed to increase. This eventually will affect an increase in rice exports.

The analysis of the estimates of elasticities of the shift variables are as follows:

There is no study of cross-elasticity of demand price but it is believed to be very inelastic or negligible. Rice in Thailand is of good quality and low in price. Other crops such as corn and potatoes are considered to be much inferior by the people. Wheat and wheat products are all imported and the quantities of import do not show much variation. Therefore, it would be logical to assume cross-elasticity of demand for rice is very small.

To estimate the change in taste affecting the demand for rice would be very difficult in quantitative terms. As rice is a staple diet of the population, so far there is no indication of shifting the demand for rices as such due to change in taste.

Income level is an important factor affecting rice consumptions, as it is estimated that 0.2 is for income elasticity of demand. As the annual rate of per capita income of the population increases to 4.5 per cent, the per capita rate of increase in rice demanded will be 0.009 per cent per year.

Export Elasticity. Assuming lagged farm price deflated by lagged cost of living index is the same as farm price deflated by cost of living index, the export elasticity of rice with respect to price can be derived from

the following equation.

$$E_{px} = E_{pq}(W_1) - E_{pd}(W_2)$$

Where

E_{px} = price elasticity of exports

E_{pq} = price elasticity of supply

E_{pd} = price elasticity of domestic demand

$W_1 = \frac{Q_q}{Q_x}$

$W_2 = \frac{Q_d}{Q_x}$

Q_q = volume of rice production

Q_x = volume of rice exports

Q_d = volume of domestic demand for rice.

In the price elasticity of rice exported by Thailand during 1951 to 1965, two alternatives of low and high limits are proposed.

For the high alternative, the estimate of 0.30 is regarded as the price elasticity of hectarages response and -0.50 is price elasticity of domestic demand. During 1951 to 1965 the average ratio of rice production to exports (W_1) was 3.3 and of domestic consumption to exports (W_2) was 2.3. The elasticity of exports with respect to the price deflated by cost of living index would be (0.30) (3.3) - (-0.50)(2.3) = 2.14.

For the low alternative, only the price elasticity of hectarage response 0.30 is

used. Due to the very low significance level of the coefficient of price in demand regressions and there is no other study available for a comparison, the price elasticity of domestic demand will be disregarded even though it is hypothesized to be negative. The low limit of price elasticity of rice exports by Thailand is 0.99.

West Malaysia

Rice Production, Area, and Yield 1951 - 1965 - Out of the total area of 50,700 square miles in West Malasia, 9,8000 square miles were under cultivation in 1963. Two-thirds of the cultivated land was devoted to rubber production, and the next important crop grown was rice which accounted for 16 per cent or approximately 1,568 square miles. The paddy production rose from 5,453,000 metric tons in 1951-53 average to 8,453,000 metric tons in 1963-65 average, equivalent to the annual rate of increase of 3.7 per cent. The annual level of increase was approximately 28,630 metric tons of paddy. During the same period the area planted increased from 270,000 hectares to 335,000 hectares representing an annual rate of increase of 1.0 per cent. Yield rose from 2,020 kilograms per hectare to 2,520 kilograms per hectare, which is equivalent to an annual rate of increase of 1.9 per cent.

Factors Influencing Rice Production. The discussion will be based on two major factors affecting farm price received and other shift variables of the supply curve.

Price received. The government guarantees a minimum farm price to farmers which is higher than the world's rice price. The guaranteed price is about $80 U.S.

dollars per metric ton of paddy of $127 U.S. dollars per ton of milled rice, as against approximately $100 to $120 U.S. dollars per ton of the world's average export price of milled rice. The government of this country has been striving to achieve the goal of near self-sufficiency in rice production, if possible. Domestic high farm price stimulates the farmers to produce more. As calculated, the price elasticity of hectarage response of 0.23 which is used as a low limit for the proxy of the supply indicates that more rice has been produced than otherwise would be the case without this price support program.

Other variable of supply function. The government has undertaken the breeding of superior seeds and a higher yield program to enable farmers to obtain better results. The Division of Drainage and Irrigation provides irrigation and drainage facilities to farmers, and it is in the process of enlarging the irrigated acreage. Agricultural extensionists are supplying farmers with information on the new technologies to enable them to increase their production. The government's Paddy Fertilizer Subsidy Scheme supplies fertilizers and makes available to farmers other assistance such as plow tractor service, pesticides, etc., at subsidized rates. Financial assistance is being furnished either directly or indirectly by the government. Benefits as such furnished by the various departments will enable Malaysian farmers to increase their production, and reach the goal set by the government.

Domestic Demand. Total domestic demand depends on population and per capita demand. The per capita demand is a function of the price of rice and other shiift variables such as price of substitutes, taste, and income. The analysis

of per capita demand will be based only on price of rice and level of income as it is believed these are the most important factors.

Malaysia has two rice price systems. Rice importers, instead of paying the import tax, are subject to import licenses which require purchase of domestic rice from the government's Reserve Stock in proportion to their regular imports. In 1966, the proportion was one to one. In other words, for each ton of rice imported oneton had to be purchased from the Reserve Stock. As the government's Reserve Stock price is higher than the open market price of most locally grown rice the importers recovered the loss by sales of lower cost of imported rice at the prevailing Malaysian prices at higher because of the good quality or strong consumer's preference. By this procedure the domestic retail price can be kept higher than otherwise would be the case. If -0.40 is regarded as the price elasticity of demand, then a higher domestic price of rice affects consumption of rice: a one per cent increase in the price of rice will decrease consumption 0.4 per cent.

As pointed out earlier, the estimate of 0.2 may be regarded as the lower limit and 0.6 as the higher limit of income elasticity of demand. This implies that if the annual rate of per capita income increases 10 per cent the per capita increase in rice consumption would be 2 per cent for the lower limit and 6 per cent for the upper limit, and then the price demand curve would shift to the right.

Elasticity of Imports. The estimate of -0.40 is regarded as elasticity of demand with respect to retail price deflated by the cost of living index and

0.23 as elasticity of hectarage response with respect to the lagged farm price. During 1951 to 1965 the average ratio of domestic rice consumption to imports (W_1) was 2.1 and rice production to imports (W_2) was 1.1. The price elasticity of imports, therefore, is (-0.40)(2.1) - (0.23)(1.1) = -1.09.

Japan

Rice Production, Area, and Yield 1952-1965. From 1952-54, the paddy production of Japan rose from an average of 12,109,000 metric tons to 16,743,000 metric tons in 1962-65--an annual rate of increase of 3.0 per cent. During the same period, the hectarage planted rose from 3,013,000 to 3,263,000 hectares, representing an annual increase of 0.7 per cent. Paddy yield rose too during this time from 3,993 kilograms per hectare to 5,050 kilograms equivalent to an annual rate of growth of 2.2 per cent.

As this country carries on a double-cropping system, total planted hectarage and physical hectarage are not the same. Total physical hectarage is less, due to their planting system. About one-third of the paddy fields were used for double-cropping in 1958-60 or 1.1 million hectares.[15]

Factors Influencing Rice Production.

Farm price received. Domestic farm price is under goverment control. The Food Control law governs the collection, distribution, and price of rice produced as well as the rice importations. With the exception of rice retained

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15 Japan, Tokyo, University of Tokyo, Department of Agricultural Economics, *Japanese Import Requirement: Projection of Agriculture Supply and Demand for 1965, 1970, 1975,* March 1964, p. 62.

for consumption, farmers must sell all the rice they produce to the government or its agents at a regulated price. The price paid to farmers may be regarded as support price to producers. By the government maintaining a high price to the farmers it more or less is assured of continuous production. Since 1960, producers' price has been based on cost and income formula. The producers' price for husked rice for first to fourth grade for 100 kilograms was 10,000 yens in 1964 and 10,920 yens in 1965, or $277.80 U.S. dollars per ton and $303.30 dollars per ton respectively. It can be seen from these figures that high prices were paid to Japanese producers, when compared to world average export price for the same period of $124.90 U.S. dollars and $127.10 U.S. dollars respectively. According to the Japanese Import Requirement, increases in paddy fields are expected, as many dry fields are being converted to paddy at an annual rate of 12,000 hectares, because paddy rice is much more profitable than other crops grown on dry fields.[16] Even the estimates of hectare response with respect to farm price computed by this study was low at 0.007 in the short run and 0.03 in the long run, but it is believed that price elasticity of supply or production would be much greater. The increase in rice production was mostly due to the increase in yield, requiring additional capital and labor.

Other variables of supply function. Double-cropping is not possible in the high and cold areas, but where it has been possible to convert dry fields, those growing various fruits, such as mulberry, to paddy, hectares planted have greatly increased. The most important factors have been land reform and technological changes.

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16 *Ibid.*, p. 63.

Before and during the period of two World Wars, the land tenure was made up of absentee landowners, but during post-war years the picture changed completely. Farmers became more receptive to market-oriented economy and new technologies. Before the Second World War, the area planted by farmers increased, as did their yield, due to the use of fertilizers, then after the war, yield continued to increase as improved varieties of seeds were available, as well as effective pesticides, and many mechanical innovations.

It is interesting to note that farm population decreased from 16.13 million in 1950 to 14.5 million by 1960. It was expected production would decrease; however, due to new technologies and extensive mechanization, the labor shortage did not appreciably affect production.

Domestic Demand. Domestic demand depends on population size and per capita demand, which is a function of price and other shift variables such as substitute goods, taste, and income.

Retail price. The government rations rice to consumers at a relatively high "fixed" price compared to that of the world rice price. In 1964 and 1965 the retail price of husked rice per ton was 95,000 yens and 111,000 yens, or $265.3, and $308.3 in U.S. dollars, respectively. The export world price as mentioned previously during this period was $124.9 and $127.1 U.S. dollars respectively.

Contradictory results were evidenced in estimates of price elasticities of

demand for rice in the previous study, "Japanese Import Requirement."[17] By time series analysis based on the "Food Balance Sheet," the price elasticity for per capita consumption was found to be -1.049 in 1951-55, -0.0338 in 1956-60, and by time series analysis based on a housefold budget survey for the latter period, was +0.30401.

As a comparison of the estimates of prices of price elasticities of demand with "Japanese Import Requirement," the estimate of this study showed a high level of significance during 1952-65, being -0.3 showing satisfactory results. The difference in estimate is due partly to the length of time used for the estimate in this study compared to the previous study.

An important substitute for rice is bread, which, because it is considerably less expensive, has been the major reason for the reduction in rice consumption. In 1966, consumers paid 40 yen for a pound loaf of bread as against a price of 60 yen for a pound of top grade milled rice. During that period, economy grade rice, the lowest priced rationed rice, was available at a cost of 44 yen per pound.[18] Even this lower grade rice was more expensive than bread when one takes into acoount preparation time.

The taste pattern of the Japanese people has changed greatly since the war. A survey taken during 1960 indicated that in the younger age bracket, the greater preference was for bread.[19]

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17 *Ibid.*, p. 74, 76.

18 Reported from Agriculture Attache, Tokyo, Japan, May 1967, No. 32.

19 *Op. cit.*, p. 89.

Income is an important variable affecting rice consumption. FAO's estimates of income elasticity in Japan in 1962 was -0.1, and they used this figure for the projection of rice consumption in 1975. The Japanese Import Requirement income elasticity by time series analysis based on the Food Balance Sheet during 1951-55 was 0.895, and during 1956-60 was 0.304. By cross-section analysis based on housefold budget data in 1959, it was about 0.278, and by time series analysis based on household budget data during 1956-60 it was -0.0338. The estimate of income elasticity arrived at from this study was 0.16 during 1952-65, and from all indications this seems fairly accurate.

CONCLUSIONS

The world milled rice production increased from an average of 119,658,000 metric tons in 1951-53 to 169,390,000 metric tons in 1963-65, or by 42 per cent. For the same period, the world trade increased from 5,012,000 to 7,112,000 metric tons or by 42 per cent. The figure showed the continuous increase both in production and trade during the period. The discrete change in rice production is anticipated in the future, and this is due to the recent new varieties of rice developed in the Philippines. The introduction of the new high yielding varieties to various countries will affect the new era of change in rice production and trade. It will shift the comparative advantage in rice production in many countries. The traditional rice exporting countries in Asia, Burma, and Thailand will face increasing competition in the world rice market.

The pattern of the world's rice trade changed substantially during 1951-65. The total volume of the world's milled rice trade increased from 4,978,000 metric tons in 1951 to 7,390,000 metric tons in 1965, the equivalent of a 49 per cent

increase. Thailand's share of the world's rice trade decreased from 33 per cent in 1951 to 27 per cent in 1965, while during the same period, Burma, its principal rival rice exporter, decreased its trade also from 26 to 18 per cent. Increases in exports from the United States and Mainland China were noted. United States' exports rose from 10 to 21 per cent, while those of Mainland China rose from 3 to 12 per cent.

The general pattern of rice trade during 1951 to 1965 measured by matrix approach technique indicated that if every region including South Asia increased trade by one per cent, it would affect exports from Southeast Asia by only -.0079 per cent. This finding implied that during that period the trade pattern for rice in Southeast Asia to other regions remained relatively stable. For the individual country basis, has each individual country's trade increased by one per cent, it would have affected rice exports of Thailand by -0.06, Burma by 0.88, the United States by -0.61, and Mainland China by 0.09 per cent.

For Thailand, it was concluded that the elasticity of the hectarage response with respect to the lagged farm price, deflated by lagged cost of living index, was in the range of 0.2 to 0.4. The elasticity of demand with respect to farm price deflated by cost of living was -0.5, and income elasticity of demand was 0.2.

From knowledge of elasticity of hectage response used as the proxy of supply and of demand, the elasticity of excess supply or export can be derived in the following fashion:

If the estimated 0.3 is used as the elasticity of hectarage response, then the elasticity of excess supply or export for the low limit during 1951 to 1965 is 0.99 and the high limit is 2.14. From this it can be concluded that if Thailand was able to increase the price of rice by 25 per cent, the increase in exports for the low limit would be 24.75 and for the high limit 53.50 per cent.

For West Malaysia, the elasticity of hectarage response regarding lagged farm price during 1951-65 was 0.23; elasticity of demand regarding retail price deflated by living cost index was -0.40. If the percentage change in lagged farm price equals that in retail price deflated by living cost index, then the price elasticity of excess demand would be -1.09. This implies that a 1% increase in price would decrease imports by 1.09%.

In Japan, the elasticity of hectarage response with respect to a lagged year farm price during 1952 to 1965 was 0.007 in the short run and 0.03 in the long run. Elasticity of demand with respect to retail price was -0.3 and income elasticity was 0.16. The low elasticity of hectarage response in mainly due to the limited supply of cultivated rice land. Production has increased appreciably in this country, due mainly to increased yield. Assuming that the precentage change in retail price, price elasticity of excess demand in the short run would be -8.04.

The two major countries causing instability in the world rice trade are the United States and Mainland China. The United States has a high capacity to export because of the low domestic consumption, as well as having large amounts

of storage built up. It can, therefore, play the role of residual supplier to meet the gap in the world rice shortage. Mainland China, the largest producer, produces one-third of the total world's rice, consequently any change in production or domestic consumption or in export policy will have a great impact on the world's total rice trade.

Theoretical Approach

a) Analysis of Trade Patterns

$$E_2 = T_2 E_1 \qquad (1)$$

$$T_2 = E_2 E_1^{-1} \qquad (2)$$

$$E_2 C' = T_2 E_1 C \qquad (3)$$

E = Zero-axial skew-symmetric matrix (ZSM)

T = Transformation or multiplier matrix or transition matrix

E_1 T E_o

$$\begin{bmatrix} f_{11} & f_{12} & f_{13} & f_{14} \\ f_{21} & f_{22} & f_{23} & f_{24} \\ f_{31} & f_{32} & f_{33} & f_{34} \\ f_{41} & f_{42} & f_{43} & f_{44} \end{bmatrix} = \begin{matrix} c_2 \\ b_2 \\ c_2 \\ d_2 \end{matrix} \quad \begin{bmatrix} t_{11} & t_{12} & t_{13} & t_{14} \\ t_{21} & t_{22} & t_{23} & t_{24} \\ t_{31} & t_{32} & t_{33} & t_{34} \\ t_{41} & t_{42} & t_{43} & t_{44} \end{bmatrix} \quad \begin{bmatrix} e_{11} & e_{12} & e_{13} & e_{14} \\ e_{21} & e_{22} & e_{23} & e_{24} \\ e_{31} & e_{32} & e_{33} & e_{34} \\ e_{41} & e_{42} & e_{43} & e_{44} \end{bmatrix} = \begin{matrix} a_1 \\ b_1 \\ c_1 \\ d_1 \end{matrix}$$

From (3)

$$\begin{bmatrix} a_2 \\ b_2 \\ c_2 \\ d_2 \end{bmatrix} = \begin{bmatrix} \\ T \\ \\ \end{bmatrix} \begin{bmatrix} a_1 \\ b_1 \\ c_1 \\ d_1 \end{bmatrix}$$

$$a_2 = t_{11}a_1 + t_{12}b_1 + t_{13}c_1 + t_{14}d_1 \qquad (4)$$

$$b_2 = t_{21}a_1 + t_{22}b_1 + t_{23}c_1 + t_{24}d_1 \qquad (5)$$

$$c_2 = t_{31}a_1 + t_{32}b_1 + t_{33}c_1 + t_{34}d_1 \qquad (6)$$

$$d_2 = t_{41}a_1 + t_{42}b_1 + t_{43}c_1 + t_{44}d_1 \qquad (7)$$

From (4)

$$1 = t_{11}\frac{a_1}{a_2} + t_{12}\frac{b_1}{a_2} + t_{13}\frac{c_1}{a_2} + t_{14}\frac{d_1}{a_2} \qquad (8)$$

Properties of T matrix:

(1) If no change in the rate of trade pattern t_{ii} the following year of rice trade is equal to 1 and the rest of T matrix elements will be equal to zero.

$$t_{ii} = 1 \text{ and } t_{ii}\frac{a_1}{a_2} = 1$$

(2) If there is the same proportionate change in the rice trade pattern for every country then T is scalar matrix, i.e., the same scalar at diagonal and the rest would be zero. The scalar is exactly the same rate of change in trade for each country, and

$$t_{ii}\frac{a_1}{a_{12}} = 1$$

From (4) shows the percentage change due to both the change in the rate of a_1 export and to the change in the distribution of trade. The rate of change from a_1 would be $t_{ii}-1$.

Equation (8) indicates the percentage contributed to a_2. As indicated above, if there is no change in the pattern of distribution of trade among the countries, t_{12} t_{13}, and t_{14} would become zero, and therefore $t_{11}\frac{a_1}{a_2}$ is equal to 1, $t_{12}\frac{b_1}{a_2}$ + 0, $t_{13}\frac{c_1}{a_2} = 0$, and $t_{14}\frac{d_1}{a_2} = 0$. $t_{11}\frac{a_1}{a_2}$ shows the export elasticity of a_2 with respect to a_1. How much percentage change of the trade of this year is due to one percentage change of the last year's trade.

If one would like to know how much the effect of only change in distribution contributed to a_2 it would be $t_{11}\frac{a_1}{a_2}$ -1.

$t_{12}\frac{b_1}{a_2}$ shows export elasticity of a_2 with respect to export of b_1.

$t_{13}\frac{c_1}{a_2}$ shows export elasticity of a_2 with respect to export of c_1.

$t_{14}\frac{d_1}{a_2}$ shows export elasticity of a_2 with respect ot export of d_1.