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Development of Selected Thai Commodity
Exports to Japan

by

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THAMMASAT UNIVERSITY
BANGKOK

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This is a revised version of the original paper presented by Supote Chunanuntathum under the title of "Thailand's Agricultural Exports with Special References to the Development of Exports of Maize, Mung Bean, and Shrimp."

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DEVELOPMENT OF SELECTED THAI COMMODITY

EXPORTS TO JAPAN

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I. INTRODUCTION AND PURPOSE OF STUDY

An interesting aspect of the international trade relationship between Thailand and Japan during the last 20 years or so has been the rapid growth of a number of Thai agricultural and mineral exports to Japan. Up to 1960, only a handful of commodities i.e. rice, rubber, maize, and teak were exported to Japan in somewhat substantial value (volume). The 1960 annual export value (volume) of rice, rubber, maize and teak to Japan were, in million of baht, 150,564,474, and 13 (90,027 tons, 40,717 tons, 441,046 tons, and 2,146 cubic meters) respectively. But after 1960, a number of new major agricultural and mineral exports to Japan have been added to the list. These include, for example, tin metal, tapioca products, frozen shrimp, and lately frozen squid and chicken, mung beans, sorghum, sugar, tobacco leaves, and fluorite. Thai maize export to Japan also increased substantially after 1960 while its rice and teak export to the Japanese market dwindled.

The purpose of this paper is to look at the development of some of these fast-growing commodity exports. They are maize, mung beans and shrimp. Specific factors contributing to the growth and development of these selected agricultural exports will be explored. This is done with special references to the Japanese market. References as to the direct role of Japan, if any, will be given. The method used

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here is to trace through the growth and development of these selected commodities. Finally, to evaluate the profitability of the expansion in production of maize, mung beans, and frozen shrimp for export, the methodology of domestic resource cost of foreign exchange earned will be adopted in our study.

II. NECESSARY BACKGROUND AND ANALYSIS

A. Facts on Agricultural Exports

Table 1 presents Thailand's agricultural and mineral exports by major groups of commodities, while Table 2 gives average annual rate of growth of these various groups of exports and as well as that of the overall value of Thai exports. Finally, Table 3 shows the relative shares of the exports of these various groups. We can briefly summarize Thailand's agricultural export from the statistics shown in the above tables as follows.

First, the share of rice export in Thailand's agricultural foreign exchange earnings has a long-run decline from the annual average of 41.8 per cent in 1961-1965 to only 20.1 per cent in 1975-1977. The average quantity of rice export and its prices tended to move in an opposite direction during 1961-1965 to 1971-1972 period resulting in a rather stagnant total value of rice export. Unit price of rice was exceptionally low in 1971-1972 period. It was in fact lowest in April 1971 as compared with the export price ten years prior to 1971. But in 1973-1974 mainly as a result of the world shortfall in rice production, the export price of rice in those two years went up exorbitantly high. Thailand's rice export earnings in 1973-1974 doubled despite a nearly 50 per cent decrease in the absolute quantity of export as compared to 1971-1972. In fact, it is not only rice that enjoyed a very high export price during 1973-1974, but all other groups of Thailand's exports as shown in Table 1 received high export prices, yielding a substantial improvement of Thailand's international terms of trade during that period. Thailand's export earnings, therefore, jumped by 43.62 per cent from that of 1971-1972. Though the level of most non-rice export prices as a group still remained high during 1975-1977, rice export

TABLE 1

AVERAGE TOTAL QUANTITY AND VALUE OF MAIN EXPORTS AS CLASSIFIED BY MAJOR GROUPS, 1961-1977

(Tons; Millions of Baht)

Commodity Group	1961-1965	1966-1970	1971-1972	1973-1974	1975-1977
1. Rice					
- Quantity	1,611,235.0	1,228,937.4	1,844,128.0	938,995.0	1,462,325.5
- Value	3,797.0	3,578.0	3,673.0	6,606.0	7,227.5
- Unit Value	2,356.6	2,911.5	1,991.7	7,120.0	4,942.5
2. Non-rice food crop					
- Quantity	1,450,960.6	2,611,761.8	3,672,740.0	5,845,564.3	6,845,564.8
- Value	1,720.6	2,976.4	4,975.0	19,766.6	19,766.6
- Unit Value	1,185.8	1,139.6	1,354.0	2,412.7	2,837.5
3. Non-food crop					
- Quantity	302,653.8	434,468.8	384,489.0	349,271.5	240,046.5
- Value	976.4	1,430.2	1,687.5	2,081.5	1,960.6
- Unit Value	3,226.1	3,296.4	4,388.9	5,959.0	8,167.6
4. Forestry					
Rubber - Quantity	198,702.4	243,572.8	312,783.0	376,538.5	369,170.0
- Value	2,040.6	2,029.4	1,883.5	4,804.0	4,978.3
- Unit Value	10,263.6	8,331.8	6,021.8	12,758.3	13,488.1
Woods - Quantity (cubic meter)	108,775.2	52,835.2	54,911.0	67,534.0	61,395.2
- Value	248.0	205.0	211.0	457.0	610.4
- Unit Value	2,279.9	3,880.0	3,842.6	6,766.9	9,942.2
5. Fisheries (shrimp only)					
- Quantity	2,503.0	7,711.0	6,159.0	12,563.0	14,140.0
- Value	47.2	244.4	293.0	702.5	1,136.0
- Unit Value	18,857.4	18,857.4	47,572.7	55,913.2	80,339.5

TABLE 1 -- Continued

Commodity Group	1961-1965	1966-1970	1971-1972	1973-1974	1975-1977
6. Livestock					
Cattle - Quantity (head)	59,902.4	41,467.8	39,998.0	38,046.0	31,228.0
- Value	104.2	78.6	103.0	129.5	160.0
- Unit Value	1,739.5	1,895.5	2,575.1	3,403.8	5,123.6
Others - Quantity	14,313.6	188,875.6	319,786.4	309,925.6	259,258.8
- Value	129.6	249.6	666.4	842.0	947.2
- Unit Value	9,054.3	1,321.5	2,083.9	2,716.8	3,653.5
7. Mineral					
Tin - Quantity	20,558.0	23,139.8	21,856.5	21,719.0	19,383.0
- Value	834.0	1,579.4	1,616.5	2,566.0	3,253.3
- Unit Value	40,568.2	68,254.7	73,959.7	118,145.4	167,843.0
Others - Quantity	24,464.0	188,875.6	319,786.4	309,925.6	259,258.8
- Value	18.4	249.6	666.4	842.0	947.2
- Unit Value	752.1	1,321.5	2,083.9	2,716.3	3,653.5
8. Overall Value of Thailand's Export	10,896.4	14,285.0	19,883.0	41,012.5	59,000.7
9. = $\frac{(1)+(2)+(3)+(4)+(5)+(6)+(7)}{(8)}$	91.0	87.2	76.6	72.2	68.0
10. = $\frac{(1)+(2)+(3)+(4)+(5)+(7)}{(8)}$	83.3	75.5	67.8	65.6	69.1

Note: Non-rice food crops includes maize, tapioca, sugar, mung beans, sorghum, soya beans, ground nuts, sesame, tamarind, and vegetable cake. Non-food crop export is defined as rubber, jute and kenaf, tobacco leaves, castor seeds, cotton seeds, kapock seeds, kapock fibre, seedlac and sticklac, as well as raw cotton. Other minerals include only fluorite, tungsten, and antimony.

Source: Department of Customs, as compiled in Bank of Thailand's Monthly Bulletin, various issues.

TABLE 2

AVERAGE ANNUAL RATE OF GROWTH OF VARIOUS MAJOR GROUPS
OF THAILAND'S EXPORTS

(Per Cent)

Commodity Group	1961-65 to 1966-70		1966-70 to 1971-72		1971-72 to 1973-74		1973-74 to 1975-77	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1. Rice	- 5.28	-1.18	22.5	1.31	-23.64	34.85	15.91	2.63
2. Non-rice food	12.47	11.58	18.58	29.89	12.54	50.20	13.74	20.76
3. Non-food agricultural export	7.49	7.93	-5.92	8.62	- 4.68	11.06	-11.75	-1.97
4. Forestry:								
- Rubber	4.15	-0.10	13.32	-3.65	9.72	59.71	- 0.65	1.19
- Woods	-13.44	-3.74	1.94	1.45	10.90	47.17	- 3.12	10.13
5. Fisheries (shrimp)	25.23	38.94	-10.62	9.49	42.82	54.84	4.01	17.37
6. Livestock:								
- Cattle	- 7.09	-5.48	- 1.78	14.47	- 2.46	12.12	- 6.36	7.30
- Others	- 6.30	-5.13	8.37	15.51	-33.35	-1.47	- 3.01	-5.22
7. Mineral:								
- Tin	2.39	13.62	- 2.81	1.16	- 0.31	25.66	- 3.72	8.23
- Others	50.49	68.45	30.12	63.40	- 1.55	12.41	- 5.77	4.0
8. Total value of export of 1-7	4.69		10.55		39.41		10.67	
9. Overall export of Thailand	5.56		17.98		43.62		12.88	

Source: Department of Customs, as compiled in Bank of Thailand's Monthly Bulletin, various issues.

prices themselves decreased consistently as compared to the level achieved in the period of 1973-1974. With import prices rising higher after 1973-1974, the country's international terms of trade were, therefore, eroded and turned much unfavourable after 1975.

Second, the export of non-rice food crop as a whole grew fast and consistently in both quantity and value in all the periods presented in Table 2. The average yearly growth rate of the quantity of non-rice food crop export is calculated to be in between 13-19 per cent. Its value grew at a rate of 12-50 per cent per annum, exceeding the rate of growth of Thailand's overall export in all respective periods covered in Table 2. As a result, the share of non-rice food crop in Thailand's total export increased from 15.7 per cent in 1961-1965 to 20.8, 25.0, 27.3 and 33.5 per cent in 1966-1970 to 1971-1972, 1973-1974 and 1975-1977 consecutively. Within the combined mineral and agricultural exports, these ratios for the non-rice food crop were 17.3, 23.8, 32.6, 37.8 and 49.2 per cent respectively. However, when we consider agricultural export alone, the annual average share of non-rice food crop rose from 18.9 per cent in 1961-1965 to 54.9 per cent in the last three years ending 1977. (See Table 3).

Rubber export increased in quantity from the average of 198,702 tons in 1961-1965 to 369,170-376,538 tons in the last five years after 1972. But due to the continuously decreasing rubber export price (between 1960-1965 to 1971-1972), its value of export declined from Bht. 2,046.6 million in 1961-1965 to Bht. 1,333.5 million in 1971-1972. Rubber share in the total export earning to Thailand then plunged by 100 per cent from 18.7 per cent to 9.4 per cent in the above corresponding period. However, with the reversed rising rubber export prices after the OPEC's oil price increase in 1973, its share in Thailand's total foreign exchange revenue then fluctuated in between 8 to 12 per cent.

TABLE 3

RELATIVE SHARES OF MAJOR EXPORT GROUPS, 1961-1977

(Per Cent)

Commodity Group	1961-65	1966-70	1971-72	1973-74	1975-77
1. Rice	34.8	25.0	18.4	16.3	12.4
	38.2	28.6	24.0	22.5	18.0
	41.8	33.6	28.3	25.5	20.1
2. Non-rice food crop	15.7	20.8	25.0	27.3	33.5
	17.3	23.8	32.6	37.8	49.2
	18.9	27.9	38.3	42.8	54.9
3. Non-food crop	8.9	10.0	8.4	5.0	3.3
	9.8	11.4	11.0	7.0	4.8
	10.7	13.4	13.0	7.9	5.4
4. Forestry - Rubber	18.7	14.2	9.4	11.7	9.4
	20.5	16.2	12.3	16.2	12.3
	22.5	19.0	14.3	18.3	13.8
- Other woods	2.2	1.4	1.0	1.1	1.0
	2.5	1.6	1.3	1.5	1.5
	2.7	1.9	1.6	1.7	1.6
5. Fisheries (shrimp)	0.4	1.7	1.4	1.7	1.9
	0.4	1.9	1.9	2.3	2.8
	0.5	2.2	2.2	2.6	3.1
6. Livestock - Cattle	0.9	0.5	0.5	0.3	0.3
	1.0	0.6	0.6	0.4	0.4
	1.1	0.7	0.7	0.4	0.1
- Others	1.1	0.6	0.6	0.3	0.1
	1.3	0.7	0.8	0.4	0.2
	1.4	0.9	1.0	0.4	0.3
7. Mineral - Tin	7.6	11.0	8.1	6.2	5.5
	8.4	12.6	10.6	8.6	8.1
	9.1	14.6	11.9	9.5	7.9
- Others	0.1	1.7	3.3	2.0	1.6
	0.1	2.0	4.3	2.8	2.3
	0.2	2.3	4.9	3.1	2.3

Note: The first line of each commodity group refers to the share relative to Thailand's overall exports. The second and third lines are the share relative to agriculture plus mineral exports and agriculture (crops, forestry, livestock and fisheries) respectively.

Source: Dept. of Customs, as compiled in Bank of Thailand's Monthly Bulletin, various issues.

For shrimp export we find that the average quantity of export together with its unit value tended to have a rising trend. The annual average growth rate of shrimp-foreign-exchange earning as shown in Table 2 was also in most periods above those of the total export earning, yielding as shown in Table 3 a rising share of shrimp export in the corresponding period since 1961-1965.

When we look at woods and livestock (cattle only) export we, however, envisage a declining trend throughout the period covered after 1961-1965. Even though the unit price of wood export rose successively after 1961-1965 resulting in the absolute increase in the value of wood export, their share in Thailand's export earning declined and remained low. The corresponding shares of other livestock were also as low as 0.1 - 0.6 per cent.

Looking back closely at individual item of agricultural export (not shown in the table), we can also find that Thailand's foreign exchange receipt from agriculture has begun to be much diversified since 1960. Maize and tapioca products first joined the four traditional Thai export of rice, rubber, tin and teak as important merchandise export around the end period of 1950's. Jute and kenaf export emerged significantly in 1960 at the time of declining teak export. Shrimp, mung bean, sorghum and the non-food crop export of tobacco, castor seed and kapok fibre joined the rank of principle commodity exports in the latter half of 1960's. Sugar became a major export item after 1970 with the value and quantity of export rising tremendously in a relatively short period of time. There are also other minor agricultural exports including, for example, soy bean, ground nuts and sesame whose values slowly increased after 1970. However, some minor exports like cotton (both cotton seed and raw cotton) have been stagnant throughout the period after 1960.

B. Analysis

What are then the main causes responsible for the prevailing structure of Thailand's agricultural exports? We can appropriately

and broadly divide these causes into external and internal factors. We will analyse these factors by concentrating on the roles played by the private and public sectors.

b.1 The role of the private sector

External demand usually renders an original stimulus. Theoretically, when the external demand for an agricultural product of a small exporting country, for any reason, rises causing the price of that commodity to increase relatively to other agricultural product prices, and assuming no change in the government intervention, relative domestic prices of these agricultural products will then be altered accordingly^{1/}.

The resultant change in price incentive among those agricultural products will be in turn transmitted through the marketing channels to producers inducing expansion in domestic production. This then causes, given no change in factor endowment and technology, a larger relative supply for the relatively higher-price agricultural product. With larger volume of production, exports of those commodities are then possible especially for non-rice food crop which are still not much consumed domestically in Thailand.

But the assumption of fixed factor endowment is still not much applicable to the case of Thailand. The relatively abundant land in Thailand has been again brought into play. The recent growth in Thailand's agricultural exports, hence, continues to fit mostly the

^{1/} For a general equilibrium analysis, the relative price of that agricultural export product vis-a-vis non-agricultural products also rises, producing all round repercussions not only in resource uses but also in consumption pattern. We are, however, concerned here with the narrow perspective of the agricultural sector only.

so-called "vent-for-surplus" theory of international trade^{1/}. So, just as in the past between 1855-1940 when Thai rice production and thus export responded rapidly to the rising rice price brought about by the steady increase in foreign demand, the recent increase in non-rice agricultural exports particularly the up-land food crop of maize, tapioca, mung beans, sugar and sorghum followed the same general pattern.

Diversification into production of various non-rice crops in the last two decades have, therefore, been largely achieved by cultivating additional hitherto-forest land rather than by crop substitution particularly at the expense of absolute rice acreage^{2/}. Nationally average yield per cultivated area in most various crops except sugar cane have also shown no sign of improvement after 1960 despite substantial increase in fertilizer uses. This is largely explained by the increase of less fertile land brought to cultivation. In the case of rice, the low fertilizer use has also been the unfavourable input-output price resulting from the government's low rice price policy for domestic (urban) consumers and from several disruptive interventions in fertilizer production and trade^{3/}. Table 4 presents data on relative planted areas of major agricultural crops while Table 5 gives their respective yields.

^{1/} The vent-for-surplus theory of international trade was first proposed by Adam Smith in 1776 (see: 22, p.415). But this simple theory is not widely known until Hla Myint used it to explain the rapid expansion of export of some tropical products from the developing countries as a result of the increase in demands from the developed countries (see: 18).

^{2/} There are cases of crop substitutions when their relative farmgate prices change. For example, when the price of cassava rose rapidly relative to declining price of kenaf in 1975-1976, about 30 per cent of kenaf land was substituted by cassava. Cassava planted area itself rose approximately 70 per cent. But areas planted in rice have increased continuously.

^{3/} Sugar-cane farmers use fertilizer substantially more than other crops during 1970's. The rate of fertilizer used per rai in the sugar cane cultivation in 1971 was 7 times compared to paddy and was 5 times higher than that of maize.

TABLE 4

PERCENTAGE OF AREA PLANTED OF VARIOUS AGRICULTURAL CROPS,
1960-1977

Commodity \ Year	1960	1961	1962	1963	1964	1965	1966	1967	1968
Paddy	78.52	78.77	79.82	74.94	75.23	71.04	70.80	69.04	70.46
Rubber	6.38	6.28	6.02	4.10	6.08	8.65	7.75	8.59	8.20
Maize	3.79	3.91	3.93	4.87	6.35	6.25	6.22	6.86	6.54
Sorghum	n.a.	n.a.	n.a.	n.a.	n.a.	0.34	0.64	0.68	0.31
Kenaf	1.86	2.43	1.38	1.79	2.51	4.16	5.05	3.61	2.40
Cassava	0.95	1.27	1.47	1.63	1.21	1.11	1.24	1.46	1.67
Sugar cane	2.09	1.58	1.22	1.72	1.87	1.53	1.18	1.56	1.77
Tobacco	0.23	0.20	0.18	0.18	0.20	0.17	0.16	0.21	0.20
Coconut	2.18	2.36	2.54	2.61	2.58	2.69	2.35	2.82	2.79
Cotton	0.74	0.73	0.71	0.85	0.77	0.81	0.80	1.16	1.30
Groundnut	1.56	1.06	1.04	0.97	1.01	1.07	1.50	1.12	1.16
Soy beans	0.30	0.30	0.33	0.39	0.39	0.21	0.44	0.66	0.52
Mung beans	0.69	0.47	0.60	1.18	1.16	1.30	1.28	1.38	1.95
Castor beans	0.42	0.47	0.55	0.53	0.45	0.39	0.41	0.50	0.38
Sesame seeds	0.28	0.18	0.22	0.23	0.21	0.28	0.29	0.36	0.28
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total area planted	47,131	49,027	51,576	55,016	54,329	57,659	65,612	60,272	64,111

TABLE 4 -- Continued

Commodity	Year									
	1969	1970	1971	1972	1973	1974	1975	1976	1977	
Paddy	70.71	68.53	68.02	65.12	64.10	61.55	63.66	61.16	58.93	
Rubber	7.94	7.88	7.86	8.01	10.52	10.84	10.06	10.97	10.22	
Maize	6.34	7.58	9.12	9.09	8.79	9.56	9.39	9.66	8.30	
Sorghum	0.33	0.46	0.50	0.48	0.68	1.56	1.40	1.07	1.08	
Kenaf	3.51	3.85	4.18	4.31	3.33	3.11	2.33	1.21	1.77	
Cassava	1.73	2.05	2.00	2.97	3.34	3.70	4.25	5.26	6.61	
Sugar cane	1.74	1.88	1.27	1.65	1.98	2.39	2.80	3.75	3.90	
Tobacco	0.19	0.23	0.26	0.26	0.32	0.35	0.34	0.34	0.30	
Coconut	2.77	2.89	2.97	3.17	2.42	2.48	2.34	2.49	3.03	
Cotton	0.87	0.28	0.42	0.56	0.22	0.40	0.22	0.18	0.58	
Ground nut	0.96	0.95	1.03	1.09	0.95	1.00	0.84	0.92	0.71	
Soy beans	0.45	0.54	0.52	0.73	0.94	1.02	0.85	0.76	1.06	
Mung beans	1.83	2.19	1.17	1.87	1.79	1.60	1.17	1.68	3.00	
Castor beans	0.34	0.42	0.41	0.44	0.35	0.24	0.17	0.34	0.27	
Sesame seeds	0.24	0.27	0.29	0.26	0.27	0.20	0.18	0.21	0.24	
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Total area planted	67,034	68,349	69,160	70,532	78,365	77,694	83,638	83,157	90,726	

Source: Ministry of Agriculture and Co-operatives, Department of Agricultural Economics, Agricultural Statistics of The Island, various issues.

TABLE 5

YIELD PER RAI (KG/RAI) OF VARIOUS AGRICULTURAL CROPS,
1960-1977

Commodity \ Year	1960	1961	1962	1963	1964	1965	1966	1967	1968
Paddy	222	231	240	253	256	249	276	274	229
Rubber	71	74	75	73	75	70	65	55	65
Maize	303	312	324	328	271	283	274	317	359
Sorghum	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Keñaf	208	201	188	221	222	220	199	193	199
Cassava (ton)	2.73	2.77	2.70	2.41	2.37	2.31	2.32	2.34	2.45
Sugar cane (ton)	5.5	5.2	5.0	5.1	5.0	5.1	5.0	5.1	5.2
Tobacco (Virginia)	80	90	93	90	84	76	72	70	62
Coconut	808	728	664	655	626	603	553	505	324
Cotton	133	116	116	112	119	132	179	134	141
Ground nut	210	209	211	221	222	219	230	202	213
Soy beans	190	169	176	165	147	166	137	145	136
Mung beans	167	181	175	188	177	169	161	152	147
Castor beans	224	148	158	189	164	153	161	131	159
Sesame seeds	143	141	146	147	129	119	109	109	120

TABLE 5 -- Continued

Commodity	Year	1969	1970	1971	1972	1973	1974	1975	1976	1977
Paddy		283	290	292	270	285	268	265	269	231
Rubber		60	56	54	57	62	61	56	57	62
Maize		402	374	361	211	326	323	349	333	223
Sorghum		n.a.	n.a.	n.a.	n.a.	256	219	230	166	n.a.
Kenaf		158	144	145	145	173	152	151	182	153
Cassava (ton)		2.58	2.45	2.25	2.36	2.39	2.08	2.18	2.32	2.06
Sugar cane (ton)		6.9	7.6	6.9	8.4	8.3	7.5	8.1	8.3	5.3
Tobacco (Virginia)		73	68	55	56	87	62	56	57	62
Coconut		301	312	259	233	213	340	331	323	234
Cotton		75	139	141	129	157	175	153	174	172
Ground nut		193	192	187	206	189	198	193	199	165
Soy beans		161	137	151	138	136	134	154	179	94
Mung beans		131	99	152	149	132	145	118	90	76
Castor beans		160	148	150	148	139	163	167	154	154
Sesame seeds		113	108	108	116	108	190	108	118	102

Source: Ministry of Agriculture and Co-operatives, Office of Agricultural Economics, Agricultural Statistics of Thailand, various issues.

b.2 The role of the public sector

So far, we have attributed that the outward-looking and flexible private sector has continued to play a major role in Thailand's agricultural export since both farmers and producers as well as traders have been able to respond quickly and impressively to the changing and generally rising external demand for agricultural exports. Thailand's agricultural sector has been, we can then say, quite dynamic as compared with that of any other Asian countries. Are there still then other domestic factors particularly those played by the Thai government in fostering the growth of the recent Thai agricultural exports? Though the public sector has played a relatively less-major role, government actions often have tremendous economic effects and repercussions. These include the following measures:-

- (a) Provision of physical infra-structure mainly road and irrigation facilities, as well as the successful malaria control in the planting areas of these new crops after the early years of 1950's.
- (b) Some crop researches and the increase of institutional credit for agriculture in most recent years.
- (c) Taxation, subsidisation as well as quantitative control of agricultural production and trade.

Public investment in agriculture has fluctuated around 8-10 per cent of total government's expenditure with approximately 60 per cent allotted to irrigation. Expansion of irrigation facilities are, however, concentrated in the Central Plain, the Western Plain and lower part of the Northern region of Thailand^{1/}. With more areas brought under irrigation, intensification and increased productivity of land have recently been possible

^{1/} For example, in 1972 almost 40 and 16 per cent out of the total irrigated area of 11, 621, 700 rais are in the Central and Western Plains respectively.

particularly in the Central Plain for rice cultivation. Crop researches have provided new breeding particularly for high-yield-variety rice seeds of relatively shorter maturity for a second rice crop in the irrigated area during dry season, as well as for rubber and maize. Recent researches are also adopted for other crops and fisheries. Road constructions, whether taken with an economic or non-economic objective have given an excess to new land and have served as a route for rapid delivery of goods to Bangkok at a reduced unit cost of transport.

Though provision of infra-structure and some recent crop researches have resulted in the increased capacity of the agricultural sector to produce in responding to foreign demand, the most important role played by the Thai government directly affecting prices and hence private profitabilities among crops are those under (c) above. Direct control on agricultural production like acreage or output restriction has never been adopted in Thailand. The government normally does not interfere in internal marketing and procurement of agricultural product either^{1/}. Nevertheless, in the more recent years the government initiated minimum farm gate prices for a number of agricultural commodities. For instance, floor prices at the farm level for paddy between Bht. 2,000 - 2,680 per kwien were announced by the government on January 1, 1976. The government then intervened by buying some paddy at those prices. The government also allotted about Baht 60 million to support the price of beans in 1978. Theoretically speaking, a farm-support price programme^{2/} with no effective control on acreage or production can be successful only if

^{1/} In the case of rice, the government procures some rice for (i) export under the government-to-government sale and (ii) for sale to urban (poor) consumers under the rice reserve requirement.

^{2/} The government tries to differentiate the farm support-price programme from the guaranteed floor price programme. We ourselves do not see any theoretical difference between the two said programmes.

the stabilization agency has enough fund and storage facility to stock up the excess-supply commodity. The stock of the commodity is then released during the market excess-demand period. In the case of Thailand, it can be said that agricultural farm-support price programmes have not been successful. During the excess-supply period, farm-gate prices ususally drop below government's announced floor prices. This is simply because the government does not have sufficient stabilization fund for the stock piling purpose. A minimum farm gate price is also usually announced by the government after there is too much production of that crop. We then can see that attempts by the Thai government to support crop prices have in many cases tended to work against the cycle for that product. This is certainly true for the example of suga r described below.

In 1960-1965 the world produced too much sugar resulting in a very low price for the product at that time. Thai sugar production began to expand in excess of domestic demand from the beginning of this same period. The government, with an objective to help sugar cane producers and sugar mills, continued to keep very high tariff for sugar import. Tariff on sugar was set at Baht 2.60 per kilogram which was almost equal to the imported sugar price in 1959. Subsequently the ban on sugar import was also instituted. The subsidy was, in addition, given for every ton of sugar exported. This kind of intervention by the Thai government therefore induced farmers to increased their sugar cane acreage. The short-run policy taken by the government gave rise to the long-run problem of excessive production of sugar cane during that time span. Later the government, however, managed to obtain a small quota of sugar export to the United States between 1966-1971.

The world food shortage and the relatively smaller production in sugar cane relative to world demand boosted the world sugar price. Production of sugar in Thailand also increased considerably. But the government banned, in 1973, export of white sugar to help sugar

consumers. In the middle of the following year, the government then intervened by imposing a sliding scale of export tax known as sugar premium for the purpose of stabilising domestic sugar price. The government also set a ceiling price at Baht 4.50 per kilogram for domestic consumers. But when the world sugar price came down again in 1975 the government then initiated the floor price for sugar cane as mentioned above. But this time it set a ceiling retail price at Baht 5.50 per kilogram. As a consequence, the government spent a total of Baht 442 million subsidising the sugar mills. Since there was a drought in Thailand in 1977, resulting in a lower production, sugar cane producers were then able to obtain about Baht 300 per ton. After that many farmers actually received a price of about Baht 280 per ton.

However, the most important intervention in the agricultural trade is certainly the taxation of rice export. Because rice is the staple food, the Thai government has an objective of keeping the rice price low for rice consumers especially for those in Bangkok. Since rice farmers as a single group still constitute the largest and poorest economic class of Thailand, the government also wishes to see farm-gate paddy price high or, since 1975, not falling below the announced floor price. We can see that these two policies of keeping the retail price of rice low and paddy price high are conflicting in themselves. In actuality, the objective of keeping relatively low retail price of rice has always been, since the end of the second world war, the top concern of the government as compared to the other objective. Moreover, the recent attempt to support farm-gate prices for paddy has been a failure. On the contrary, the Thai government has rather been very successful in keeping the retail price of rice lower than the world price. This is mainly to please urban rice consumers who are, of course, more politically vocal than paddy growers. Various measures to insulate the domestic price from the international price are as follows:-

1. Quantitative restrictions on rice export through annual target or quota setting with rice export licensing as well as outright rice export ban.
2. Export taxes on rice in the form of rice premium and export duties.
3. Rice reserve requirement. This is a mandatory procurement of rice by the government instituted since 1962. Rice exporters are compelled to sell to the government a certain physical quantity of rice of specific grade in proportion to every ton of rice of specific grade in proportion to every ton of rice exported. The price received by exporters under this compulsory sales is lower than the Bangkok wholesale price. It is then a loss to private rice exporters especially when compared with the much higher export price receivable during the period of tight international rice market. This can, therefore, be an extremely heavy implicit tax on rice sector especially when the ratio of rice reserved requirement is raised as high as 100 per cent.

The combined ad valorem equivalent of rice premium and export duties on various white-rice export fluctuated on the average around 15 to 48 per cent during 1956-1971^{1/}. In 1971 the government abolished rice premium for almost all rice exported except a few high-quality-rice export. But when the world price rose exorbitantly high during the second half of 1972 to 1974, the rice premium was brought back and raised very high. Reserve requirement was also set as high as 100 per cent during some of this period. The combined ad valorem equivalents on all taxes on rice export therefore escalated to 100 per cent. This inflicted a heavy tax burden to rice producing sector

^{1/} See Supote Chunanuntathum (see 7: pp. 94-96).

relative to light or no export taxes collected from other agricultural products except sugar in 1974.^{1/}

It is crystally clear that such a policy of relatively heavy tax on the traditional product of rice export, and hence its production, coupled with the physical infrastructure expansion has yielded the so-called "stick and carrot" policy of an agricultural crop diversification. This policy, however, can be said to come about without any initial governmental realization or intention.^{2/} The price-sensitive private producers then quickly respond to it to meet the generally rising external demand for various Thai agricultural export. It was and still continues to be a remarkable period of agricultural diversification in production and export.

III. SOME SELECTED AGRICULTURAL COMMODITY EXPORTS

We have just analysed those important factors affecting the growth of production and export of non-rice agricultural crops. The domestic factor (mainly land) endowment together with the

^{1/} Since rice production is usually land and labour intensive relative to capital, the tax burden falls heavily on the hard-working rice farmers and rice-land owners. Rice milling industry also shoulders some burden of the rice tax. Since the foreign demand for Thai rice export in the long-run is also rather elastic, (see Supote Chunanuntathum, 7), foreign buyers bear only some burden of the rice tax. In the immediate short-run particularly when export tax is raised quickly after the tight international rice market, rice export tax also falls on the carry-over rice stock of exporters and millers. The heaviest incidence of course falls on farmers who own land in those areas which cannot be shifted to other crops. As an intelligent conjecture, the higher ratio of rice land tenancy in the rice bowl of the Central Plain can be attributed to this long and heavy taxation. It is only after 1974 that rice premium (and sugar premium) has been set aside directly as the "farmers' aid fund". Nevertheless, the implicit tax on rice through the rice-reserve-requirement is still in use even though the requirement of rice reserve ratio is rather low at the moment of this writing.

^{2/} For a good historical description and analysis of originally light rice tax (before World War II) and the heavy rice tax (after World War II), see Jame C. Ingram (14). See also Ammar Siamwalla (21).

important role of the private sector and the implications of various government policies in agricultural production and trade are stressed. We also simply state that because Thailand is a small-and-open economy taking fluctuating prices of agricultural products as given from abroad, the external demand has usually provided the original stimulus. It is now appropriate to concentrate ourselves on certain commodity exports. We will intentionally select only maize, mung beans, (mainly black matpe) and shrimp export for our deeper studies. These commodities are chosen here simply because they are Thailand's new principle exports whose main international outlets are the Japanese market. We will attempt to trace through the development of these selected commodity exports. In the process we will try to see whether Japan has played any role in the development of these exports.

A. Maize

Table 6 presents data on maize production in Thailand, while Table 7 shows Thai maize export to Japan, Taiwan and other market during 1951-77. Statistics of import of maize in Japan and its feed production are also given in Table 8 for 1967-1977.

a.1 The initial role of foreign government

We can see from Table 8 that diversification of production toward maize slowly took place in the first half of 1950's. The significant rise in maize yield of 114 kilograms per rai in the period of 1951-52 to about 200 kilograms in the middle of 1950's was mainly a result of planting a hard-variety maize for export. Hard maize is used as a feed grain as opposed to sweet corn for direct human consumption. Ten kilograms of the hard yellow flint maize of "Guatemala" type was initially brought to Thailand in 1951 by the American advisers for planting tests under the United States Operation Mission's research activities. Since research tests indicated the suitability of Guatemala type for Thai soil, additional seeds were then imported in 1952. Local breeding for Guatemala type then

TABLE 6

AREA PLANTED, OUTPUT, AND YIELD PER RAI OF MAIZE, 1951-1976

Year	Area planted (1,000 rais)	Output (1,000 tons)	Yield/rai
1951-1952	269.5	43.2	114
1953	298.0	51.1	167
1954	332.0	62.2	147
1955	347.0	67.0	193
1956	514.0	114.0	221
1957	606.0	136.0	224
1958	792.0	186.0	234
1959	1,249.0	317.0	253
1960	1,789.0	543.0	303
1961	1,916.0	598.0	312
1962	2,050.0	665.0	324
1963	2,612.0	857.0	328
1964	3,441.0	935.0	271
1965	3,605.0	1,021.0	283
1966	4,083.0	1,122.0	274
1967	4,138.0	1,314.0	317
1968	4,193.0	1,507.0	359
1969	4,248.0	1,700.0	402
1970	5,180.0	1,938.0	374
1971	6,368.0	2,300.0	361
1972	6,231.0	1,315.0	211
1973	7,172.0	2,339.0	326
1974	7,749.0	2,500.0	322
1975	8,200.0	2,863.0	349
1976	8,029.0	2,675.0	333

Source: Ministry of Agriculture and Co-operatives, Department of Agricultural Economics, Agricultural Statistics of Thailand, various issues.

TABLE 7

THAILAND'S MAIZE EXPORT CLASSIFIED BY MAJOR MARKETS, 1951-1976

(1,000 Tons)

Year	Japan	Taiwan	Others	Total
1951	5	-	18	23
1952	10	-	15	25
1953	13	-	22	35
1954	30	-	7	37
1955	18	-	50	68
1956	37	-	44	81
1957	36	-	28	64
1958	130	-	33	163
1959	139	-	48	237
1960	441	2	72	515
1961	405	2	161	567
1962	230	-	242	472
1963	453	10	281	744
1964	845	10	260	1,115
1965	560	9	235	804
1966	826	17	335	1,218
1967	670	144	332	1,146
1968	666	395	490	1,551
1969	487	450	618	1,555
1970	650	447	351	1,448
1971	925	322	627	1,874
1972	842	503	489	1,834
1973	468	321	607	1,386
1974	978	468	786	2,232
1975	826	119	1,159	2,104
1976	989	457	973	2,419

Source: 1. USDA, Agricultural Data Book: for the Far East and Oceania, 1969, for 1950-1968.

2. Bank of Thailand, Monthly Bulletin, for later years

TABLE 8

FEED PRODUCTION AND IMPORT OF MAIZE IN JAPAN, 1967-1977

(1,000 Tons)

Year	Feed Production	Maize import for		
		Feed	Other Purposes	Total
1967	10,324	3,185	775	3,960
1968	11,357	4,042	1,102	5,144
1969	13,361	4,172	1,316	5,488
1970	15,076	4,387	1,635	6,022
1971	15,693	3,401	1,606	5,007
1972	17,345	4,346	1,705	6,051
1973	18,084	5,825	1,945	7,770
1974	17,019	5,841	2,099	7,940
1975	16,818	5,767	1,703	7,470
1976	18,059	6,261	2,122	8,383
1977	19,529	6,815	2,253	9,068

Source: Data prepared by Product Department, Marubeni Corporation, Bangkok, 1979

made it available for widespread use by more farmers in latter years. Expansion of maize planted areas accelerated during 1955 to 1958. This came as a result of increasing overseas demand for Thai maize particularly in Japan. Growth of maize production was also facilitated by the demonstration in 1955 of a tractor use for forest clearance and ploughing of the maize land. Furthermore, the opening of the friendship highway, constructed primarily for a military reason under the American aid in the early 1960's, resulted in the improved link with Bangkok. Land along and within the vicinity of this economically important highway was mostly brought under maize cultivation particularly those in Saraburi, Nakorn Rachasima, Petchaboon, Nakorn Sawan and part of Lopburi. These are the places in which Thai maize production has been concentrated. We can then see that there is an important contribution made by the American government and its advisers to the initial hard-variety maize production and expansion in Thailand.

a.2 The Japanese demand

However, it was not until 1958 that a rapid growth of international demand for Thai maize especially in Japan occurred. Thai maize export to Japan jumped from 36,000 tons in 1957 to 130,000, 189,000 and 441,000 tons in 1958, 1959 and 1960 respectively. The Japanese market accounted for 56.2, 79.7 and 85.6 per cent of the total Thai maize export in these corresponding years.

The very rapid rise of Thai maize export to Japan since 1960 (and to Taiwan since 1966) is mainly a result of the latter's increased need of feed grains for its livestock production. Japan has also pursued a liberal policy on maize import. There was a very spectacular growth of real national product in Japan especially from 1959 to the early of the 1970's (10.81 per cent per annum). With higher and fast rising income, the demand for meat products has increased. Since hard maize is a feed grain, the derived demand for maize import has then risen in Japan. The income and price elasticity

of the Japanese demand for maize import (1960-72) are estimated to be 0.93 and 1.49 respectively^{1/}.

Assuming equal income elasticities of the demands for Thai maize export to various destinations, and assuming equal cross price elasticity of the demand for maize export with respect to other feed grains, we can theoretically show that the price elasticity of the total demand for Thai maize export is equal to the sum of the price elasticity of substitution of Thai maize vis-a-vis non-Thai maize in these various export markets, weighted by their respective shares in the total Thai maize export. The share of the Japanese market in total Thai maize export fluctuated in between 31.3 - 67.8 per cent during 1966-76 while that of Taiwan was 5.0 - 27.4 per cent during this same period. Since the price elasticity of substitution is usually much higher than 1.49, and since their combined share in the total Thai export ranged from 44.8 to 72.4 per cent we can then reasonably infer that the price elasticity of the demand for Thai maize export should, as a whole, be higher than 1.49. The inferred price elasticity of the Japanese demand for Thai maize export is, for the same reason, quite elastic. Thailand is, therefore, a price taker in the international maize trade.

a.3 Bilateral agreement of Thai maize export

The rapid growth of Thai maize export during the late 1950's to the early of 1960's gave rise to many new firms entering maize trade. A number of problems then rose including, for example, delay of shipment, price undercutting, non-delivery according to an individual contract. The breach of an individual contract came about because local maize price, due mainly to uncertain supply condition,

^{1/} Martin E. Abel and Mary E. Ryan, "The Market for Feed Grains in East Asia-Japan, South Korea and Taiwan", Minnesota Agricultural Economist, 1974, as quoted in Chaiwat Konjing (see: 15, pp. 114-115).

might become higher resulting in losses for those who sold forward. On the contrary, when the local price was lower than the contract price, Thai exporters individually competed for more exports by cutting prices. This in turn induced buyers to break their former contracts. Thus, free trade in maize export was (still is) viewed to be disorderly and unstable by the Thai government officials concerning with international trade (mainly at the Ministry of Commerce). This has been used as a reason to control maize export.

So, in 1961, the government promulgated a law requiring all exporters to obtain prior permission from the Department of Foreign Trade (DFT) before exporting maize. The DFT also introduced export quota system after having concluded a bilateral maize export agreement with Thai Maize Importer Council (TMIC) of Japan^{1/}. During 1962-63 the bilateral trade agreement in maize with TMIC fixed the amount and price of maize export a month in advance. This bilateral trade agreement did not actually help solve the problem, particularly the breaching of the contract. This problem became serious again in 1964-65 season when the domestic price of maize rose sharply. The Thai government then decided to let the maize export trade go free by abolishing all export regulations. The number of maize export firm then increased rapidly to about 100. Intense competition among exporters in both domestic and export market was again considered to be the cause of price and trade instability. In 1965 the Thai government then brought back the bilateral agreement with Japan. This agreement has served as a basis for the annually negotiated agreement up to the present time.

The main substance of the annual bilateral agreement in maize trade basically concerns (i) the amount of yearly Thai maize export shipped in different time intervals and (ii) the pricing formula. The export price has been, since 1966 up to the time of this

^{1/} TMIC is the outgrowth of the Japan Feedstuff and Cereals Import Export Association (JFCIEA).

writing, based on the average of prices taken from the Chicago future market during a specified period prior to the actual shipment. This export price is computed periodically and announced about one month before the commencement of the maize shipment. To ensure the fulfilment of the contract, the maize export quota system has been adopted. Buyers and sellers then meet each another within a stipulated number of days to conclude an individual agreement of maize shipment. The list of authorised exporters who obtain a quota from the DFT is periodically furnished to the Japanese buyers.

Since the export price under the contract is linked directly to international price through the future market, the arbitrary fixing of the physical quantity of maize export can then result in the shipment different from the desired amount demanded and supplied at that fixed price. Setting the quota amount less than the desired amount of export at the agreed price gives rise to an economic rent (windfall gain) to the quota holders. Since maize quotas are transferrable, they command, in this case, a premium (a price) in the market. Besides, fixing export quota below the desired level at that fixed price results in lower export volume giving rise to misallocation of resources. On the contrary, should export quota be made above the desired level at that international price, it will be difficult to find enough exporters and buyers to fill up the total maize commitment under the contract. Only in the lucky case when the amount of the agreed export and hence its fixed quota is consistent with the quantity demanded and supplied at the agreed price, the problem of windfall gain or loss cannot usually be avoided.

We can now see that the bilateral trade agreement with its use of quota system cannot eliminate the problem of price undercutting and breach of contract. Whether the bilateral trade agreement can much reduce this problem or not also depends essentially on the severity of punishment (normally fines) which are themselves very difficult to enforce administratively. This is because it often works

against the economic incentive of honoring or not honoring the contract. One more important point to make here is that fixing the quantity and price of export which are announced usually one month prior to shipment also gives rise to much speculation in the domestic trade. Some rural maize wholesalers may hold maize as long as the storage cost is less than the spread between domestic and the agreed export price. Since exporters and rural wholesalers are not usually the same person and since the latter have grown to be bigger in most recent years, the former then may find it difficult to secure all the maize needed to meet their export commitments.

The export quota system which allocates to each exporter a quota equal to 70 per cent of his total export in the previous year plus an equal share distributed among all firms has also contributed to the fragmentation of Thai maize export. A number of dummy firms are set up to capture the quota and its economic rent. The quota rent was found by Chaiwat Konjing to range between 2-8 U.S. Dollars per ton of export depending on the market condition^{1/}. Though quotas are legally transferrable, it does not help to counter the tendency of fragmentation of maize export firms.

a.4 The question of monopsony

An important aspect of trading with Japan is the alleged monopsonistic buying of Japanese importers who bind together in dealing with foreign exporters. This can make Japan, as a whole, behave somewhat like a monopsonist particularly in the regional market. In the case of maize, it is the Japan Feed Trade Association (JFTA) which entered the bilateral trade agreement with Thailand. In the process of negotiation for an annual bilateral trade agreement, the

^{1/} To the extent that real resources are expended to obtain quota, as is the case of dummy firms here, it will be an economic waste. Quota dispensers can cut in for their own benefit, see Krueger (see 13).

advice of trading firms are usually sought by JFTA because of the latter's relative lack of knowledge of the Thai domestic maize market. Japanese trading firms are usually designated by JFTA to import maize from Thailand. After the agreement is reached, the Japanese trading firm earns, of course, some commission fee for providing their services^{1/}.

This monopsonistic buying behavior by the Japanese is, of course, an empirical issue and is very difficult to detect. It is true that Japan accounts for about 40.0 per cent of total Thai maize export. Large scale buying of Thai maize by Japan has, therefore, some impact on the local price but the price Japan pays is based on the world price. This very likely to be true for maize products which are only slightly differentiated in themselves. The share of Japan in world maize import is in between 14.0 - 16.0 per cent. The best way to counter any monopsonistic buying of maize by Japan, which is doubtful to exist, is to widen the range of Thai export markets. Factors making the Thai export price to be more competitive should be encouraged. Recently, there have also been a few maize silos built. Hence, there is the improvement with respect to maize drying. Quota system for maize export, if it is still the government's policy to keep, should be re-designed. Export quota permits should be publicly auctioned to the highest bidder. Some specified minimum size of the firm as a pre-condition for bidding eligibility should also help to reduce the present fragmentation of maize exporting firm. Economy of scale in maize export shipping will then be possible.

^{1/} We are told that a Japanese trading firm earns a small commission for each of the transaction ranging from a minimal of half a per cent to three per cent. The Japanese trading firms have no doubt provided a useful and efficient function of a middle man in international trade. For a glimpse of the economic performance (profit) of the Japanese trading firms, readers are referred to Hugh Patrick (see: 20, chapter 6, pp. 385-397).

B. Mung beans

Table 9 presents data of mung bean production in Thailand during 1961-77. Thailand's total export of mung beans and its export to Japan are shown in Table 10. From Table 9, we can see that production of mung beans rose rapidly from 1965. Planted area increased from the average of 454,825 rais in 1961-64 to 1,251,246 rais in 1966-1977. This was mainly due to the rapid increase of the Japanese demand for Thai mung beans export since 1966. The Japanese market contributed about 12.0 - 60.1 per cent to the total increase in Thailand's export during 1965-1977. (See Table 10). Import of mung beans in Japan classified by important countries of export are also given in Table 11.

There are two main factors which contributed to the growth of Thai mung bean export to Japan:-

1. The liberal import policy by the Japanese government. Unlike other beans (small red beans, kidney-type beans, broad beans and peas), the Japanese government does not put any quota or tariff on the import of its mung beans. Exports of mung beans have also been free from the Thai government intervention. The taxation of mung beans is also minimal.

2. The disruption of the Burmese source of supply to Japan resulting mainly from the change in the political situation in Burma during the later half of the 1960's. Export of Burmese mung bean to Japan started to decline after 1965. Thailand has been able to substitute Burma as the most important supplier of mung bean (black matpe) to Japan. (See Table 11).

Just as the maize trade, Japanese trading firms buy mung beans on behalf of the Japan Bean Sprout Association (JBSIA). Black matpe was first introduced to the Thai growers through trading firms in the middle of 1960's. This is probably due to their correct anticipation of the decline of the Burmese supply. A number of black

TABLE 9

PRODUCTION OF BLACK MATPE* AND TOTAL MUNG BEANS, 1961-1977

Year	Area Planted (1,000 Rais)		Output (1,000 Tons)		Percentage Share of Black Matpe	
	Black Matpe	Total	Black Matpe	Total	Area Planted	Output
1961	n.a.	230.43	n.a.	41.71	n.a.	n.a.
1962	n.a.	309.46	n.a.	54.16	n.a.	n.a.
1963	n.a.	649.19	n.a.	122.05	n.a.	n.a.
1964	n.a.	630.22	n.a.	111.55	n.a.	n.a.
1965	n.a.	749.57	n.a.	126.68	n.a.	n.a.½
1966	n.a.	839.83	n.a.	135.21	n.a.	n.a.
1967	n.a.	831.75	n.a.	126.43	n.a.	n.a.
1968	n.a.	1,250.16	n.a.	183.77	n.a.	n.a.
1969	n.a.	1,226.72	n.a.	160.70	n.a.	n.a.
1970	n.a.	1,496.84	n.a.	148.19	n.a.	n.a.
1971	356.0	809.17	54.0	122.99	43.9	43.9
1972	378.0	1,318.95	55.0	196.52	28.6	27.9
1973	423.0	1,402.73	64.0	185.16	30.1	34.5
1974	441.0	1,243.10	39.0	180.25	35.4	21.6
1975	454.0	978.56	51.0	115.47	46.3	44.1
1976	678.0	1,397.04	66.0	125.73	48.5	52.4
1977	757.0	2,721.78	85.0	206.86	27.8	41.0

* Black Matpe is a kind of mung bean whose skin color is black as opposed to traditional green color of its skin.

Source: Ministry of Agriculture and Co-operatives, Department of Agricultural Economics, Agricultural Statistics of Thailand, various issues.

TABLE 10

THAILAND'S EXPORT VALUE OF MUNG BEANS TO JAPAN
AND NON-JAPANESE MARKET, 1965-1977

(Millions of Baht)

Year	Total Export		$\frac{(2)}{(2)+(3)} \times 100$
	Japan	Non-Japan	
(1)	(2)	(3)	(4)
1965	14	104	11.8
1966	30	101	22.9
1967	34	88	27.8
1968	41	91	31.0
1969	69	146	32.0
1970	93	162	36.4
1971	91	164	35.6
1972	101	175	36.5
1973	140	234	37.4
1974	149	305	32.8
1975	190	274	40.9
1976	568	377	60.1
1977	553	504	52.3

Note: Within the total Japanese import of mung beans from Thailand, the share of black matpe is in between 60.0 - 95.5 per cent.

Source: Bank of Thailand, Monthly Bulletin, January, 1979.

TABLE 11

IMPORTS OF MUNG BEANS IN JAPAN CLASSIFIED BY
SOURCES OF SUPPLIES, 1955-1976

Year	Thailand	Burma	Others	Total
1955	-	12,463	-	12,463
1956	-	16,228	-	16,228
1957	-	12,027	-	12,027
1958	-	13,819	-	13,819
1959	-	20,125	-	20,125
1960	-	21,312	50	21,362
1961	-	29,119	550	29,669
1962	-	22,380	2,505	24,885
1963	-	24,392	2,333	26,725
1964	Mung beans from Burma came to Thailand			
1965	7,000	25,546	537	33,083
1966	14,511	12,966	1,477	28,954
1967	13,726	22,163	1,236	37,125
1968	12,776	12,940	9,664	35,380
1969	19,434	8,622	5,454	33,510
1970	27,758	7,842	1,170	36,770
1971	31,591	6,007	2,053	39,651
1972	31,889	2,196	3,909	37,994
1973	29,101	14,083	8,235	51,419
1974	25,346	8,763	5,368	39,477
1975	31,163	2,291	6,731	40,185
1976	43,424	1,245	1,587	46,256

Source: Customs Clearance Statistics, Ministry of Finance, Japan.

matpe seeds were then brought from Burma for planting tests in Thailand in 1965. Since black matpe grows well in Thailand, its produced beans are usually bigger than those obtained in Burma. Bean sprouts made from Thai black matpe are, therefore, generally preferred to those produced from the Burmese beans^{1/}. There has, most recently, been some slight increase of competition from Australia which can offer a bigger size of black matpe bean than the presently produced one in Thailand. The Australian beans are of course higher priced. Nevertheless, through recent researches since 1975, Thailand was able to come up with a new variety of black matpe (U-Tong II) in 1978. U-Tong II gives an average yield approximately 12 per cent higher and the size of the produced beans is generally comparable to that of the Australian black matpe. It is hoped that the U-Tong II will be in the near future released to farmers for commercial planting. It should be mentioned here that JBSIA contributed a minimal sum of Baht 300,00 in 1974 for the purpose of doing research in black matpe seed improvement. Export to the Japanese market then grew quite rapidly during the latter years of the 1960's. So, if Thai export prices continued to be competitive, Thailand can hope to maintain its high market share in Japan. In fact, Thailand's share in Japan's mung bean import as shown in Table II amounted to more than 90 per cent in the last three years ending in 1978.

Since the market share of Thai mung beans in the total Japanese market is now very high, and since the demand for bean sprouts and hence its derived demand for mung bean shall not increase considerably in the future, the Japanese demand for import of Thai mung bean in tonnage can then be reasonably expected to remain rather

^{1/} We were told that bean sprouts made from Thai black matpe are usually shorter but relatively fatter than those produced from the Burmese ones. The Thai bean sprouts are then relatively more durable and nutritious and hence more marketable. Sometime, processors in Japan mix the two kinds of bean sprouts together presumably to reduce its price.

stagnant or at most grow only slowly. There are, however, very good prospects for Thailand to export other beans to Japan if the Japanese government shall slowly abolish all the trade barriers or at least increase the import quota of these beans particularly the kidney beans^{1/}.

C. Shrimp

Thai shrimp production can be broadly classified into marine and fresh water shrimp with the latter accounting for about 3.0 - 7.0 per cent of the total shrimp production during 1973-76. Though most of the shrimp production (75-90 per cent) in Thailand is consumed domestically, almost all of the Thai shrimp export consists of marine shrimp. Table 12 gives data on total marine shrimp production in Thailand and the total shrimp export together with its market in Japan during 1961-77.

c.1 The initial role of the government

We can see from Table 12 that marine shrimp production in Thailand began to rise during 1959-61. The increase in production accelerated after 1961 up to the early 1970's. Production during 1974-76 grew slowly. But it jumped up again in 1977 to 118,953 tons as compared to 82,000 - 89,000 tons during the 1974-76 period.

Just as the crop farmers, private Thai fishermen as well as processing entrepreneurs have been quite responsive to the rising price of shrimp and various promotion measures provided by the government. With natural endowment of a relatively long coast line of 2,600 kilometres (comprising of 1,800 kilometres along the Gulf of Thailand and 800 kilometres of Andaman Sea), the increase of the production to meet the rising domestic demand and export is then possible. Nevertheless, much of the increase in Thailand's marine

^{1/} Thailand's share in total Japanese import of kidney beans is at present about 30 per cent.

TABLE 12

THAILAND'S MARINE SHRIMP PRODUCTION, TOTAL EXPORT AND
EXPORT TO JAPAN, 1958-1977

(Tons)

Year	Total Marine Production	Total Export	Export to Japan	Percentage	
				$\frac{(2)}{(1)} \cdot 100$	$\frac{(3)}{(2)} \cdot 100$
	(1)	(2)	(3)	(4)	(5)
1958	8,406	39	-	0.46	-
1959	7,514	198	-	2.64	-
1960	10,433	942	-	9.03	-
1961	11,559	869	-	7.69	-
1962	15,491	1,279	42	12.11	3.28
1963	23,353	2,053	456	8.79	22.21
1964	29,544	3,414	1,079	11.56	31.61
1965	35,244	4,880	1,773	20.46	36.33
1966	44,326	7,882	3,621	24.47	45.94
1967	49,137	8,829	5,104	17.97	58.22
1968	59,755	7,290	4,248	12.20	58.27
1969	58,313	8,133	4,949	13.95	60.85
1970	63,652	6,421	3,643	10.09	56.74
1971	67,614	5,593	3,447	13.92	61.63
1972	66,887	6,725	3,864	14.66	57.46
1973	77,525	14,875	10,926	19.19	73.45
1974	81,868	10,251	6,577	12.52	64.16
1975	87,039	13,541	9,583	15.56	70.77
1976	88,672	15,218	10,000	17.16	65.71
1977	118,953	13,662	7,395	11.46	54.13

Source: Ministry of Agriculture and Co-operation, Department of Fisheries, Fishery Record of Thailand, Various Issues and Bank of Thailand, Monthly Bulletin, June 1979

shrimp production in the last few years is said to be attributed to the shrimp caught in the non-Thai territorial sea water. In 1978 the Thai government also entered into a bilateral agreement with the government of Bangladesh for sharing in fishery caught in the Bangladesh sea water by Thai fishermen. No statistics are, however, available to show us the outcome of this agreement.

The rapidity in the increase of shrimp production in the early years of 1960's was much affected by the change in the technique of fishing. In 1960 and through the technical co-operation of the West German government, a new technique of fishing was demonstrated in the Gulf of Thailand by using the Otter-board trawl. The technique of fishing by means of the movable and flexible Otter-board trawl as controlled by a gear is, of course, superior to the Chinese purse seine (Tung-ge). With this successful demonstration of the new catching technique, fishermen then began to adopt it by either replacing their Chinese purse seine or equipping their new fishing boat with the Otter-board trawl net^{1/}. About 60-70 per cent of the total fishing boats with Chinese purse seine was changed to Otter-board trawl during 1962-63.

There was also (and still is) very low taxation on shrimp export (only a couple per cent). Shrimp export is also free from the Thai governmental control. Thai shrimp exporters (or packers as it is sometimes called) do not usually deal directly with the Japanese shrimp wholesalers. Japanese trading firms are usually designated as the buying agent for the Japan Marine Products Importers Association. Domestically, the private cold-storage industry was accepted for the first time in 1962 for investment promotion under the Thai industrial development policy. To take advantage of the various

^{1/} Out of the total registered fishing boats of 11,407 in 1977, 4,962 was equipped with Otter-board trawl net.

tax incentives offered under the initial investment promotion policy and later under the export promotion policy of Board of Investment, the number of cold storage establishments increased rapidly from 3 during 1963-65 to 13, 16, 24 and 32 in 1966-68, 1969-71, 1972-74 and 1975-77 respectively. These enlarged cold storage facilities are of course, mainly used for freezing marine products (mainly shrimp and more recently cuttle fish and squid as well as chicken) for export.

c.2 The Japanese market

The rapid expansion of the foreign demand for Thailand's shrimp export did not come about until the middle of 1960's. In the two years of 1963-64, the United States and Japan respectively bought an annual average of 490 and 768 tons out of the yearly total Thai export of 2,739 tons. But after 1964, Thailand's total shrimp export rose quickly to not less than 5,000 tons per annum. It reached more than 10,000 tons in 1973. During 1973-78 the yearly quantity of shrimp export fluctuated around 10,000 - 15,000 tons. Japan at present takes about 60-70 per cent of the total Thai shrimp export (see Table 12). Thai shrimp export to Japan, on the contrary, constitutes only a small percentage of the Japanese total import of frozen shrimp. Its share (not shown in Table), however, declined slightly from 7.7 per cent in 1975 to 5.7 and 5.8 per cent in 1977 and 1978.

The rapid increase of Thailand's shrimp export to Japan can also be attributed to 2 main factors:-

(a) The effects of higher and fast-rising real income in Japan. The demand for shrimp consumption should be income elastic because it is considered a high-priced luxury item as compared to most other marine products. The income elasticity of the Japanese demand for shrimp consumption is estimated to be $1.4\frac{1}{2}$. With higher level

^{1/} Asian Development Bank (See: 1, p. 39.)

and increasing real per capita income and with domestic production falling far short of demand, shrimp import in Japan therefore rose sharply. Frozen shrimp import rose continuously from 21,000 tons in 1965 to 143,962 tons in 1978. Shrimp import accounted for 31.0 per cent of the total tonnage of Japanese import of marine product in 1978. There seems to continue to be a good future market for shrimp in Japan especially for Thailand's export, whose share in the total shrimp market in Japan is still low. There are of course, other secondary problems for example, weighting, sizing, and quality control of the shrimp export.

(b) Japan's liberal shrimp import policy. Unlike a number of other marine products which are generally subject to both tariff and quota, shrimp import in Japan has been liberalised since 1961. There has been no shrimp import quota and the tariff rate on shrimp import in Japan is also low. Tariff rate on frozen shrimp import has long been 10 per cent while the same rate under GATT has been only 5 per cent.

c.3 Promotion of shrimp cultivation in Thailand

It is generally believed that at present the catch of the marine shrimp in Thailand's territorial water has reached a ceiling and may soon shift downward due to limitation of resources. This is mainly attributed to over-fishing with small-mesh size trawling nets particularly in the estuary area which is the growing place of juvenile shrimp. The enforcement of the long discussed "200 mile-territorial zone", also affects the Thai fishing fleet and hence its marine shrimp caught. This is because the fleet will be operating in the increasingly restricted fishing areas. At the same time, there is still much room for Thailand to increase its shrimp export particularly to Japan.

Realising this situation, the Thai Government has seriously begun to adopt a programme of shrimp cultivation development since the early years of 1970's. This programme was included and emphasized in

the country's Third Five-Year Economic and Social Development Plan in 1976^{1/}.

The Thai government through its Fishery Department then concluded an agreement for a long term technical aid in shrimp farming development with the Japanese government in 1973. The main substance under this technical co-operation includes the provision of mechanical equipment and machinery as well as some Japanese experts for shrimp researches. Some Thai technical personnels have also been trained in shrimp researches^{2/}. Mass production of shrimp seeds and better method of shrimp farming at lower per unit cost are then the objective. This is because the ultimate purpose of the shrimp-cultured development researches is to expand a commercial shrimp cultivation in Thailand. So far, researches in shrimp farming still do not have much effect on its development in Thailand. The recorded increase in shrimp cultivated area after 1972 has been due to the initiative taken by the private shrimp farmers themselves responding mainly to higher prices of the products^{3/}. Thick mangrove trees along the Thai coastal line are first cleared. Inland ponds are dug and mechanical pumps are mostly used to draw sea water with its supposedly larval seeds into the pond. Circulation of sea water in and out of the pond makes its water brackish and brings in natural feed for shrimp. Baby shrimps in the pond are then left to grow naturally for about 2 months before a periodical catch begins. Output per a cultivated area depends, of

^{1/} Shrimp culture development plan was also mentioned in the second economic development plan (1967-71). But no concrete measures were taken by the Government to promote shrimp cultivation at that time.

^{2/} Total technical aid under the agreement amounted to slightly over Bht. 13 million during 1973-75.

^{3/} There are 76,850 rais of shrimp farms producing 2,533 tons in 1976 as compared to 56,602 rais with 991 tons of shrimp output in 1972.

course, not only on the availability of the natural larval seeds but also on the care taken by farmers of their shrimp ponds especially prior to the crop period by drying up the pond and by disease killing as well as shell and fish eradication before pumping sea water in.

Thick mangrove forest along the coastal line is usually the estuary for shrimp and other fishery. Uncontrolled and excessive private cutting down of those trees tend to be socially self destructive in the long run. There is of course, no empirical evidence as to the point raised here. But the government should now take this matter more seriously because there are some indications of further cutting down of more mangrove forest for shrimp cultivation^{1/}. This is very likely to happen because the mass production of shrimp seeds for commercial purposes has just only begun. The unit cost has not sufficiently been brought down. To give an example, the larval seeds of 30-45 days at the Phuket fishery station costed between Baht 0.06 - 0.07 per shrimp in 1976^{2/}. Even if it is sold to shrimp farmers equal to its cost of production at the fishery station, it is still generally not profitable for private farmers to buy 16,000 shrimp seeds for raising in a rai of his shrimp farm. Assuming a zero cost of larval seeds, gross private profitability in shrimp farming is calculated under our survey data to be Baht 182-359 per rai in Samutsongkram and Samutsakorn in 1978. The rise in the seed cost of about Baht 960.0 per rai will then wipe out the private incentive for using any

^{1/} During our survey of shrimp cultivation in Samutsongkram, there were a few cases, we were told, of fighting (killings) for larval seeds.

^{2/} A larval seed in Japan in relatively more recent years costed between Baht 0.027 - 0.11 (¥ 0.27 - 1.12) per shrimp depending on the location of the fishing research station and the age of the baby shrimp (35-120 days). Though the *Penaeus Japonicus* (Japanese shrimp) and *Penaeus Monodon* (Thai shrimp as used for our illustration above) are not strictly comparable, the unit cost of the Japanese shrimp-seed production is certainly lower than the one in Thailand.

cultivated larval seeds. So unless the cost of seeds and better technique of shrimp transporting as well as larger-size farming are found, we can expect to see a continued clearance of mangrove forest along the Thai coastal zone for more relatively small farm of shrimp cultivation.

IV. PROFITABILITY OF EXPORTING SHRIMP, MUNG BEAN AND MAIZE

A. The methodology of the domestic resource cost of foreign exchange

The technique of domestic resource cost (DRC) of foreign exchange is generally well known^{1/}. Basically, the DRC is the measurement of the total real opportunity cost of producing a net marginal unit of foreign exchange as for a commodity export. Or it is a measurement of the use of all domestic resources in saving a net marginal dollar as in the case of an import substitute. The concept has a close relationship with the theory of comparative advantage in the international trade theory. The DRC can then be used in this respect as an investment criteria for private or social profitability. Under the usual cost-benefit analysis of a project, the internal rate of return, which is defined as that rate of discount equating streams of the total cost and total benefit, is computed. This is then used

^{1/} The concept of DRC was developed and much used for the economic development planning of Israel as early as the second half of 1950's. See, for example, Michael Bruno (5), Anne O. Krueger (11, 12). This concept is, however, very similar to the effective rate of protection (ERP) which was independently developed by a number of international trade theorists such as Harry G. Johnson, W.M. Corden and Bela Balassa. Krueger (12) showed that under the assumption of all goods being traded, perfect competition in the domestic factor markets, and all prices reflecting their marginal rate of transformation among goods, DRC is identical to ERP. Persons who are interested in the clarification and synthesis of the two approaches as well as the appropriate uses of either concept in different situations, should read the various relevant articles by Krueger, Bruno, as well as the article by Balassa (4).

to compare with some measure of the real or accounting rate of interest which is the opportunity cost of capital. Under the DRC technique, foreign exchange is regarded as an important factor of production. It is, therefore, singled out for special consideration. The ratio of the total domestic resource per unit of foreign exchange is calculated. This parameter is then compared with the measured accounting rate of foreign exchange.

It has been shown in the previous section that Thailand has been successfully expanding her exports of maize, mung beans and shrimp to Japan. In this section our main concern is to measure the opportunity cost of further expanding export of the three commodities using the DRC technique. Following Bruno, the general formula used for the calculation of the DRC is

$$DRC_j = \frac{\left(\sum_{s=2}^M f_{sj} v_s + \sum_{i=1}^N a_{ij} p_i \right)}{u_j - m_j} \dots\dots\dots (1)$$

- where f_{sj} = primary factor (s) used in j commodity
- v_s = shadow price of the primary factor (s) in producing j commodity
- a_{ij} = commodity (i) used in the production of j commodity
- p_i = shadow price of commodity input (i) used in producing j commodity
- u_j = marginal foreign exchange revenue from the j commodity
- m_j = marginal foreign exchange cost for the j commodity

There are then M + N coefficients including the one for the f_{1j} factor (foreign exchange primary factor). Positive and negative coefficients are considered to be output and input respectively.

We can readily see from the above equation that the two terms in the numerator are respectively (i) the direct value added of all domestic factors including labour, and capital evaluated at their opportunity costs and (ii) the accounting value of the non-traded domestic commodity inputs. If we assume that the domestic non-traded inputs do not require any imported input in their own production, the second term in the numerator will become identical with the indirect value-added of the domestic primary factors of production. In this case, the numerator becomes the total (direct and indirect) domestic

value-added measured at their opportunity costs. The denominator is the foreign exchange earned or saved, which is equivalent to the international free-trade value-added. But domestic inputs usually require some imports in their production. We, however, can handle this problem by expressing all the non-traded inputs in terms of direct and indirect primary factors of production inclusive of the foreign factors. We can theoretically do this by going down the input-output structure until the tradable input is reached. But in practice, as it is also adopted here in our study, we usually move backward by only one step in the input-output chain. The domestic resource cost can then be conveniently re-written as

$$DRC_j = \frac{\sum_{s=2}^M \bar{f}_{sj} v_s}{u_j - \bar{m}_j} \quad \text{-----} \quad (2)$$

All the meanings of variables are the same as in equation (1) except that the bar on top of the variables refers now to the total (direct and indirect) primary factor of production used in the production process of commodity j. The computed DRC_j is then compared with the measure of the accounting shadow exchange rate under an optimal government policy.

Let v_1 be the shadow exchange rate because f_{1j} is defined above as the foreign exchange factor of production. Then the country has a social profitability of producing commodity j if

$$DRC_j = \frac{\sum_{s=2}^M \bar{f}_{sj} v_s}{u_j - \bar{m}_j} < v_1 \quad \text{-----} \quad (3)$$

Now consider the case^{1/} of multiplying the dollar foreign exchange earned or saved in the denominator of DRC by the official exchange rate, v_1^* , the new DRC_j becomes

$$DRC_j^* = DRC_j \frac{1}{v_1^*} \quad \text{-----} \quad (4)$$

The criteria for a country to have a comparative advantage in producing commodity j is then

$$DRC_j^* = DRC_j \frac{1}{v_1^*} < \frac{v_1}{v_1^*} \quad \text{-----} \quad (5)$$

Equation (5) can be re-written as

$$\frac{DRC_j^*}{v_1/v_1^*} < 1 \quad \text{-----} \quad (6)$$

Equation (6) is, of course, equivalent to equation (3). In our study below, we will apply them to the three selected Thailand's export commodities of maize, black matpe, and shrimp.

B. Empirical application

a. Source of data

Basing on the concept of DRC as discussed above, we apply the methodology to Thailand's foreign exchange earning in maize, black matpe and shrimp cultivation. Both the private and social profitability in producing the commodity for export will be our concern. We are assuming here that the average yield cost and return used in our calculation provide close approximation to their respective marginal values.

^{1/} See this manipulation in the article by Scott R. Pearson, Narongchai Akrasanee, and Gerald C. Nelson (see: 19).

The provinces chosen for maize are Saraburi, Lopburi (both in the Central Region) and Chiangrai (in the Northern Region). The production of black matpe in the province of Uthairat and Sukothai (both in the lower part of the Northern Region) are selected for our investigation. For shrimp export, we concern ourselves only with the shrimp cultivation in Samutsongkram and Samutsakorn (both in the Eastern Region). Maize data are taken from the field surveys by the Department of Agricultural Economics, Ministry of Agriculture and Co-operative in the crop year of 1977/1978. However, for black matpe and shrimp, we gathered cost data from our own surveys in the early part of 1979. For shrimp we have 30 samples from Samutsongkram Province and 15 samples from Samutsakorn. Shrimp farms selected are usually small-size farms averaging 33.07 and 33.70 rai in Samutsakorn and Samutsongkram respectively. Information on the cost of black matpe production is based on 30 farm samples in Uthairat and 15 in Sukothai, whose respective average farm size is 12.20 rai and 16.20 rai.

b. Cost and value of production

b.1 Private cost of production

Private cost of production refers to the real opportunity cost of primary factors of land, labour, and capital, as well as tradable and non-tradable inputs used in all stages of production. Land cost is the next highest net return in the alternative use of that piece of land. In the case of shrimp cultivation, the next highest alternative return at market price is salt farming. For maize production, the alternative crop used here is mung bean for Saraburi and Lopburi and glutinous rice for Chiangrai. The net revenue from sugar cane is adopted as the alternative crop for black matpe production.

Labour cost is divided into (i) direct labour in shrimp, maize, and black matpe production at the farm, as well as labour in

transporting and processing of the products for export; (ii) indirect labour embodied in various inputs. The market wage rate in the vicinity of the farming area is used as the opportunity cost of the direct labour (hired and family labour). The daily wage rate during the time of our survey fell in between Baht 30-40 per worker. The wage bill is the product of man-days utilised in the crop year and the wage rate.

Labour in processing and transportation is indirectly estimated from the export price less all export taxes, less equivalent farm-gate price of frozen shrimp^{1/}, maize, and mung bean. Since the processing cost of black matpe is minimal, we then assume it to be zero in our calculation. The derived processing and transportation cost inclusive of profit are then distributed as the cost of capital, land, and foreign cost. For transportation, the proportions are 41, 24 and 30 per cent. But fuel used for pumping sea water in and out of the shrimp farm is given the proportion of 7, 1 and 62 per cent for capital, labour and foreign cost. The rest is attributed to be all taxes paid to the government.

We similarly segregate all other inputs including for example, insecticide, pesticide, fertilizer, gunny bag, tea seeds (used for disease eradication in shrimp pond), as well as the tractor service into components of capital, labour and foreign cost. The proportions used in their distribution are, however, different among inputs. They depend on the available data of the production processes of the commodity and on our ventured guesses.

Maize and black matpe seeds used in planting are totally regarded as traded or foreign cost. But for the natural larval

^{1/} In the case of shrimp 1.53 is the conversion ratio meaning that 1 kilogram of raw shrimp can be processed to 0.63 kilograms of frozen shrimp. Shrimp is internationally traded in the form of "headless with shell and tail on", at different sizes ranging from 8-15 shrimps to 71-90 shrimps per pound.

seeds used in shrimp cultivation, we take it as a zero cost. Cost of capital also has two components namely the direct cost of capital and the capital embodied in all other inputs. The direct cost of capital is (i) the opportunity cost of the loanable fund invested in the purchase of the capital input, together with (ii) depreciation as well as maintenance cost of the capital assets. A capital input is defined in this study as the input which lasts more than a crop year. These are fixed physical structures at the farm as well as other implements including, for example, shrimp trap and net, knife and sickle for maize and black matpe farming, and spraying equipment, etc. The interest rate of 18 per cent per annum is used here to calculate the real opportunity cost of capital. The indirect capital inputs are obtained in the same manner as described above for indirect labour. Depreciation rates vary among capital inputs with relatively longer life span for fixed structure and shorter life for other non-fixed instruments.

b.2 Private value of production

The commercial value of production of each exported commodity is the f.o.b. price per kilogram minus all export taxes. For maize, exporters pay the business tax of 2 per cent plus a municipal tax of 10 per cent on the business tax. The private value for maize export is Baht 2.036 per kilogram. For frozen shrimp export, the average f.o.b. price to Japan during January to October last year was Baht 116.54 per kilogram. Black matpe export, which is subject to the same tax levy as maize, has a commercial value of Baht 9.046 per kilogram.

b.3 Social cost and value of production

The social costs of production are the cost of primary factors and inputs evaluated at their social prices. It is the concept of social opportunity cost. We have already considered the private market opportunity cost for land, labour, and capital. We

will assume that these market prices are also the approximations of the social prices of land, labour and capital. But we remove all taxes which are internal transfer payments. Taxes are part of the social benefit and cost.

C. Social price of foreign exchange

The shadow exchange rate is defined as that rate of foreign exchange which equates, under a free condition, the total demand and supply of foreign exchange. The supply of foreign exchange also includes all the net long-term capital inflow in the balance of payments. The actual calculation of the shadow exchange rate requires the knowledge of elasticity of demand for and supply of foreign exchange as well as effective exchange rates facing exporters and importers under the existing structure of Thailand's exports and imports. Using this information, the shadow price of foreign exchange (SPFX) is calculated under a study^{1/} to be 3.3 - 8.8 per cent above the approximate official exchange rate (OER) of Baht 20.4 per U.S. Dollar in 1976. The shadow exchange rate adopted in this study, to err on the side of exporting, is 8.8 per cent above the official exchange rate. The SPFX is then Baht 22.20 for a U.S. Dollar.

D. Empirical results

Table 13 presents the result of the calculated private and social profitability of producing and exporting shrimp, maize, and black matpe. Private profitability is shown on line 5, while the gross and net social profitability measured at the official exchange rates are given on line 10 and 12 respectively. The net social profitability is re-calculated at the shadow exchange rate and is shown on line 14. The nominal protective coefficients both on output and input as well as the effective protective estimates appear correspondingly on line 15, 16 and 17. Line 18 and 19 in Table 13 show

^{1/} Supote Chunanuntathum (See: 6, pp. 37-43)

TABLE 13

COSTS AND RETURNS DATA AND VARIOUS PRIVATE AND SOCIAL INDICATORS FOR SHRIMP, MAIZE, AND BLACK MATPE

	(Baht/rai)						
	Shrimp			Maize		Black Matpe	
	S'songkram	S'sakorn	Lopburi	Saraburi	Chiangrai	Uttraradit	Sukhothai
1. Gross output at actual market price	1,591.459	1,223.881	763.574	842.904	716.672	1,080.902	1,141.605
2. Tradable inputs at actual market price	421.355	312.433	91.070	88.393	118.950	214.955	284.050
3. Value added at actual market price (1-2)	1,170.104	911.148	672.504	754.511	597.722	866.947	857.555
4. Factor costs other than capital at actual market prices	810.969	728.923	382.930	425.870	521.160	662.422	668.533
5. Private profitability (3-4)	359.135	182.225	289.574	328.641	76.562	204.525	189.022
6. Gross output at world market price	1,618.158	1,244.414	780.750	861.948	732.864	1,106.300	1,167.350
7. Tradable inputs at world market prices	327.981	244.269	84.490	80.360	109.300	196.016	263.005
8. Value added at world market price (6-7)	1,290.177	1,000.145	696.260	781.588	623.564	910.284	904.345
9. Domestic resource costs other than capital cost	810.969	728.923	382.930	425.870	521.160	662.422	668.533
10. Social profitability (8-9)	479.208	271.222	313.330	355.718	102.404	247.862	235.812
11. Domestic capital cost	269.814	193.863	69.830	97.44	102.330	143.378	158.790
12. Net social profitability at official exchange rate (10-11)	209.394	77.359	243.50	258.274	0.074	104.484	77.022

TABLE 13 -- Continued

Costs and Returns and Indicators	Shrimp		Maize			Black Matpe	
	S'songkram	S'sakorn	Lopburi	Saraburi	Chiangrai	Uttarakradit	Sukhothai
13. Ratio of shadow price of foreign exchange (SPFX) to official exchange rate (OER)	1.090	1.090	1.090	1.090	1.090	1.090	1.090
14. Net social profit- ability at SPFX (8 x 13) - (9 - 11)	325.509	167.372	306.163	328.621	56.195	186.409	158.413
15. Nominal protective coefficient on output (NPCO) $1 \div 6$	0.984	0.983	0.978	0.978	0.978	0.978	0.978
16. Nominal protective co- efficient on tradable inputs (NPCI) $2 \div 7$	1.284	1.280	1.077	1.099	1.088	1.096	1.079
17. Effective protective coefficient on value added (EPC) $3 \div 8$	0.906	0.911	0.971	0.965	0.958	0.952	0.948
18. Domestic resource cost coefficient (ERC)	0.837	0.922	0.650	0.669	0.999	0.885	0.916
19. Ratio of DRC to SPFX/OER $18 \div 13$	0.768	0.845	0.596	0.614	0.915	0.812	0.840
20. Yield (kgs./rai)	13.885	10.678	375.0	414.0	352.0	119.600	126.200
21. Conversion ratio	0.630	0.630	1.000	1.000	1.000	1.000	1.000

the estimates of the domestic resource cost coefficients calculated at the official and the accounting exchange rate. The last two lines bestow yield per rai and the conversion ratio adopted in our calculation of the various indicators of profitability as mentioned above.

Net private profitability (not shown on Table 13) in producing all the three commodities in various provinces, except shrimp farming in Samutsakorn and maize production in Chiangrai, is positive. The calculation, of course, uses 18 per cent as the threshold for the cost of capital. Shrimp farming in Samutsakorn will be just passing the profitability test as a commercial investment if the real opportunity cost of capital is lowered to 10 per cent. The higher capital cost as well as the higher labour cost per unit of land in Samutsakorn as opposed to those in Samutsongkram is due to a much smaller size of shrimp farm in the former province. The average farm size in Samutsakorn under our samples is only 33.07 rais as against 83.70 rais in Samutsongkram. In addition, the yield per rai in Samutsongkram's shrimp farming is about 30 per cent higher than that in Samutsakorn. These factors have, therefore, accounted for a relatively higher profitability of shrimp cultivation in Samutsongkram.

Net private profitability is clearly pronounced in the production of maize in the two chosen provinces of the Central Plain, while it is highly negative in Chiangrai. For black matpe, the net private profitability is Baht 61.15 and Baht 30.23 respectively for Utradit and Sukothai.

Social profitability in foreign exchange earning is clearly shown across products and provinces by the estimates of the domestic resource cost coefficients calculated at the shadow exchange rate. All the said coefficients are less than one, implying that social cost is less than the social revenue of one dollar earned. Thus the expansion of production of the three commodities for exports is socially profitable.

For maize production and export, the DRC coefficient is lowest in Lopburi (0.596) followed by 0.614 and 0.916 for Saraburi and Chiangrai. This implies that maize production in Lopburi is, from the point of view of resource allocation, 3.0 per cent and 53.6 per cent more efficient than that in Saraburi and Chiangrai respectively. If it is the policy of the Thai government to promote a marginal increase in maize production, the province chosen among the three above should be Lopburi. Even though all the three provinces possess a comparative advantage in the same line of maize export business, the most comparative advantage occurs in Lopburi. Similarly, we can infer from the results of our estimates of DRC that black matpe is socially more profitable to produce for export in Uttradit than in Sukothai. But its social profitability is only 3.8 per cent more. For shrimp production, the relative comparative advantage in Samutsongram over that of Samutsakorn is about 12 per cent. Nevertheless, in the case of shrimp farming, we have to be a little more cautious in trying to make an inference from their relative efficiencies. This is because of the two factors mentioned above i.e. the lower cost per unit of cultivated area and the higher yield per rai of shrimp production in Samutsongkram vis-a-vis Samutsakorn. The prescription of a policy for a marginal increase in shrimp production in Samutsongkram over that of Samutsakorn under the DRC concept^{1/} is based on the implicit assumption of a constant marginal cost of shrimp production in both places. With a larger farm size, cost per rai in Samutsakorn may be reduced. However, yield per rai still depends crucially on the abundance of natural shrimp seeds. We, therefore, have to keep in our minds all these marginal adjustments. These refined points are lastly and explicitly spelled out here because our surveyed and available data do not guarantee us the constant marginal cost which is an important assumption

^{1/} As is the case for maize or black matpe or in other commodity using the DRC concept.

required to make a practical comparison of the comparative high of DRC coefficients.

Alternatively, we can compute the total domestic resources used to obtain one dollar of net international value-added. Table 14 shows the results of our calculation.

TABLE 14

DOMESTIC COST OF \$1 OF FOREIGN EXCHANGE EARNED FROM EXPORT OF SHRIMP, BLACK MATPE AND MAIZE

Commodity	Province	Baht Re- quired to Produce \$1 of Net Output	DRC Coefficient at Official Exchange rate
Shrimp (1979)	Samutsongkram	17.074	0.837
	Samutsakorn	18.808	0.922
Black matpe (1979)	Uttraradit	18.054	0.885
	Sukhothai	18.666	0.915
Maize (1977/78)	Lopburi	13.260	0.650
	Saraburi	13.647	0.669
	Chiangrai	20.379	0.999

Source: See Table 13.

We can see that total Baht spent to earn one net U.S. Dollar of shrimp or black matpe or maize is, in each case and in every province, lower than the shadow exchange rate of Baht 22.20. It is lowest, about Baht 13.00, for maize in the 2 provinces of the Central Plain, while it is approximately Baht 17-19 for shrimp and black matpe. The domestic resources used to earn one net dollar for maize in Chiangrai is Baht 20.379.

Table 13 also illuminates the level of protection of the three commodities and on their inputs. Nominal rates of protection on output of shrimp, maize, and black matpe are slightly negative (not exceeding 3 per cent). Tradable inputs used in their production have much higher nominal rate of protection. Input used in shrimp production is nominally protected by about 20 per cent. Input used in maize and black matpe productions are, however, much less protected. They are about 8-9 per cent, which give rise to a relatively higher rate of negative effective protection of shrimp production as compared to maize and black matpe. The effective rate of protection on value-added in shrimp is about 9.0 per cent while those of black matpe and maize are about 3.0 - 5.0 per cent. As is reasonably expected, the negative rates of effective protection on the same commodity are approximately equal among different provinces. Considering the whole system of incentive structure, we then can conclude that maize, black matpe, and shrimp have faced some disincentives in their production for export despite the fact that each of the commodity enjoys a comparative advantage.

V . SOME CONCLUSIONS AND POLICY PRESCRIPTIONS

There is no doubt that Thailand's agricultural export policy has been biased against the export of staple food crop of rice relative to other agricultural export products. Rice production has been much heavily taxed relative to almost all other agricultural products. Judging from historical experiences, the Thai government has rather been willing and ready to intervene in the international commerce of any other Thai essential food product, e.g. sugar in 1973-1974. The purpose of the intervention in these commodities is to ensure a sufficient supply for consumers at a relatively lower than the world price particularly during the period of a tight international market for the commodity. Efforts to help agricultural producers through farm-gate price support program have not been successful.

The government has, however, invested rather a large sum of money in building infrastructure. This has generally resulted in an increase in the agricultural capacity and flexibility to produce in different areas.

Taxing the staple rice crop heavily and spending rather a large sum of the government budget in infrastructure investment have given rise to a rapid expansion and a diversification of agricultural crops. With flexible and outward looking private sector responding readily to the created incentives and with the availability of land in the last two decades, agricultural production of non-rice food crops have tremendously responded (not at the expense of absolute rice acreage) to supply the generally rising and fluctuating foreign demands. These are the cases of maize and black matpe which are separated out for more detailed studies. In the case of shrimp, the recent increase in domestic production is not only a response to the rising foreign demand but also to supply the domestic demand resulting from the relatively fast increase of real per capita income in Thailand.

Though Japan is still the most important foreign market for shrimp, black matpe, and maize, the relative share of the Japanese market for maize has declined in recent years. Japan has, however, been the market where the initial acceleration of the export of maize, black matpe, and shrimp occurred.

Besides all the above domestic factors, foreigners also played an important role in the initial expansion of maize, black matpe, and shrimp production. The growth of maize production was a result of the original introduction of hard maize of "Guatemala" type to the Thai soil by the American technical advisers under a research activity of USOM. Japanese trading firms, anticipating the disruption of the Burmese supply of black matpe, originally brought black matpe to Thailand for production. Thailand then quickly developed to become the most important supplier of black matpe to

Japan. Shrimp production for export was also initially affected by the fast adoption of a relatively more efficient fishing technique by using Otter-board trawl net as opposed to the Chinese purse seine. The German Government played a role here by being the first to introduce the new catching technique to Thai fishermen.

The application of DRC concept to Thailand's cultivated shrimp, black matpe, and maize export indicate that Thailand has a comparative advantage in the production and expansion of these three commodities. Marginal expansions particularly of maize in Lopburi and Saraburi, shrimp in Samutsongkram as well as black matpe in Uttraradit and Sukhothai, are socially warranted. Since there is also much net private profitability in the aboved mentioned provinces, their marginal expansions are, therefore, possible. Net private profitability is, however, negative for maize in Chiangrai because of the relatively high opportunity cost of land.

There are some degree of negative nominal and negative effective protection on the three commodities. In shrimp cultivation, the nominal protection on input and the effective rate of protection on value-added have been somewhat more negative. Exports of these commodities have, as a result, been penalized even though it is much less so when compared with rice production.

The development of these commodity exports to Japan has clearly resulted in net positive benefits to the Thai economy. The obvious policy implication is for Thailand to promote these exports further especially for production in areas of high comparative advantage.

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