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COMPARATIVE ADVANTAGE IN RICE PRODUCTION IN THAILAND†

Rice is the most important commodity in Thailand. Its significance is in every aspect of life—political, economic, as well as social and cultural. Value added in rice production has consistently accounted for more than 10 percent of the gross national product, and more than 75 percent of the total population of 42.3 million in Thailand live or work on farms where their main occupation is rice cultivation. Rice has for many years been a major foreign exchange earner, and a major source of government revenue.

This study is concerned with the comparative advantage of rice production. Our aim is to evaluate the export expansion of rice, using the criteria of private and social profitability, nominal and effective protection, and domestic resource cost (DRC).[1] We begin with a discussion of the significance of the study and then describe the areas and techniques of the cases under examination and the methods of computation used. We next present an analysis of the results, draw conclusions, and discuss policy implications. An appendix explains details of the calculations.

RICE AS A MAJOR EXPORT

As shown in Table 1, rice has been Thailand's most important export crop. In 1961 rice accounted for 36 percent of export earnings. But since then the share of rice in total export earnings has declined to less than 20 percent, even though its export value in 1974 was almost 10 billion *bahts* (฿). Taking its place were maize, cassava products, and sugar, all of which compete with rice in land usage. The combined share of these three competing crops in total export value rose from 9.8

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[1] See Pearson, Akrasanee, and Nelson (*3*), for a discussion of these concepts.

TABLE 1.—THAILAND'S VALUE OF EXPORTS OF RICE AND SELECTED MAJOR CROPS COMPARED TO TOTAL EXPORTS, 1960-74*

(millions of bahts)

Year	Rice		Maize		Cassava products		Sugar		Others		Total	
	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent	Value	Percent
1960	2,570	29.8	551	6.4	288	3.3	8	0.1	5,197	60.3	8,614	100.0
1961	3,598	36.0	599	6.0	446	4.5	3	0	5,351	53.5	9,997	100.0
1962	3,240	34.0	516	5.4	423	4.4	46	0.5	5,304	55.7	9,529	100.0
1963	3,424	35.4	857	8.9	439	4.5	122	1.3	4,834	50.0	9,676	100.0
1964	4,389	35.6	1,388	11.2	653	5.3	211	1.7	5,698	46.2	12,339	100.0
1965	4,334	33.5	1,004	7.8	676	5.2	100	0.8	6,827	52.8	12,941	100.0
1966	4,001	28.4	1,577	11.3	644	4.6	82	0.6	7,795	55.3	14,099	100.0
1967	4,653	32.8	1,431	10.1	726	5.1	37	0.3	7,319	51.7	14,166	100.0
1968	3,775	27.6	1,647	12.0	772	5.6	—	0	7,485	54.7	13,679	100.0
1969	2,945	20.0	1,767	12.0	876	6.0	47	0.3	9,087	61.7	14,722	100.0
1970	2,517	17.0	1,969	13.3	1,223	8.3	94	0.6	8,969	60.7	14,772	100.0
1971	2,909	16.8	2,286	13.2	1,240	7.2	382	2.2	10,464	60.6	17,281	100.0
1972	4,437	19.7	2,085	9.3	1,547	6.9	1,264	5.6	13,158	58.5	22,491	100.0
1973	3,594	11.2	2,969	9.2	2,537	7.9	1,116	3.5	22,010	68.3	32,226	100.0
1974	9,778	19.4	6,078	12.1	3,836	7.6	3,757	7.5	26,876	53.4	50,325	100.0

*Bank of Thailand, *Monthly Bulletin*, XVI, 4, April 1976, Table III.7.

percent in 1960 to 27.2 percent in 1974. The fact that the export of rice has declined and been unstable has been a cause for concern, since Thailand continues to rely a great deal on rice exports as a source of foreign exchange earnings.

The export of rice has also resulted in sizable government revenues through the collection of rice premium and export duty. Table 2 reveals that the revenue from rice exports has been the principal source of export duties, accounting for as much as 14.5 percent of total government revenues. This source of revenue has fluctuated widely in recent years.

Because of its significance as an export and as a staple food commodity, rice has received a great deal of attention in Thailand. Governments have interfered with rice prices at all levels from paddy production to domestic comsumption and export.[2] Rice policies have been designed to achieve the maximum level of export earnings, a low and stable domestic price of milled rice, and a high and increasing price of paddy, but these three objectives are often contradictory. The major policy instrument employed has been the rice premium.[3] The objective of maintaining a low domestic price of milled rice for the urban consumption has usually received the most weight, and the rice premium has been used for this purpose, except when the world price of rice was very low such as in 1970-71. In establishing rice policy, little attention has been given to the economic comparative advantage of rice. Consequently, the real cost of earning foreign exchange through rice export has not been determined and has played a small role in influencing rice policy.

RICE PRODUCTION AREAS

Rice cultivation in nine provinces was selected for investigation. Eight of these provinces, Nontaburi, Chainat, Ayudhya, Nakorn Nayok, Cachoengsao, Singburi, Supanburi, and Pathumtanee, are in the Central Region and the ninth, Chiengmai, is in the Northern Region. The areas selected are important and relevant to our study because they usually supply rice for export. They are largely in the delta of the Chao Praya River and are very fertile. Substitution of other crops for rice in the wet as well as dry season is possible. Recognizing the importance of this area, the Ministry of Agriculture conducted an agricultural survey on costs of various agricultural products in the crop year 1973-74; that survey is the major source of our data.

Data are available on the second crop in eight provinces and on the first crop in two provinces. The first crop data cover traditional varieties on transplanting and broadcasting farms and modern varieties on transplanting farms. The first crop is grown during the wet season, about July/August to October/November, and the second crop during the period of March to June. Farmers generally use traditional varieties of seed which have long stems and produce long grain rice. Modern varieties which produce better yields but are usually more difficult to grow have also been tried. There are two methods of planting, transplant and broadcast.

[2] For a comprehensive analysis of the historical development of rice policies in Thailand, see Siamwalla (4).

[3] The rice premium is a type of export tax that has been a hotly debated economic and political issue. See Ingram (2) and Siamwalla (4) for more details.

TABLE 2.—THAILAND'S TAXES ON RICE EXPORT AND TOTAL GOVERNMENT REVENUE

*(millions of bahts)**

Year	Taxes on rice export: Premium	Taxes on rice export: Duty	Taxes on rice export: Total	Total export duties	Taxes on rice export as percent of total export duties	Total government revenue	Taxes on rice export as percent of total revenue
1960	745	143	888	1,233	72.0	6,792	13.1
1961	872	189	1,061	1,277	83.1	7,449	14.2
1962	753	161	914	1,098	83.2	8,002	11.4
1963	819	172	991	1,164	85.1	8,819	11.2
1964	1,238	202	1,440	1,609	89.5	9,957	14.5
1965	1,192	197	1,389	1,570	88.5	11,344	12.2
1966	995	192	1,187	1,361	87.2	12,901	9.2
1967	995	199	1,194	1,319	90.5	14,777	8.1
1968	1,268	173	1,441	1,568	91.9	16,889	8.5
1969	1,037	139	1,176	1,505	78.1	18,296	6.4
1970	540	121	661	848	77.9	19,793	3.3
1971	225	144	369	414	89.1	19,355	1.9
1972	158	188	346	406	85.2	21,535	1.6
1973	333	148	481	1,041	46.2	26,950	1.8
1974	3,123	651	3,774	5,001	75.5	38,958	9.7

*Bank of Thailand, *Monthly Bulletin*, *XVI*, 4, April 1976, Table II.1.

With the transplant method seeds, which are first grown in a small plot of land, are transplanted by hand to a larger area; in the broadcast method seeds are scattered over an entire area. By implication, the former generally uses more labor hours while the latter uses more seeds on the same area of land. In summary, the data permit cost comparisons between crops in different areas, modern and traditional varieties, and transplanting and broadcasting farms.

METHODOLOGY FOR CALCULATING COMPARATIVE ADVANTAGE IN RICE PRODUCTION

To calculate comparative advantage in rice production, private and social values and costs of production must be determined. The methodologies employed in obtaining them are described here.

Private Value of Costs of Production

The private costs of production is the return received by exporters for one kilogram of exported milled rice. Private costs of production are imputed costs plus actual expenses in all stages of the production. The costs include primary factors and tradable and nontradable inputs. Primary factor costs are labor, capital and land incurred in the processing and transportation of paddy and in the production of paddy and its tradable and nontradable inputs. Tradable inputs include seed, fertilizer, insecticides and fungicides, and the tradable content of nontradable inputs such as tractor services.

Value of Production

The private value of production is the f.o.b. price of one kilogram of milled rice less all export taxes. In 1974 rice was subject to an export duty of 5.1 percent, a special form of export tax called the rice premium of about 30 percent ad valorem on average, and a requirement to sell reserve rice to the government in amounts equal to 50 percent per ton exported at a price of about 25 percent of the f.o.b. price.[4] The average f.o.b. price of 5 percent broken rice was ฿11,170 per ton in 1974 and the private return was ฿5.76 per kilogram.[5]

Costs of Production[6]

Primary Factor Costs of Labor, Capital, and Land.—The cost of labor has two components: labor used in the production of paddy, and labor employed in the

[4] The reserve rice was 5 or 10 percent broken milled rice. The reserve ratio was reduced from 100 percent to 50 percent after January 31, 1974. After October 30, 1974, the reserve rice price paid by the government for 5 percent broken milled rice was $250 per 100 kilograms. The system was abolished in 1975.

[5] Let P represent the f.o.b. price of one ton of rice. The ad valorem equivalent of all export taxes was

$$\frac{.351P + .5(1 - .25)P}{1.5} = .484P,$$

or 48.4 percent of the f.o.b. price. The private value received by exporters for one ton of exported rice was thus .516P.

[6] Unless otherwise indicated, data used are from the Ministry of Agriculture, *Agricultural Survey of the Crop Year 1973/1974*, Bangkok, unpublished.

processing, transportation, and production of inputs. The former was obtained by multiplying the wage rate by the number of man-days of hired and family labor. The wage rate used was the weighted average daily wage on an annual basis of one hired laborer, which was about ฿12 per day.[7]

Processing and transportation costs were estimated from the f.o.b. price of milled rice less taxes less the equivalent farm gate price of milled rice, using the standard conversion ratio of 3 to 2 between paddy to milled rice. Eighty percent was considered to be domestic cost, and the remaining 20 percent foreign cost. The domestic cost was then divided into 60 percent labor cost and 40 percent capital cost.

Using the f.o.b. price of milled rice of ฿11.17 per kilogram, the equivalent export tax rate of 48.4 percent, and the farm gate price of paddy of ฿2.15 per kilogram, the processing and transportation cost inclusive of profit and traders' margin per kilogram of milled rice was estimated to be

$$11.17 - .484(11.17) - \frac{3}{2}(2.15) = ฿2.54 .$$

Labor costs of other inputs were part of the added cost of imported inputs and part of the nontradable inputs.[8] The distribution between labor cost and capital cost was estimated as follows:

Inputs	*Labor (percent)*	*Capital (percent)*
Fertilizer	50	50
Insecticides	50	50
Fuel	10	90
Other	100	—
Tractor and farm machinery	50	50
Animal	20	80

Capital costs also have two components which are similar to those of labor costs. The direct capital cost of paddy production is the opportunity cost of funds invested in the production process plus depreciation of fixed assets. The price of capital was estimated to be 15 percent, and the depreciation rate was set at 10 percent.[9] The other part of capital costs was discussed above.

Land cost was approximated by the net revenue from growing an alternative crop evaluated at market prices. For second cropping, mungbeans is the alternative crop in Chainat, Singburi, Supanburi, Nonthaburi, Ayudhya, Pathumthanee, and Nakorn Nayok. The possible alternative crop is cassava for Chachoengsao, and soybeans for Chiangmai. Using information from the *Agricultural Survey of the Crop Year 1973/74*, we estimated the net benefit from growing

[7] The weighted average daily wage on an annual basis can be obtained by averaging the on farm wet season wage and the dry season wage, using the proportions of the seasons as weights. The on farm wage was ฿12 a day. The areas under study are mostly in the central plain where construction jobs are usually available in the dry season, with the daily wage estimated to be also about ฿12.

[8] Added cost is the cost involved from the point of import to the user, net of taxes.

[9] The opportunity cost of seed is determined by the length of time between sewing and cultivation.

mungbeans, cassava, and soybeans to be ฿66.40, ฿44.04, and ฿39.30 per rai, respectively.[10]

For the wet season crop, if the area cultivated is low land or irrigated under two or three meters of water, the opportunity cost of land is zero. But in the upland area, alternative uses for the land are possible. The study of the wet season crop pertains to Singburi and Chainat provinces which have sugar cane as the alternative crop. The calculation was therefore made from the net revenue from growing sugar cane, which we estimated to be ฿177.80 per rai.

Costs of tradable inputs.—The major tradable inputs are seed and fertilizer. Other inputs, including fuel and insecticides, are grouped together. The cost of a tradable input is the cost of the material component of each input, which is the user's cost net of added cost and all taxes. Since the data we have are the costs of inputs paid by farmers, the material cost had to be estimated. For inputs which were imported, the following equation was used to estimate the material cost:

$$x(1 + t_m + c) = U_c,$$

where x equals material cost, t_m equals tax rate on imports,[11] c equals added cost,[12] and U_c equals user's cost.

For domestic inputs, the material cost is the user's cost net of indirect taxes. Seed is usually from the previous season, and the material cost of seed is equal to its farm gate value. The costs of the service of tractor and farm machinery were broken down into tradable and nontradable components. The tradable component was the import content of the service cost net of transportation.[13] Finally, 20 percent of the total processing and transportation costs was estimated to be foreign cost. The total costs of private tradable inputs, shown in Appendix Table A-16, include the import taxes on these inputs.

The Social Value and Costs of Production

The social value of production is the f.o.b. price of one kilogram of milled rice, which in 1974 was ฿11.17. Social costs of production are costs of primary and tradable inputs valued at opportunity cost. In this study labor costs at market prices were considered to reflect opportunity costs. We have already approximated the private costs of capital and land by their opportunity costs at market prices. Hence we have assumed that the social costs and the private costs of primary inputs are reasonable approximations for each other.

Except for seed, the social cost of each tradable input was the same as the private (material) cost calculated net of taxes. Most tradable inputs were actually

[10] Data on cassava are based on cassava production in Cholburi, a province close to Cachoengsao.

[11] Imports into Thailand are subject to tariffs and business taxes. The overall ad valorem rate is t_m, expressed as a percentage of the c.i.f. price.

[12] Added cost varies from input to input. These costs were calculated to be 22.2 percent for fertilizer and 21 percent for insecticides.

[13] According to the *Industrial Survey of 1971* conducted by the National Statistical Office, the value of tractor and farm machinery production has the following cost structure: value added, 25.8 percent; domestic input, 5.9 percent; and imported parts and components, 68.3 percent. Transportation cost was estimated at 6 percent of the service cost.

traded, and there were few domestic inputs which were sold at distorted prices. For seed, the heavy taxation of exported milled rice kept the farm gate price lower than its social value. The social cost of seed was therefore obtained by evaluating seed at its border price, which was the f.o.b. price of milled rice adjusted by the conversion ratio of two-thirds, resulting in the price of ฿7.45 per kilogram.

Social Cost of Foreign Exchange

The shadow exchange rate is defined as the rate of exchange which would be in force if all trade distortions were removed and if the trade balance were to remain the same. The calculation of the shadow exchange rate takes into consideration the elasticity of demand for imports, the elasticities of demand and supply of exports, and the knowledge of the structure of trade and factors affecting trade distortions. Using this information, we estimated the shadow exchange rate to be ฿25.8 per US$1. See (*1*).

Indicators of Private and Social Profitability and Comparative Advantage

With this information on costs and returns, we can calculate various indicators of private and social profitability and comparative advantage. Six indicators will be calculated according to the following definitions:

1. Private profitability (PP) equals value added less factor costs other than capital less indirect taxes at market prices.

2. Social profitability (SP) equals value added less factor costs other than capital at opportunity cost.

3. Net social profitability (NSP) equals SP less capital costs at opportunity cost. NSP will be calculated at the official exchange rate and at the shadow price of foreign exchange.

4. Nominal protective coefficient on output (NPCO) equals the ratio of gross output at the actual market price to gross output at the world market price. This indicator shows the extent to which the actual gross return differs from what it would be without the output price distortion.

5. Effective protective coefficient on value added (EPC) equals the ratio of value added at actual market prices to value added at world market prices. (Value added includes value of the nontraded elements of traded inputs.) This indicator shows the extent to which private value added differs from what it would be without distortion in the prices of output and inputs.

6. Domestic resource cost coefficient (DRC) equals the ratio of total (direct and indirect) domestic factor costs at opportunity cost to value added at world market prices, in domestic currency. For an exported commodity, this indicator shows the extent to which the total domestic cost of producing a unit of output differs from the value obtained from exporting it. If value added at world market prices is shown in foreign currency, then the DRC will show the domestic cost of foreign exchange earned. The coefficient will be calculated at the official exchange rate and at a shadow exchange rate. When it is expressed at the shadow exchange rate, a coefficient value less than one, implying that costs are less than returns, will indicate the degree of comparative advantage in production.

COMPARATIVE ADVANTAGE OF ALTERNATIVE AREAS AND SYSTEMS

Calculations have been made for the second (dry season) crop in eight provinces and the wet season crop in two provinces. The wet season crop is further broken down into modern and traditional varieties, and transplanting and broadcasting farms. Detailed calculations are given in the Appendix. In this section we analyze the results obtained and draw some policy conclusions.

The General Pattern of Comparative Advantage in Rice Production

Comparative advantage refers to the whole process of rice production—from the production of paddy to the exportation of milled rice. The key issues are: if Thailand were to expand the production of rice for export, from which areas should the production come, and what type of rice and what method should be used? The production of paddy is therefore crucial to our analysis. Consequently, the results will be discussed in relation to areas and techniques of paddy production.

Various indicators of private and social benefits and costs of rice production are given in Table 3. As expected, the wet season crop costs the economy much less than the dry season crop; the highest DRC coefficient was .33 for the former, whereas the lowest coefficient for the latter was .37. In terms of social cost, the modern variety was not much superior to the traditional variety, with a difference in the DRC of .02 to .03 for Singburi and Chainat, respectively. Finally, the transplanting and broadcasting techniques yielded almost identical DRC coefficients.

Although the cost of the dry season crop has been found to be higher than that of the wet season crop, the cultivation of the second crop was still very efficient in all provinces under study. The DRC coefficients ranged from .37 for Nontaburi to .46 for Pathumtanee. If Thailand were to increase the export of rice, the domestic cost of earning an extra US$1 at the official exchange rate would range from ฿7.64 up to ฿9.36 for paddy production from Nontaburi and Pathumtanee, respectively, considerably lower than the exchange rate of ฿20.40 per US$1. The efficiency was even more pronounced when DRCs were expressed in terms of the shadow exchange rate, indicating a strong comparative advantage in rice production.

The variation in DRCs was not large among the eight provinces. This result was not surprising since, except for Chiangmai, the provinces are in the Central Region. The Chiangmai results reveal that it is economic to grow the second crop even in the high land. The ranking of provinces according to social cost or social profitability is very similar, and the ranking of provinces according to the private profitability criterion follows the same pattern.

Chainat and Singburi have been chosen for the study of comparative advantage of different techniques of production. A comparison between modern and traditional varieties on transplanting farms shows the modern varieties to have a slight advantage over the traditional ones, in terms of both private benefits and social cost. Singburi seems to be more suitable for the modern varieties. However, as

TABLE 3.—PRIVATE AND SOCIAL PROFITABILITY, NOMINAL AND EFFECTIVE PROTECTION, AND DOMESTIC RESOURCE COST OF RICE PRODUCTION IN SELECTED AREAS OF THAILAND, 1973-74 CROP YEAR*

Areas/techniques	Private profitability	Social profitability	Net social profitability[a]	Net social profitability[b]	Nominal protective coefficient on output	Nominal protective coefficient on input	Effective protective coefficient on value added	Domestic resource cost coefficient	Domestic resource cost coefficient (฿/US$1)	Domestic resource cost coefficient: Social price of foreign exchange / Official exchange rate
Second crop										
Nontaburi	1.82	7.08	6.01	8.51	.52	.91	.45	.37	7.64	.29
Chainat	1.64	6.90	5.84	8.38	.52	.89	.46	.40	8.21	.32
Ayudhya	1.55	6.78	5.73	8.24	.52	.88	.46	.41	8.36	.33
Supanburi	1.48	6.75	5.65	8.19	.52	.89	.46	.42	8.65	.33
Chachoengsao	1.43	6.64	5.52	8.04	.52	.85	.46	.43	8.78	.34
Chiengmai	1.57	6.80	5.81	8.45	.52	.81	.49	.43	8.78	.34
Nakorn Nayok	1.28	6.51	5.38	7.93	.52	.86	.47	.45	9.21	.36
Pathumtanee	1.06	6.31	5.22	7.73	.52	.89	.46	.46	9.36	.37
First crop										
Traditional varieties, transplanting farms										
Chainat	2.55	7.78	6.79	9.44	.52	.80	.49	.33	6.70	.26
Singburi	2.84	8.08	7.16	9.84	.52	.80	.49	.31	6.26	.25
Modern varieties, transplanting farms										
Chainat	2.90	8.16	7.20	9.87	.52	.83	.49	.30	6.08	.24

Singburi	2.93	8.24	7.32	10.02	.52	.88	.49	.29	6.00	.23
Traditional varieties, broadcasting farms										
Chainat	2.68	7.76	6.81	9.42	.52	.70	.49	.32	6.54	.25
Singburi	2.64	7.70	6.77	9.38	.52	.69	.50	.33	6.70	.26

*Appendix Table A-16.

[a]Calculated at the official price of foreign exchange.

[b]Calculated at the shadow price of foreign exchange.

mentioned earlier, the difference in advantage between the two types of farming is negligible. While transplanting farms seemed to be slightly more profitable privately for Singburi, broadcasting farms were slightly more profitable in Chainat. Transplanting farms were more socially profitable in both provinces.

Table 3 also illustrates the degree of protection. Since the same export tax rate was applied to rice from all areas, the nominal rate of protection on output was uniform at a negative rate of 48 percent. As for inputs, the nominal protection was also negative because the high export tax on rice kept the price of seed low, and there was a low level of protection on other inputs, some of which were produced domestically in only small amounts. Finally, the effective rates of protection varied slightly among different areas and different techniques, ranging from 50 to 55 percent. Considering the whole system of incentives on output and inputs, we can therefore conclude that there was a strong disincentive against rice production in Thailand.

Other important results in Table 3 are the differences between private and social profitability, which were very large in all cases under study. These differences ranged from ฿5.06 to ฿5.31 per kilogram of milled rice, about 50 percent of the f.o.b. price of rice at the time. The large difference was due to the high f.o.b. price and the export tax on rice.

Sensitivity of Domestic Resource Cost Results

The extent of comparative advantage as given by the DRC coefficients depends upon the price of rice, yield per rai, and various cost components. We analyze here the sensitivity of the DRC coefficients with respect to these variables. Since the price of rice is the most important variable in terms of its instability in the world market, we will demonstrate the relationship between the world price of rice and Thailand's comparative advantage as a major rice exporter.

DRC elasticities.—We have selected four different situations to illustrate DRC elasticities, Chainat and Nontaburi for the dry season crop, and Chainat and Singburi for the wet season crop using modern varieties on transplanting farms. The DRC elasticities presented show the percentage change in that particular variable needed to produce a one percent change in the DRC coefficient. For each variable the lower the value shown, the higher is the DRC elasticity with respect to that variable.

Various DRC elasticity values with respect to the opportunity cost of labor, land, and domestic capital, fertilizer, processing and transportation, and the yield per rai are presented in Table 4. The elasticity of DRC with respect to each variable depends upon the significance of that variable in determining the value of DRC. Because labor costs and the costs of processing and transportation are the largest cost components, it can be expected that the elasticity of DRC with respect to these costs would be highest. This expectation is confirmed by the DRC elasticities which range from 1.42 to 1.85 for the cost of labor and from 1.38 to 1.73 for processing and transportation cost. The cost of capital is next in terms of the high degree of elasticity. DRCs are more elastic with respect to fertilizer cost than to land cost for the dry season crop and vice versa for the wet season crop. Finally, the DRC elasticities are negative and very high with respect to yield per rai, ranging from -2.18 to -3.14.

TABLE 4.—DRC ELASTICITIES IN THAILAND*

Areas/techniques	Labor	Land	Domestic capital	Fertilizer	Processing and transportation	Yield
Nontaburi, second crop	1.42	17.99	3.35	15.85	1.59	-2.30
Chainat, second crop	1.46	23.70	3.75	19.82	1.73	-2.18
Chainat, first crop, modern varieties on transplanting farms	1.85	7.01	3.19	201.20	1.38	-3.14
Singburi, first crop, modern varieties on transplanting farms	1.79	7.09	3.33	222.20	1.38	-2.96

*See Appendix and Tables A-2, A-3, A-12, A-13.

The two provinces producing the dry season crop have very similar values of DRC elasticities, with almost the same ranking with respect to each variable beginning with the cost of labor, then processing and transportation, yield per rai, capital, fertilizer, and land. For example, the DRC elasticity for labor costs in the Chainat dry season crop indicates that if the cost of labor increased by 1.46 percent, the DRC would increase by 1 percent.

Both provinces producing the wet season crop also have very similar patterns of DRC elasticities, running from the cost of processing and transportation to labor, yield per rai, capital cost, land, and fertilizer. DRCs are particularly insensitive to the cost of fertilizer for the wet season crop due to the relatively small usage of fertilizer. For example, the cost of fertilizer would have to increase by 201.2 percent in Chainat before the DRC would increase by 1 percent.

DRC elasticities were different between dry season and wet season crops particularly with respect to the costs of land and of fertilizer. For the wet season crop the elasticities with respect to land ranged from 7.01 to 7.09, whereas they were between 17.99 and 23.70 for the dry season crop. The opportunity cost of land was rather high during the wet season because of the possibility of growing sugarcane in the area. In the case of the cost of fertilizer the elasticities were 15.85 to 19.82 for the dry season crop, and 201.2 to 222.2 for the wet season crop. The results show clearly that fertilizer was significant for the dry season crop and that farmers used a very small amount of fertilizer during the wet season.

Relationship between comparative advantage and the world price of rice.—To demonstrate the relationship between comparative advantage and the world price of rice, we have selected the dry season crop in Nontaburi and the wet season crop in Singburi (modern varieties), the provinces which show the highest degree of efficiency in rice production. We have constructed two diagrams with the world price of rice on the horizontal axis and the ratio of DRC to the shadow price of foreign exchange on the vertical axis. The ratios were obtained by calculating DRCs at various levels of the world price of rice.

Chart 1 contains two graphs, N and S, one for the dry season crop (Nontaburi), and another for the wet season crop (Singburi).[14] For the dry season crop the critical minimum world price was about $180 per metric ton. The wet season crop was more efficient and would be profitable at a world price as low as about $125 per metric ton.

These results depend upon the shadow exchange rate used. If the shadow exchange rate were not so high as the estimated rate of ฿25.8 per US$1, then the critical minimum world price would be higher. To illustrate, suppose the official exchange rate is in fact the shadow exchange rate; S and N would then be replaced by S' and N'. In this event, the critical minimum world price would be about $150 per metric ton for the wet season crop and $220 per metric ton for the dry season crop. In view of the likely inaccuracy of the calculated shadow exchange rate, it is therefore appropriate to state the critical minimum world price of rice in

[14] See the numerical results in the Appendix. As explained therein, we have calculated low and high DRC coefficients. But since the low coefficients seemed to be unrealistically low, we have demonstrated only the high coefficients here. These estimates are considered more conservative and accurate.

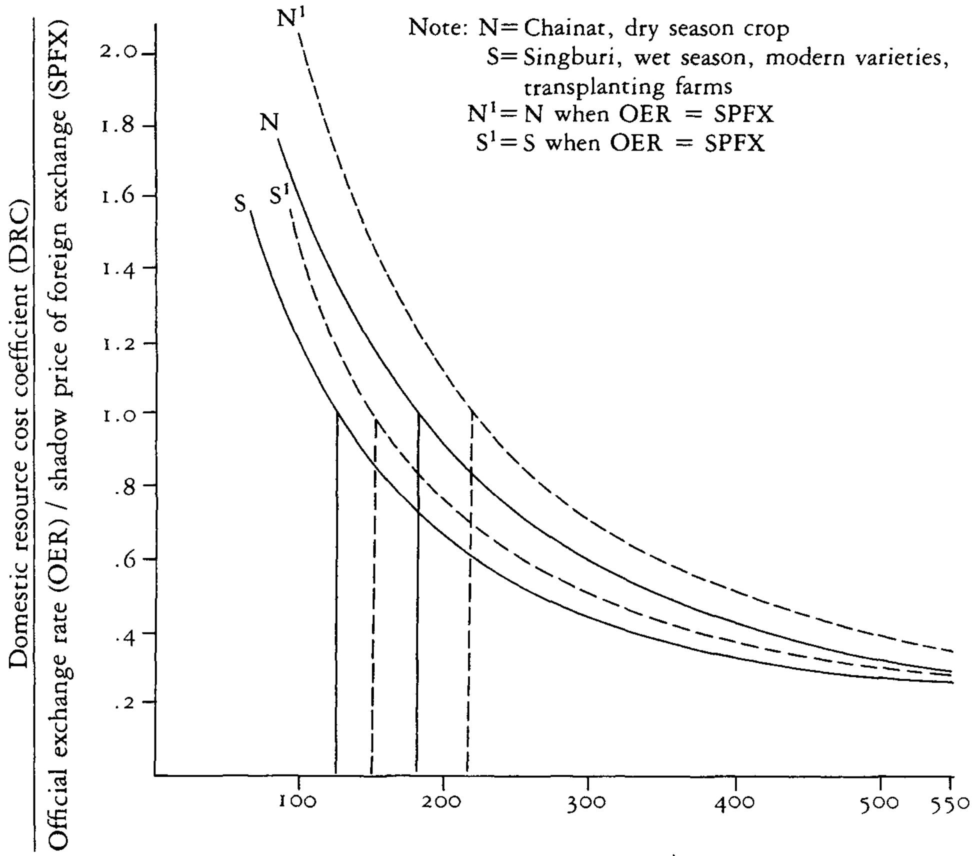

CHART 1.—WORLD PRICES OF RICE (*US$/metric ton*)

a range of $125-150 per metric ton for the wet season crop and $180-220 per metric ton for the dry season crop.

CONCLUSIONS AND POLICY IMPLICATIONS

The most important result of this study, though perhaps an obvious one, is that Thailand has a very strong comparative advantage in the production of rice.[15] What was not obvious was that the comparative advantage was so strong that the DRC at the shadow exchange rate was as low as .23 and that the highest value was only .37. It thus can be said that Thailand has a comparative advantage in rice production in both wet and dry season crops, in modern and traditional varieties, in transplanting and broadcasting farms, and finally in the areas of the central plain as well as of the North.

Second, the production of rice exhibits both private and social profitability, although it was not clear from our results at what level of production the private profitability lay.

Third, the taxation system has discriminated against the expansion of rice production, as indicated by the negative effective rates of protection. Since other crops (except for sugar which became subject to export taxes only in 1974) were not subject to the same extent of taxes, it can be concluded that the strong discrimination against rice acted as an incentive to cultivate other crops.

Fourth, changes in cost components might be expected to have different effects on the levels of DRC in different provinces and technologies. While the increase in labor costs would have a strong effect on DRCs in all cases, the increase in fertilizer cost would mostly affect DRCs of the dry season crop. The increase in capital cost through mechanization, for example, would also generally have a strong effect on DRCs.

Fifth, with the "critical minimum" world price of rice known we can determine Thailand's position in relationship to that level, assuming a constant cost structure. In 1974 the world price of rice was more than double the critical minimum price, indicating that Thailand has a comfortable comparative advantage.

Five policy implications result from this study. First, the most obvious policy implication is that the expansion of rice production, by increasing areas and/or production of the second crop or the first crop, is justified on grounds of comparative advantage, unless world prices for rice fall to very low levels. But since modern varieties on transplanting farms yielded particularly low DRCs, the adoption of modern varieties might well be encouraged.

Second, because of the existence of private profitability, the expansion of rice production should be possible. With a large difference between private and social profitability, an effort might be made to narrow the gap.[16] The likely outcome

[15] The conclusions and recommendations to be made in this paper are based on a partial analysis. It is not known to what extent the results would be affected if the interactions among variables were taken into consideration. Interpretation of our results should thus be made with this limitation in mind.

[16] Of course it is well known that the large difference was due to the abnormally high price of rice in 1974. Since then the price has declined to a more normal range of $250-300 per metric ton.

would be a higher private profitability, thus providing an incentive to expand rice production.

Third, the high degree of negative nominal and effective protection on rice production resulting from the taxation system distorts resource allocation. A more appropriate taxation system would provide a more uniform incentive for all crops. Obviously, this uniformity is difficult to accomplish in the case of agricultural products whose prices fluctuate frequently.

Fourth, the knowledge of DRC elasticities with respect to various cost components and yield can assist evaluation of rice development programs, when used in conjunction with technological parameters.

Fifth, the critical minimum price of rice should be assessed frequently so that we know the range of prices within which Thailand would continue to have comparative advantage.

CITATIONS

1 Narongchai Akrasanee and Atchana Wattananukit, "A Domestic Resource Cost Study of Rice Production in Thailand," Department of Economics, Thammasat University, October 1975.

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3 Scott R. Pearson, Narongchai Akrasanee, and Gerald C. Nelson, "Comparative Advantage in Rice Production: A Methodological Introduction," *Food Research Institute Studies*, *XV*, 2, 1976.

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APPENDIX

CALCULATION OF COSTS OF PRODUCTION AND INDICATORS OF PROFITABILITY, PROTECTION, AND DOMESTIC RESOURCE COST

Cost of Processing and Transportation

Data available are costs of production at the farm level and yield of paddy per rai. Since we required costs per unit of milled rice the processing and transportation cost had to be estimated. This was obtained by first converting the processing and transportation cost per kilogram of milled rice shown earlier per kilogram of paddy. Then for each area we multiplied it by yield per rai. Yields per rai were from the *Agricultural Survey of 1973/74*. The results are shown in Table A-1.

Costs of Tradable Inputs, Domestic and Foreign

Following the methodology outlined earlier and basic data in Akrasanee (*1*), costs of tradable inputs were calculated. Seed was treated as traded, and thus appeared as foreign cost. Fertilizer, insecticide, and fuel were fully traded. Costs paid by farmers were divided into four components: material (foreign), added cost (domestic), taxes on import (tariff and business tax on import), and business tax

TABLE A-1.—DOMESTIC PROCESSING AND TRANSPORTATION COST PER RAI*
(*in bahts*)

Areas/techniques	Processing and transportation cost per rai	
	Labor	Capital
Second crop		
Nontaburi	411	274
Chainat	477	318
Ayudhya	444	293
Supanburi	362	241
Chachoengsao	329	212
Chiengmai	296	197
Nakorn Nayok	329	220
Pathumtanee	370	247
First crop		
Traditional varieties, transplanting		
Chainat	344	229
Singburi	395	263
Modern varieties, transplanting		
Chainat	498	332
Singburi	512	341
Traditional varieties, broadcasting		
Chainat	336	224
Singburi	331	220

*See Appendix text.

on domestic production. We grouped insecticides and fuel together and called them "other." To this category was added import content of the service of tractor and farm machinery. The remaining other costs were treated as domestic costs. Finally, there was the foreign component of the cost of processing and transportation.

Market and Social Costs of Rice Production

Factor costs and costs of tradable inputs were calculated for 14 cases, both at market and social prices. Factor costs include costs of labor, land, domestic capital, and an item which was the summation of domestic costs of processing and transportation, fertilizer, other tradable inputs, and service of tractor and agricultural machinery. This item was then allocated to labor and capital costs. Costs of tradable inputs include seed, fertilizer, other inputs, and the foreign cost of processing and transportation. Finally, tariffs, or import taxes, as well as business tax of domestic production, of all items were added up. The results are shown in Tables A-2 through A-15.

TABLE A-2.—COST OF PRODUCTION FOR PADDY FROM NONTABURI, SECOND CROP WITH 500 KILOGRAMS PER RAI YIELD*

(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	363.22	363.22	481.72
Land	66.40	66.40	
Capital			308.72
Return	33.49	33.49	
Depreciation (on nontraded only)	15.64	15.64	
Nonallocated	790.44	790.44	
Tradable Inputs			
Seed	22.50	80.10	
Fertilizer	198.63	198.63	
Other	72.46	72.46	
Processing and transportation	170.00	170.00	
Taxes: Tariffs	8.18		
Other	5.12		

*See Appendix text.

TABLE A-3.—COST OF PRODUCTION FOR PADDY FROM CHAINAT, SECOND CROP WITH 580 KILOGRAMS PER RAI YIELD*

(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	512.93	512.93	527.03
Land	66.40	66.40	
Capital			350.49
Return	45.98	45.98	
Depreciation (on nontraded only)	9.33	9.33	
Nonallocated	877.52	877.52	
Tradable Inputs			
Seed	25.56	88.57	
Fertilizer	197.27	197.27	
Other	50.03	50.03	
Processing and transportation	197.20	197.20	
Taxes: Tariffs	6.98		
Other	1.97		

*See Appendix text.

TABLE A-4.—COST OF PRODUCTION FOR PADDY FROM AYUDHYA, SECOND CROP WITH 540 KILOGRAMS PER RAI YIELD*

(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	480.92	480.92	481.07
Land	66.40	66.40	
Capital			327.7
Return	43.30	43.30	
Depreciation (on nontraded only)	3.20	3.20	
Nonallocated	808.77	808.77	
Tradable inputs			
Seed	28.65	99.27	
Fertilizer	211.23	211.23	
Other	43.83	43.83	
Processing and transportation	183.60	183.60	
Taxes: Tariffs	6.95		
Other	1.95		

*See Appendix text.

TABLE A-5.—COST OF PRODUCTION FOR PADDY FROM SUPANBURI, SECOND CROP WITH 440 KILOGRAMS PER RAI YIELD*
(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	400.62	400.62	428.76
Land	66.40	66.40	
Capital			268.20
Return	35.54	35.54	
Depreciation (on nontraded only)	18.43	18.43	
Nonallocated	696.96	696.96	
Tradable inputs			
Seed	20.45	70.86	
Fertilizer	133.67	133.67	
Other	49.98	49.98	
Processing and transportation	149.60	149.60	
Taxes: Tariffs	6.18		
Other	2.35		

*See Appendix text.

TABLE A-6.—COST OF PRODUCTION FOR PADDY FROM CHACHOENGSAO, SECOND CROP WITH 400 KILOGRAMS PER RAI YIELD*
(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	407.28	407.28	364.70
Land	40.04	40.04	
Capital			243.60
Return	33.70	33.70	
Depreciation (on nontraded only)	22.31	22.31	
Nonallocated	608.30	608.30	
Tradable inputs			
Seed	26.12	90.51	
Fertilizer	109.72	109.72	
Other	58.37	58.37	
Processing and transportation	136.00	136.00	
Taxes: Tariffs	6.00		
Other	2.02		

*See Appendix text.

TABLE A-7.—COST OF PRODUCTION FOR PADDY FROM CHIENGMAI, SECOND CROP WITH 360 KILOGRAMS PER RAI YIELD*

(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	483.23	483.23	314.58
Land	39.36	39.36	
Capital			206.94
Return	36.48	36.48	
Depreciation (on nontraded only)	3.58	3.58	
Nonallocated	521.52	521.52	
Tradable inputs			
Seed	19.73	68.36	
Fertilizer	40.84	40.84	
Other	22.60	22.60	
Processing and transportation	122.40	122.40	
Taxes: Tariffs	2.37		
Other	.89		

*See Appendix text.

TABLE A-8.—COST OF PRODUCTION FOR PADDY FROM NAKORN NAYOK, SECOND CROP WITH 400 KILOGRAMS PER RAI YIELD*

(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	448.20	448.20	363.62
Land	66.40	66.40	
Capital			241.82
Return	36.47	36.47	
Depreciation (on nontraded only)	23.86	23.86	
Nonallocated	505.44	605.44	
Tradable inputs			
Seed	22.76	78.86	
Fertilizer	110.30	110.30	
Other	39.46	39.46	
Processing and transportation	136.00	136.00	
Taxes: Tariffs	4.91		
Other	1.77		

*See Appendix text.

TABLE A-9.—COST OF PRODUCTION FOR PADDY FROM PATHUMTANEE, SECOND CROP WITH 450 KILOGRAMS PER RAI YIELD*

(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	504.57	504.57	435.13
Land	66.40	66.40	
Capital			274.20
Return	40.04	40.04	
Depreciation (on nontraded only)	12.40	12.40	
Nonallocated	709.33	709.33	
Tradable inputs			
Seed	22.55	78.14	
Fertilizer	182.64	182.64	
Other	41.05	41.05	
Processing and transportation	153.00	153.00	
Taxes: Tariffs	5.90		
Other	1.31		

*See Appendix text.

TABLE A-10.—COST OF PRODUCTION FOR PADDY FROM CHAINAT, FIRST CROP WITH 418.30 KILOGRAMS PER RAI YIELD, TRADITIONAL VARIETIES, TRANSPLANTING FARMS*

(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	138.70	138.70	357.71
Land	177.80	177.80	
Capital			251.30
Return	18.29	18.29	
Depreciation (on nontraded only)	4.80	4.80	
Nonallocated	609.01	609.01	
Tradable inputs			
Seed	23.16	80.25	
Fertilizer	3.86	3.86	
Other	40.27	40.27	
Processing and transportation	142.20	142.20	
Taxes: Tariffs	3.16		
Other	1.82		

*See Appendix text.

TABLE A-11.—COST OF PRODUCTION FOR PADDY FROM SINGBURI, FIRST CROP WITH 480.3 KILOGRAMS PER RAI YIELD, TRADITIONAL VARIETIES, TRANSPLANTING FARMS
(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	141.69	141.69	409.16
Land	177.80	177.80	
Capital			272.35
Return	14.83	14.83	
Depreciation (on nontraded only)	4.80	4.80	
Nonallocated	681.51	681.51	
Tradable inputs			
Seed	22.28	77.20	
Fertilizer	6.78	6.78	
Other	25.91	25.91	
Processing and transportation	163.30	163.30	
Taxes: Tariffs	2.07		
Other	1.09		

*See Appendix text.

TABLE A-12.—COST OF PRODUCTION FOR PADDY FROM CHAINAT, FIRST CROP WITH 606.4 KILOGRAMS PER RAI YIELD, MODERN VARIETIES, TRANSPORTATION FARMS

(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	153.44	153.44	515.71
Land	177.80	177.80	
Capital			359.73
Return	23.23	23.23	
Depreciation (on nontraded only)	4.80	4.80	
Nonallocated	875.44	875.44	
Tradable inputs			
Seed	27.12	93.97	
Fertilizer	21.24	21.24	
Other	49.11	49.11	
Processing and transportation	206.18	206.18	
Taxes: Tariffs	3.69		
Other	2.75		

*See Appendix text.

TABLE A-13.—COST OF PRODUCTION FOR PADDY FROM SINGBURI, FIRST CROP WITH 622.3 KILOGRAMS PER RAI YIELD, MODERN VARIETIES, TRANSPLANTING FARMS*
(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	183.41	183.41	521.54
Land	177.80	177.80	
Capital			356.06
Return	19.75	19.75	
Depreciation (on nontraded only)	4.80	4.80	
Nonallocated	877.60	877.60	
Tradable inputs			
Seed	19.44	67.36	
Fertilizer	19.13	19.13	
Other	35.72	35.72	
Processing and transportation	211.58	211.58	
Taxes: Tariffs	3.00		
Other	.95		

*See Appendix text.

TABLE A-14.—COST OF PRODUCTION FOR PADDY FROM CHAINAT, FIRST CROP WITH 406.5 KILOGRAMS PER RAI YIELD, TRADITIONAL VARIETIES, BROADCASTING FARMS*
(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	86.01	86.01	347.56
Land	177.80	177.80	
Capital			237.46
Return	16.31	16.31	
Depreciation (on nontraded only)	4.80	4.80	
Nonallocated	585.02	585.02	
Tradable inputs			
Seed	38.53	133.51	
Fertilizer	.35	.35	
Other	38.49	38.49	
Processing and transportation	138.21	138.21	
Taxes: Tariffs	3.04		
Other	1.83		

*See Appendix text.

TABLE A-15.—COST OF PRODUCTION FOR PADDY FROM SINGBURI, FIRST CROP WITH 402.12 KILOGRAMS PER RAI YIELD, TRADITIONAL VARIETIES, BROADCASTING FARMS*
(bahts per rai)

Costs	Market cost	Social cost	Unspecified
Factor costs			
Labor	113.29	113.29	339.49
Land	177.80	177.80	
Capital			228.31
Return	15.94	15.94	
Depreciation (on nontraded only)	4.80	4.80	
Nonallocated	567.80	567.80	
Tradable inputs			
Seed	38.82	134.51	
Fertilizer	2.05	2.05	
Other	26.97	26.97	
Processing and transportation	136.72	136.72	
Taxes: Tariffs	2.14		
Other	1.21		

*See Appendix text.

Calculation of Indicators of Profitability, Protection, and Domestic Resource Cost

The calculation was made using information from Tables A-2 through A-15, the f.o.b. price of rice in 1974, the overall taxation on rice export, the official exchange rate of $20.40 per US$1, and the shadow exchange rate of $25.8 per US$1. Results and step-by-step calculations are shown in Table A-16.

CALCULATION OF DRC ELASTICITIES

DRC elasticities were calculated with respect to the costs of labor, land, domestic capital, fertilizer, and yield per rai.

For each cost component, a 10 percent increase was assumed. For factor costs, the increased cost was added to the total factor cost of the relevant area. A DRC coefficient at the new factor cost was obtained, from which the change in DRC coefficient was calculated. Dividing the percentage change in the factor cost under consideration by the percentage change in DRC coefficient gave us the DRC elasticity.

In the case of fertilizer, its cost was added to the cost of tradable inputs, thus reducing value added at world prices. The DRC coefficient was obtained using this new value added and the existing factor costs. The procedure described above was then applied to calculate the DRC elasticity.

Changes in the cost of processing and transportation affected both value added and factor cost. The factor cost part of the processing and transportation cost, which was estimated at 80 percent, was added to the existing factor cost. The remaining 20 percent, the tradable input part, was added to the cost of tradable inputs. (The cost was in baht per kilogram of milled rice.)

Changes in yield per rai affected average cost and value added. Using costs from Tables A-1 and A-2 through A-15, the total processing and transportation cost was adjusted for the increase in yield, also assumed to increase by 10 percent. (The processing and transportation cost considered to be factor cost was $1.37 per kilogram of paddy.) This was added to other factor costs, from which the average cost per kilogram of milled rice was obtained. For value added, the foreign part of processing and transportation cost was added to the cost of tradable inputs. The new average cost and hence value added were obtained for one kilogram of milled rice. DRC elasticity was then calculated.

CALCULATION OF DRC AT DIFFERENT HYPOTHETICAL WORLD PRICES OF RICE

Two sets of calculations were made. The high estimates were those which were adjusted for only world prices of rice and the tradable input cost of paddy which changed as the f.o.b. price of rice changed. The low estimates took into consideration the implied change in the cost of processing and transportation, since this was estimated from the 1974 f.o.b. price of rice. They were considered low estimates because the processing and transportation cost became unrealistically low at a low level of f.o.b. price of rice. They reduce factor costs much more than value added, resulting in a very low DRC coefficient.

Factor Costs at Opportunity Cost

To adjust factor costs for the cost of processing and transportation, we used the estimated proportion of 23 percent of the respective world price of rice to multiply the processing and transportation cost. This was then converted to the cost per kilogram of paddy, out of which 80 percent was considered to be factor cost. Multiplying the unit cost to paddy yield gave us the relevant processing and transportation cost. The 1974 factor cost at opportunity cost was then adjusted accordingly. When the processing and transportation cost was assumed not to change with the world price, the 1974 factor cost at opportunity cost was used.

Value Added at World Prices

Costs of tradable inputs were adjusted for paddy cost. Paddy input was valued at two-thirds of each world price of milled rice. The adjusted value was obtained by multiplying the opportunity cost of paddy at 1974 price by the ratio of the new calculated paddy price to the 1974 calculated paddy price.

The tradable input part of the processing and transportation cost was obtained for each f.o.b. price, using the proportion of 23 percent, of which 20 percent was the cost of tradable input. This cost of tradable input was deducted from the 1974 cost, following the method of estimation described above. The numerical results are shown in Table A-17.

TABLE A-16.—COSTS AND RETURNS DATA AND INDICATORS FOR THAILAND, 1974*

(Thailand bahts per kilogram, or as indicated)

Costs and return data and indicators (1)	Second crop								Traditional variety, transplanting		Modern variety, transplanting		Traditional variety, broadcasting	
	Nonta-buri (2)	Chai-nat (3)	Ayud-hya (4)	Supan-buri (5)	Cha-choeng-sao (6)	Chieng-mai (7)	Na-korn Nayok (8)	Pa-thum-tanee (9)	Chai-nat (10)	Sing-buri (11)	Chai-nat (12)	Sing-buri (13)	Chai-nat (14)	Sing-buri (15)
1. Gross output at actual market prices	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76	5.76
2. Tradable inputs, at actual market prices	1.41	1.24	1.33	1:22	1.26	.83	1.18	1.35	.77	.68	.76	.70	.81	.77
3. Value added, in actual prices [(1)-(2)]	4.35	4.52	4.43	4.54	4.50	4.93	4.58	4.41	4.99	5.08	5.00	5.06	4.95	4.99
4. Factor costs, other than capital, at actual market prices	2.53	2.88	2.88	3.05	3.05	3.35	3.29	3.35	2.43	2.24	2.09	2.13	2.26	2.35
5. Indirect taxes	.02	.004	.005	.01	.02	.01	.01	.003	.01	0	.01	0	.01	0
6. Private profitability [(3)-(4)-(5)]	1.82	1.64	1.55	1.48	1.43	1.57	1.28	1.06	2.55	2.84	2.90	2.93	2.68	2.64
7. Gross output, at world market prices	11.17	11.17	11.17	11.17	11.17	11.17	11.17	11.17	11.17	11.17	11.17	11.17	11.17	11.17
8. Tradable inputs, at world market prices	1.56	1.39	1.51	1.37	1.48	1.02	1.37	1.51	.96	.85	.92	.80	1.15	1.12
9. Value added in world market prices [(7)-(8)]	9.61	9.78	9.66	9.80	9.69	10.15	9.80	9.66	10.21	10.32	10.25	10.37	10.02	10.05
10. Domestic resource costs other than capital, at opportunity costs	2.53	2.88	2.88	3.05	3.05	3.35	3.29	3.35	2.43	2.24	2.09	2.13	2.26	2.35
11. Social profitability [(9)-(10)]	7.08	6.90	6.78	6.75	6.64	6.80	6.51	6.31	7.78	8.08	8.16	8.24	7.76	7.70

12. Domestic capital costs, at opportunity costs	1.07	1.06	1.05	1.10	1.12	.99	1.13	1.09	.99	.92	.96	.92	.95	.93
13. Net social profitability at official exchange rate [(11)-(12)]	6.01	5.84	5.73	5.65	5.52	5.81	5.38	5.22	6.79	7.16	7.20	7.32	6.81	6.77
14. Ratio of shadow price of foreign exchange (SPFX) to official exchange rate (OER)	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
15. Net social profitability at SPFX [(9)x(14)-(10)+(12)]	8.51	8.38	8.24	8.19	8.04	8.45	7.93	7.73	9.44	9.84	9.87	10.02	9.42	9.38
16. Nominal protective coefficient on output (NPCO) [(1)÷(7)]	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52	.52
17. Nominal protective coefficient on tradable inputs (NPCI) [(2)÷(8)]	.91	.89	.88	.89	.85	.81	.86	.89	.80	.80	.83	.88	.70	.69
18. Effective protective coefficient on value added (EPC) [(3)÷(9)]	.45	.46	.46	.46	.46	.49	.47	.47	.46	.49	.49	.49	.49	.50
19. Domestic resource cost coefficient (DRC) [(10)+(12)÷(9)]	.37	.40	.41	.42	.43	.43	.45	.46	.34	.31	.30	.29	.32	.33
20. Ratio of DRC to SPFX/OER [(19)÷(14)]	.29	.32	.33	.33	.34	.34	.36	.37	.26	.25	.24	.23	.25	.26
21. Yield (*kilogram of paddy per rai*)	500	580	540	440	400	360	400	450	418.13	480.30	606.40	622.30	406.50	402.10
22. Milling ratio (*kilograms of paddy per kilogram of milled rice*)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50

*See Appendix text.

TABLE A-17.—HYPOTHETICAL WORLD PRICES OF RICE AND DOMESTIC RESOURCE COST*

	Nontaburi, second crop				Singburi, modern varieties, first crop			
	High DRC		Low DRC		High DRC		Low DRC	
World price	DRC	DRC / OER/SPFX	DRC	DRC / OER/SPFX	DRC	DRC / OER/SPFX	DRC	DRC / OER/SPFX
550	.37	.29	.37	.29	.29	.23	.29	.23
450	.46	.36	.42	.33	.36	.29	.32	.26
350	.60	.47	.49	.39	.46	.37	.35	.28
250	.85	.68	.63	.50	.64	.51	.41	.33
150	1.49	1.18	1.02	.81	1.06	.84	.56	.44
100	2.05	1.62	1.43	1.13	1.59	1.26	.77	.61

*See Appendix text.