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Agricultural Incentives, Comparative Advantage and Employment in Thailand : A Case Study of Rice, Maize, Cassava and Sugar Cane

by

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Praipol Koomsup

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Abstract

The study examines the incentives and comparative advantage of Thailand's four major export crops, namely, rice, maize, cassava and sugar cane in 1977/78. Effective protective rates are estimated to quantify the degree of effective protection in the form of price incentives. Comparative advantage is represented by domestic resource costs. Labor-capital ratios, labor-land ratios, factor shares of domestic cost and factor shares of value added are calculated to indicate labor intensity and labor utilization for each crop activity.

The result indicates that the government's system of price incentives has been neutral towards the production and export of maize and tapioca products, and has discriminated heavily against the production and export of rice, and, to some extent, against sugar. It is found that the export taxes on rice were the major disincentive on rice export and production in 1977. The pattern of domestic resource cost shows the highest degree of comparative advantage in rice production, particularly in the Central Region, followed by cassava, sugar cane and maize respectively. Labor intensities are highly different both among crops and regions. The major factors affecting these intensities are the physiology of crop, the technique of production, and the institutional as well as other subjective factors. Modern techniques, represented by the use of fertilizers and pesticides, tend to allocate resources to a relatively more

capital-intensive method of production. However, modern technology could increase labor requirements if some intermediate inputs are used intensively, and if yields are increased and harvesting is not done by machines.

The government's policy against rice can perhaps be justified by the fact that crop diversification could prevent the economy from being so heavily dependent on rice, and that rice export taxes will withdraw agricultural surplus to finance government expenditure on other projects. Moreover, the cheap rice policy might be politically motivated to keep the cost of living and wages at low levels, thus tending to favor the richer urban sector.

In general, the structure of incentives tends to allocate resources to a more labor-intensive method of production. For example, the promotion of cassava production indicates an efficient way of resource allocation, judging by the high degree of comparative advantage with relatively high values of labor-capital ratio and labor share of domestic cost. The diversification of crops from activities with relatively high values of domestic resource cost (DRC) to those with lower values of DRC is employment-creating on the inter-crop basis. But in view of the fact that there are differences in DRC for the same crop grown in different areas and there are overlapped intervals of DRC among crops, it is useful to investigate in more detail the choice of crop which each area should produce to ensure efficiency in domestic factor use and maximum rural employment. The study seems to indicate that any policy measure to be adopted, either in the form of price and nonprice incentives or in the form of technical and economic assistance, must take into account regional differences, and that government policy cannot be formulated on the assumption that any of these crops has the same performance in terms of costs and yields in different producing areas of the country.

1.1.2 Data and selected production activities

The empirical analysis is mainly based on the survey data of costs and returns in the crop year 1977/78 provided by the Ministry of Agriculture and Cooperatives. It is rather unfortunate that the yields of maize and rice in some areas in that crop year were abnormally low due to droughts and floods. While data for other cost components seem reasonable, the use of 1977/78 yield data for the two crops creates a downward bias on production returns. The only and compelling reason why the yield data are used in our calculation is because the survey data for that particular year are the only set available in the detailed form which enables us to estimate important variables. However, some adjustments are made in order to portray the normal picture of production. For instance, yield data in a normal year are used for those activities which were adversely affected by weather conditions.

The information on export policy and tariffs is collected from the Ministry of Commerce and the Department of Customs respectively. Data on nonprice incentives are supplied by the Bank of Agriculture and Agricultural Cooperatives, the Market Organization for Farmers, the Royal Irrigation Department, and other organizations and government agencies.

The costs and returns data are available for <u>changwad</u> (or provinces) in about 10 agro-economic zones.[1] After discarding and adjusting activities with incomplete and unrealiable data, an attempt is made to select activities in the zones in which substantial planted areas of at least one of the four crops are located. Therefore, the selected activities should represent a set of the best possible (high-yield, low cost) production in the country for the crops. In total 20 production activities are included in the study. They are as follows:

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[1] The country is divided into 19 agro-economic zones, each of which contains provinces with similar characteristics in agro-economic factors, namely, the type of soil, rainfall, temperature, economic crops, production efficiency, the type of farm, principal sources of farm income, communication and transportation. The main purpose of the division is to determine the pattern of crops best suited for different zones. Zones 1-5 are in the Northeast, zones 9-10 are in the North, zones 17-19 are in the South, and the rest are in the Central Plain. See <u>Agro-Economic Zones for Agricultural Extension and Development</u>, the Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Bangkok, September 1972, p.1

No.	Crop	Production Technique	Cultivation Period	Changwad	Zone
1.	Rice	Transplanting	First crop(June-Jan.)	Rajburi	12
2.	"	"	" " " "	Nakorn Nayok	11
3.	"	"	" " " "	Nakorn Raj-sima	5
4.	"	Broadcasting	" " " "	Rajburi	12
5.	"	"	" " " "	Nakorn Nayok	11
6.	"	"	" " " "	Ayudhaya	11
7.	"	Transplanting	Second crop(Jan.-May)	Nakorn Pathom	11
8.	"	"	" " " "	Nakorn Raj-sima	5
9.	"	"	" " " "	Supanburi	11
10.	Maize	-	First crop(April-Sept.)	Lopburi	7
11.	"	-	" " " "	Saraburi	7
12.	"	-	First crop(May-Sept.)	Chiangrai	10
13.	"	-	" " " "	Nakorn Raj-sima	5
14.	"	-	Second Crop(Aug.-Jan.)	Nakorn Raj-sima	5
15.	Cassava	-	May - April	Cholburi	15
16.	"	-	" "	Rajburi	12
17.	"	-	" "	Nakorn Pathom	5
18.	Sugar Cane	-	March-February	Rajburi	12
19.	" "	-	May - April	Nakorn Pathom	11
20.	" "	-	May - April	Supanburi	11

CHAPTER 2

THE DESCRIPTIVE ANALYSIS OF AGRICULTURAL INCENTIVES

The incentives (and disincentives) provided by the government to the produciton of the four crops can be classified into two main categories, namely, price incentives and nonprice incentives.

2.1 Price Incentives

There are incentives which directly affect crop prices. The prices affected can be at the farm, wholesale, retail, and export levels. Price incentives are further divided into two groups, namely, taxes, and direct price support or price control. The former generally depresses farmgate prices, while the latter is designed to push up (down) farm prices, if price support (control) is used.

2.1.1 Taxes: There are several tools which the government can use to influence agricultural prices, but the most important one seems to be the imposition of taxes.

Rice: Rice is perhaps the most heavily-taxed export in Thailand. The export of rice is subject to a special export tax called "rice premium". The premium was first imposed in 1955, and has been collected by the Ministry of Commerce. The original purpose of the rice premium was to siphon off excessive profits obtained by rice exporters during the postwar period when the world prices of rice were very high. Since then, it has been used by the government as one of the instruments to regulate rice export volume and the domestic prices of rice. Changes in the premium rate have been made with a varying degree of frequency. Since 1967 it has been changed more frequently than in the past, and its changes have usually followed the changes in the world prices. (See the detail of changes in the premium rate between 1969 to 1977 in Table A.1 of appendix A.) During 1955-1965, the rice premium was also one of the main sources of government revenue, contributing to over 10% of total government revenue. After that period, its share has declined continuously, except in 1974.

The rice premium is basically a specific tax,[1] whose rate per ton of rice exports varies according to the types of exported rice. A higher premium rate is imposed on a better and thus more expensive grade of exported rice. Converted to an ad valorem tax rate, the premium rate since 1955 has ranged from 10% to 35% of world rice prices, except in a few years when the rate was reduced to a single-digit percentage. In 1977/78 --the year on which our study is based --the rice premium was between ฿700 and ฿900 per ton for 100% and 5% white rice. While the average f.o.b. price of 100% rice was around ฿ 6,139.50 per ton, the premium rate amounted to over 11% of the world price. Undoubtedly, a tax of this magnitude is bound to be controversial; and the rice premium has indeed been

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[1] The rice premium was changed to an ad valorem tax during the period 1967-1969.

subject to several discussions and debates. A number of studies[1] have shown that the rice farmers bear most of the burden of this tax. Most economists agree that it depresses the farmgate prices of rice. Therefore, we would expect to find the rice premium to be one of the factors which greatly influence the degree of disincentive in rice production.

Since 1962, rice exporters have had to sell to the government rice of certain grades at the amount expressed as some percentages of rice to be exported. The purpose of this so-called "rice reserve requirement" is to ensure sufficient supply of rice for domestic consumption. The percentage and grade of required rice vary according to conditions in the domestic and world markets. For instance, in January 1976 when the world demand for Thai rice was rather weak, the government abolished the rice reserve requirement. In October 1976 when the market price of rice started to climb the government reintroduced to reserve scheme by requiring exporters to sell both 5% and 15% white rice to the government. In 1977. the average price paid by the government for the reserve rice was about 60% of the f.o.b. price. (See changes in the rice reserve

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[1] For example, see Melvin Wagner and Sopin Tongpan, "The Structure of Thai Rice Prices: Some Preliminary Findings," Proceedings of the Fourth Conference on Agricultural Economics, (Kasetsart University, Bangkok, 1965); and Dan Usher, "The Economics of the Rice Premium," Bangkok, undated. (mimeographed.)

requirement during 1973-1977 in table A.2 of appendix A.) Because the reserve-rice prices paid by the government are always lower than the prevailing wholesale market prices, it is legitimate to regard the losses made by the exporters from this mandatory sale as a kind of export tax. In 1977, additional amounts of rice have to be sold by the exporters to the government for rice export on the government-to-government basis. The prices paid to the exporters for this purpose are also lower than the wholesale prices. In 1977, the prices were about 70% of the f.o.b. price. Therefore, more export tax is paid by the exporters in the form of losses made on government rice export.

Rice export is also subject to other relatively minor taxes, namely, an export duty, business and municipal taxes, and an income tax. Their rates are relatively constant, and altogether they amount to 7.4% of the f.o.b. price.

When the rice premium, the tax-equivalent of losses in rice reserve requirement and government rice, and other taxes are combined, the total amount of taxes paid in 1977 by the rice exporters is about ฿1720 per ton, or 28% of the average world price in that year.[1]

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[1] The calculation of total export taxes on rice is shown in detail on pages 29-30 when the private returns on rice production are estimated.

Sugar cane: Tax policy on sugar export has undergone changes through time. In the early 1960's, export of sugar was encouraged by government subsidy given to exporters, and protection was given to sugar producers by a 9.5% tariff rate on imported sugar. As a result, several new sugar mills were established and the planted area of sugar cane was expanded drastically. These policy measures were terminated when there was an oversupply of sugar in the later period.

The period of 1972-75 was characterized by a world-wide sugar shortage caused mainly by production failures in the world's major sugar producing countries. In 1972 Thailand's sugar cane production dropped due to serious droughts. In order to solve the problem of domestic sugar shortage the government briefly imposed an export ban of white sugar in 1973. In 1974 when the world price of sugar skyrocketed, a "progressive-rate premium" was imposed on sugar export. (Changes in the sugar premium rate are shown in table A.3 of appendix A.) The main purpose of the sugar premium was to divert sugar exporters' excessive profits to the government treasury since there was a substantial difference between the domestic and world prices of sugar.[1] In 1976-77 when the world price of sugar came tumbling down, the government

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[1]The difference is partly due to the fact that the domestic price of sugar has been controlled by the government. See details on this in the later section of price support and price control.

started subsidizing the sugar which is exported at a certain low level of price. The business tax on sugar export was reduced from 7.7% to 1.65% of the f.o.b. price in 1976 to help sugar exporters. Since the world price of sugar in 1977 was never higher than the floor price (฿6,670 per ton), beyond which the premium was imposed on sugar export, the sugar premium was not paid in that year.

Maize and tapioca products: There is no significant tax on exports of maize and tapioca products. The only taxes exporters have to pay are business and municipal taxes which amount to a little over 2% of f.o.b. prices. There are export quotas in various forms imposed on maize, but their effects on world prices are likely to be insignificant.

2.1.2 Price Support and Price Control: Rice and sugar are two major commodities which are subject to either price control or price support or both by the government at one time or another. In general, price support is given at the farm level, while prices are controlled at the wholesale and retail levels. For instance the minimum farmgate price of 5% paddy was set at ฿2,500 per kwien[1] in 1975/76. But due to the lack of administrative capacity, storage facilities and finance, the price supporting program for rice was far from successful. Even when a lower guarantee price was subsequently used, the program was effective only in few localities.[2]

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[1] One kwien of paddy weighs about one metric ton.

[2] See the evaluation of the price supporting program for rice in The Situation of Agriculture in Thailand, (in Thai), The Bank of Thailand, Department of Economic Research, Bangkok, 1977.

In the case of sugar cane, the government fixed a minimum millgate price at ฿300 per ton in 1974. The sugar program was also unsuccessful because of the difficulty in determining the grade of sugar cane, the shortage of government funds and manpower, and the claim by sugar producers that the minimum price of sugar cane pushed up their unit production cost to the levels higher than the controlled prices of their sugar products in the domestic market.

As basic food items, the domestic prices of rice and sugar are legally controlled by the government. For example, in 1974/75 white sugar could not be sold for more than ฿4 and ฿4.50 per kilogram at the wholesale and retail level respectively. In 1976/77 the price ceilings were raised by ฿1 to assist both sugar mills and cane growers. Maize and tapioca products are relatively free of any government intervention in price determination, since they are nonfood commodities and their domestic consumption, relative to export, is not very significant.

2.2 Nonprice Incentives

Though not directly affecting crop prices, the nonprice incentives influence producers' income aminly through their production costs and physical returns in the form of changes in crop yields. These incentives include the subsidies on fertilizers and other inputs, agricultural credit subsidy, irrigation, and provision of such infrastructure as roads, bridges, and electricity.

2.2.1 Fertilizer subsidy: The use of fertilizers per arable land area and per capita in Thailand is still very low when compared with other countries in Asia. For instance, while Thailand used 11 kilograms of fertilizers in a hectare of arable land in 1974/75, the figures for Japan, South Korea, and Malaysia are 432,358, and 59.4 respectively.[1] Nevertheless, fertilizer use in Thailand has steadily increased during the past two decades, and there was a fivefold increase in the quantity of fertilizer consumed during the period 1966-1977. (See data on the quantity of imported and locally produced fertilizers in Thailand in table A.4 of appendix A.)

The rate fertilizer application varies among crops. As far as the four crops are concerned, table 2.1 shows that in 1973/74 sugar cane and second crop rice are the heaviest users of fertilizers. Nonglutinous rice, both first and second crops, uses more fertilizers than glutinous rice, maize, and cassava. Therefore, any benefit from fertilizer subsidization by the government is likely to be in favor of the growers of second crop nonglutinous rice and sugar cane.

The government started subsidizing the use of fertilizers in 1955 when it established a program of providing

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[1] The figures are quoted from Food and Agriculture Organization, Production Year Book, (Rome), 1974, 1975.

TABLE 2.1

THE RATE OF FERTILIZER APPLICATION FOR RICE, MAIZE, CASSAVA, AND SUGAR CANE, 1973/74

Unit: kg./rai

Crop	Consumption of Fertilizers Per Cultivated Area	Consumption of Fertilizers Per Applied Area
Nonglutionous rice (first crop)	5.20	9.96
Glutinous rice	2.78	5.13
Nonglutinous rice (second crop)	9.00	33.14
Maize	0.06	8.34
Cassava	1.11	6.88
Sugar Cane	22.91	29.18

Source: Division of Agricultural Economics, Fertilizer Report (in Thai), April, 1978, p.7

fertilizers to farmers on credit at a fixed price of two baht per kilogram. The repayments were allowed to be made after harvesting. The program was mainly intended fro farmers in the poor land of the North and Northeast regions. The fertilizers subsidized by the government in 1955 amounted to 10% of the total fertilizers used in that year. In later years, however, the percentage of subsidized fertilizers rapidly declined to less than 1%. It was not until 1966 that the program was revitalized and the fertilizer credit policy was implemented by the Market Organization for Farmers (MOR) and the Agricultural

CHAPTER 1

INTRODUCTION

One of the most significant changes in the Thai economy in the past two decades is the transformation of its agricultural sector. Thailand has changed from a mono-culture agricultural economy dominated by rice into a more diversified agriculture producing more kinds of products for foreign markets. This shift was the result of the combined effect of pressure on rice prices and of greatly improved transport and irrigation facilities provided by the government. Emphasis on the diversification of agriculture was clearly stated in Thailand's first national economic plan of the 1961-1966 period. The following economic plans of 1967-1971 and 1972-1976 also expressed the need of greater diversification.

Yet while the diversification process has been going on, there are hardly any attempts to seriously study and evaluate its causes and consequences.[1] There seems to be a gap between policy implementation and academic research in this regard. Our study is intended to fill that gap by trying to examine the relationship among agricultural incentives (or disincentives), comparative advantage, and employment in some of the major export crops in Thailand.

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[1] On the relationship between export diversification and instability in Thailand, see Praipol Koomsup, Export Instability and Export Diversification: A Case Study of Thailand. Unpublished Ph.D. dissertation, Yale University, 1978.

TABLE 2.2

THE COMPARISON OF 16-20-0 FERTILIZER PRICES PURCHASED IN CASH AND ON CREDIT FROM VARIOUS SOURCES, 1972-1977.

Unit: baht/kg.

Source	1972	1973	1974	1975	1976	1977
MOF						
Cash	n.a.	n.a.	n.a.	3.80 (24.00)	2.23 (41.01)	2.60 (13.33)
Credit	n.a.	n.a.	n.a.	n.a.	2.40 (46.90)	2.80 (22.22)
ACFT						
Cash	2.37 (2.07)	2.11 (37.39)	4.68 (15.52)	4.56 (8.80)	3.05 (19.31)	n.a.
Credit	n.a	n.a	n.a	n.a	3.14 (30.53)	n.a
Private dealers						
Cash	2.42	3.37	5.54	5.00	3.78	3.00
Credit	3.54	3.81	6.90	6.72	4.52	3.60

Note:

Figures in parentheses are subsidy rates which equal the differences between the prices charged by private dealers and the prices charged by MOF or ACFT expressed as percentages of the former.

Source: Division of Agricultural Economics, Fertilizer Report, (in Thai), April, 1978, pp. 17-18.

the MOF higher than that by the ACFT; and the subsidy for fertilizers sold on credit was greater than that for fertilizers sold on cash, probably due to the fact that interest rates charged by the MOF and the ACFT were lower than those charged by private merchants.

the production of different crops and in different regions of the country.

Since fertilizers have not been widely used in the Thai agricultural sector, and less than half of fertilizers used in the country has been subsidized, it is likely that the fertilizer subsidization policy has had little impact on agricultural production, at least as far as the four crops are concerned. It seems that the kind of fertilizers subsidized by the government are mainly for second crop paddy and sugar cane. Therefore most benefit from this policy seems to go to sugar cane growers and rice farmers in the irrigated central plain areas where two crops of rice can be grown.

2.2.2 Credit subsidy : Credit subsidy given by the government to agriculture has recently become a factor which increasingly provides incentive to the Thai farmers. This is significant in view of the fact that most farm households are in debt of various forms. Moreover, as more advanced techniques are used in crop cultivation, credit will be one of the factors needed for the purchase of modern inputs, e.g. tractors, mechanical threshers, fertilizers and pesticides.

Two studies are cited here to give a picture of agricultural debt and credit situation in 1971/72 and 1975/76[1].

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[1] The 1975/76 situation is described in Pracherd Sinsap and Sri-On Somboonsap, Problems and the Behavior of Private Investment in Agricultural Sector in Selected Regions of Thailand, (in Thai), Economic Research Report No.2102, Faculty of Economics and Business Administration, Kasetsart University, April 1978. In this study, a sample of 2,246 farm households was selected from 20 provinces in different regions (except the Northeast and the South) of Thailand for the crop year 1975/76. The information on debt and credit in 1971/72, is given in Division of Agricultural Economics, Debt Situation of Farmers in 1971/72, Ministry of Agriculture and Cooperatives, Bangkok, 1975. The latter covers the whole country.

In 1971/72 it is found that about one-third of farm families in the whole country were in debt, with the highest percentage of debt-ridden families in the Central Region and the lowest in the North and the South. The national average debt per family was ฿3,831, with the highest amount in the Central Region and the lowest in the Northeast. The Pracherd-Sri-On study indicates that more than half of selected farm households were in debt in 1975/76, with the average debt per household of ฿6,732.

Both studies show that at least half of farmers' debts came from noninstitutional sources. In 1971/72 nearly 80% of farm borrowings in the Central Region were from noninstitutional sources, the highest percentage in the country. The results in both studies indicate that the most important noninstitutional lenders of farm loans were merchants, neighbors and relatives, who charged the interest rates ranging from 18%-34% per annum. Most of the institutional lendings to the farm sector originated from two sources, namely, the Bank of Agriculture and Agricultural Cooperatives (BAAC), and agricultural cooperatives, both of which are financed mainly by government budget. In the past three years private commercial banks have been urged by the government, mainly through the Bank of Thailand, to expand their credit to agriculture. This has been done by the government setting a target in terms of a percentage of total bank deposit to be loaned to the agricultural sector. Consequently, the share of commercial banks' lending in agriculture has recently increased, and their share is probably about 10% of total agricultural credit. Since all institutional lenders, by law, have to charge 12% per annum which is substantially lower than noninstitutional rates, credit financed by the government through BAAC and agricultural cooperatives can be considered a government subsidy on farmers' borrowings.

A rough measurement of credit subsidy can be made by comparing the actual interest payments on loans from institutional sources with the interest payments a farmer has to pay if he borrows the average amount of loan from noninstitutional lenders. With 64% of the average borrowing of ฿3,831 and 49% of the average debt of ฿6,732 in 1971/72 and 1975/76 respectively, and the average annual interest rates of 26% and 12% charged by noninstitutional and institutional lenders respectively, the credit is estimated to be about ฿343 and ฿462 in 1971/72 and 1975/76. These amount to 8.95% and 6.86% of the average borrowings in 1971/72 and 1975/76 respectively.

Due to lack of information, it is not possible to indicate the distribution of agricultural credit subsidy among different regions in Thailand. But it is likely that the Central Region would have received most benefit from this government measure, since it is the most commercialized area and it is the region where most agricultural cooperatives, lending institutions and their branches are located.

It is estimated that about 10%-15% of all farmers benefited from government credit subsidy in 1975.[1] There are various reasons why the distribution of government agricultural credit has not reached the majority of the farmers. One of the important factors which make it difficult for most farmers to benefit from subsidized credit is the fact that there are stringent rules and regulations for institutional borrowing. For instance, to be eligible for credit, the BAAC stipulates that its customers have to earn reasonable income from the selling of their agricultural products, and that each farmers' group applying for loans should not have landless members more than one third of the total members. Moreover, land ownership is also a condition to be eligible for membership in agricultural cooperatives. It is therefore usual to find that most of the BAAC's customers are rather well-to-do farmers whose number accounts for a small percentage of the total, and whose average land holding is larger than the national average.

The figures in table 2.3 indicate that at least 70% of subsidized short term loans from the BAAC were made by the growers of the four crops under study. The total amount of such loans increased over three fold in 1976, as compared with the previous eight-year period (And the amount for every crop was significantly boosted in that year.) While the percentage shares of these short term loans for maize, cassava

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[1]See Pracherd Sinsap and Sri-On Somboonsap, ibid, p. 123.

TABLE 2.3

THE AMOUNT AND PERCENTAGE OF SHORT TERM LOANS FROM THE BANK OF AGRICULTURE AND AGRICULTURAL COOPERATIVES, CLASSIFIED BY CROPS

Crop	Amount (million baht)		Percentage	
	1967-75	1976	1967-76	1976
Rice	1,003.2	3,449.1	51.52	53.15
Maize	186.6	602.2	9.58	9.28
Cassava	149.5	312.2	7.67	4.81
Upland crops (including sugar cane)	366.4	1,052.2	18.81	16.21
Others	241.8	1,073.6	12.42	16.55
Total	1,947.5	6,489.3	100.00	100.00

Source: The Bank of Agriculture and Agricultural Cooperatives, Annual Report, 1978.

and sugar cane decreased slightly in 1976, the share of rice improved from 51.52% of the total in the 1967-75 period to 53.15% in 1976. It appears that most subsidized loans are directed towards the rice sector. But when it is recognized that the share of rice in terms of production value, planted area and the number of growers is at least 60% of the agricultural sector, it is likely that the benefits received by the rice farmers from agricultural credit subsidy, estimated on the per planted area or per household basis, are proportionally less than the other three crops.

2.2.3 Irrigation and other infrastructures: The irrigation projects since the early 1960's have been concentrated in the Central Region which is the country's major rice-producing area. The first large-scale government irrigation project is the Great Chao Phya Project, involving flood control, irrigation and drainage for both banks of the Chao Phya River in the Central Plain. There are altogether three main dams in the projects, namely, the Chainat Dam, the Bhumipol Dam, and the Sirikit Dam. The project covers approximately,7.2 million rail of rice area in seven provinces in the Central Plain. Irrigation projects in other regions, namely, the North, the South, the Northeast, and the West, were started after the Great Chao Phya Project, and most of their major dams are still under construction.

Even in the Great Chao Phya Project where all dams were completed, water control and distribution are still not effective because ditches, dikes and other irrigation and drainage facilities at the farm level are not widely available. However, as far as incentives and benefits from irrigation are concerned, only the Central Plain seems to be the only region that benefits significantly from the government.

The benefits of irrigation in the Central Region can be reflected in at least four effects: the reduction in the damage area of cultivation, changes in techniques of crop production, the frequency of crop cultivation, and the increase in yield per rai.

According to Leslie Small,[1] irrigation in the Central Region has enabled rice farmers to change their cultivation technique from broadcasting to transplanting. Partly as a result of this, the average yield of rice has increased from 262 kg./rai in the 1955-1962 period to 325 kg./rai in the 1963-1969 period - an increase of about 24%. Indeed, the yield increase is due to other factors, e.g., the application of fertilizers and insecticides, the use of high yielding varieties, but they are complimentary to irrigation. Small's rough estimation indicates that about 15% of the total increase in yield could be directly attributed to water control. Irrigation also enables rice farmers in some areas of the Central Region to grow rice twice a year. Though these two-crop areas are still small relative to the rainfed areas, their second crop rice production has continuously increased since water control was made possible by the irrigation project.

Most irrigation projects have so far been designed to benefit rice producers. But as more dams in the regions other than the Central Region are to be completed in the future, the upland crops such as maize, cassava and sugar cane will increasingly receive positive effects from proper flood control and water drainage.

Other infrastructures also contribute to economic incentives for crop production. The most notable and visible infrastructure is the development of road and highway systems over the countryside.

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[1] Leslie E.Small, "Economic Evaluation of the Development of Water Control in the Northern Chao Phya Region: Some Preliminary Results," Staff Paper No. 4, Department of Agricultural Economics, Kasetsart University, Bangkok, August, 1971.

While most of the major national highways were completed during the First and Second Social and Economic Development Plans, the Third Plan (1972-1976) emphasized on developing farm-to-market road networks consisting of feeder roads. Rural and local roads increased from 50% of the total road network in 1971 to 59% in 1975. Thailand had 145 meters of road per one square kilometer of cultivated land in 1975. Though the increase was substantial, the figure is far below the World Bank standard of 1500 meters.

Requirements for additional roads are not uniform for all regions of the country. In the Northeast the greatest need is for rehabilitation of rural roads. In the South and Southeast all-weather roads are required to bring rubber and fruits to the market throughout the years In addition, penetration roads are to be built in specific areas to open up potential agricultural areas.

Transportation facilities such as roads and highways are important for cash crop production because they lower the marketing costs of agricultural products, and thus increase the profit margins of the growers. While the role of these facilities in providing incentives to the production of the four crops is significant, it is beyond the scope of this study to estimate their contribution to incentives in crop production. In fact, for most nonprice incentives, we can only note their existence and describe them, without quantifying their effects on the four crops. Therefore, the unavoidable exclusion of these incentives from our subsequent calculation can lead to the underestimation of some indicators, e.g. the effective protective rate and the domestic resource cost.

CHAPTER 3

Values and Costs of Crop Production

Private and social values and costs of production are to be determined in order to calculate the degree of profitability and protection, and the domestic resource costs of the four crops being examined. For most variables mentioned below, attempts have been made to use the 1977/78 data in our calculation. But in some cases, up-to-date data are not available, and thus we have to use the latest available data which pertain to the pre-1977 period.

3.1 Private and Social Values of Production

The private value of production is the f.o.b. price of one kilogram of an exported crop less all export and indirect taxes. The private value of production is therefore the portion of output which is received by private individuals directly of indirectly involved in the process of production from farm to border.

In 1977 rice export was subject to the following taxes:[1]

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[1] Since the premium rates and rice reserve requirement were changed periodically in 1977, the figures shown here are weighted averages of tax amounts and percentages. In the weighting, we take into account the amount and value of rice export as well as the duration in which taxes were imposed.

(i) The rice premium of ฿860 per ton or about 14% of the f.o.b. price.

(ii) A requirement for an exporter to sell reserve rice in the form of 5% and 15% rice to the government in the amount equalling 67% of exported rice at a price of about 60% of the f.o.b. price. This is equivalent to an export tax of 10% of the f.o.b. price.

(iii) A requirement for an exporter to sell rice in the from of 100% second class rice for government-to-government sale in the amount of 100% of exported rice at a price of about 70% of the f.o.b. price. This requirement is equivalent to an export tax of 29% of the f.o.b. price.

(iv) Other taxes, namely, an export duty, business and municipal taxes, and an income tax, which altogether amount to 7.4% of the f.o.b. price.

The average f.o.b. price of 100% rice was about ฿6,139.50 per ton in 1977, and all export taxes mentioned above were estimated at ฿1719 per ton or 28% of the f.o.b. prices. [1]

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[1] For a ton of 100% first class rice exported, the average amounts of reserve rice and government-to-government rice are equivalent to 0.95 ton and 0.23 ton of 100% first class rice respectively. If we let P be the f.o.b. price of 100% first class rice per ton, the ad valorem equivalent of all export taxes would be

$$\frac{(0.14 + 0.10 + 0.29 + 0.074)}{1 + 0.95 + 0.23} P \text{ or } 0.28 P.$$

Therefore, the private value of rice was ฿4.42 per kilogram in 1977.

The average f.o.b. price of maize was about ฿2,516 per ton in 1977, while maize exporters had to pay a business tax of 2% of sale price, and a municipal tax which was 10% of the business tax. The private value of maize, which is the difference between the world price and the indirect taxes, was estimated at about ฿2.12 per kilogram in 1977.

Exporters of tapioca products had to pay the same rates of business and municipal taxes as in the case of maize exporters. The weighted average f.o.b. price of tapioca products was about ฿1,840 per ton in 1977, which, after deducting the taxes from it, yielded the private value of tapioca products of about ฿1.80 per kilogram.

In 1977 sugar export was subject to a business tax (7% of sale price), a municipal tax (10% of the business tax) and the formal passport fee for export which amounted to ฿310.11, ฿31.60 and ฿3.80 per ton respectively. While the 1977 world price of sugar was averaged at about ฿4,516 per ton, the private value of production for sugar was about ฿4.16 per kilogram.

From the point of view of a country, the social value of an export should reasonably be approximated by foreign exchange earned from selling that export in the world market. Therefore, in this study the social values of the four crops are their f.o.b. prices which are as follows:

rice : ฿ 6.14 per kilogram of 100% white rice.

maize : ฿ 2.52 per kilogram of average-grade maize.

cassava: ฿ 1.84 per kilogram of tapioca pellets.

sugar : ฿ 4.52 per kilogram of raw sugar.

3.2 Private and Social Costs of Production

For the purpose of calculating profitability, protection and domestic resource costs, the costs of production can be divided into primary factor costs, the costs of tradable inputs, the costs of processing, marketing and transportation, and the social cost of foreign exchange.

3.2.1 Primary factor costs: These costs can further be divided into the costs of labor, capital and land, both directly and indirectly used in the production process.

a) Direct labor cost: The private cost of direct labor is the actual cost of labor directly utilized in the farm-level prodiction of primary products, namely, paddy, tapioca roots, sugar cane and maize. This labor cost is therefore the sum of all labor costs actually incurred in every stage of farming, namely, land preparation, planting, caring and harvesting. The private cost of direct labor is calculated by multiplying the sum of physical units (namely, man-days) of direct labor by wage rates of both family and hired labor.

The wage rates used are those which prevailed in each producing area in 1977 and are categorized according to different activities in the production process. Our survey data indicate that the daily wage rate of a hired laborer ranges from ฿15 to ฿30. The difference in the wage rate used for different production activities is due to different labor market situations in the selected areas and different types of skill and experience required in various stages of farming of each crop.

The social cost of direct labor is the physical units of direct labor multiplied by shadow wage rates. Theoretically, a shadow wage rate should reflect the social opportunity cost of labor. In this study, the shadow wage rates used are approximately represented by the weighted averages of market wage rates in farm and non-farm periods over the year. The duration of these periods are used as the weights in estimating those averages. The range of the estimated shadow wage rates shown in table 3.1 is similar to the market wage rates, i.e. between ฿30 per day in Nakorn Pathom and ฿15 per day in Chiangrai. It should be noted that wage rates, both market and shadow, are the highest in the Central Region Changwad like Ayudhaya and Nakorn Pathom, and are relatively low in the Northern and Northeastern areas, such as Chiangrai and Nakorn Rajsima.

b) Indirect labor cost: Indirect labor is that part of labor which is used in the production of all non-primary inputs used in producing the four export crops. These inputs include

TABLE 3.1

THE ESTIMATED SHADOW WAGE RATES

unit: ฿/day

Changwad	Wage Rates
Rajburi	23
Nakorn Nayok	23
Supanburi	22
Ayudhaya	28
Nakorn Pathom	30
Nakorn Rajsima	18
Chiangrai	15
Saraburi	20
Lopburi	23
Cholburi	21

Source: Estimated from survey data.

fertilizers, pesticide, insecticide, herbicide, fungicide, fuel, tractors, water pumps, animals, various farm implements and other services. Included in indirect labor is the labor domestically used in processing, transporting and marketing these exports.[1] As far as

[1] See the separation of indirect labor cost in non-primary inputs, processing, transportation and marketing in sections 3.2.2 and 3.2.3.

wage rates for indirect labor are concerned, we have no basis and information to distinquish between market and social costs. Consequently, we assume that both social and private costs of indirect labor are the same.

c) Capital cost: Capital cost consists of the opportunity cost of loanable funds used in production and depreciation and maintenance costs of fixed assets. The cost of loanable funds is represented by interest charged on total variable cost of production. The interest rate paid by farmers varies according to the source of fund and the location and size of farm. Ideally, the social interest rate should be reflected by the social opportunity cost of capital. In this study, it is beleived that the interest rate in the noninter-vation unorganized capital market approximately indicates the true social cost of capital. Therefore, the social opportunity cost of loanable funds is calculated using interest rates charged by noninstitutional sources in different regions. These rates range from 22% per annum to 26% per annum. The private cost of loanable funds is calculated from the weighted average of institutional and noninstitutional interest rates, the weights being the shares of institutional and noninstitutional loans for each region. The estimated private interest rate ranges from 12% per annum to 19% per annum.

Capital depreciation is estimated by the straight line method of depreciation of fixed assets whose value exceeds ฿100. Maintenance cost of fixed assets is obtained directly from our survey data. While there is no basis for any distinction between private and social costs, the estimate of depreciation and maintenance cost is assume to be identical for private and social calculation.

Direct capital and indirect capital are distinquished based on the same concept used in distinquishing direct labor and indirect labor.[1]

d) Land cost:[2] Land cost is represented by net returns on the best alternative use of land in the producing areas evaluated at market price. Private and social land costs are assumed to be identical. For sugar cane, cassava is the best alternative crop for Rajburi and Supanburi, while rice and maize are the best alternative crops for Nakorn Pathom and Utaradit respectively. Sugar cane yields the best alternative returns for rice in Rajburi, Nakorn Pathom and Supanburi. Rice in Nakorn Rajsima and Nakorn Nayok has cassava and maize respectively as the best alternative crops. The best alternative crop for maize are mungbeans in Lopburi and Saraburi, rice in Chiangrai, and cassava in Nakorn Rajsima. For cassava, sugar cane is the possible alternative crop in Rajburi and Utradit, and maize in Chiangrai.

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[1] The separation of indirect capital cost in non-primary inputs, processing, transportation and marketing is shown in sections 3.2.2 and 3.2.3.

[2] See detailed calculation of land cost in appendix B.

3.2.2 Cost of tradable inputs [1]

The intermediate inputs used in producing the four products are fertilizers, insecticide, fuel, tractor, water pumping and animal. Some of these intermediate inputs are imported, and tariff and any other special taxes are imposed on them. Before these intermediate inputs are distributed to the farmers, they generate value added in the domestic market which can be separated into two components, namely, labor and capital costs. The user's cost at farm level are divided into three important components as shown in the formula below:

$$U_c = F + V + T$$

U_c = user's cost at farm level

F = foreign content of U_c

V = value added generated in the domestic economy

T = over all taxes levied by the government

V is further divided in indirect capital cost (K) and indirect labor cost (L). The breakdown of components for these intermediate inputs, most of which are tradable inputs, is shown in the table below.

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[1] See detailed explanation on the calculation and description of tradable inputs in appendix C.

TABLE 3.2

THE BREAKDOWN OF COST COMPONENTS OF INTERMEDIATE INPUTS, AS PERCENTAGES OF USER'S COST

Intermediate Inputs	Foreign Content	Capital Cost	Labor Cost	Taxes
Fertilizers				
-rice and maize	85	11	2	2
-sugar cane	74	5	6	15
Fuel	62	7	1	30
Pesticide	80	6	10	4
Tractor service	54	12	30	4
Pump service	79	6	5	10
Animals	-	80	20	-

Source: See appendix C.

Seed, stem and stalk are also tradable inputs in the cultivation of the four crops. For rice and maize, the private cost of seed is the expense that farmers actually pay in growing them. Its social cost is represented by the equivalent f.o.b. price of unprocessed product, i.e. unmilled rice in the case of paddy and unprocessed maize in the case of maize. The method of cost calculation for sugar stalks is similar to the cases of rice and maize. While the private cost of sugar stalks is what sugar cane growers actually pay for using them in planting, their social cost is the value of sugar cane stalks evaluated at their equivalent world price.

Cassava stems, on the other hand, have very negligible cost, both private and social. The only cost incurred is labor cost involved in stem cutting. Therefore, only labor cost is regarded as social and private cost of cassava stems.

3.2.3 Processing, marketing and transportation costs:[1]

For each crop, the sum of these three costs are estimated using the following identity:

$$PR + TR + M = WP - T - FP$$

where PR = the cost of processing primary output

TR = domestic transportation cost

M = domestic marketing cost

WP = world price of finished product to be exported or f.o.b. price

T = all export taxes

FP = farmgate price of primary output

These variables are expressed in terms of baht per unit of exported product. First, the processing costs of rice,

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[1] See detailed explanation and estimating procedures of the processing cost in Appendix C.

maize, cassava and sugar cane are derived from the cost studies of rice milling, on-farm maize processing, tapioca chipping and pelletizing and sugar milling. Then the processing cost structures of these crops are broken down into foreign content, capital cost, labor cost, and taxes, as done in the case of tradable inputs. The breakdown of these cost components is shown in table 3.3.

TABLE 3.3

THE BREAKDOWN OF COST COMPONENTS OF PROCESSING, MARKETING AND TRANSPORTATION COSTS, EXPRESSED AS PERCENTAGES OF USER'S COST

	Foreign Content	Capital Cost	Labor Cost	Taxes
Processing				
- Rice	4	63	33	-
- Maize	54	12	30	4
- Tapioca	13	18	51	18
- Sugar cane	34	53	13	-
Transportation	30	41	24	5
Marketing	10	30	50	10

Source : See Appendix C.

After deducting export taxes, farmgate price and processing cost form the f.o.b. price, the remaining represents marketing and transportation costs. Since we have no empirical basis to separate marketing cost and transportation cost, an assumption is made that they are approximately equal. Based on some empirical studies of transportation cost, its cost components are broken down into foreign content, capital cost, labor cost and taxes, as shown in table 3.3. As for marketing cost, it is reasonable to assume that half of the cost can be accounted for by labor cost, and approximately 10%, 30% and 10% are allocated to foreign content, capital cost and taxes respectively.

3.2.4 Social cost of foreign exchange: Although there are various definitions of the social cost of foreign exchange, we will use the most practical and widely used one. In this study, we define the shadow exchange rate as the rate of exchange which would prevail when all trade barriers were eliminated and when the balance of payments was in equilibrium. A study has been made to estimate the shadow exchange rate of the baht for 1976.[1] The study takes into account the elasticity of demand and supply of exports, the elasticity of demand for imports, the structure of trade and trade distortions, the value of imports and exports at the effective exchange rate, and net capital inflow. In the

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[1] See Supote Chunanantathum, Trade and Balance of Payments of Thailand, 1977, (Mimeographed.)

case where net capital inflow is ignored, the shadow exchange rate is found to vary from ฿21.93 per US. dollar to ฿24.50 per US. dollar, or from 7.50% to 20.10% above the average official rate of ฿20.40 per US. dollar in 1976. When net capital inflow is taken into account, the shadow exchange rate is 3.30% to 8.80% above the official rate, or between ฿21.07 per US. dollara and ฿22.20 per US. dollar. The calculation which takes into account net capital inflow is believed to be more realistic. Therefore, to reflect the maximum degree of overvaluation of the <u>baht</u>, we select ฿22.20 per US. dollar as the estimate of shadow exchange rate to be used in this study.

CHAPTER 4

PROFITABILITY AND PROTECTION

4.1 Indicators of Profitability and Protection

The estimates of values and costs described in the previous chapter now enable us to calculate the degree of profitability and protection for rice, maize, cassava and sugar cane. The following indicators will be used as measures of profitability and protection.

1. Private profitability (PP): This indicator is calculated by subtracting factor costs other than capital evaluated at domestic prices and indirect taxes from value added at domestic prices. It indicates how much the private individuals involved in the production of each export crop will receive as their profit.

2. Social profitability (SP): This equals value added at world prices less factor costs other than capital at opportunity cost. It shows a return in the form of profit to a society as a whole. Social profitability is inclusive of taxes because tax revenue is regarded as part of the return to the society.

3. Net social profitability (NSP): This is social profitability netted by the opportunity cost of capital used in production. Net social profitability is calculated at the actual exchange

rate and at the shadow price of foreign exchange. NSP at the shadow exchange rate can be used as one of the indicators which reflect comparative advantage for each crop.

4. Nominal protective coefficient on output (NPCO): This indicator is represented by the ratio of gross output at its domestic price to gross output at its world price. It indicates the extent to which the private gross return deviates from what it would be without output price distortion.

5. Nominal protective coefficient on tradable inputs (NPCI): This equals the ratio of tradable inputs at domestic prices to tradable inputs at world prices. The indicator shows the degree to which the actual cost of tradable inputs differs from what it would be with no tradable input price distortion. Nominal protective coefficient on tradable inputs at the farm level ($NPCI_F$) is also estimated by excluding processing, marketing and transportation costs from total tradable input cost. Another measure of nominal protection is nominal protective coefficient on tradable inputs exclusive of seed cost ($NPCI_S$). This measure is calculated to assess how much NPCI would change if seed cost, which is depressed by export taxes (especially the case of rice production), is excluded.

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[1] See Appendix E. for the explanation and derivation of EPC.

6. Effective protective coefficient (EPC)[1]: The concept of nominal protection on output does not take into account the effect of protection on tradable inputs. A better measure is effective protective coefficient which includes the nominal protective effect on both output and input. EPC is expressed as the ratio of value added at domestic prices to value added at world prices. Using Corden's method, we include the value of nontraded inputs, indirectly and directly used in production, in value added. EPC indicates the extent to which the actual return to primary factors and nontraded inputs differs from what it would be if there is no trade distortion in the prices of output and inputs.

The estimated indicators of profitability and protection for the four crops in some selected provinces are shown in table 4.1.

4.2 Intracrop Comparison

Rice: The differences in private and social profitability of rice production in different changwad can be explained by the variations in yield in these producing areas. The highest yields in Nakorn Pathom and Ayudhaya cause the values of all their profitability indicators to be the highest. The lowest private and social profitability can be found in such low-yield areas as Nakorn Rajsima and Rajburi. This result generally conforms with our expectation, since it is generally believed that the Central Region, in which Nakorn Pathom and Ayudhaya are located, is one of the most efficient rice producing areas in the country.

[1] See Appendix E. for the explanation and derivation of EPC.

TABLE 4.1

PRIVATE AND SOCIAL PROFITABILITY, NOMINAL AND EFFECTIVE PROTECTION, AND YIELD OF RICE, MAIZE, CASSAVA AND SUGAR CANE IN SELECTED CHANGWAD, 1977/78

Production Activity	Private Profitability (PP)	Social Profitability (SP)	Net Social Profitability at Official Exchange Rate (NSP at OER)
Rice:			
Rajburi, wet season, transplanting	194.99	445.78	245.16
Rajburi, wet season, broadcasting	87.41	-130.87	-221.26
Nakorn Nayok, wet season, transplanting	217.17	679.40	454.85
Nakorn Nayok, wet season, broadcasting	168.14	-340.26	214.98
Nakorn Rajsima, wet season, transplanting	122.58	-398.30	-542.01
Ayudhaya, wet season broadcasting	190.69	1,031.72	837.73
Nakorn Rajsima, dry seseason, transplanting high-yield variety (HYV)	215.46	217.31	-120.24
Supanburi, dry season, transplanting	163.89	913.87	753.93
Nakorn Pathom, dry season, transplanting (HYV)	258.55	1,749.37	1,483.51
Maize:			
Lopburi, first crop	66.60	-269.67	-339.50
Saraburi, first crop	96.21	176.99	79.55
Chiangrai, first crop	85.55	-207.35	-309.68
Nakorn Rajsima, first crop	96.95	- 38.32	-144.89
Nakorn Rajsima, second crop	75.21	-225.53	-339.76
Cassava:			
Cholburi	234.76	372.84	124.54
Rajburi	362.81	573.16	263.96
Nakorn Rajsima	159.91	643.74	466.90
Sugar cane:			
Rajburi	563.45	738.22	110.95
Nakorn Pathom	809.93	994.24	99.02
Supanburi	624.97	752.54	40.98

TABLE 4.1--Continued

Production Activity	Net Social Profitability at Shadow Price of Foreign Exchange (NSP at SPFX)	Nominal Protective Coefficient on Output (NPCO)	Nominal Protective Coefficient on Tradable Inputs (NPCI)
Rice:			
Rajburi, wet season, transplanting	356.60	0.72	0.96
Rajburi, wet season, broadcasting	-181.96	0.72	0.79
Nakorn Nayok, wet season, transplanting	586.13	0.72	0.88
Nakorn Nayok, wet season, broadcasting	300.56	0.72	0.85
Nakorn Rajsima, wet season, transplanting	-503.35	0.72	1.05
Ayudhaya, wet season, broadcasting	967.83	0.72	0.76
Nakorn Rajsima, dry season, transplanting, high-yield variety (HYV)	- 24.68	0.72	1.01
Supanburi, dry season, transplanting	892.48	0.72	0.92
Nakorn Pathom, dry season, transplanting (HYV)	1,707.39	0.72	1.03
Maize:			
Lopburi, first crop	-329.31	0.98	1.07
Saraburi, first crop	133.81	0.98	1.11
Chiangrai, first crop	-281.44	0.98	1.09
Nakorn Rajsima, first crop	- 80.16	0.98	1.12
Nakorn Rajsima, second crop	-297.82	0.98	1.12
Cassava:			
Cholburi	217.49	0.98	1.16
Rajburi	415.74	0.98	1.19
Nakorn Rajsima	593.87	0.98	1.28
Sugar cane:			
Rajburi	256.76	0.92	1.18
Nakorn Pathom	334.39	0.92	1.11
Supanburi	225.73	0.92	1.03

TABLE 4.1--Continued

Production Activity	NPCI Exclusive of processing, Marketing and Transportation Costs ($NPCI_F$)	NPCI Exclusive of Seed Cost ($NPCI_S$)	Effective Protective Coefficient (EPC)	Yield (kg./rai)
Rice:				
Rajburi, wet season, transplanting	0.94	1.09	0.67	338.08
Rajburi, wet season, broadcasting	0.76	1.09	0.70	141.02
Nakorn Nayok, wet season, transplanting	0.86	1.07	0.70	398.86
Nakorn Nayok, wet season, broadcasting	0.78	1.08	0.70	273.27
Nakorn Rajsima, wet season, transplanting	1.04	1.09	0.59	145.00
Ayudhaya, wet season, broadcasting	0.64	1.13	0.71	411.00
Nakorn Rajsima, dry season, transplanting, high-yield variety (HYV)	1.01	1.06	0.64	332.44
Supanburi, dry season, transplanting	0.89	1.08	0.68	441.25
Nakorn Pathom, dry season, transplanting (HYV)	0.97	1.06	0.66	732.00
Maize:				
Lopburi, first crop	1.06	1.09	0.92	86.41
Saraburi, first crop	1.08	1.12	0.96	271.11
Chiangrai, first crop	1.06	1.09	0.94	167.90
Nakorn Rajsima first crop	1.12	1.10	0.95	327.14
Nakorn Rajsima, second crop	1.10	1.10	0.95	233.75
Cassava:				
Cholburi	1.05	1.16	0.95	1,956.09
Rajburi	1.07	1.19	0.94	2,859.25
Nakorn Rajsima	1.06	1.28	0.96	2,196.08
Sugar cane:				
Rajburi	1.32	1.09	0.85	5,471.94
Nakorn Pathom	1.24	1.06	0.88	8,315.04
Supanburi	1.16	1.07	0.88	6,732.86

[a]For private and social profitability, the unit is <u>baht</u> per <u>rai</u>. All protective coefficients are ratios.

Source : See appendix E.

The transplanting technique of rice production seemed to be more profitable than the broadcasting one in the same changwad, such as Rajburi and Nakorn Nayok. Again the result is as expected, because the transplanting technique enables more intensive use of land and labor, thus yielding more rice per rai than broadcasting.

The result for Nakorn Rajsima also shows that rice production in the dry season was more profitable thantin the wet season. But this is simply because the high yield variety of rice is grown i in the dry season, while farmers usually grow the traditional variety in the wet season. Based on the estimates of net social profitability at shadow price of foreign exchange for rice production, the results clearly show that broadcasting, wet season rice production in Rajburi, and transplanting, wet and dry season rice production in Nakorn Rajsima had no comparative advantaged in the crop year 1977/78

The nominal protective coefficient on rice output is 0.72, mainly because the overall tax rate of 28% of the f.o.b. price was imposed on rice export in 1977. The negative protection given to tradable inputs, as reflected by the nominal protective coefficient on tradable inputs (NPCI) being less than heavy export tax. The value of seed, which is regarded as a tradable input, was substantially depressed the tax. And consequently this lowers the overall degree of protection on tradable inputs in most activities, particularly when processing, marketing and transportation costs are excluded. The role of rice export tax in causing negative protection on tradable inputs is confirmed when nominal protective coefficient on tradable inputs exclusive of seed cost ($NPCI_s$) is calculated. The exclusion of seed from tradable inputs raises the values of $NPCI_s$ for rice in all selected _changwad_ above unity, which means that there was positive protection on tradable inputs other than seed. However, in cases where seed cost constitutes a relatively small portion of total tradable input cost, all measures of NPCI have the value greater than unity. This occurs in Nakorn Rajsima's wet and dry season rice and in Nakorn Pathom's dry season HYV rice. It should be noted also that the NPCI for the broadcasting technique seems to be smaller than that for the transplanting technique. And this can be explained by the fact that the broadcasting technique uses much more seed per _rai_ than the transplanting technique.

The effective protective coefficients (EPC) for all rice production activities are significantly less than unity, ranging from 0.59 to 0.70. Again, this is mainly due to the export tax which substantially depressed the domestic price of rice in 1977. Therefore, there is an evidence that the tax system was a major disincentive to rice production. The activities with low EPC are those with positive nominal protection on tradable inputs. Broadcasting rice seems to have a higher EPC than transplanting rice, simply because its NPCI is lower.

Maize: Private profitability per rai for all maize production activities was relatively low, and all measures of social profitability were negative for all except for maize production in Saraburi. This is because the crop year 1977/78 was really a disastrous year for maize growers. The yield in that year was abnormally low. For instance, the normal maize yield in Lopburi usually exceeds 300 kilograms per rai, while the 1977/78 yield was at the very low level of 86 kilograms per rai. An adjustment is made in chapter 5, where normal yield data are used instead of the actual yield data of 1977/78.

The NPCO of maize shows an only 2% decrease of gross output value as a result of a minor tax on maize export. All measures of NPCI were greater than unity, ranging from 1.06 to 1.12. Therefore, the tradable inputs used in maize production were subject to 6% to 12% nominal rates of protection. The EPC was slightly less than unity, implying that when protection on output and inputs is taken into account, the net effect of negative protection on maize production was rather small.

Cassava: The highest private profitability can be found in Rajburi, but Nakorn Rajsima had the highest social profitability. This is due to the fact that the social opportunity cost of land in Nakorn Rajsima was not so high because its next best alternative crop did not give a high return. The positive NSP at SPFX for cassava indicates that Thailand had a comparative advantage in cassava production in 1977/78.

The NPCO of cassava was slightly lower than unity, and all indicators of NPCI were 7%-28% above unity. Its EPC, averaging about 0.95, indicates that the net effect of price disincentives on cassava was to lower the domestic value added by 5%.

Sugar cane: Sugar cane production in Nakorn Pathom yielded the highest private and social profitability because it had the highest yield per rai. All three producing areas certainly had comparative advantage in sugar cane production as their NSP at SPFX for 1977/78 was positive. The figures for NPCO, NPCI, $NPCI_F$ and $NPCI_S$ show a similar picture as in the cases of maize and cassava. The EPC of 0.85-0.88 indicates that domestic value added of sugar cane production was reduced by 15%-12% as a result of taxes on sugar export and the tradable inputs used in its production.

4.3 Intercrop Comparison

The results in table 4.1 give a clear evidence that, among the four crops, rice was the crop most heavily suffered from taxes and other price disincentives. Its NPCO and EPC were the lowest and significantly below those for the other three crops.

In comparing these crops, it is reasonable to examine them in the same changwad. As far as our study is concerned, there are four changwad in which more than one crop was grown in 1977/78. They are Rajburi (rice, cassava and sugar cane), Nakorn Rajsima (rice, maize and cassava), Supanburi (rice and sugar) and Nakorn Pathom (rice and sugar).

It seems that sugar cane was the most privately and socially profitable crop in Rajburi. Nevertheless, when social profitability is netted by capital social cost, the net social profitability at the official exchange rate and the shadow price of foreign exchange of cassava was higher than those of sugar and rice. This is because sugar cane required relatively more capital in its production, and subtracting capital cost from social profitability lowers NSP of sugar cane more than that of cassava.

In Nakorn Rajsima it was most privately profitable to grow dry season transplanting rice, but SP and NSP of cassava was the highest, exceeding those for rice and maize. Cassava was the only crop with positive NSP, indicating that it had definite comparative advantage over other crops, at least as far as production in 1977/78 is concerned.

In Supanburi and Nakorn Pathom, it was much more profitable, from the private point of view, to grow sugar cane than rice. But rice became more socially profitable, in terms of gross and net calculation, than sugar cane. This was due to the factothat

sugar can

sugar cane cultivation was more capital intensive and, thus; its opportunity cost of capital was very high relative to rice.

Therefore, based on the 1977/78 yield data, it can be concluded taht it was most privately profitable to grow sugar cane in Rajburi, dry season transplanting rice in Nakorn Rajsima and sugar cane in Supanburi and Nakorn Pathom. While from the social point of view, the society would be better off in terms of profitability by growing cassava in Rajburi and Nakorn Rajsima, and rice in Supanburi and Nakorn Pathom. But it must be pointed out that our conclusion drawn here is based on the 1977/78 costs and returns data. Since the abnormality in weather condition in 1977/78 adversely affected production of the four crops differently-maize was the crop most affected, any conclusion on their relative profitability cannot be generalized for other time periods. Moreover, due to lack of information, we can include only price incentives and disincentives in our calculation, and totally ignore the effect of nonprice incentives, such as agricultural credit subsidy and irrigation. Including these nonprice incentives would certainly raise the values of all profitability and protection indicators to some extent.

CHAPTER 5

DOMESTIC RESOURCE COST

5.1 The Pattern of Comparative Advantage

The degree of comparative advantage in export production is represented by domestic resource cost ratio (DRC) which equals the ratio of total domestic factor cost at social opportunity cost to value added at world prices, expressed in domestic currency unit.[1] This indicator shows the extent to which the total domestic cost of producing a unit of output varies from the value gained from exporting it. If value added at world prices is evaluated in terms of foreign currency, the ratio of the DRC to shadow price of foreign exchange shows the degree to which the social opportunity cost of domestic factors differs from a net marginal unit of foreign exchange earned. When the ratio for an export is less than one, it implies that the country has a comparative advantage in producing that product because its total domestic factor cost is less than its return.

The estimated domestic resource cost indicators for the selected production activities are shown in table 5.1. Normal yields

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[1] See detailed explanation and derivation of domestic resource cost in appendix E.

TABLE 5.1

DOMESTIC RESOURCE COST AND YIELD OF RICE, MAIZE, CASSAVA AND SUGAR CANE IN SELECTED CHANGWAD, 1977/78

CANE IN SELECTED CHANGWAD, 1977/78

Production Activity	Domestic Resource Cost Ratio (DRC)[a]	Ratio of DRC[a] to SPFX/OER	Yield[b] (kg./rai)
Rice:			
Rajburi, wet season transplanting	0.80	0.74	338.08
Rajburi, wet season, broadcasting	1.51 (0.82)	1.38 (0.75)	141.02 (234)
Nakorn Nayok, wet season, transplanting	0.69	0.63	398.86
Nakorn Nayok, wet season, broadcasting	0.77	0.71	273.27
Nakorn Rajsima, wet season, transplanting	2.26 (1.54)	2.08 (1.41)	145.00 (201)
Ayudhaya, wet season, broadcasting	0.42	0.38	411.00
Nakorn Rajsima, dry season, transplanting, high-yield variety (HYV)	1.11	1.02	332.44
Supanburi, dry season, transplanting (HYV)	0.51	0.47	441.25
Nakorn Pathom, dry season transplanting (HYV)	0.40	0.37	732.00
Maize:			
Loburi, first crop	4.00 (0.90)	3.67 (0.82)	86.41 (375)
Saraburi, first crop	0.87 (0.66)	0.80 (0.60)	271.11 (414)
Chiangrai, first crop	1.99 (0.99)	1.82 (0.91)	167.90 (352)
Nakorn Rajsima, first crop	1.20	1.10	327.14
Nakorn Rajsima, second crop	1.73 (1.31)	1.59 (1.20)	233.75 (267)
Cassava:			
Cholburi	0.88	0.81	1,956.09
Rajburi	0.84	0.77	2,859.25
Nakorn Rajsima	0.67	0.61	2,196.08
Sugar cane:			
Rajburi	0.93	0.85	5,471.94
Nakorn Pathom	0.96	0.88	8,315.04
Supanburi	0.98	0.90	6,732.86

[a] Figures in parentheses are estimated using normal yields.

[b] Figures in parentheses are yields in the 1976/77 crop year which is regarded as a normal year.

Source: See appendix E.

are also used in the calculation in cases where abnormally low yields were obtained in 1977/78, mainly for maize and rice in some areas.

Among rice priduction activities, the Central Region changwad, such as Nakorn Pathom, Ayudhaya, Supanburi and Nakorn Nayok, seemed to have the msot comparative advantage over changwad in other regions, such as Nakorn Rajsima in the Northeast. Their domestic resource cost, compared with the shadow price of foreign exchange, ranged from 0.37 to 0.71, while that of rice in Nakorn Rajsima exceeded one, even when normal yields are used instead of the actual 1977/78 yield. Transplanting rice seemed to a slight edge in comparative advantage of production over broadcasting rice, as seen in the cases of Rajburi and Nakorn Nayok, where the DRC for transplanting rice was slightly lower than that of broadcasting rice. In general, our DRC estimates for rice production are higher than those found by Narongchai and Atchana.[1] While their ratio of DRC to SPFX/OER of rice production in some Central Region changwad ranged from 0.23 to 0.37, our estimates in the same region ranged from 0.37 to 0.75. The main reason for the difference is because the world price of rice in 1974, the year on which their study was based, was ฿11,170 per ton, which is 80% higher than the 1977 world price.

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[1] See Narongchai Akrasanee and Atchana Wattananukit, op.cit., table A-16, pp. 210-11

The DRC indicators for maize, when estimated form the actual 1977/78 yields, show no comparative advantage in production in all selected producing areas, except Saraburi. But when the normal yield date are used, it is found that Nakorn Rajsima was the only changwad that had no comparative advantage in producing maize.

Table 5.1 also shows that activities for cassava and sugar cane consistently have their DRC estimates below one. But although those for cassava are significantly different from one, those for sugar cane are only marginally below one. This means that while cassava from Thailand had a clear comparative advantage in the world market, some small reductions in the world price and/or the yield of sugar cane could possibly eliminate Thailand's comparative advantage in sugar export.

In comparing the DRC of crops grown in the same areas, the results are very similar to those found in the analysis of net social profitability at the shadow price of foreign exchange in the previous chapter. The crops with the most comparative advantage are the lowest DRC ratio were cassava and rice in Rajburi, cassava in Nakorn Rajsima, and rice in Supanburi and Nakorn Pathom.

The overall picture seems to be that, when adjustment is made for those activities with abnormally low yields, all selected crop activities, except rice and maize in Nakorn Rajsima, had comparative advantage in production. On the average, rice, particularly rice grown in the Central Region changwad, had the highest comparative advantage, followed by cassava, maize and sugar cane. This conclusion seems to support the hypothesis, put forward in chapter 1, that rice production has the lowest DRC, and thus the highest comparative advantage among Thailand's major export crops. If this is true, crop diversification in Thailand over the past period, which has resulted in reducing the share of rice in total production, seems to have shifted resources in a rather inefficient manner. In other words, resources have been allocated away from the lowest-cost crop to the higher-cost crops. Therefore, the result seems to reject the hypothesis of efficient resource allocation stated also in the first chapter. However, we hasten to add that this conclusion may be more applicable to the Central Region than to other regions, since it is found in our study that the Central Region has a clear comparative advantage in rice production, while in other regions, such as the Northeast (represented by Nakorn Rajsima in our study), non-rice crops seem to be more suitable and profitable to grow than rice.

5.2 Sensitivity Analysis

The result and conclusion in the preceding section is rather static in the sense that they are based on the 1977 world prices of output and only one set of cost and yield data, which partain to the 1977/78 crop year or some other "normal" year. For policy purpose, it is interesting to examine what would happen to the DRC estimates of these crops when the values of these data change marginally. It would be useful to know, for instance, how world prices of the crops in a future year would affect their comparative advantage, given other things being constant. This knowledge will assist policy makers to decide on a plan to diversify crop production in Thailand.

Such an examination involves a sensitivity analysis of the effects of changes in input-output coefficients and world prices on DRC estimates. For the sake of simplicity and clarity, the *ceteris paribus* assumption is adopted in the analysis. That is, when examine changes in one variable on costs, yield and world price, it is assumed that all other variables remain constant.

5.2.1 The DRC sensitivity analysis with respect to input-output coefficients: The degree of sensitivity of a DRC ratio with respect to a variable is represented by a DRC elasticity which shows the percentage change in that variable needed to cause a one percent change in the DRC ratio. Therefore, the lower the value of DRC elasticity is, the more sensitive the DRC ratio is to changes in the variable.

DRC elasticity estimates with respect to the opportunity cost of labor, land, domestic capital, fertilizer, processing-transportation-marketing, and yiild per rai are presented in table 5.2.

For almost all crop production activities under study, the DRC elasticities with respect to yield indicate the highest degree of sensitivity of DRC to changes in yield. For rice, the elasticities range from -1.17 for Rajburi to -2.13 for Ayudhaya. The elasticities for nonrice upland crops have their values ranging from -0.4 for Lopburi maize to -2.12 for Rajburi cassava.

As far as rice is concerned, labor cost comes next in terms of the high degree of DRC sensitivity, with the elasticity values between 1.47 in Ayudhaya and 2.43 in Nakorn Nayok. The DRC elasticities with respect to land cost are consistently higher for dry season rice than for wet season rice, while the reverse is true in the case of DRC elasticities with respect fertilizer cost.[1] This particular result can be attributed to the fact that the opportunity cost

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[1] This has also been found in the study by Narongchai and Atchana. See Narongchai Akrasanee and Atchana Wattananukit, op.cit., p. 190.

TABLE 5.2

DRC ELASTICITIES WITH RESPECT TO INPUT - OUTPUT COEFFICENTS

Production Activity	Labor	Land	Domestic Capital
Rice			
Rajburi, wet season, transplanting	2.24	2.83	4.95
Nakorn Nayok, wet season, transplanting	2.43	2.75	4.48
Ayudhaya, wet season, broadcasting	1.47	-	3.13
Nakorn Rajsima, dry season, transplanting, HYV	1.76	4.49	4.77
Supanburi, dry season, transplanting	1.68	4.97	4.88
Nakorn Pathom, dry season, transplanting, HYV	1.95	4.44	3.76
Maize			
Lopburi, first crop	2.21	2.54	6.49
Saraburi, first crop	2.11	2.93	5.36
Chiangrai, first crop	2.18	2.64	6.09
Nakorn Rajsima, first crop	2.98	1.85	8.08
Cassava			
Cholburi	1.58	10.88	3.64
Rajburi	1.47	9.48	4.58
Nakorn Rajsima	2.10	2.96	5.31
Sugar cane			
Rajburi	2.73	4.57	2.40
Nakorn Pathom	2.76	3.54	2.81
Supanburi	2.77	3.75	2.87

Source: See appendices E and F.

TABLE 5.2--Continued

Production Activity	Fertilizer	Processing, Transportation and Marketing	Yield Per *rai*
Rice			
Rajburi, wet season, transplanting	205.27	5.85	-1.17
Nakorn Nayok, wet season, transplanting	19.57	4.22	-1.26
Ayudhaya, wet season, broadcasting	-	1.56	-2.13
Nakorn Rajsima, dry season, transplanting, HYV	15.75	7.87	-1.18
Supanburi, dry season, transplanting	18.62	2.82	-1.36
Nakorn Pathom, dry season, transplanting, HYV	10.43	3.62	-1.20
Maize			
Lopburi, first crop	-	2.80	-0.40
Saraburi, first crop	-	2.43	-1.52
Chiangrai, first crop	-	2.75	-1.04
Nakorn Rajsima, first crop	688.37	3.67	-1.25
Cassava			
Cholburi	17.37	3.00	-1.41
Rajburi	-	1.47	-2.12
Nakorn Rajsima	-	2.84	-1.54
Sugar cane			
Rajburi	14.20	2.45	-1.58
Nakorn Pathom	35.18	1.92	-1.56
Supanburi	25.29	1.97	-1.48

Source: See appendixes E and F.

of land during the wet season is usually higher than during the dry season, so that any change in land cost in the wet season will affect DRC more than in the dry season. As for fertilizer, the difference in DRC response is because the cultivation of dry season rice, which is mainly of high-yield variety, needs and actually uses a greater amount of fertilizer per rai than that of wet season, traditional variety rice.

In the case of maize, labor cost ois the next highest in terms of DRC response, while fertilizer cost and edomestic cost are the variables to which the DRC's show a low degree of sensitivity. In fact, fertilizer was hardly used in maize production. The DRC responds highly to changes in land cost in Nakorn Rajsima because the opportunity cost of land, in terms of net returns of cassava on land use, was quite high.

The degree of DRC sensivity to changes in labor cost is also the next highest in cassava. This is followed by the cost of processing, transportation and marketing. The main reason for this is because tapioca products need a substantial cost of processing which involves turning cassava roots into pellets and chips. On the other hand, the DRC elasticities with respect to domestic capital cost, land cost and fertilizer cost are among the highest, indicating that their changes do not greatly affect DRC's. The only area that used fertilizer in cassava cultivation is Cholburi, where cassava has been grown for quite some time and the suse of fertilizer seemed necessary to prevent soil erosion.

The only crop whose DRC's do not respond significantly to labor cost, compared with other cost variables, is sugar cane. Here changes in capital cost and the cost of processing, transportation and marketing seem to affect DRC's more than other variables, except yield. The DRC elasticities with respect to land cost are lower in Nakorn Pathom and Supanburi than in Rajburi. This should indicate that the production in the two changwad was more land intensive and involved higher land cost than in Rajburi.

When the average DRC elasticities are compared among the four crops, it is found that the DRC for maize is most sensitive to changes in yield. For this reason, a reduction in 1977/78 from the normal maize yield can easily push up the DRC ratios above unity, as our result shows when the actual 1977/78 yields are used in the DRC calculation. In general, the result in table 5.2 suggests that rice and cassava are the crops in which the DRC elasticities with respect to labor cost are relatively low. This should indicate that rice and cassava are rather labor intensive in their production. The rather high DRC sensitivity to changes in land cost is found for wet season rice and maize. The relatively high degree of response of DRC's to changes in domestic capital cost confirms our earlier finding that sugar cane production is quite capital intensive.

The response of DRC's to changes in fertilizer cost is rather low in general, but the highest response is in the production of dry season high-yield variety rice, cassava in Cholburi and sugar cane in Rajburi. The ranking of crops according to their DRC response to changes in processing, transportation and marketing cost is not clear. But it seems that the DRC's are most responsive to processing, transportation and marketing cost for rice in Ayudhaya, cassava in Rajburi, and sugar cane in Nakorn Pathom and Supanburi. As expected, the crop with processing cost as a high percentage of its total cost, such as cassava and sugar cane in our study, should have a rather low DRC elasticity with respect to processing cost.

5.2.2 <u>The DRC sensitivity analysis with respect to world prices:</u> In analysing the relationship between DRC and world prices, we draw diagrams with DRC/(SPFX/OER) on the vertical axis and world prices on the horizontal axis. The curves are constructed by calculating DRC ratios at different levels of world prices for the four crops. Only the most efficient activity of each crop is shown in figures 1-5. They are represented by wet season rice in Ayudhaya, dry season rice in Nakorn Pathom, maize in Saraburi, cassava in Nakorn Rajsima and sugar cane in Rajburi. Table 5.3 also shows, for some selected activities, the critical minimum world prices of the four crops--the world prices which equate DRC/(SPFX/OER) and DRC to one. The critical minimum world

FIGURE 1

CRITICAL MINIMUM WORLD PRICE FOR PRICE
IN AYUDHAYA, FIRST CROP BROADCASTING

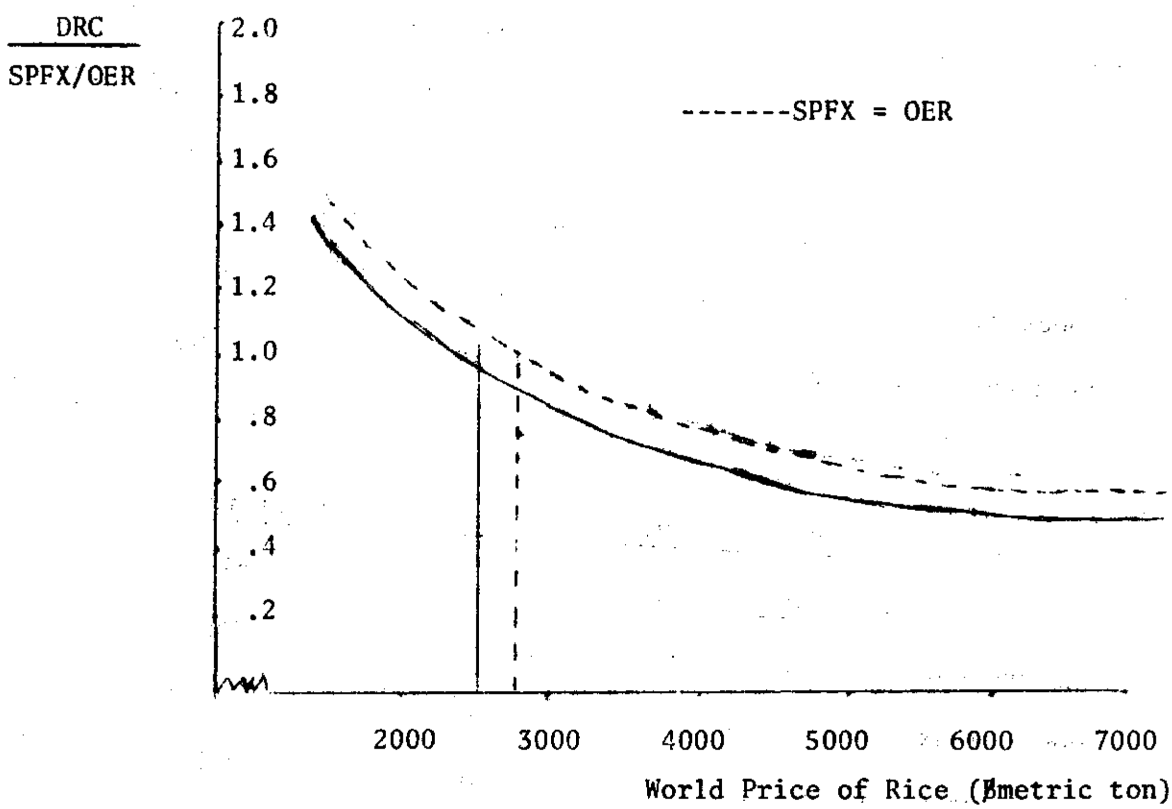


FIGURE 2

CRITICAL MINIMUM WORLD PRICE FOR RICE IN
NAKORN PATHOM SECOND CROP TRANSPLANTING

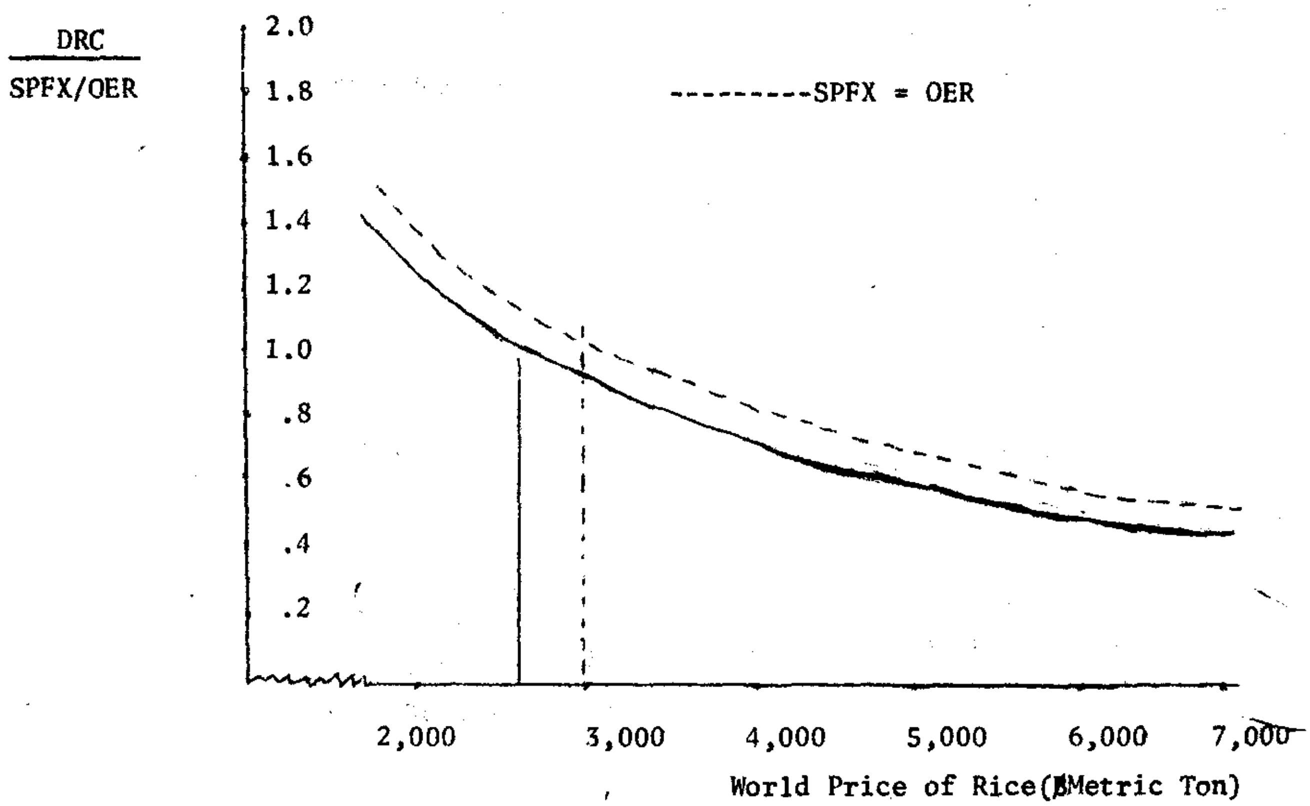


FIGURE 3

CRITICAL MINIMUM WORLD PRICE FOR
MAIZE, FIRST CROP SARABURI

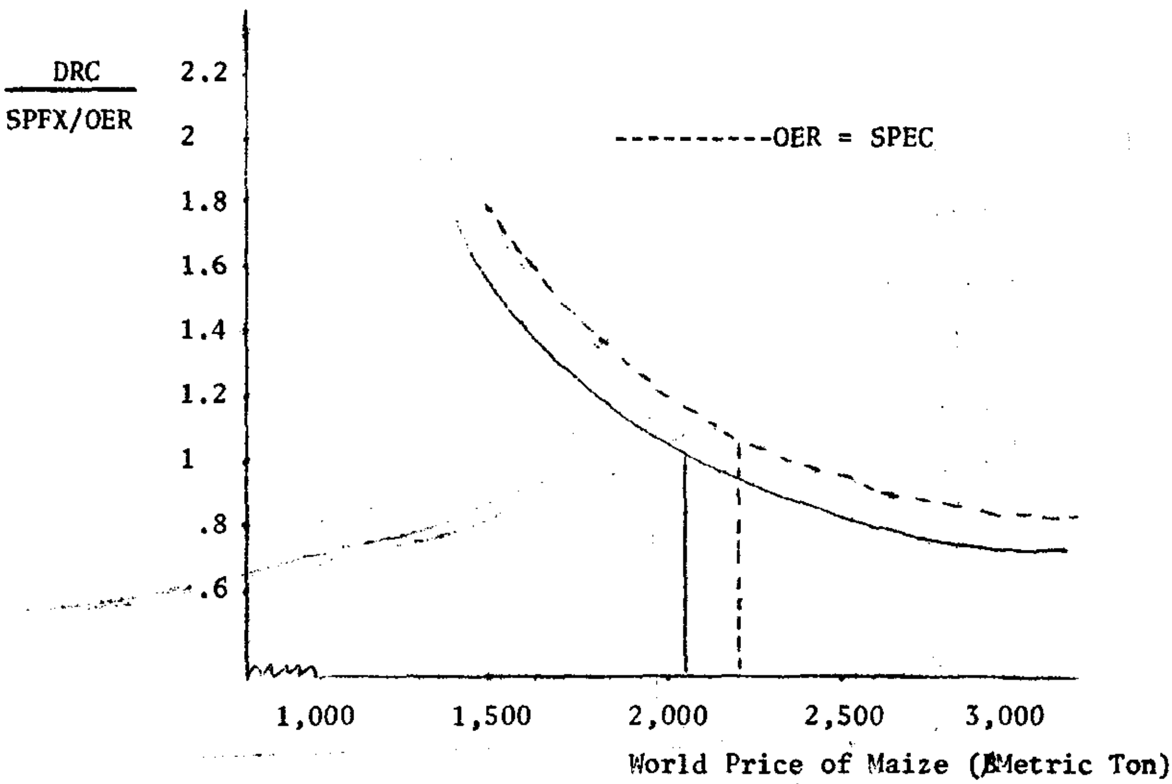
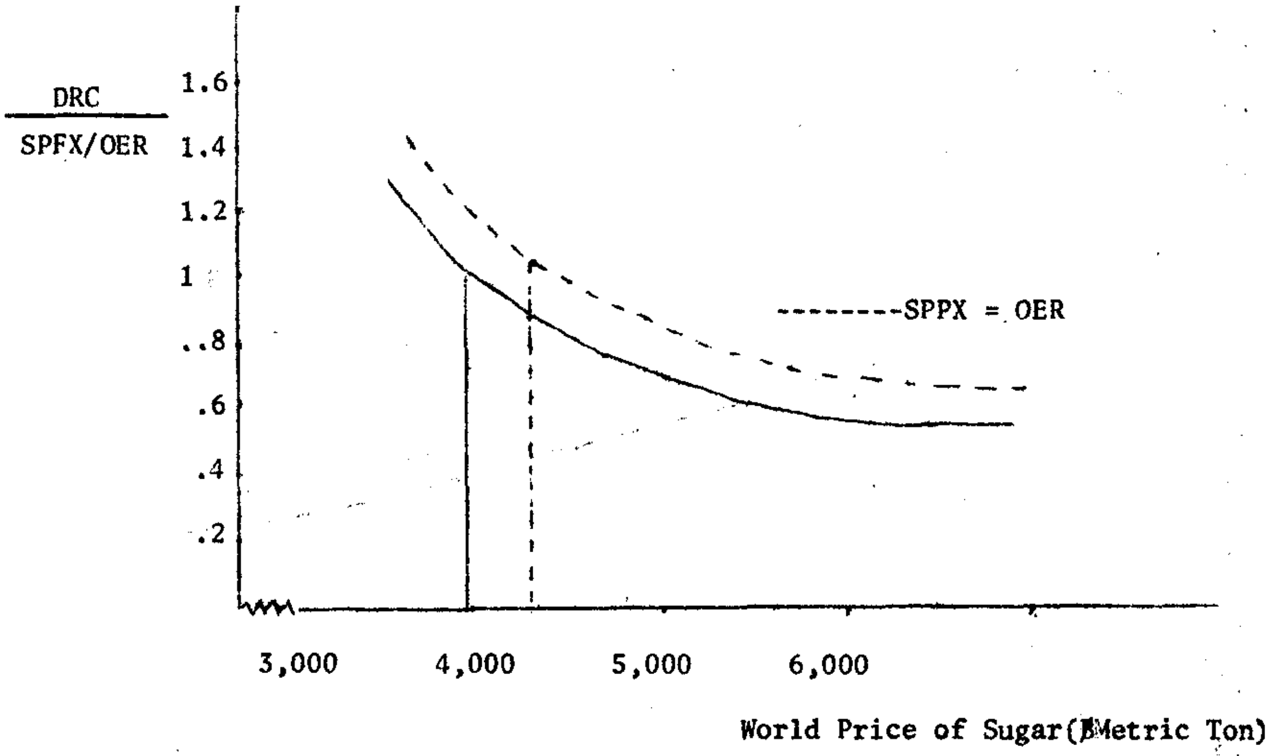


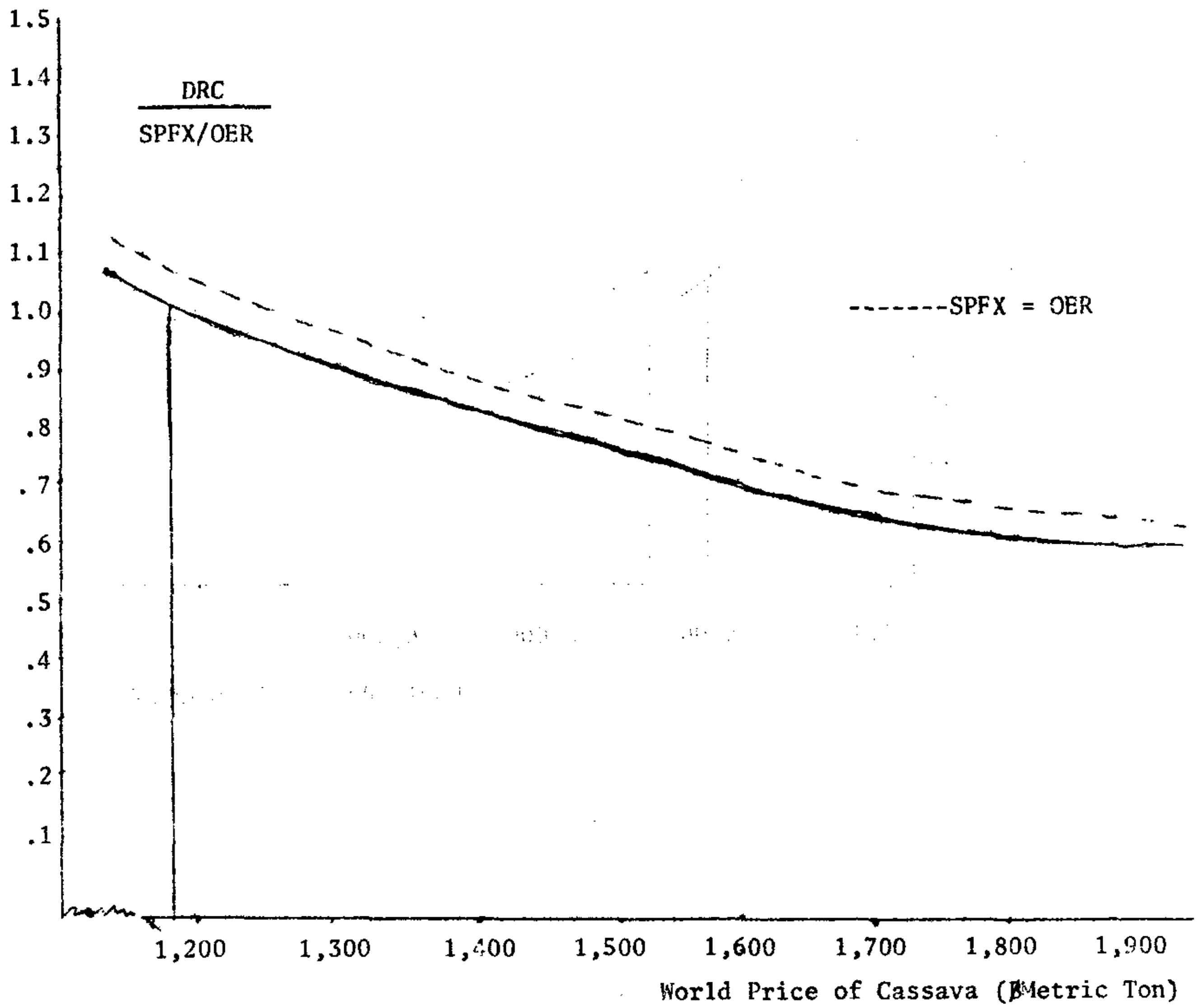
FIGURE 4

CRITICAL MINIMUM WORLD PRICE FOR SUGAR IN RAJBURI



FIGRE 5

CRITICAL MINIMUM WORLD PRICE FOR
CASSAVA IN NAKORN RAJSIMA



prices for wet season broadcasting rice from Ayudhaya are between ฿2,600 and ฿2,875 per ton, while those for dry season HYV transplanting arice are in the vicinity of ฿2,850-฿3,000 per ton.[1] For maize, cassava and sugar cane, the critical minimum world prices are found to be in the range of ฿2,060-฿2,225, ฿1,180-฿1,280, and ฿4,000-฿4,300 per ton respectively.

It is also interesting how DRC ratios change when the world prices in the past years are used instead of the 1977 prices. Table 5.4 illustrates the DRC ratios of the best crop activities, calculated by using the 1975 and 1976 world prices. We find here that the DRC ratios for rice were always the lowest among the four crops, ranging from 0.28 to 0.44 It seems certain to conclude that rice was the crop with the highest comparative advantage among the four major export crops. Sugar cane came second in 1975 and 1976, but came last in 1977. Cassava improved its DRC ranking, moving from the third position in 1975 and 1976 to the second in 1977.

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[1] Our estimates for wet season rice are very close to the figures in Narongchai and Atchana, which are in the range of ฿2,500-฿3,000 per ton. However, our critical minimum world prices for dry season rice are substantially below theirs, which are between ฿3,600-฿4,400 per ton.

TABLE 5.3

CRITICAL MINIMUM WORLD PRICES OF RICE, MAIZE, TAPIOCA PRODUCTS AND SUGAR

Production Activity	World Price When DRC/(SPFX/OER)=1	World Price When DRC =1
Rice		
Rajburi, wet season, transplanting	4,700	5,000
Nakorn Nayok, wet season, transplanting	4,100	4,450
Ayudhaya, wet season, broadcasting	2,600	2,875
Nakorn Rajsima, dry season, transplanting, HYV	6,200	6,700
Supanburi, dry season, transplanting	3,200	3,450
Nakorn Pathom, dry season, transplanting, HYV	2,850	3,000
Maize		
Lopburi, first crop	5,875	6,375
Saraburi, first crop	2,060	2,225
Chiangrai, forst crop	4,062	4,373
Nakorn Rajsima, first crop	2,750	2,970
Tapioca products		
Cholburi	1,525	1,640
Rajburi	1,480	1,585
Nakorn Rajsima	1,180	1,280
Sugar		
Rajburi	4,000	4,300
Nakorn Pathom	4,100	4,350
Supanburi	4,150	4,450

Note:

The average 1977 world prices of rice, maize, tapioca products and sugar were ฿6,139, ฿2,520, ฿1,840 and ฿4,520 per ton respectively.

Source : See appendix E.

TABLE 5.4

DRC RATIOS WITH ALTERNATIVE WORLD PRICES

Year	Rice	Maize	Cassava	Sugar cane
1975	0.28	0.72	0.61	0.38
1976	0.44	0.86	0.59	0.56
1977	0.40	0.87	0.67	0.93

Note:
The following are selected to represent the crops: rice from Nakorn Pathom, maize from Saraburi, cassava from Nakorn Rajsima and sugar cane from Rajburi.

Source: See appendix E.

And maize has consistently had a rather high DRC ratio, but moved up from the last rank in 1975 and 1976 to the third slot in 1977. However, all four activities had their DRC ratios below one, indicating that during the period Thailand had comparative advantage in producing these four crops.

CHAPTER 6

EMPLOYMENT AND INCENTIVES

This chapter deals with the issue of employment derived from the farm-level production of rice, maize, cassava and sugar cane in Thailand. It involves the measurement of labor-capital ratios, labor-land ratios, factor shares of deomestic cost and factor shares of value added for each activity. Modern techniques and their employment effects will also be investigated.

6.1 Relative Labor Intensity

Physical labor intensity is measured in relation to land and capital use. The labor-capital ratios and labor-land ratios for all selected activities are shown in table 6.1. Both types of ratio indicate some regional differences in the use of labor input relative to the other two inputs. One good example is the production of sugar cane, with the ratios ranging from 1.52 man-day per ฿100 of capital and 8.88 man-day per rai to 3.77 man-day per ฿100 of capital and 19.40 man-day per rai. Another example can be seen in the distinct difference of the ratios for second crop transplanting rice in Nakorn Pathom and Nakorn Rajsima. This phenomenon indicates that the techniques of production of the same crop, as in the cases of sugar cane and second crop transplanting rice, could be and, in fact, were actually much different among regions.

TABLE 6.1

THE EFFECTIVE PROTECTIVE COEFFICIENT, THE LABOR-CAPITAL RATIO AND THE LABOR-LAND RATIO FOR RICE, MAIZE, CASSAVA AND SUGAR CANE, 1977/78

Activity	Effective Protective Coefficient (EPC)	Labor-Capital Ratio (L/K) (manday/100 baht)	Labor-Land Ratio (L/T) (manday/rai)
Sugar cane:			
Rajburi	0.85	1.52	8.88
Nakorn Pathom	0.88	2.56	115.24
Supanburi	0.88	3.77	19.40
Cassava:			
Cholburi	0.95	3.06	11.96
Rajburi	0.94	3.92	12.76
Nakorn Rajsima	0.96	6.66	10.75
Maize:			
Lopburi	0.92	3.00	4.76
Saraburi	0.96	3.22	4.11
Chiangrai	0.94	3.56	7.22
Nakorn Rajsima, first crop	0.96	4.48	7.55
Nakorn Rajsima, second crop	0.95	4.24	6.72
Rice, first crop:			
Rajburi (T)	0.67	4.28	13.14
Rajburi (B)	0.70	3.46	6.16
Nakorn Nayok (T)	0.70	3.79	10.99
Nakorn Nayok (B)	0.70	2.20	3.87
Nakorn Rajsima (T)	0.59	4.37	13.37
Ayudhaya (B)	0.71	2.48	5.30
Rice, second crop:			
Nakorn Rajsima (T)	0.64	6.31	30.77
Supanburi (T)	0.68	3.95	12.52
Nakorn Pathom (T)	0.66	1.36	9.69

Note: T and B stand for transplanting and broadcasting respectively.

Source: See table 4.1 and appendix F.

However, the ratios for maize do not show any great differences among regions.

The general, the values of L/K and L/T for transplanting rice are significantly higher than those for broadcasting rice, indicating the relatively more labor-intensive method of production of transplanting rice. There seems to be no distinction between the ratios for first crop and second crop rice, although on the basis of the result in Nakorn Rajsima, we are inclined to suggest that second crop rice production is more labor-intensive. It is interesting to note that the highest values of L/K and L/T can be found in Nakorn Rajsima. This should indicate that relatively more labor-intensive techniques of production were very prevalent in the area. The lowest labor intensity in relation to capital is found in sugar cane production in Rajburi and Nakorn Pathom, broadcasting rice production in all areas, and second crop transplanting rice production in Nakorn Pathom. The activities with the lowest labor-land ratios are maize production in all areas and the production of broadcasting rice.

In summary, even though the results do not enable us to rank the crops in terms of labor intensity, we can probably compare some pairs of activities, such as transplanting and broadcasting rice.

6.2 Factor Shares of Domestic Cost

While the labor-capital ratio expresses the use of labor input relative to capital input at the farm level, the factor shares of domestic cost (FSDC) would extend the scope of the study from farm gate to the border. And in line with the methodology used in calculating DRC, the relative intensity of farm labor, non-farm labor, capital and land, and the value of net social profitability per unit of domestic cost are estimated and displayed in Table 6.2 with the following formula:[1]

$$1/DRC = Lf/DC + Ln/DC + K/DC + N/DC + NSP/DC \text{---}(1)$$

where; 1/DRC = the reverse ratio of DRC which is equal to the ratio of the value added to the domestic cost (VA/DC),

Lf/DC = farm labor share of DC,

Ln/DC = non-farm labor share of DC,

K/DC = capital share of DC,

N/DC = land share of DC and

NSP/DC = net social profitability per unit of DC.

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[1] This method is similar to Stryker's approach in estimathing the factor shares of value added. See D.J. Stryker, "Western Africa Regional Project, Ivory Coast Agriculture," Food Research Institute, Stanford University, 1975. (Mimeographed). Since the yields of the four crops are drastically low as a result of droughts in some regions during the crop year (1977-78), the estimated values on the cost side rather than on the revenue side are considered as better indicators.

The factor shares of domestic cost are inter-related; changes in the intensity of one factor would affect the intensities of the rest. And this is due to the fact that they are added up to unity. The costs of non-farm labor are the labor costs incurred in the production of intermediate inputs, farm implements, machinery, and in the processing, transportation and marketing of the products. These are the indirect employment opportunities generated from the production of the crops.

For tapioca products the intensity of non-farm labor was greater than that of farm labor in all regions, whereas for rice the intensity of the former was less than that of the latter in all regions except for broadcasting rice in Nakorn Nayok and Ayudhaya. These exceptions are the results of the relatively high yields which require more labor inputs in processing, transportation and marketing, together with relatively low levels of farm-labor input in these two regions. For maize, except for Lopburi where the product yield was significantly low, the non-farm labor intensities were higher than the farm labor intensities for all activities. For sugar cane, only in Rajburi where the capital-intensive technique of production with relatively high levels of fertilizers, pesticides and traction was used, the non-farm labor intensity was higher than the farm labor intensity.

TABLE 6.2

FACTOR SHARES OF DOMESTIC COST AND THE NET SOCIAL PROFITABILITY PER UNIT OF DOMESTIC COST FOR TWENTY AGRICULTURAL ACTIVITIES, CROP YEAR 1977-78

Activity		Factor Share of Domestic Cost				NSP/DC
		Labor		Capital	Land	
		Farm	Nonfarm			
Sugar Cane:						
Rajburi		0.136	0.230	0.416	0.218	0.176
Nakorn Pathom		0.182	0.180	0.356	0.282	0.136
Supanburi		0.213	0.173	0.348	0.266	0.111
Cassava:						
Cholburi		0.277	0.358	0.273	0.092	0.234
Rajburi		0.206	0.472	0.217	0.105	0.299
Nakorn Rajsima		0.205	0.271	0.187	0.337	0.639
Maize:						
Lopburi		0.242	0.210	0.154	0.394	-.728
Saraburi		0.157	0.316	0.186	0.314	0.250
Chiangrai		0.224	0.234	0.164	0.378	-.450
Nakorn Rajsima	1st crop	0.131	0.205	0.123	0.541	-.091
	2nd crop	0.150	0.165	0.105	0.580	-.371
Rice 1st Crop:						
Rajburi	(T)	0.304	0.141	0.202	0.353	0.351
	(B)	0.215	0.115	0.138	0.532	-0275
Nakorn Nayok	(T)	0.252	0.160	0.224	0.364	0.587
	(B)	0.121	0.212	0.170	0.497	-.408
Nakorn Rajsima	(T)	0.248	0.123	0.148	0.481	-.519
Ayudhaya	(B)	0.244	0.437	0.319	0.000	1.632
Rice 2nd Crop:						
Nakorn Rajsima	(T)	0.469	0.100	0.209	0.222	-.020
Supanburi	(T)	0.351	0.245	0.203	0.201	1.128
Nakorn Pathom	(T)	0.290	0.221	0.265	0.224	1.703

Note : See the note in table 6.1

Source: Survey data.

TABLE 6.3

FACTOR SHARE OF VALUE ADDED FOR TWENTY AGRICULTURAL ACTIVITIES, CROP YEAR 1977-78

Activity	Factor Share of Value Added				
	Labor				
	Farm	Nonfarm	Capital	Land	Residual
Sugar Cane:					
Rajburi	0.116	0.195	0.354	0.185	0.15
Nakorn Pathom	0.160	0.159	0.313	0.248	0.12
Supanburi	0.192	0.156	0.313	0.239	0.10
Cassava:					
Cholburi	0.224	0.290	0.221	0.075	0.19
Rajburi	0.159	0.363	0.167	0.081	0.23
Nakorn Rajsima	0.125	0.165	0.114	0.206	0.39
Maize:					
Lopburi	0.888	0.771	0.565	1.446	-2.67
Saraburi	0.126	0.252	0.149	0.273	0.20
Chiangrai	0.408	0.426	0.298	0.688	-0.82
Nakornrajsima 1st crop	0.144	0.262	0.135	0.595	-0.10
2nd crop	0.239	0.262	0.167	0.922	-0.59
Rice 1st Crop:					
Rajburi (T)	0.225	0.104	0.150	0.261	0.26
(B)	0.297	0.159	0.190	0.734	-0.38
Nakorn Nayok (T)	0.159	0.101	0.141	0.229	0.37
(B)	0.086	0.150	0.121	0.353	0.29
Nakorn Rajsima (T)	0.516	0.256	0.308	1.000	-1.08
Ayudhaya (B)	0.093	0.166	0.121	0.000	0.62
Rice 2nd Crop:					
Nakorn Rajsima (T)	0.478	0.102	0.213	0.227	-0.02
Supanburi (T)	0.165	0.115	0.096	0.094	0.53
1 Nakorn Pathom (T)	0.107	0.082	0.098	0.083	0.63

Note: See the note in table 6.1.

Source: Survey data.

The high capital intensity usually indicates the correlation between yield and capital input use. For example, the capital intensity was higher for sugar cane in Rajburi and the second crop transplanting rice in Nakorn Pathom. This is because more capital input was used both in Rajburi and Nakorn Pathom, and a relatively higher yield was obtained from Nakorn Pathom.

The intensity of land valued at its social opportunity cost (the economic rent of its best alternative) is also a factor affecting the intensities of other factor shares. For example, the swampy land in Ayudhaya with its social opportunity cost equal to zero has substantially inflated the values of its complementary factors in terms of intensity.

The net social profitability per unit of domestic cost would indicate the degree of competitive advantage. The highest value of NSP/DC is the most desirable. And when NSP/DC is the highest, DRC is usually the lowest, for they are the two sides of the same coin, resulting from their algebraic relationship:

$$\begin{aligned} NSP/DC &= (VA-DC)/DC \\ &= (VA/DC)-(DC/DC) \\ &= (1/DRC)-1 \end{aligned}$$

In Table 6.2, the highest and the lowest values of NSP/DC are 1.703 for the second crop transplanting rice in Nakorn Pathom and -0.728 for maize in Lopburi, whereas their corresponding values of DRC are 0.37 and 3.67 respectively as shown in Table 5.1.

6.3 Factor Shares of Value Added

While FSDC indicates the allocation of resources on the input side, the factor shares of value added (FSVA), on the other hand, would provide us with a better set of indicators to investigate the pattern of income distribution on the output side. In estimating these indicators, by the same taken, the concept of DRC is employed as the following:

$$DRC = Lf/VA + Ln/VA + K/VA + N/VA \text{ -----------(2)}$$

$$DRC+1 = Lf/VA + Ln/VA + K/VA + N/VA + 1$$

$$1 = Lf/VA = Ln/VA + K/VA + N/VA + 1 - DRC$$

$$1 = Lf/VA + Ln/VA + K/VA + N/VA + NSP/VA \text{----(3)}$$

where; Lf/VA = farm labor share of VA,

Ln/VA = non-farm labor share of VA,

K/VA = capital share of VA,

N/VA = land share of VA and

NSP/VA = net social profitability per unit of VA or the residual profit.

Using the relation--formula (1),DRC is equivalent to formula (3), FSVA can be estimated as given in Table 6.3 by multiplying the indicators of FSDC in Table 6.2 by their corresponding values of DRC from Table 5.1.

For every activity with positive NSP (and DRC being lessthan one), all FSVA are lower than their corresponding FSDC. Therefore, any conclusion on the relative shares of different factors in each of these activities is the same as in the preceding section. Any general comparison among different crops in terms of FSVA will not give a definite answer, since there are vast differences even for the same crop produced in different areas. For example, in the case of cassava, the farm labor share ranges from 0.125 to 0.224, while the capital share varies from 0.114 to 0.221.

6.4 Incentives, Resource Allocation and Factor Income Distribution

The effects of incentives on resource allocation and factor income distribution can be studies by comparing the effective protective coefficient with the labor-capital ratio, the labor-land ratio, the factor shares of domestic cost and the factor shares of value added using the indicators in Table 6.1, Table 6.2 and Table 6.3. Judging from the L/K and L/T, it is difficult to conclude whether the crop diversification process, apparently accelerated by relatively heavy disincentives in rice production, would allocate resources to a relatively more labor-intensive or capital-intensive method or production. Since the effects of the scheme can be both ways depending on the values of L/K and L/T of each activity. For instance, in Rajburi the diversification of the first crop transplanting rice (L/K=4.28 and L/T=13.14) into sugar cane (L/K=1.52 and L/T=8.88) would tend to allocate resources to a relatively more capital-intensive and land-intensive method of production. In Nakorn Rajsima the diversification of the second crop transplanting rice (L/K=6.31 and L/T=30.77) into maize (L/K=4.24 and L/T=6.72) would favor capital-intensive and land-intensive way of production, whereas the diversification of rice into cassava (L/K=6.66 and L/T=10.75) would bring about a reverse result.

As far as non-farm labor is concerned, the structure of incentives tends to create more indirect employment opportunities per unit of DC. This is justified by the relatively high non-farm labor shares of DC in the production of cassava and maize as compared with that of rice in most cases. As for the distribution of factor income, the system of incentives, which is biased against rice production, tends to distribute income away from farm laborers in most cases. For instance, in switching from rice to cassava the farm labor share of VA for Rajburi would decline, whereas its non-farm labor share of VA would increase. This result is also true for Nakorn Rajsima, Supanburi and Nakorn Pathom if their production of the second crop transplanting rice are replaced by either maize or sugar cane.

6.5 Modern Technology and Employment

Studies of the effects of farm mechanization on employment opportunities have led to many arguments and counter-arguments.

A good example is, perhaps, that of Inukai's study in which he has pointed out the possibility that adoption of modern technique in terms of farm mechanization would increase employment opportunities as stated:[1]

> There is thus quite a good change that, on balance, selective mechanization will increase the total labor requirements of a unit of land. In other words, in a dynamic setting selective mechanization may create more jobs than it eliminates.

This optimistic argument must, however, rely on the condition stemmed from his hypothesis that the using of tractor in substitution for animal power would lead to a higher percentage of the transplanting method relative to the broadcasting one, in rice production. His conclusion, however, being without statistical proof is hypothetical rather than empirical. And, consequently, his argument has often create disenchantment on the reader's mind. Songsak, for instance, has pointed out in his study that Inukai's argument is highly implausible.[2] His counter-argument was backed up by the fact that,,in most instances, changing from the broadcasting

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[1] I. Inukai, "Farm Mechanization, Output and Labor Input: A Case Study in Thailand," Essays on Employment (Geneva: ILO, 1971), p.71.

[2] Songsak Sriboonchitta, "The Private Cost of Using Tractors versus Buffaloes: A Case Study of Farmers in Cha Choeng Sao Province" (Unpublished M.A. Thesis, Thammasat University, 1975).

method to the transplanting method is not feasible; broadcasting method is widely practised in swampy areas with floating varieties, and due to the physiology of these varieties transplantation cannot be done.

Nevertheless, Songsak has suggested that, as far as timeliness is concerned, mechanization may create more jobs per unit of cultivated land for areas where double cropping is feasible, provided that the use of tractor would induce farmers to grow the second crop in a greater degree.

The apple of discord stemmed from Inukai's argument has, perhaps, come about as a consequence of the absence of the "other things being constant" assumption. This assumption, though seems to be tautological, has always provided economists with an analytical tool by making their partial analysis defensible and, thus, free from negative criticism. For instance, Sunee Bussavit in her study of the sugar cutting machine has analysed the impact of mechanization on labor input of which the result can be summarized as follows.[1]

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[1] Sunee Bussavit, "The Cost Comparison of Hand Cutting Versus Mechanical Cutting of Sugar Cane: A Case Study of the Western Part of Thailand" (Thai version, unpublished M.A. Thesis, Thammasat University, 1978), p.21.

(1) The capacity of the cutting machine is 78.18 tons per day with two men to operate the machine and eight men to gather the cut-canes.

(2) If hand-cutting is employed for harvesting this amount, 69 man-days and 12 man-days would be required for cutting and gathering respectively.

For a partial analysis, it is quite logical and thus defensible to indicate that in switchingffrom hand cutting to mechanical cutting the efficiency of labor increases by 8.1 times. And, consequently, the requirement for labor input would decrease by the same degree for sugar cane harvesting.

In advanced countries, where the level of technology and wage rate are relatively high modern techniques are widely used in all stages of production; in addition to tractor, other mechanical devices and machine-accessories such as tractormounted row crop planter, power sprayer, mechanical cob-picker, combine harvester fitted with attachment, cutting machine and power thresher, ect. are extensively used.

But in Thailand, due to her relatively low level of technological knowhow accompanied with inadequate capital investment and low wage rate, only tractor and water pump are widely used. The use of other mechanical devices is not popular. For instance, Sunee has quoted in her study that in 1976 only as much as 2% of sugar cane was cut by machine. The figure has shown ono tendency to increase. And the higher costs (both social and private) incurred from using the machine has, perhaps, justifiably accounted for the nonuse of this device.[1] In her sensitivity analysis, other things being constant, the private costs in using mechanical cutting and hand cutting would be equal if wage rate increased by 55%[2]. And this finding has, to some extent, verified our low wage argument. By and large, there is no report of the use of other machines in significant level. According to our data, out of twenty agricultural activities only two activities were reported to use power sprayer with 8% and 36% of the total spraying costs for the first crop broadcasting rice in Rajburi and the second crop transplanting rice in Nakorn Pathom respectively. And only 8% of mechanical weeding cost was reported for maize cultivation in Lopburi.

The effect of modern technology on employment opportunities is rather complicated. Repercussions always exist. Since the change of one input ingredient would often affect the utilization and implementation of other ingredients of the input-mix in different manners depending on many other factors--economic, technical and

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[1] ibid., p. 105.

[2] ibid., p. 58.

even subjective, etc., these differences would, consequently, exert different effects on labor requirement. For instance, in growing rice, a change from using traditional varieties of seeds to high yield varieties would result in many subsequent operations. plowings for better seed-bed preparation, more irrigations for better water control, more fertilizations and more pesticide applications are required to gain optimum yields. But, in fulfilling these requirements farmers influenced by factors mentioned above may operate with different factor intensities and different techniques. Better seed-bed preparation may increase labor input with additional animal plowing, or decrease labor input if the increase in plowing requirement justified the use of tractor. And, moreover, the increase in plowing may vary from farm to farm depending on many factors such as the type of soil, the cost of plowing and other subjective factors. This argument can as well be applied to weed control with hand-weeding versus power sprayer, to water control with hand-irrigation versus water pump and to fertilization with chemical fertilizers versus animal manure, etc.

In order to study the effects of modern technology on labor input in a more general way, this study will investigate only the use of some intermediate inputs that may affect the relative employment in terms of labor intensity in relation to capital use. For this partial analysis, disregarding the irrigation which cannot be easily quantified, the application of fertilizers and pesticides are regarded as indicators of modern technology. And since the use of these two items are relatively very low in Thailand as compared with other advanced countries, there is still more room for Thai farmers to improve their product yields by increasing the use of fertilizers and pesticides in adopting modern technology.

The relative study of labor services to capital services is derived from Stryker's approach.[1] The total labor-capital ratio in any activity is the weighted average of the labor-capital ratios of all input ingredients as the following simulation:

$$\frac{Lw}{Kw} = a.\frac{Lf}{Kf} + b.\frac{Lp}{Kp} + c.\frac{Lo}{Ko}$$

where; $\frac{Lw}{Kw}$ = the labor-capital ratio of the whole process of production,

$\frac{Lf}{Kf}$ = the labor-capital ratio of fertilization,

$\frac{Lp}{Kp}$ = the labor-capital ratio of pesticide application,

$\frac{Lo}{Ko}$ = the labor-capital ratio of all other inputs, and

a, b, c are their intensity coefficients.

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[1] J.D. Stryker, op.cit.

Therefore, given (+) and (-) as indicators for which the increasing use of the corresponding input would allocate resources to a relatively more labor-intensive and capital-intensive way of production respectively, the labor-capital ratios expressed in man-day per 100 baht for the application of fertilizers and pesticides, and the whole production process can be estimated and compared with the following implications:

(1) $Lw/Kw < Lf/Kf \Rightarrow (+)$,

(2) $Lw/Kw > Lf/Kf \Rightarrow (-)$,

(3) $Lw/Kw < Lp/Kp \Rightarrow (+)$, and

(4) $Lw/Kw > Lp/Kp \Rightarrow (-)$.

First, with the "other things being constant" assumption, this analysis would investigate whether the increasing use of chemical fertilizers and pesticides would allocate resources to a relatively more capital-intensive way of production, by ignoring the indirect effects that may occur when farmers switch from using animal manure to chemical fertilizers and from hand-weeding to herbicides. Second, the assumption will be removed and the likely indirect effects on employment will be discussed intuitively.

The results given in Table 6.4 indicate that the increasing use of chemical fertilizers would allocate resources to a relatively more capital-intensive method of production. Because, except for

TABLE 6.1

THE LABOR-CAPITAL RATIOS (MAN-DAY PER 100 BAHT OF FERTILIZATION, PESTICIDE APPLICATION AND THE WHOLE PRODUCTION PROCESS WITH INDICATORS OF THE CHANGE IN RELATIVE INTENSITY FOR TWENTY AGRICULTURAL ACTIVITIES, CROP YEAR 1977-78

Activity		Lw/Kw	Lf/Kf	Sign (f)	Lp/K	Sign (P)
Sugar Cane:						
Rajburi		1.52	0.37	(-)	0.31	(-)
Nakorn Pathom		2.56	1.06	(-)	0.92	(-)
Supanburi		3.77	1.44	(-)	0.38	(-)
Cassava:						
Cholburi		3.06	0.65*	(-)	3.41	(+)
Rajburi		3.92	-	IE	1.07	(-)
Nakorn Rajsima		6.66	-	IE	-	IE
Maize:						
Lopburi		3.00	0.67*	(-)	4.54	(+)
Saraburi		3.22	-	IE	-	IE
Chiangrai		3.56	-	IE	-	IE
Nakornrajsima	1st Crop	4.48	1.37*	(-)	-	IE
	2nd Crop	4.24	4.70	(+)	-	IE
Rice 1st Crop:						
Rajburi	(T)	4.28	3.83*	(-)	5.00	(+)
	(B)	3.46	-	IE	5.98	(+)
N Nakorn Nayok	(T)	3.79	1.02*	(-)	8.43	(+)
	(B)	2.20	0.36*	(-)	6.10	(+)
Nakorn Rajsima	(T)	4.37	-	IE	-	IE
Ayudhaya	(B)	2.48	-	IE	3.68	(+)
Rice 2nd Crop:						
Nakorn Rajsima	(T)	6.31	0.33	(-)	0.92	(-)
Supanburi	(B)	3.95	0.18	(-)	1.54	(-)
Nakorn Pathom	(T)	1.36	0.30	(-)	0.58	(-)

* Activities with manure fertilizer.

Note: IE means inestimable, while T and B stand for transplanting and broadcasting respectively.

Source: Survey data.

the second crop of maize in Nakorn Rajsima, Lf/Kf is less than Lw/Kw for every region with fertilizer application. The effects of pesticide application on labor-capital ratio, on the other hand, show great differences among crops. Its use would allocate resources to a relatively more capital intensive way of production for sugar cane and the second crop transplanting rice. But for the first crop of rice (both transplanting and broadcasting) and the production of maize its application would bring about reverse effects; the allocation is relatively more labor-intensive. Whereas for cassava, the (+) sign in one region and the (-) sign in another causes the result to be inconclusive on the crop level.

It should be noted that the above study is a partial analysis which ignores the derived effects that may ential. When the "other things being constant" assumption is removed, the indirect effects both on the input side and the output side must be considered.

On the input side, the use of chemical fertilizers would suppress the use of animal manure and may lower Lw/Kw. The result would be the same for pesticide application if hand-weeding is replaced by herbicides, especially when power sprayer is used.

On the output side, modern technology would increase labor requirements if the increasing use of such intermediate inputs is carefully implemented. Product yields would increase substantially. Thus, if mechanized harvesters are not used, labor inputs for harvesting must be increased. And this would cause Lw/Kw to increase. Therefore, in studying the effects of technology on employment, unless all repercussions are known, the total effect cannot be effectively estimated and a partial analysis has to be used.

CHAPTER 7

SUMMARY, CONCLUSION AND POLICY IMPLICATION

7.1 Summary

There is a clear indication that the government's system of price incentives has been neutral towards the production and export of maize and tapioca products, and discriminated heavily against the production and export of rice, and, to some extent, against sugar. It is found that the export taxes, in various forms, on rice were the major disincentive on rice production in 1977. Even though there have been measures to subsidize some inputs, such as fertilizers and credit, their effects are found to be relatively insignificant and poorly distributed.

Among the four crops under study, the apttern of domestic resource cost indicates the highest degree of comparative advantage in the production of rice, particularly rice in the Central Region, followed by cassava, sugar cane and maize respectively. The high degree of compparative disadvantage has usually come about when product yields were abnormally low, as in the case of maize. Even when yields are normalized, the ranking in terms of domestic resource cost remains unchanged.

The intensities of the factors of production in the cultivation of crops are highly different both among crops and regions, Major factors influencing these intensities are the physiology of the crop, the technique of production, and the institutional as well as the subjective factors. The use of input-mix would affect product yields and, inttrun, labor input for the harvest of the crops.

Modern techniques, represented by the use of fertilizers and pesticides, tend to allocate resources to a relatively more capital-intensive method of production. However, modern technology could increase labor requirements if some intermediate inputs are used intensively, if yields are substantially increased and harvesting is not done by machines.

7.2 Policy Implication and Concluding Remarks

It is interesting to note that the government's system of price incentives was strongly against rice, despite the relatively high degree of comparative advantage in rice production. This policy can perhaps be justified by the desire to diversify crop production in orderrto prevent the economy from being so heavily dependent on rice. The justification can be that rice export taxes will withdraw revenue to finance government expenditure on other projects. Moreover, the cheap rice policy might be politically motivated to keep the cost of living and wages at low levels, thus tending to favor the richer urban sector.

In general, the structure of incentives tends to allocate resources to a more labor-intensive method of production in line with government's policy to create more employment opportunities. The promotion of cassava products indicates an efficient way of resource allocation judging by the high degree of comparative advantage with a relatively high value of labor-capital ratio and a high factor share of domestic cost in terms of indirect labor cost. But for maize, it is not yet conclusive that the diversification has led to the misallocation of resources. Since both its labor-capital ratio and the non-farm labor share of domestic cost are relatively higher than those of the production of rice. The diversification of crops from activities with relatively high values of DRC to those with lower values of DRC is recommended only on the inter-crop basis, provided that the scheme is consistent with the existing factors of production--labor supply, arability of land and capital formation, in conformity with the substitutability of the two crops in question and in anticipation of the domestic requirements and the demand for export of the crops. But in view of the fact that there are differences in DRC for the same crop grown in different areas and there are overlapped internals of DRC among crops, it is useful to investigate in more detail the choice of crop in which each area should be specialized.

On the other hand, incentives may be given to areas with higher values of DRC in order to subsidize these regions in compensation of the lower yields realized from the previous crop year in case of crop failure. Moreover, if the high value of DRC is due to technical problems via the low level of technology or techniques in a particular region, incentives in terms of the provision of technological knowhow and technical assistance with subsidization of intermediate inputs may, in effect, boost up product yield bringing about a higher degree of comparative advantage for the productiin the coming year.

This study is fraught with some data problems. After weeding out all incomplete and unreliable data, we are left with 20 production activities which, though covering the main producing areas of the four crops, do not give an economy-wide representative picture of their production. Some of the yield data obtained are unusually low due to serious droughts and floods in 1977. Even though those yields have been normalized, their costssof production cannot be adjusted because of lack of information. Nonprice incentives cannot beqquantified, and this has underrated the degree of effective protection of the four crops.

Despite these data weaknesses, the results of the study strongly indicate that the crop with the highest degree of comparative advantage has been penalized by the government price incentive system, that some particular crops in particular regions are more labor-intensive than the others, and that some modern techniques may worsen the problem of rural unemployment and underemployment. The study also implies that any policy measures to be taken must take into account regional differences, and that government policy cannot be formulated on the belief that any of these crops has the same performance in terms of costs and yields in different producing areas.

Finally, further studies should be done not only to remedy those weaknesses found in our study, but also to fill in the areas and aspects neglected by us. The types of study on the four crops that could extend and perfect our study are, for example:

1. The effects of nonprice incentives on effective production and domestic resource costs.

2. The complete and reliable input-output structure.

3. The effects of farm mechanization on domestic resource cost and labor intensity.

4. The application of time-series data in finding changes over time in effective protection, domestic resource cost and labor utilization.

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