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NET SOCIAL PROFITABILITY AND DOMESTIC RESOURCE COST OF EIGHT AGRICULTURAL COMMODITIES IN THAILAND

by

Tipaporn Lokaphadhana
Instructor, Faculty of Economics
Chulalongkorn University
Bangkok, Thailand

and

Delane E. Welsch
Professor
Agricultural & Applied Economics
University of Minnesota

Department of Agricultural and Applied Economics

University of Minnesota
Institute of Agriculture, Forestry and Home Economics
St. Paul, Minnesota 55108

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I INTRODUCTION

Government may intervene in agricultural price setting in different ways and for different reasons. Schultz [21] classified government interventions to alter market prices, and thereby incentives, in agriculture into three types of policies. First, there are economic policies that are neutral with respect to the opportunity cost of agricultural production. Second, there are those which overvalue agricultural production. And third, there are policies which undervalue agricultural products. Only a few countries follow the first set of policies. High income, developed, countries usually fall into the second category. Most low income developing countries fall into the third category. The overvalued agricultural product price policies produce effects which are opposite to those of undervalued pricing. However, both policies are costly in terms of global welfare.

Thailand, like many other countries, has discriminated against its agricultural sector by means of restrictive trade policies. The methods used by the Thai government vary, and include export taxes, export quotas or licenses, export subsidies, taxes on imported inputs, and others. These and other similar policies have transferred income from rural producers to urban consumers by keeping domestic agricultural prices below their world opportunity costs. Exports have been less than they otherwise would have been, and social costs in the form of economic wastage have been imposed on the society at large. [4, 13, 20, 21]

The Thai agricultural sector has further been indirectly discriminated against through the incentives provided to import substitution industries in non-agricultural sectors of the economy. Narongchai's study [1] indicated that the incentives provided by the government were for investment in import substitution industries, not in agricultural exports.

Protection has often been criticized for its tendency to misallocate scarce resources,-and to induce a pattern of economic growth that is not in the best interest of any country's long run development. Protection that is biased against exports which a given country could produce with comparative advantage and that encourages the substitution of imports of products in which that given country is at a disadvantage tends to slow the rate of growth of national income and cause balance of payment problems.

Much of the discrimination against agriculture in Thailand as well as in other developing countries is self imposed. The main motivation for the policy is to keep the cost of living down. An important element in the cost of living is food. In formulating food and agricultural policies, the stated objectives of the Thai government are: first, to increase both agricultural production and the farm gate price in order to raise farmers' income; second, to keep urban food prices low and stable for the benefit of urban consumers; and third, to expand exports in order to earn more foreign exchange [19]. These objectives conflict with one another and so require compromise. In practice, the objective of low and stable urban prices seems to dominate the others.

The Thai government's main policy instrument in the pursuit of those three objectives is the regulation of exports. An agricultural exporting country can usually achieve its major agricultural product price objectives by exerting pressure at the export point. The magnitude of the effects of these policies on agricultural output, efficiency, and income distribution between producers and consumers are often not fully appreciated by policy makers.

Furthermore, little attention has been given in Thailand to the relationship between government policies and the relative economic efficiency of alternative commodity production. Consequently, the real cost of earning foreign exchange through alternative commodity exports has not been determined and therefore has not influenced policies. The high degree of government intervention clearly limits the extent to which economic efficiency is allowed to dictate patterns of production and trade.

Scope and Objectives

The main purpose of this study is to measure, among commodities and among agro-economic zones, the economic efficiency and the real cost of earning foreign exchange through producing and exporting eight selected commodities by using the concepts of social profitability and domestic resource cost. The eight selected commodities are namely: rice, sugar cane, maize, cassava root, kenaf, mung beans, ground nuts and soyabeans. The interaction between economic efficiency and government intervention in the external trade of these commodities will also be examined. The period included in the study will be 1977/78, 1978/79, 1979/80 and 1980/81 crop years.

The eight commodities were selected on the basis of three criteria. First, as shown in Table 1 these eight commodities accounted for an average of 44 percent of the total export earnings of Thailand during the past 10 years. Second, there is some competition for the use of labor and capital among all eight crops, and stronger competition for use of land between several pairs of crops. Examples of competition for land use are between rice and sugar cane and between cassava and kenaf. Hence, comparison of the degree of economic efficiency and protection will provide some insights into the process of diversification. Third, among all the agricultural exports, government intervention in the trade of these selected exports was the most pronounced and controversial, especially for rice, sugar and maize.

Table 1 Percent that each of Eight Selected Major Agricultural Exports is of Total Value of Exports from Thailand, in Current Prices, 1970-81

Year	Rice	Maize	Cassava Products	Sugar	Jute and Kenaf	Mung Beans	Ground Nuts	Soyabeans	All other Exports	Total Value of Exports
	percent of total value of exports									(billion baht)
1970	17.0	13.3	8.3	0.6	4.9	1.7	0.2	0.1	53.9	14.8
1971	16.8	13.2	7.2	2.2	6.3	1.5	0.1	0.1	52.6	17.3
1972	19.7	9.3	6.9	5.6	6.3	1.2	0.0	0.1	50.9	22.5
1973	11.2	9.2	7.9	3.5	4.7	1.2	0.1	0.2	62.0	32.2
1974	19.4	12.1	7.6	7.5	1.7	0.9	0.1	0.1	50.6	49.8
1975	13.0	12.7	10.2	12.7	1.4	1.0	0.1	0.3	48.6	45.9
1976	14.2	9.4	12.4	11.3	1.0	1.6	0.1	0.1	49.9	60.8
1977	18.8	4.7	10.8	10.5	0.6	1.5	0.2	0.1	52.8	71.2
1978	12.6	8.7	13.1	4.8	0.5	1.4	0.2	0.1	58.6	83.1
1979	14.4	5.2	9.1	4.4	0.4	1.3	0.2	0.1	64.9	108.2
1980	14.6	5.5	11.2	2.2	0.1	1.1	0.0	0.0	65.3	133.2
1981	17.2	5.4	10.1	0.1	6.8	1.1	0.2	0.0	59.1	153.0
Average	15.7	9.1	9.6	5.5	2.9	1.2	0.2	0.1	55.8	66.0

Source: Department of Customs, Ministry of Finance.

Overview of the Production and Trade Aspects of the Eight Selected Commodities

Rice

Rice is produced in nearly every province in Thailand, but most of the rice that Thailand exports is produced in the central region, which is predominantly a rice growing region. Total rice output increased from 6.9 million metric tons (milled basis) in 1967/68 crop year to 9.2 million metric tons in 1971/72 and to 10.6 million metric tons in 1979/80. The average output over the 11 year period was 9.0 million metric tons, of which 1.7 million metric tons (milled basis) was exported, earning 7.4 billion baht of foreign exchange annually. Regular customers for Thai rice are Malaysia, Singapore, Hong Kong, Indonesia, Japan and Saudi Arabia. Occasional customers are Sri Lanka, India, Philippines and Senegal.

Sugar

Sugar cane is produced in all regions except the south, but about 80 percent of sugar cane production is in the central region. Of the rest, 12 and eight percent come from the north and northeast, respectively. Sugar cane production has increased considerable during the past decade due to increasing world demand for sugar. Total sugar production[1/] increased from 0.18 million metric tons in 1967 to 0.65 million metric tons in 1972 and to 2.6 million metric tons in 1978. Raw sugar exports averaged 0.77 million metric tons with an value of 3.9 billion baht annually since 1971. The major markets for Thai sugar are Japan, Malaysia, Singapore and the U.S.A.

1/ This includes both white plantation sugar for domestic consumption and raw sugar for exports.

Maize

A variety of maize suitable only for animal feed was first introduced into the country in the early 1950's. Maize production has increased rapidly, from 0.9 million metric tons in 1963/64 to 2.3 million metric tons in 1970/71 and 2.9 million metric tons in 1979/80. About 90 percent of the total production of maize is now concentrated in the upper central plain.

Thailand's maize industry is chiefly export oriented, with about 85-90 percent of annual production being exported. An average of 1.8 million metric tons has been exported each year since 1971, and the average foreign exchange earnings each year since 1971 have been 4.1 billion baht. Thailand's maize trade has been characterized by three groups of export markets: (1) markets with long term export agreements--Japan and Taiwan: (2) traditional markets--Hong Kong, Singapore and Malaysia: and (3) casual markets--irregular buyers such as the Middle East. The first group seems to have the greatest impact on the maize trade, since up to 70 percent of Thai maize exports went to this group under long term trade agreements in the early 1970's.

Cassava

Cassava has become popular in the eastern seaboard provinces during the past 40 years and has spread rapidly to provinces in the northeastern and central regions since 1970. The two main reasons for the rapid expansion were the increasing demand from countries in the European Economic Community (EEC) for cassava for animal feed and the competitive position of cassava for resource use, chiefly land and labor, in certain areas of Thailand. The production of fresh cassava roots increased from 2.11 million metric tons in 1963/64 to 3.43 million metric tons in 1970/71 and to 15.05 million metric tons in the 1978/79 crop year.

Cassava products can be divided into cassava flour (or starch) and cassava for animal feed. Some flour or starch is utilized domestically and the rest is exported, with more than 50 percent going to Japan and the U.S.A. Since 1973, almost all cassava for animal feed has been exported in the form of pellets. More than 98 percent of the pellets went to the EEC countries. Between 1971 and 1981, Thailand earned an average of 4.6 billion baht of foreign exchange annually from exporting cassava products.

Kenaf

About 95 percent of the kenaf produced in Thailand comes from the northeastern region. Kenaf production increased in the first half of the 1960's, reaching a peak of 0.67 million metric tons in 1966/67. Since then, production has decreased sharply, due mainly to decreasing external demand. The export demand for Thai kenaf is primarily based on international market conditions and is a residual demand, as Thai kenaf is a second choice substitute for Indian and Bangladesh jute in the London market. A poor crop of jute in India or Bangladesh drastically increases the demand for kenaf exports from Thailand. This is what occurred in 1961/62, 1965/67 and 1971/73. But when the world jute supply is adequate, world prices for Thai kenaf prices drop to very low levels. Moreover, in recent years the substitution of synthetic products (plastics) for both jute and kenaf has added further to the degree of uncertainty in the demand for both crops. Furthermore, because of increased world demand for cassava pellets and maize for animal feed, most farmers moved from kenaf production to the other two products. Production of kenaf was only 0.32 and 0.22 million metric tons in the 1968/69 and the 1979/80 crop years, respectively.

Most of Thailand's kenaf production is either processed domestically or exported as baled kenaf. Mill consumption has tended to grow more rapidly than exported baled kenaf. The principal products manufactured by domestic mills are gunny bags and rope. Exports of baled kenaf have averaged 0.17 million metric tons with a foreign exchange value of 0.75 billion baht annually since 1971. Although the importance of kenaf in the Thai economy decreased during the last one-half of the 1970's, it was the fifth or the sixth largest foreign exchange earner among the Thai agricultural exports in the 1960's and early 1970's. The markets for Thai kenaf are in Japan, Taiwan, U.S.A. and most European countries.

Mung Beans

Since 1957, mung beans has become an important cash crop of Thailand. Mung beans production is concentrated in the northern part of the country. The rate of mung beans production increased from 0.12 million metric tons in 1963 to 0.19 million metric tons in 1977 and to 0.27 million metric tons in 1980. The average output over the 12 year period was 0.17 million metric tons, of which 0.07 million metric ton was exported. Thailand is an important mung beans exporter in the world market. Regular customers of Thai mung beans are Japan, Taiwan, Malaysia, Hong Kong and Singapore.

Ground Nuts

Ground nuts are widely grown throughout the kingdom. However, more than 72 percent of ground nuts production concentrated in agro-economic zones 4, 5, 6, 9, 10 and 15. The average rate of ground nuts production over the past five years was 138 thousand metric tons, of which 12 thousand (or nine percent of total production) was exported. Singapore, Hong Kong, Malaysia, Iran and Sarawak are the major customers of first grade Thai ground nuts.

Soyabeans

More than 90 percent of the area planted in soyabeans is in the northern part of the country. The share of soyabeans production is small compared to other crops. The average output over the past five year period was 119 thousand metric tons, of which only an average of 8,169 metric tons (or six percent of total production) was exported. Singapore, Malaysia and Hong Kong are the major customers of first grade Prapudhabaht and Chiangmai soyabeans.

It is interested to note that Thailand also import second grade soyabeans from Brazil and the U.S.A. for the purpose of oil extraction by the vegetable oil industry.

Sources of Data

The measurement of social profitability and domestic resource cost coefficients in this study will be based mainly on data from the survey of costs and returns in the 1977/78, 1978/79, 1979/80 and 1980/81 crop years which were conducted by the Ministry of Agriculture and Cooperatives. Supplementary data will be obtained from the Bank of Thailand Monthly Bulletin and the F.A.O. Trade Yearbook.

The costs and returns data are available for each agro-economic zone. The country is divided into 19 agro-economic zones as shown in Figure 1. Each zone 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. Zones 1-5 are in the northeast, Zones 6, 8, 9 and 10 are in the north. Zones 17-19 are in the south and the rest are in the central region [9].

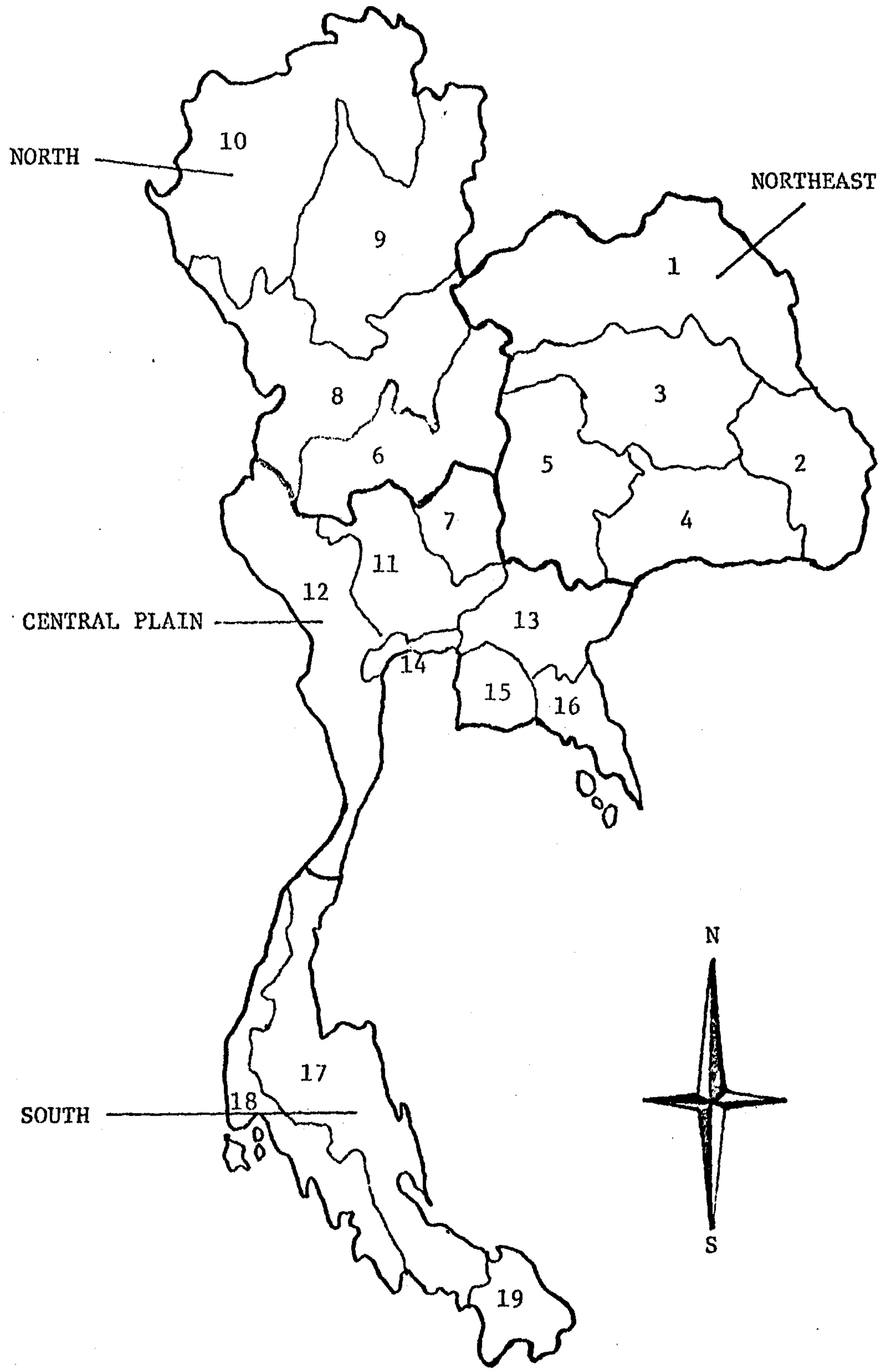

Figure 1 Agroeconomic Zones of Thailand

Organization of this Study

This study is organized as follows: Section I serves as the introduction to the study. Section II is a presentation of the theoretical consideration on which the analysis is based. Section III presents a brief discussion of exchange rate policies and government intervention in the external trade of the eight selected commodities. Section IV deals with the data base used in the calculation of net social profitability and domestic resource cost. Section V presents the empirical results. The last section presents the conclusion and policy implications.

II THEORETICAL MODEL

According to the classical concept of the gain from international trade, a nation can increase its output from specialization and exchange. The law of comparative advantage as developed by Ricardo [3] showed that countries could mutually benefit from trade if the relative prices of commodities differed between countries in the absence of trade. A country possesses a comparative advantage in a commodity if, before trade, that commodity is relatively cheaper in that country compared to the price ratio abroad.

Chenery [6] pointed out that a country has a comparative advantage in exporting a commodity if the social opportunity cost of producing a unit of the commodity is less than the commodity's export price.

$$F.E + D < P.E. \qquad (1)$$

where F = direct and indirect foreign factor costs per unit of output (in foreign currency)

E = exchange rate (local currency to foreign currency)

D = direct and indirect domestic factor costs per unit of output (in local currency)

P = price of the export per unit (in foreign currency)

Bruno [5] further developed and applied Chenery's ideas in project appraisal work related to the Israeli economy. He suggested that a country has a comparative advantage in an economic activity if the domestic resource cost (DRC) per unit of foreign exchange earned or saved is less than the shadow price of foreign exchange.

$$DRC = \frac{D}{P - F} < S \qquad (2)$$

where S is the shadow price of foreign exchange.

Pearson and Meyer [17] applied Bruno's concept of DRC to evaluate comparative advantage among African Coffee producers. By dividing each side of the pervious equation by S, the criterion for comparative advantage becomes

$$\frac{DRC}{S} < 1 \quad . \qquad (3)$$

The relative comparative advantage of one country to another in a single commodity is obtained by comparing the DRC/S ratios.

Pearson, Akrasanee and Nelson [18] used a modification of Bruno's framework in a rice policy research project covering four countries, namely, the United States, Thailand, the Philippines and Taiwan.

Page and Stryker [16] developed a common methodology in estimating the comparative costs and incentives for various rice activities in five West African countries, namely, Ivory Coast, Liberia, Mali, Senegal and Sierra Leone. Their methodology was built upon the methodology of Pearson, Akrasanee and Nelson. Page and Stryker based their analysis on the twin concepts of private and social profitability. Individuals or firms make private investment decisions on the basis of observed or market prices. Hence, the concepts of net private profitability (NPP) and the effective protection coefficient (EPC) were used as the measures of incentives and protection to producers. The concepts of net social profitability (NSP) and domestic resource cost (DRC) were used as indicators for public investment.

The concept of net social profitability and domestic resource cost employed in this study will build upon the methodology of Pearson, Akransanee and Nelson [18] and they will be presented in the following section.

Net Social Profitability (NSP)

A technique for producing an additional unit of a commodity is efficient if the social value of its output is equal to or greater than the social opportunity cost of the factors of production employed in producing it. The measure of efficiency, thus defined, is the net social profitability (NSP) of the activity [16].

The net social profitability (NSP_j) can be defined as the net gain (or loss) associated with the j^{th} economic activity when all commodity output produced and material inputs and factors of production employed are evaluated at their social opportunity cost and when all external effects on the domestic economy are given a social valuation and included directly in the measure.

$$NSP_j = \sum_{i=1}^{n} a_{ij}P_i - \sum_{s=1}^{m} f_{sj}V_s + E_j \qquad (4)$$

where P_i is the shadow price of the i^{th} commodity output (or of the i^{th} material input) (in domestic currency)

V_s is the shadow price of the s^{th} factor of production (in domestic currency)

E_j is a measure of the net external benefits or costs imparted by the j^{th} activity to the rest of the domestic economy.

A second definition of NSP will be developed by making the following two adjustments:

1. All outputs are assumed to be tradable as either exports that earn foreign exchange or import substitutes that save foreign exchange.

2. All input costs are divided into costs of tradable inputs and costs of primary domestic factors. A locally produced input is classified as (a) tradable if it is fully traded, i.e., if the country also imports some of the good, or (b) nontradable if it is nonfully traded, i.e., if the country does not import any of the good. The nontradable inputs are then decomposed into tradable components and primary domestic factors by moving one step backward through the input-output chain.

The second definition of NSP is given as:

$$NSP_j = (u_j - \overline{m}_j - r_j)\, V_1 - \sum_{s=2}^{m} \overline{f}_{sj}V_s + E_j \qquad (5)$$

where u_j is the value at world price of the output of the j^{th} activity (in foreign currency)

$\overline{m}_j$ is the total value both direct and indirect of tradable materials used by the j^{th} activity (in foreign currency)

r_j is the total value both direct and indirect of repatriated earnings of foreign-owned factors of production employed by the j^{th} activity (including repatriated portions of the direct foreign factor costs, $f_{1j}V_1$, and of the indirect foreign factor costs)

V_1 is the shadow price of foreign exchange, expressed as a ratio of local currency to foreign currency

$\overline{f}_{sj}$ is the total, both direct and indirect, quantity of the s^{th} primary domestic factor employed by the j^{th} activity.

Hence, an activity is judged efficient if total social cost of an incremental project including direct and indirect tradable costs $(\overline{m}_j+r_j)V_1$ and direct and indirect costs of primary domestic factors $(\sum_{s=2}^{m} \overline{f}_{sj}V_s)$ less net external benefits (E_j) are less than total social returns (u_jV_1), or

$$(\overline{m}_j + r_j)V_1 + \sum_{s=2}^{m} \overline{f}_{sj}V_s - E_j < u_jV_1 \qquad (6)$$

By rearranging the terms in equation 6, the relationship between a positive NSP and the existence of efficiency is

$$(u_j - \overline{m}_j - t_j)V_1 - \sum_{s=2}^{m} \overline{f}_{sj}V_s + E_j > 0; \text{ or NSP} > 0 \qquad (7)$$

Domestic Resource Cost

The value of net social profitability varies with the measure of output of each activity. Therefore, the concept of domestic resource cost is derived in order to measure the relative efficiency of activities producing different outputs. This alternative criterion is independent of units of measurement and can be derived from the NSP criterion.

The domestic resource cost ratio can be obtained by setting equation 5 equal to zero and solving for V_1. With respect to the

j^{th} activity, DRC_j is a measure of the social opportunity cost (in terms of domestic factors of production) of earning a net marginal unit of foreign exchange for a commodity export or it is a measure of the use of all domestic resources in saving a net marginal unit of foreign exchange as in case of an import substitute.

$$DRC_j = \frac{\sum_{s=2}^{m} \bar{f}_{sj} V_s - E_j}{u_j - \bar{m}_j - r_j} = \frac{DC_j}{NVA_j} \quad (8)$$

where DC_j is the opportunity cost of domestic resources employed by the j^{th} activity (in domestic currency)

NVA_j is net foreign exchange earned or saved (in foreign currency) or equivalently, value added at world prices.

A direct relationship between DRC and NSP can be obtained by substituting (8) into (5)

$$NSP_j = (V_1 - DRC_j)(u_j - \bar{m}_j - r_j) \quad (9)$$

$$NSP \gtreqless 0 \text{ as } DRC \lesseqgtr V_1 \quad (10)$$

Thus, an activity is socially profitable if its DRC ratio, which measures its efficiency in transforming domestic resources into foreign exchange, is less than the shadow price of foreign exchange. That is when

$$\frac{\sum_{s=2}^{m} \bar{f}_{sj} V_s}{u_j - \bar{m}_j - r_j} < V_1 \quad (11)$$

or $$DRC_j < V_1 \quad (12)$$

or $$\frac{DRC_j}{V_1} < 1 \quad (13)$$

Hence, a commodity is socially profitable or economically efficient to produce and export if condition (11) or (12) or (13) is satisfied.

It will be more convenient to use a modified form of DRC in which both numerator and denominator are expressed in terms of domestic currency. Then DRC and V_1 will become

$$DRC_j{*} = \frac{\sum_{s=2}^{m} \bar{f}_{sj} V_s - E_j}{(u_j - \bar{m}_j - r_j)V_1} = DRC_j \frac{1}{V} \qquad (14)$$

The criterion for economic efficiency is

$$\frac{\frac{DRC_j}{V_1}}{\frac{V_1}{V_1{*}}} < 1 \qquad (15)$$

Within a single country, the DRC concept can be used to evaluate a single project or several alternative projects.2/ Several projects

2/ Pearson, Akrasanee and Nelson also used DRC as a criteria for "comparative advantage." Use of the term "comparative advantage" in the literature discussed earlier may lead to some confusion. Assume a simple example of two countries, two goods and one factor of production in which one country is assumed to have an absolute advantage in both goods, i.e., its input productivity is higher or unit input cost is lower. Ricardo [3] used such an example to show that the more productive country should specialize in the production of the good in which its relative degree of productivity was the greatest. The other country should produce and export the other good. Thus the criteria of comparative advantage is founded on the idea of the relative degree of productivity in the production of two goods in two countries. Given the above idea, Ford [10] has proved that comparative advantage as measured by DRC analysis after only investigating one product in one country can be extremely inaccurate.

can be ranked according to their DRC ratios so long as they can be assumed not to alter relative prices in the economy. DRC as used in this study will be emphasized as an indicator for comparing the relative efficiency of the same economic activity in alternative regions, or alternative economic activities within the same region in the same country. Given a desire to expand a particular crop within the country, the region with the lowest DRC is the most efficient avenue for expansion and DRC ranking thus indicates where the country can expect the highest social rate of return on its investment. Furthermore, this approach permits an interaction between economic efficiency and government intervention. A high degree of government intervention clearly limits the extent to which economic efficiency is allowed to dictate the patterns of production and trade.

The readers should bear in mind that the DRC approach was built on the assumptions that (1) the world price of output is given exogenously, (2) technology in production processes as well as relative factor prices are assumed unchanged over the period, and (3) the shadow prices of output, primary factors, tradable inputs, and foreign exchange can be calculated. Furthermore, physical constraints on factors of production, especially land, might be a caveat to the application of the DRC approach.

III EXCHANGE RATE POLICY AND THE GOVERNMENT INTERVENTION IN THE PRODUCT AND FACTOR MARKETS

Exchange Rate Policy

Between 1947 and August 1955, the Thai government maintained a multiple exchange rate system [7]. Since then, Thailand has followed an adjustable peg system under the International Monetary Fund's Article of Agreement almost continuously up to the present time. The rate of exchange was in the neighborhood of ฿20.45 - ฿20.50 per U.S. dollar until 1974 when it was lowered slightly to ฿10.25 - ฿20.45 per U.S. dollar. During a short period between March and October 1978, the value of the baht was linked to a basket of currencies (replacing the earlier fixed parity with the U.S. dollar). Between November 6, 1978 and July 14, 1981, the Bank of Thailand had adopted a daily fixing of the baht against the U.S. dollar. On July 15, 1981, the Thai government devalued the baht relative to the U.S. dollar. The official exchange rate was changed from an average nominal rate of ฿20.40 per U.S. dollar to ฿23.00 per U.S. dollar, or a 12.75 percent devaluation. This new exchange rate is believed to approximate the equilibrium exchange rate.

Rice Trade Policy

The two principal rice policy objectives of the Thai government are to control the quantity exported in order to make sure domestic supplies are adequate to maintain a stable domestic rice price and to earn revenue from collecting the rice export taxes. Since 1962, the exports of rice have been subjected to three kinds of taxes: export taxes, export premium, and taxes implied by the rice reserve requirements. [22, 23] These three taxes accounted for 30 percent of the F.O.B. price of rice for the period

1959 to 1981 (See Figure 2 and 3). The imposition of these export taxes depressed the domestic price, favoring consumers and discriminating against producers. Part of the loss of the producers' surplus was transfered to the government as tax revenue. Exports were less than otherwise would have been. The author's other study [13] found that the foregone increase in export earnings ranged from 9.2 to 63.7 percent of the annual average value of Thai exports for the period 1959 to 1979. Based on the assumption that Thai rice exports can affect world rice prices, at least in the short run, the analysis results suggest that the sum of the transfers from the foreign consumers was greater than the domestic social loss. Hence, the Thai society as a whole gained from the imposition of the rice export taxes in the short run. The gain was in the range of 0.04 to 0.10 percent of the average total GNP or 0.20 to 0.50 percent of the rice GNP. However, in the longer run, the Thai exports are believed to have no price setting power in the world market. The imposition of export taxes therefore incurred a net social loss to the Thai society. This loss was in the range of 1.26 to 2.07 percent of the average total GNP or 6.20 to 10.18 percent of the rice GNP.

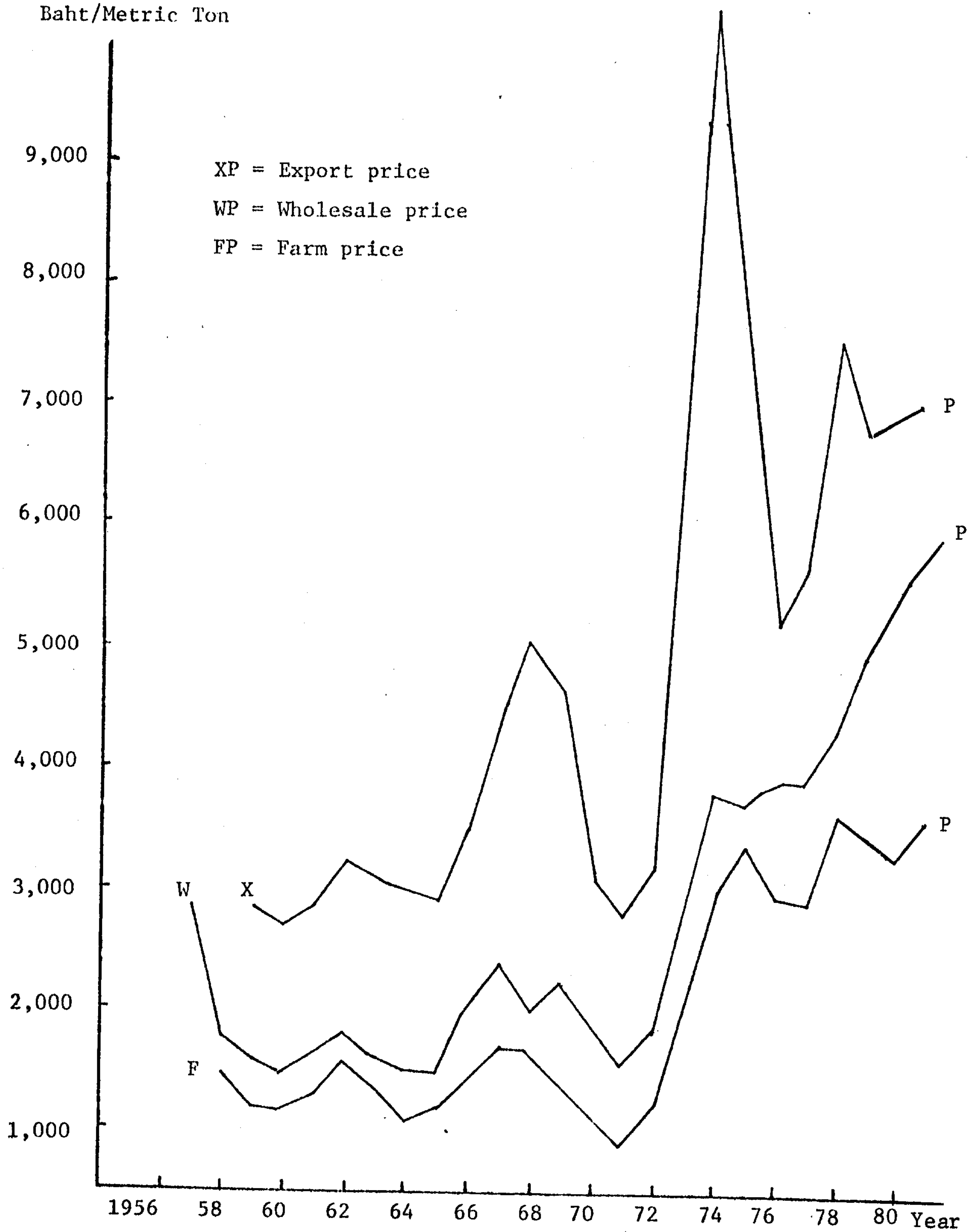

Figure 2 F.O.B. Price, Wholesale Price and Equivalent Farm Gate Price of 5% White Rice at the Official Exchange Rate, Thailand, 1957-1981

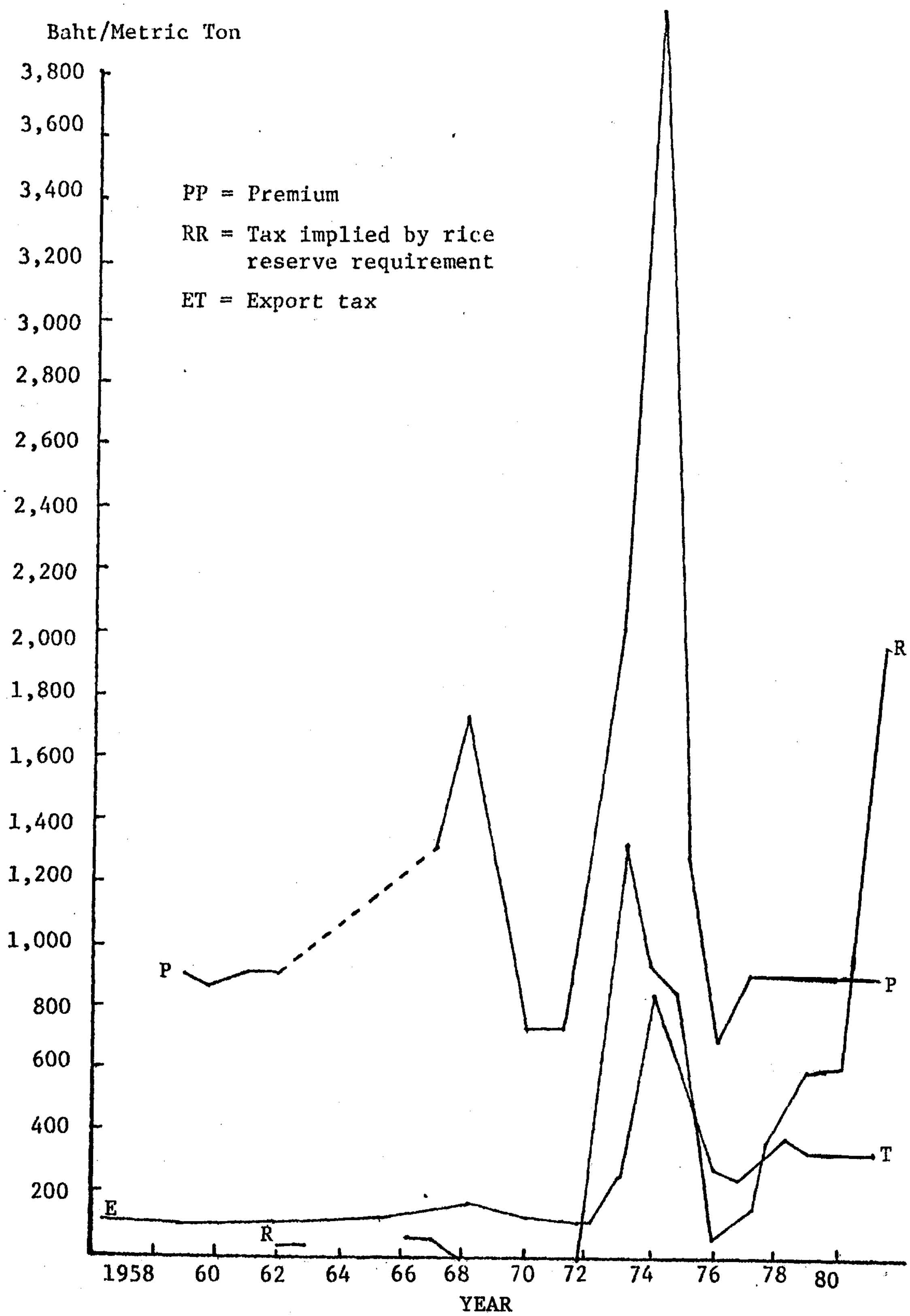

Figure 3 Rice Export Tax, Rice Premium and Tax Implied by Rice Reserve Requirement for 5% White Rice, Thailand, 1959-1981

Sugar Trade Policy

The Thai sugar industry changed from a net importer to a net exporter in 1960. Government policies prior to 1960 consisted mainly of tariffs on sugar imports. Since then the government has subsidized exports when world prices were low and taxed exports when world prices were high (See Figure 4). The import tariffs or exports subsidies raised domestic prices, which favors producers and discriminates against consumers, resulting in an income transfer from consumers to producers. When the results of 1974 and 1975 were excluded from the analysis, the average result of 1954-60, 1962-66 and 1977 and 1979 showed that sugar exports with no government intervention would have been lower than the actual mean exports [13]. Hence, there were gains in foreign exchange earnings resulted from the government interventions in sugar. This gain was equal to 1.4 percent of the average annual value of Thai exports or 20 percent of the average sugar GNP. Although the government intervention incurred a net loss to society, this loss was only 0.04 to 0.07 percent of total GNP. The social loss was more significant, about 3.8 to 5.6 percent, when compared to sugar GNP.

Maize Trade Policy

Government intervention in the maize trade consisted of bilateral agreements with the Japanese and Taiwanese governments and export quotas designed to fulfill those agreements. The system of assigning quotas to Thai exporters was criticized as making the large exporters suffer because it decreased their market shares. The announcement of the formula export prices as well as export quotas 30 days in advance of shipment affected accumulation and disposal of the rural wholesalers' stock. Furthermore,

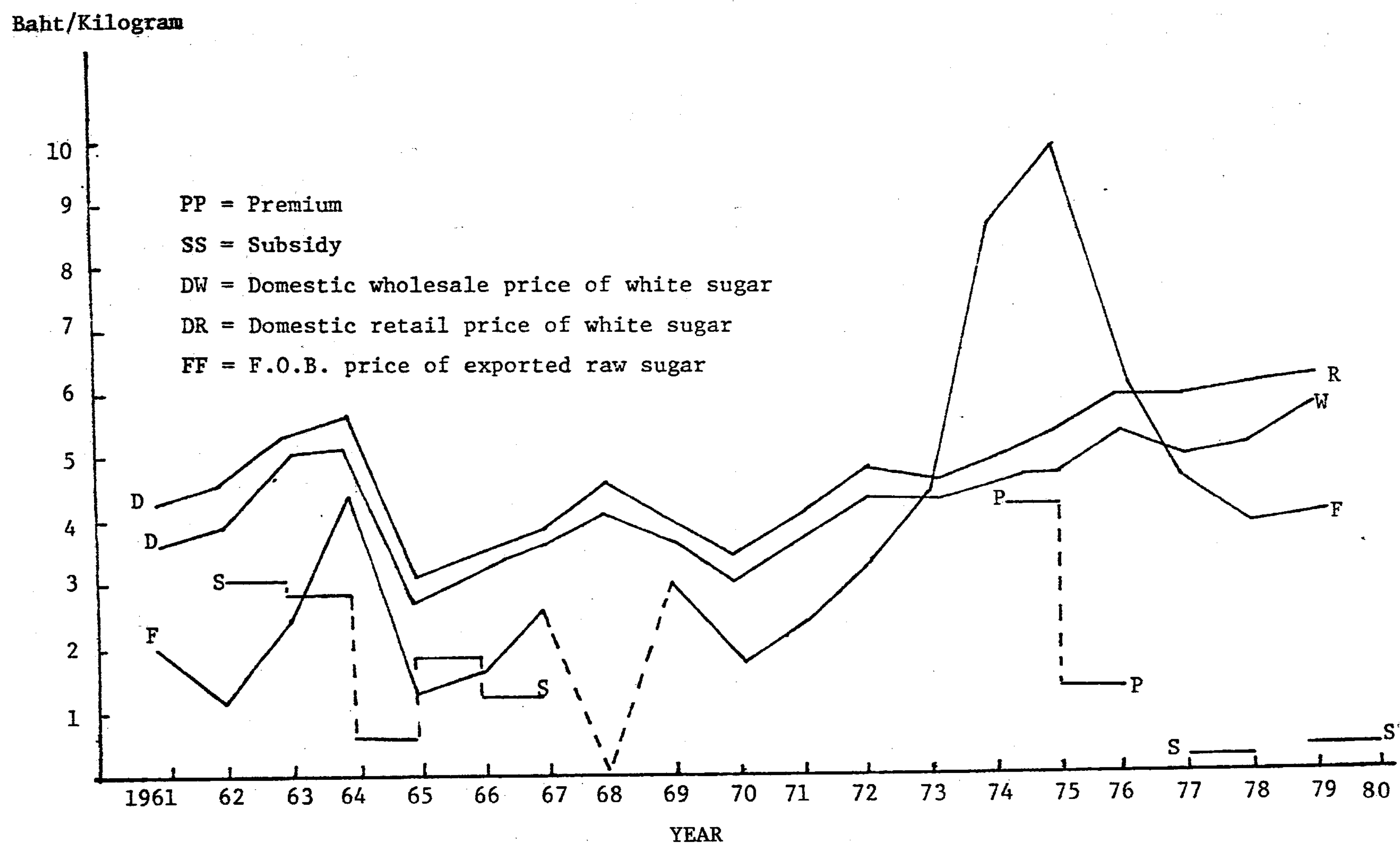

Figure 4 Sugar: Domestic Prices, F.O.B. Prices, Average Rate of Subsidy and Average Rate of Premium, 1961-80, Thailand

the empirical results showed that the exporters incurred a windfall loss nearly every year in meeting the Japanese quota due to the lower formula contract price to Japan compared to the free trade price during the contractual months. This windfall loss by the export quota holders was equivalent to 0.04 percent of the annual average value of exports for the period 1966 to 1979 and 2.27 percent of maize GNP [13]. Furthermore, the export quotas and agreements decrease the amount of potential exports and hence the foreign exchange earnings. The foregone increase in foreign exchange earned ranged from 0.26 to 1.86 percent of the average annual value of the Thai exports. However, the social loss associated with the maize trade interventions account for only 0.0003 to 0.02 percent of total GNP or 0.02 to 1.22 percent of maize GNP.

The government realizes the negative effects of the maize trade interventions and hence, abandoned the quota system and the bilateral agreements in late December, 1981. The private maize trade now is free though there is still same government to government trade agreements.

<u>Government Control of Cassava Products</u>

The trade in cassava pellets has faced attempts at quality control for a long time but only very recently (January, 1981) was subjected to export quotas and licenses. Cassava pellets exported to EEC are subject to an EEC import tax of six percent advalorem or 18 percent of the barley levy, whichever is lower. This implicitly subsidized the cassava pellets importers because cassava imports were cheaper per unit of energy than other animal feed grains in the EEC market. It is believed that the Thai exporter is a price taker in the EEC market since there are some other feed grains substitutes to cassava pellets. Hence, the burden of the import tariff seems to go to the Thai exporters more though not all, than the EEC importers.

The Thai government and the EEC are currently trying to find means to reduce the quantity of cassava products supplied to the EEC. Two suggested means to reduce the cassava exports are imposing an export quota on cassava products, and inducing Thai farmers to shift from cassava to some other crops.

Government and Kenaf Exports

Since 1960, kenaf is free traded except some form of export quality control. It was quite obvious that the export quality control system was ineffective. Bribery of the officer involved was prevalent and hence there was a lack of strict enforcement of the grading standards. It is believed that the aggregate demand for Thai kenaf at all levels in the marketing channel in Thailand reflects supply and demand conditions in the international markets. Changes in prices in the London market are hypothesized to result in similar changes in farm prices in Thailand. This means that most of the penalty for poor export quality control which results in decreased prices in the world market is absorbed by the Thai farmers.

Mung beans, Ground nuts and Soyabeans

Mung beans, ground nuts and soyabeans are free traded. The exporters have to pay only business and municipal taxes at a rate of 2.2 percent of F.O.B. price which is the same as other agricultural exports.

Agricultural Imports Policies

In the 1970's, about 95 percent of the fertilizer used in Thailand was imported. Both imported and domestically produced fertilizer are subject to business tax and municipal tax. Since the end of 1973, the fertilizer trade was freed. The government interference in the fertilizer trade has been minimal. The only effort the government has been trying is to subsidize the farmers implicitly by providing loans to them to purchase fertilizer.

The importation of other chemical inputs such as insecticide, herbicide etc. are subject to some percentage of tariff, business tax and municipal tax. In the 1970's, they were subject to five percent import tariff. As for farm machinery, the tariff rate was about 10 percent in 1974.

IV DATA BASE USED IN THE CALCULATION

Social Value of Production

Border prices of output are used as the social prices of output because they represent the opportunity cost of the traded commodities. Hence, the social value of output at the farm level is the equivalent F.O.B. price of one unit of the exported commodity.

As discussed earlier, the imposition of any kind of taxes at the export level will depress the farm price compared to the F.O.B. price. Hence, from social point of view, the prices of all outputs to the farmers have to be adjusted upwards to take into account the taxes collected by the government. For paddy, sugar cane and maize, the upward adjustment will have to take into account the export premium or the exporters' windfall loss (in case of maize) in addition to the ordinary business and municipal taxes. For the other crops, the upward adjustments will take into account only the business and municipal taxes. Since the taxes imposed at the export level is for the final products instead of the raw product, the upward adjustments of the farm prices have to take into account the conversion rate between the raw product and the final product (i.e. the conversion rate between paddy and milled rice etc.) and also the proportion of retail prices received by farmers.

The calculation of shadow prices for the selected farm products can proceed, as follows:

$$U_j = P_j + \frac{0.8\ T}{\text{conversion ratio}}$$ 3/

where U_j = shadow price for one kilogram of the j product, namely: paddy, sugar cane, maize, cassava root, kenaf, mung beans, ground nuts or soyabeans.

3/ In case of export subsidies, the positive sign changed to negative sign.

P_j = actual farm price of one kilogram of the j product received by the farmers

T = total taxes paid by the exporters or the government export subsidies rate for one kilogram of the j product.

The conversion ratio is equivalent to 1.5 for paddy (i.e. 1.50 kgs. of paddy required to get one kg. of milled rice); 11.76 for sugar cane (i.e. 11.76 kgs. of sugar cane required to get one kg. of sugar); 1.00 for maize; 2.69 for cassava root (i.e. 2.69 kgs of cassava roots required to get one kg. of cassava pellets); 1.06 for kenaf (i.e. 1.06 kgs. of kenaf fiber required to get one kg. of baled kenaf); 1.43 for ground nuts (i.e. 1.43 kgs. of unshelled ground nuts required to get one kg. of shelled ground nuts); and 1.00 for mung beans and soyabeans.

0.8 is the proportion of the retail prices received by farmers. The export control mechanisms affect the product price at the farm level through their influence on the domestic retail price. Ingram [11] estimated that farmers receive between 70 and 80 percent of the domestic retail price of rice. Narkswasdi [14] found that farmers in the central plains received 72 percent of the retail price of rice while Usher [25] concluded from his studies that the farm price of paddy was 79 percent of the retail price of rice. All authors concluded that if there were no rice export taxes, the wholesale price of rice in Bangkok would differ from the F.O.B. export price by only a small exporters' margin, and that the Bangkok wholesale price is closely linked to the retail price, with only a small margin. The price linkage data for all selected crops except rice is not available. Hence, it has been assumed in this study that the producers of all selected crops received 80 percent of the retail price of the respective product similar to that of paddy farmers.

Social Cost of Production

The social cost of production are all costs of production evaluated at their social opportunity costs or at their shadow prices. For the purpose of this study, the cost of production will be divided into primary factor costs and tradable input costs.

Primary Factor Costs

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

Labor Costs

Direct labor cost is cost of labor employed in every stage of paddy, sugar cane, maize, cassava root, kenaf, mung beans, ground nuts and soyabeans production. It is the total cost of labor from the start of land preparation to final harvesting of each crop.

The direct labor cost is determined by the summation of the physical units or mandays of labor multiplied by the shadow wage rate. The price of labor in a perfectly competitive market is determined by the marginal value product of labor. Thus, the shadow wage rate under perfect competition is equal to the opportunity cost of employing an additional worker or the output foregone which would have been generated by the additional worker. There is no evidence of significant open unemployment in rural Thailand. The labor force survey done by the National Statistics Office [15] reports that the unemployment for all regions of the country and for both the wet and the dry seasons has typically been below one percent of the labor force since the beginning of the 1970's. It is believed that the labor market is very tight during peak agricultural seasons, when lots of youngsters and females normally involved only in household activities and hired workers from nonagricultural jobs were drawn into agricultural employment. In the dry season there are a lot of nonagricultural employment opportunities available for the farmers, mainly in manufacturing, construction, commerce and services. Furthermore, the expansion of the transportation network helps the farmers to move more easily to the city or to Bangkok during the dry season for employment. Due to the above factors, the market wage rate received by farm workers at the farm level seems to reflect the opportunity cost of farm labor and hence the shadow wage rate is assumed to approximate the market wage rate.

The indirect labor cost includes part of the domestic added cost of imported inputs and of the nontradable inputs used in producing the selected commodities. These inputs include fertilizer, pesticide, insecticide, herbicide, fuel, tractor service, water pump services, etc.

Land Cost

The benefit foregone from the next best alternative utilization of land is assumed to be the opportunity cost of land. This cost of land in other words can be defined as the difference between the shadow value of output of the alternative crop and the shadow cost of non-land inputs used in producing the alternative crop. The cost of land thus will be evaluated as the difference between the value of output evaluated at the farm price and the total variable cost plus depreciation of fixed assets. However, in defining the economic rent of land this way, part of the return to management of the alternative crop is also included.

Since the production period of each crop is different due to its biological characteristics, the net return of the alternative crop for estimating land cost has to be adjusted by multiplying the weighted average of the production period of the alternative crop.

The formula used is as follows:

$$LC_o = NR\frac{L_o}{L_i}$$

where LC_o = opportunity cost of land

NR = net return of alternative crop

L_o = production of paddy, sugar cane, maize, cassava, kenaf, mung beans, ground nuts or soyabeans.

L_i = production period of alternative crop i

Capital Cost

Direct capital cost has two components, namely the return to capital and the depreciation of fixed assets.

Return to Capital

The capital cost concept used here is the opportunity cost of the variable costs of producing the selected crops. One has to take into account the appropriate rate of interest and the different lengths of time according to the pattern of production. In agriculture, the rate of interest is varied according to the sources of funds, security, risk and uncertainty. The appropriate rate of return is difficult to obtain. In this study, capital is priced at 18 percent per annum which is equal to the loanable rate of interest of the commercial banks in late 1970's.

The formula used to adjust for timing of the return on capital is as follows:

$$R = r\frac{t_{ij}}{T} C_{ij}$$

where R = return on capital

r = rate of return (18 percent)

t_{ij} = production period of step i in crop j; for example, land preparation period (i) in producing paddy (j)

T = period of return on capital (12 months)

C_{ij} = funds invested in process i of crop j

Depreciation and Maintenance

The value of the fixed assets (from the MOAC survey) is depreciated by the straight line method over a 10 year period (10 percent per year). This amount is assumed to include both depreciation and maintenance.

Indirect capital cost is defined in the same way as indirect labor cost. It includes part of the domestic added cost of imported inputs and of the tradable inputs.

Tradable Input Costs

As mentioned earlier, an input is tradable if it is exportable or importable. The social cost of tradable inputs is equal to the C.I.F. price or the share of the foreign contents of the user's cost. However, the data available are the users' cost which includes not only the foreign contents but also the domestic added cost, namely, capital and labor costs and taxes. Hence the foreign content has to be estimated. The user's cost can be divided into components as shown in the formula below.

$$U_c = F + V + T$$

where U_c = user's cost

F = tradable input cost or foreign or material content

V = value added generated in the domestic market

T = overall taxes levied by domestic government

The domestic value added (V) consists of labor cost (L) and capital cost (K) which are simply the indirect labor and capital cost discussed earlier. The breakdown of components for the inputs used, both tradaboe and nontradable, is shown in Table 2

Planting materials for seven of the eight commodities (excluding cassava) are considered as fully tradable inputs. The planting material or seed cost should be adjusted upward by the amount of taxes in the same way as the adjustment was made for output. The cost of cassava stems which are used for planting is equal to zero. Therefore, there is no foreign content in the stems, only the domestic labor cost of collecting, storing, and cutting the stems are considered.

Table 2 The Break-Down of Cost components of Intermediate Input

Intermediate Inputs	Foreign Content	Domestic Value Added	Taxes
	-------- Percentage of Users' Cost ----		
Seed (stalk) for paddy, maize, sugar cane, kenaf, mung beans, ground nuts and soyabeans.	100	--	--
Cassava stem cutting	--	100	--
Fertilizer for			
paddy, maize, cassava, kenaf, mung beans, ground nuts and soyabeans.	85	13	2
sugar cane	74	11	15
Organic fertilizer	--	100	--
Pesticide	80	16	4
Fuel	62	8	30
Tractor service	54	42	4
Water pumping	79	11	10
Animal	--	100	--
Repair service	25	75	--

Source : Koomsup, Praipol. "Agricultural Incentives, Comparative Advantage and Employment in Thailand." mimeographed, Faculty of Economics, Bangkok: Thammasat University, 1979, page 37.

Note : The primary data of the cost structure of each item used are from the following sources:

Fertilizer : Metharom, P., Menasutra, K. and Gingkaew, S. Fertilizer Industry : Industrial Planning of Thailand, 1977-81. Bangkok, NESDB, January, 1977

Fuel: The Thai Oil Refinery, Facts and Figures on Oil. Bangkok, 1 974

Tractor and Pumping Service : Aranyakanonda, C., Production Marketing and Demand for Tractor in Thailand. Department of Economic Discussion Paper No. 1803. Bangkok: Kasetsart University, 1975;
Pinthong, C., "Economics of Small Tractor Production in Thailand." Master Thesis, Bangkok: Thammasat University,

V EMPIRICAL RESULTS

This section deals with the social profitability and the domestic resource cost of the eight selected commodities. The analysis will be done both among the different agro-economic zones within the same crop and among crops within the same agro-economic zone. The DRC sensitivity analysis with respect to the input-output coefficients will also be examined.

A brief explanation of the definitions used in this section will be presented here. Detailed definitions and specifications of calculations were presented in section II.

1. Net Social Profitability (NSP) is equal to value added at opportunity cost minus primary factor costs, also priced at opportunity cost. (Value added is equal to gross output minus tradable input cost -- section II)

2. Net Social Profitability calculated at the shadow price of foreign exchange (NSP') is equal to value added at world price multiplied by the ratio of shadow price of foreign exchange (SPFX) to official exchange rate (OER), minus primary factor costs, also priced at world price (which is the opportunity cost). The official exchange rate here is assumed to be overvalued by 12.5 percent for crop years 1977/78, 1978/79 and 1979/80. For crop year 1980/81, the official rate is assumed to be overvalued by 6.5 percent. The calculation of the overvaluation here based on the assumption that ฿23.00 per U.S. dollar is the equilibrium exchange rate. (This is the official exchange rate applied after the baht devaluation in mid 1981)

3. Domestic Resource Cost Coefficient (DRC) is equal to the

ratio of primary factor costs to value added, both priced at world prices, in domestic currency, using the official exchange rate.

4. The domestic resource cost coefficient calculated at the shadow price of foreign exchange (DRC') is equal to the DRC divided by the ratio of SPFX/OER.

Intra-Commodity Comparison

Wet Season Paddy

As shown in Table 3, it is socially profitable to produce wet season paddy, as indicated by the positive average NSP, in 14 of the 16 agro-economic zones. (It is unprofitable in zones 2 and 7) The NSP' which is the NSP evaluated at the shadow exchange rate reveals the same pattern in profitability among zones as that of NSP, but with a higher value due to the overvaluation of the official exchange rate. The consideration of the overvalued exchange rate changed zone 7 to be a socially profitable producing zone. The average NSPs' range from ฿83 per rai to ฿515 per rai in the profitable zones. Normally, areas with high social profitability are associated with low domestic resource cost coefficients. Hence, all zones except zones 2 and 5 which have a positive NSP' show a less than unity DRC'. The average DRC' ratio shows that for wet season paddy, zones 9, 10, 11 and 15 are the most efficient producing areas, because their DRCs' range from only 0.68 to 0.79

It should be noted that the two measures of efficiency leads to different conclusion in zone 5. The positive average NSP' does not associated with a less than unity DRC'. This occurs only when we consider the average value of NSP or DRC of the four crop years. Considering the individual crop years, one will see that a positive NSP is always associated with a less than unity DRC or vice versa. Due to the fact that in zone 5, the greater than unity DRC' in 1977/78 crop year is so dominant that it lead to a greater than unity DRC when we take the simple average of the four crop years.

Sugar Cane

The average NSPs' shows that it is socially profitable to produce sugar cane in all the 11 producing zones. The NSPs' range from ฿369 per rai to ฿1,689 per rai. Zones 4, 7 and 8 are the most efficient zones to produce sugar cane and hence possesses the greatest economic efficiency, as indicated by the low DRCs', which are only 0.60, 0.62 and 0.69 respectively.

Maize

It is socially profitable to produce maize in 13 out of the 14 maize producing zones. It is unprofitable in zone 3. The NSPs' range from only ฿18 per rai to ฿152 per rai in the profitable zones. Similarly, the DRCs' of all zones except zone 3 are less than unity. The most efficient maize producing zones are 4 and 15, with the DRCs' of these two zones being 0.74 and 0.79 respectively.

Cassava Roots

It is socially profitable to produce cassava roots in 13 out of the 14 cassava producing zones. The unprofitable zone is zone 11. The NSPs' range from ฿138 per rai to ฿747 per rai. The efficiency of cassava production in Thailand can be further confirmed by the low DRCs'. The most efficient zones are 3, 5, 6, 10 and 12, with the DRCs' being in the range of 0.60 and 0.70

Kenaf

The NSPs' show that kenaf production is not socially profitable in most of the five producing zones and in most of the crop years. For example, in 1979/80 crop years, kenaf production in zones 2 to 4 are socially unprofitable. However, considering the average value of the four crop years, the NSPs' reveal that it is slightly profitable to produce kenaf. The NSPs' range from only ฿7 per rai to ฿73 per rai. The average DRCs' of zones 1, 4 and 5 are slightly below unity and the DRCs' of zones 2 and 3 are approximately equal to unity. Of all the five kenaf producing zones, zone 5 is the most efficient zone with an average DRC' of 0.92

Mung Beans

The average NSPs' shows that it is profitable to produce mung beans in all the 13 mung beans producing zones. The NSPs' range from only ฿2 per rai to ฿356 per rai. However, consider the NSPs' of 1980/81 crop year, the production of mung beans is inefficient in at least four zones. Furthermore, the NSPs' in the efficient zones are not very pronounced. For example, the NSPs' of at least three efficient zones are less than ฿35 per rai. The average DRCs' reveal that it is profitable and efficient to produce mung beans in all zones except zone 11. The most efficient mung beans producing zones are zones 4, 7 and 12, with the DRCs' of these three zones being 0.62, 0.79 and 0.77 respectively.

Though the average NSP' of zone 11 is slightly positive, but the considerably greater than unity of DRC' in 1980/81 lead to a greater than unity average DRC'.

Ground Nuts

Ground nuts production is efficient in 11 out of the 15 producing zones by means of the NSPs'. The NSPs' of the efficient zones range from ฿59 per rai to ฿213 per rai. The DRCs' measures show that only nine out

Table 3 Net Social Profitability of Paddy, Sugar Cane, Maize, Cassava Roots, Kenaf, Mung Beans, Ground Nuts and Soyabeans Production in Different Agro-Economic Zones, Thailand, 1977/78 to 1980/81 Crop Years.

Commodity and Agro-Economic Zone		NSP 77/78	NSP 78/79	NSP 79/80	NSP 80/81	NSP Avg.	NSP' 77/78	NSP' 78/79	NSP' 79/80	NSP' 80/81	NSP' Avg.	Average Yield
		baht/rai										Kg./rai
Wet Season Paddy												
Northeast	1	103.0	27.4	0	102.8	77.7	171.8	99.8	72.0	157.0	125.2	225
	2	-39.5	0	-112.6	-110.6	-87.6	- 6.4	43.5	-66.2	-77.2	-26.6	132
	3	0	26.5	-25.5	0	0.5	57.2	85.8	35.7	46.2	56.2	195
	4	-17.6	0	0	277.8	130.1	21.0	60.4	66.9	340.3	122.2	187
	5	-231.3	147.5	0	281 .2	65.8	-207.7	222.8	78.2	343.6	109.2	202
North	6	48.5	111.9	108.3	122.1	97.7	104.4	218.3	202.3	217.4	185.6	278
	8	0	45.9	10.4	41 7.3	1 57.9	68.8	169.7	115.6	517.6	217.9	312
	9	114.9	116.4	247.2	109.2	146.9	203.2	263.0	381.7	209.5	264.4	310
	10	345.3	241.5	302.6	560.5	362.5	468.4	412.3	478.7	699.3	514.7	365
Central	7	96.2	193.5	8.7	-383.2	-21.2	201.4	292.7	118.1	-279.7	83.1	475
	11	50.0	57.1	258.6	185.2	137.7	149.4	163.5	376.7	286.6	244.1	335
	12	0	52.7	90.3	39.5	60.8	76.4	145.8	184.0	107.4	128.4	251
	13	0	110.8	0	34.7	72.8	52.2	219.0	99.1	118.6	122.2	284
	14	0	0	0	0	0	89.5	143.9	151.6	97.1	120.5	366
	15	127.2	234.7	0	207.1	1 89.7	190.4	355.5	80.8	292.3	229.8	263
	16	85.6	0	0	366.3	226.0	181.5	114.9	78.5	457.4	208.1	290
Sugar Cane												
Northeast	1	75.8	31.3	26.2	1947.1	520.1	262.8	149.6	243.4	2216.8	718.2	6340
	3	-	0	94.0	2072.8	1083.4	-	95.8	258.7	2341.2	898.6	5250
	4	945.1	-	264.1	1844.5	1017.9	1216.0	-	528.9	2109.4	1284.8	7340
North	6	-	-	127.7	842.1	484.9	-	-	359.6	1097.2	728.4	6280

Table 3 (Continued)

Commodity and Agro-Economic Zone		NSP 77/78	NSP 78/79	NSP 79/80	NSP 80/81	NSP Avg.	NSP' 77/78	NSP' 78/79	NSP' 79/80	NSP' 80/81	NSP' Avg.	Average Yield
		baht/rai										Kg./rai
North	8	129.6	490.5	438.7	1335.1	598.5	283.5	683.3	710.6	1631.9	827.3	6750
	9	109.1	0.8	103.9	455.3	167.3	216.7	219.9	381.4	657.6	368.9	6120
Central	7	-	-	-	1419.0	1419.0	-	-	-	1689.3	1689.3	7380
	11	572.4	0	192.3	650.3	471.7	862.1	211.9	343.9	906.5	581.1	7120
	12	14.8	126.8	0	902.9	348.2	208.2	309.0	123.3	1146.2	446.7	6170
	13	-	-	-	534.4	534.4	-	-	-	698.3	698.3	4840
	15	503.8	0	290.7	447.7	414.1	745.9	179.0	517.5	668.1	527.6	6380
Maize												
Northeast	1	-	15.6	78.9	47.5	47.3	-	66.4	145.3	94.4	102.0	308
	3	-79.6	-129.5	-101.6	95.3	-53.9	-46.0	-99.7	-65.3	136.9	-18.5	228
	4	-2.2	195.0	129.1	77.5	99.9	26.3	262.5	203.5	117.3	152.4	292
	5	-11.4	0	36.2	74.1	33.0	21.5	37.2	93.9	122.1	68.7	252
North	6	61.2	0	45.7	62.9	56.6	110.4	70.2	122.4	122.9	106.5	336
	8	-	13.7	93.5	66.6	57.9	-	59.7	152.5	112.8	108.3	282
	9	-44.1	16.2	0	14.8	-4.4	-21.8	57.2	45.8	59.7	35.2	228
	10	0	-28.8	75.7	47.4	31.4	43.4	6.7	150.5	112.2	78.2	302
Central	7	0	46.6	24.2	201.6	90.8	28.4	114.3	99.1	256.9	124.7	292
	11	-	-	-	0	0	-	-	-	44.2	44.2	269
	12	-	-	-	65.2	65.2	-	-	-	117.8	117.8	306
	13	-	-	31.7	102.6	67.2	-	-	112.0	138.9	125.5	276
	15	-	-	-	59.8	59.8	-	-	-	85.3	85.3	148
	16	0	-83.3	2.3	0	-40.5	34.2	-58.2	52.4	41.5	17.5	234
Cassava Roots												
Northeast	1	90.5	714.6	394.7	492.7	423.1	224.1	910.1	602.8	609.2	586.6	2335
	2	-412.7	644.0	391.8	426.8	262.5	-310.3	785.6	535.1	502.1	378.1	1619
	3	138.3	652.5	474.0	126.5	347.8	238.3	807.7	642.5	218.7	476.8	1693

Table 3 (Continued)

Commodity and Agro-Economic Zone		NSP 77/78	NSP 78/79	NSP 79/80	NSP 80/81	NSP Avg.	NSP' 77/78	NSP' 78/79	NSP' 79/80	NSP' 80/81	NSP' Avg.	Average Yield
		baht/rai										kg./rai
Northeast	4	307.2	284.7	-387.4	131.8	84.1	418.4	478.4	-258.8	246.7	221.2	1965
	5	243.4	909.2	265.9	185.2	400.9	376.5	1133.6	439.3	296.6	561.5	1962
North	6	-	-	-	620.2	620.2	-	-	-	737.0	737.0	2045
	8	-	418.5	164.7	280.5	287.9	-	652.9	318.4	385.9	452.4	2173
	10	-	-	-	679.4	679.4	-	-	-	837.2	837.2	2497
Central	7	-	-	-	46.1	46.1	-	-	-	138.1	138.1	1962
	11	0	-	39.0	-921.5	-441.3	139.0	-	183.3	-807.6	-161.8	2218
	12	210.2	730.7	633.7	688.2	565.7	360.2	971.2	841.0	814.5	746.7	2640
	13	-	0	178.2	443.5	310.9	-	146.6	354.0	548.0	349.5	2069
	15	306.0	633.7	153.4	110.6	300.9	443.0	915.8	291.7	223.4	468.5	2336
	16	124.6	-	284.6	158.1	189.1	274.8	-	445.0	277.8	332.5	2505
Kenaf												
Northeast	1	0	-106.6	-68.4	101.8	-24.4	86.2	-48.5	0.3	160.6	49.7	177
	2	-19.4	-34.4	-148.1	0	-67.3	38.8	30.6	-92.0	52.5	7.5	156
	3	49.6	-65.8	-165.1	-66.3	-61.9	119.9	-0.5	-103.8	22.3	9.5	164
	4	0	-46.1	-115.5	0	-80.8	84.6	20.1	-53.5	54.1	26.3	173
	5	0	-11.2	-87.9	96.4	-0.9	90.9	63.4	-18.1	156.3	73.1	199
Mung Beans												
Northeast	1	79.1	-	-	24.8	52.0	146.1	-	-	85.3	115.7	149
	3	133.8	-	-	-100.9	16.5	194.9	-	-	-84.1	55.4	83
	4	-	-	-	298.7	298.7	-	-	-	355.9	355.9	124
	5	16.1	-	95.9	0	56.0	74.4	-	155.5	23.8	84.6	92
North	6	59.7	-	0	59.3	59.3	103.8	-	48.5	89.1	80.5	91
	8	47.1	41.0	34.3	0	40.8	88.7	89.8	79.3	35.1	73.2	91
	9	23.2	0	13.2	33.0	23.1	58.1	41.9	55.7	184.5	85.1	97
	10	42.1	151.4	0	-62.0	43.8	92.5	216.8	54.4	-39.5	81.1	98

Table 3 (Continued)

Commodity and Agro-Economic Zone		NSP 77/78	NSP 78/79	NSP 79/80	NSP 80/81	NSP Avg.	NSP' 77/78	NSP' 78/79	NSP' 79/80	NSP' 80/81	NSP' Avg.	Average Yield
		baht/rai										kg./rai
Central	7	128.8	0	43.0	-26.6	48.4	163.7	40.6	88.3	-6.2	71.6	80
	11	92.8	-	0	-197.2	-52.2	153.5	-	38.6	-186.6	1.8	86
	12	38.2	0	26.5	225.1	96.6	74.5	58.8	65.1	268.3	116.7	104
	13	-	-	-	0	0	-	-	-	29.2	29.2	89
	15	-	-	-	0	0	-	-	-	17.9	17.9	60
Ground Nuts												
Northeast	1	-497.3	0	-43.2	0	-270.3	-477.7	83.5	39.2	50.0	-76.3	122
	2	-362.9	-	0	-	-362.9	-335.4	-	79.1	-	-128.2	112
	3	-253.9	-	0	1.8	-126.1	-219.7	-	87.0	63.5	-23.1	151
	4	-191.4	83.8	14.7	2.9	-22.5	-156.8	178.6	103.3	64.2	47.3	162
	5	294.5	17.9	-25.3	7.9	73.8	434.7	110.7	52.9	87.7	171.5	198
North	6	0	-40.1	-26.2	87.9	7.2	75.6	46.1	46.7	194.8	90.8	174
	8	-224.4	0	45.0	1.6	-59.3	-173.6	89.4	139.6	145.7	50.3	180
	9	0	7.6	-1.6	0	3.0	71.6	90.0	84.9	78.1	81.2	171
	10	69.2	0	76.2	279.3	141.6	173.9	105.1	207.1	366.0	213.0	216
Central	7	-110.8	-33.4	0	254.7	36.8	-49.3	38.8	94.7	319.8	101.0	156
	11	-	-	-	229.6	229.6	-	-	-	321.4	321.4	249
	12	-	-	-211.0	0	-211.0	-	-	-147.3	59.7	-43.8	157
	13	-	-	-	38.5	38.5	-	-	-	108.5	108.5	159
	15	0	-	-9.8	400.1	195.2	49.8	-	68.1	502.6	206.8	154
	16	217.0	-97.2	60.3	-	60.0	301.7	-16.6	182.0	-	155.7	184
Soyabeans												
Northeast	1	-	-	158.8	18.5	88.7	-	-	279.1	62.5	170.8	176
	3	-	-	30.4	-	30.4	-	-	105.0	-	105.0	123
	5	-143.6	-	-	-	-143.6	-116.3	-	-	-	-116.3	60

Table 3 (Continued)

Commodity and Agro-Economic Zone		NSP 77/78	NSP 78/79	NSP 79/80	NSP 80/81	NSP Avg.	NSP' 77/78	NSP' 78/79	NSP' 79/80	NSP' 80/81	NSP' Avg.	Average Yield
		baht/rai										kg./rai
North	6	84.8	226.5	21.2	0	110.8	146.9	330.0	107.9	51.0	159.0	135
	8	133.2	95.4	38.9	-	89.2	214.0	205.0	117.7	-	178.9	153
	9	-126.5	282.7	134.4	-43.3	61.8	-109.9	364.8	209.6	-6.5	114.5	110
	10	59.1	235.2	87.7	0	127.3	138.8	347.4	192.2	50.0	182.1	165
Central	7	121.4	210.2	137.9	0	156.5	186.8	311.5	212.5	40.2	187.8	133
	11	-	-	-	-13.3	-13.3	-	-	-	23.7	23.7	129
	12	-	-	43.1	48.7	45.9	-	-	108.1	117.7	112.9	160

Table 4 Domestic Resource Cost Coefficients of Eight Selected Agricultural Products in Different Agro-Economic Zones, Thailand, 1977/78 to 1980/81 Crop Years.

Commodity and Agro-Economic Zone		DRC					DRC'				
		77/78	78/79	79/80	80/81	Avg.	77/78	78/79	79/80	80/81	Avg.
		baht/rai									
Wet Season Paddy											
Northeast	1	0.81	0.95	1.00	0.88	0.91	0.72	0.84	0.89	0.82	0.82
	2	1.15	1.00	1.30	1.21	1.17	1.02	0.89	1.16	1.14	1.05
	3	1.00	0.94	1.05	1.00	1.00	0.89	0.84	0.93	0.94	0.90
	4	1.06	1.00	1.00	0.71	0.94	0.94	0.89	0.89	0.67	0.85
	5	2.22	0.76	1.00	0.71	1.17	1.98	0.68	0.89	0.66	1.05
North	6	0.89	0.87	0.86	0.92	0.89	0.79	0.77	0.76	0.86	0.80
	8	1.00	0.95	0.99	0.73	0.92	0.89	0.84	0.88	0.68	0.82
	9	0.84	0.90	0.77	0.93	0.86	0.74	0.80	0.68	0.87	0.77
	10	0.65	0.82	0.79	0.74	0.75	0.58	0.73	0.70	0.69	0.68
Central	7	0.89	0.76	0.99	1.24	0.97	0.79	0.68	0.88	1.17	0.88
	11	0.94	0.93	0.73	0.88	0.87	0.83	0.83	0.65	0.83	0.79
	12	1.00	0.93	0.88	0.96	0.94	0.89	0.83	0.78	0.90	0.85
	13	1.00	0.87	1.00	0.97	0.96	0.89	0.77	0.89	0.91	0.87
	14	1.00	1.00	1.00	1.00	1.00	0.89	0.89	0.89	0.94	0.90
	15	0.77	0.76	1.00	0.84	0.84	0.68	0.68	0.89	0.79	0.76
	16	0.89	1.00	1.00	0.74	0.91	0.79	0.89	0.89	0.69	0.82
Sugar Cane											
Northeast	1	0.95	0.97	0.98	0.53	0.86	0.84	0.86	0.87	0.50	0.77
	3	-	1.00	0.93	0.50	0.81	-	0.89	0.83	0.47	0.73
	4	0.56	-	0.88	0.55	0.66	0.50	-	0.78	0.51	0.60
North	6	-	-	0.93	0.79	0.86	-	-	0.83	0.74	0.79
	8	0.89	0.68	0.80	0.71	0.77	0.80	0.60	0.71	0.66	0.69
	9	0.87	0.99	0.95	0.85	0.92	0.78	0.88	0.84	0.80	0.83
Central	7	-	-	-	0.66	0.66	-	-	-	0.62	0.62
	11	0.75	1.00	0.84	0.83	0.86	0.67	0.89	0.75	0.78	0.77
	12	0.99	0.91	1.00	0.76	0.92	0.88	0.81	0.89	0.71	0.82

Table 4 (continued)

Commodity and Agro-Economic Zone		DRC					DRC'				
		77/78	78/79	79/80	80/81	Avg.	77/78	78/79	79/80	80/81	Avg.
Central	13	-	-	-	0.79	0.79	-	-	-	0.74	0.74
	15	0.74	1.00	0.84	0.88	0.87	0.66	0.89	0.75	0.81	0.78
<u>Maize</u>											
Northeast	1	-	0.96	0.85	0.93	0.91	-	0.85	0.76	0.88	0.83
	3	1.30	1.54	1.35	0.85	1.26	1.15	1.37	1.20	0.80	1.13
	4	1.01	0.64	0.78	0.87	0.83	0.90	0.57	0.69	0.82	0.74
	5	1.04	1.00	0.92	0.90	0.97	0.93	0.89	0.82	0.84	0.87
North	6	0.84	1.00	0.93	0.93	0.93	0.75	0.89	0.83	0.87	0.84
	8	-	0.96	0.80	0.91	0.89	-	0.85	0.71	0.85	0.80
	9	1.25	0.95	1.00	0.98	1.05	1.11	0.84	0.89	0.92	0.94
	10	1.00	1.10	0.87	0.95	0.98	0.89	0.98	0.77	0.89	0.88
Central	7	1.00	0.91	0.96	0.76	0.91	0.89	0.81	0.85	0.72	0.82
	11	-	-	-	1,00	1.00	-	-	-	0.94	0.94
	12	-	-	-	0.92	0.92	-	-	-	0.86	0.86
	13	-	-	0.95	0.82	0.89	-	-	0.84	0.77	0.81
	15	-	-	-	0.85	0.85	-	-	-	0.79	0.79
	16	1.00	1.41	0.99	1.00	1.10	0.89	1.25	0.88	0.94	0.99
<u>Cassava</u>											
Northeast	1	1.09	0.54	0.76	0.72	0.78	0.97	0.48	0.68	0.68	0.70
	2	1.50	0.43	0.66	0.63	0.81	1.34	0.38	0.59	0.59	0.73
	3	0.83	0.47	0.65	0.91	0.72	0.74	0.42	0.58	0.86	0.65
	4	0.65	0.82	1.38	0.93	0.95	0.58	0.73	1.23	0.87	0.85
	5	0.77	0.49	0.81	0.89	0.74	0.69	0.44	0.72	0.84	0.67
North	6	-	-	-	0.65	0.65	-	-	-	0.61	0.61
	8	-	0.78	0.87	0.83	0.83	-	0.69	0.77	0.78	0.75
	10	-	-	-	0.72	0.72	-	-	-	0.68	0.68

Table 4 (continued)

Commodity and Agro-Economic Zone		DRC					DRC'				
		77/78	78/79	79/80	80/81	Avg.	77/78	78/79	79/80	80/81	Avg.
Central	7	-	-	-	0.97	0.97	-	-	-	0.91	0.91
	11	1.00	-	0.97	1.53	1.17	0.89	-	0.86	1.43	1.06
	12	0.82	0.62	0.62	0.65	0.68	0.73	0.55	0.55	0.61	0.61
	13	-	1.00	0.87	0.72	0.86	-	0.89	0.77	0.68	0.78
	15	0.72	0.72	0.86	0.94	0.81	0.64	0.64	0.76	0.88	0.73
	16	0.90	-	0.78	0.91	0.86	0.80	-	0.69	0.86	0.78
<u>Kenaf</u>											
Northeast	1	1.00	1.23	1.12	0.89	1.06	0.89	1.09	1.00	0.83	0.95
	2	1.04	1.07	1.33	1.00	1.11	0.93	0.95	1.18	0.94	1.00
	3	0.91	1.13	1.34	1.10	1.12	0.81	1.01	1.19	1.03	1.01
	4	1.00	1.09	1.23	1.00	1.08	0.89	0.97	1.09	0.94	0.97
	5	1.00	1.02	1.16	0.90	1.02	0.89	0.91	1.03	0.84	0.92
<u>Mung beans</u>											
Northeast	1	0.85	-	-	0.97	0.91	0.76	-	-	0.91	0.84
	3	0.73	-	-	1.39	1.06	0.65	-	-	1.30	0.98
	4	-	-	-	0.66	0.66	-	-	-	0.62	0.62
	5	0.97	-	0.80	1.00	0.92	0.86	-	0.71	0.94	0.84
North	6	0.83	-	1.00	0.87	0.90	0.74	-	0.89	0.82	0.82
	8	0.85	0.90	0.90	1.00	0.91	0.76	0.80	0.80	0.94	0.83
	9	0.92	1.00	0.96	0.83	0.93	0.82	0.89	0.85	0.78	0.84
	10	0.90	0.71	1.00	1.18	0.95	0.80	0.63	0.89	1.11	0.86
Central	7	0.54	1.00	0.88	1.08	0.88	0.48	0.89	0.78	1.02	0.79
	11	0.81	-	1.00	2.20	1.34	0.72	-	0.89	2.07	1.23
	12	0.87	1.00	0.91	0.66	0.86	0.77	0.89	0.81	0.62	0.77
	13	-	-	-	1.00	1.00	-	-	-	0.94	0.94
	15	-	-	-	1.00	1.00	-	-	-	0.94	0.94

Table 4 (continued)

Commodity and Agro-Economic Zone		DRC					DRC'				
		77/78	78/79	79/80	80/81	Avg.	77/78	78/79	79/80	80/81	Avg.
Ground nuts											
Northeast	1	4.16	1.00	1.07	1.00	1.81	3.70	0.89	0.95	0.94	1.62
	2	2.65	-	1.00	-	1.83	2.35	-	0.89	-	1.62
	3	1.93	-	1.00	1.00	1.31	1.71	-	0.89	0.94	1.18
	4	1.69	0.89	0.98	1.00	1.14	1.50	0.79	0.87	0.94	1.03
	5	0.74	0.98	1.04	0.99	0.94	0.66	0.87	0.92	0.93	0.85
North	6	1.00	1.06	1.04	0.95	1.01	0.89	0.94	0.98	0.89	0.91
	8	1.55	1.00	0.94	1.00	1.12	1.38	0.89	0.84	0.94	1.01
	9	1.00	0.99	1.00	1.00	1.00	0.89	0.88	0.89	0.94	0.90
	10	0.92	1.00	0.93	0.79	0.91	0.82	0.89	0.83	0.74	0.82
Central	7	1.23	1.06	1.00	0.75	1.01	1.09	0.94	0.89	0.70	0.91
	11	-	-	-	0.84	0.84	-	-	-	0.79	0.79
	12	-	-	1.41	1.00	1.21	-	-	1.25	0.94	1.10
	13	-	-	-	0.96	0.96	-	-	-	0.91	0.91
	15	1.00	-	1.02	0.75	0.92	0.89	-	0.91	0.70	0.83
	16	0.68	1.15	0.94	-	0.92	0.60	1.02	0.84	-	0.82
Soyabean											
Northeast	1	-	-	0.84	0.97	0.91	-	-	0.75	0.91	0.83
	3	-	-	0.95	-	0.95	-	-	0.84	-	0.84
	5	1.66	-	-	-	1.66	1.47	-	-	-	1.47
North	6	0.83	0.73	0.97	1.00	0.88	0.74	0.65	0.86	0.94	0.80
	8	0.79	0.89	0.94	-	0.87	0.71	0.79	0.84	-	0.78
	9	1.95	0.57	0.78	1.08	1.10	1.74	0.51	0.69	1.01	0.99
	10	0.91	0.74	0.90	1.00	0.89	0.81	0.66	0.80	0.94	0.80
Central	7	0.77	0.74	0.77	1.00	0.82	0.68	0.66	0.68	0.94	0.74
	11	-	-	-	1.02	1.02	-	-	-	0.96	0.96
	12	-	-	0.92	0.95	0.94	-	-	0.82	0.90	0.86

of the 15 producing zones are efficient. Zones 1, 2, 3 and 12 are unprofitable and inefficient by both measures. But for zones 4 and 8, the average DRCs' are slightly above unity regardless of the slightly positive average NSPs'. This is due to the high degree of inefficiency reveal by the DRC' of the 1977/78 crop year of both zones. Zones 10, 11, 15 and 16 are the most profitable and efficient ground nuts producing zones. The DRCs' of these zones lie in the range of 0.79 to 0.83

Soyabeans

The average value of NSPs' show that soyabeans production is socially profitable in nine out of the ten producing zones. It is unprofitable in zone 5. The NSPs' of the efficient zones range from ฿24 per rai to ฿188 per rai. The profitable and efficient soyabeans producing areas are further confirm by the less than unity DRCs'. Zones 6, 7 and 8 are the most efficient soyabeans producing areas. The DRCs' of these zones being 0.80, 0.78 and 0.74, respectively.

Inter-Commodity Comparison

The data in Table 5 show cassava to be the most efficient crop to produce in zones 1, 2, 3 and 5 in the northeast, since their DRCs' are the lowest among all other crops within the same zone. Within the framework of this study, sugar cane is the best alternative to cassava in zones 1 and 3. Kenaf seem to be the best alternative to cassava in zone 2 even though kenaf's DRC' is around unity. Sugar cane is the highest efficiency crop to produce in zone 4 and mung beans and maize are the first and second best alternative to sugar cane in this zone. Mung beans is again , the first best alternative to cassava in zone 5.

Table 5 Comparison of Domestic Resource Cost efficients (DRC') of Selected Crops in the same Agro-Economic Zone, Thailand, 1977/78 to 1980/81 Crop Years Average.

Agro-Econ Zone		Paddy	Sugar Cane	Maize	Cassava	Kenaf	Mung Beans	Ground Nuts	Soyabeans
Northeast									
	1	0.82	0.77	0.83	0.700	0.95	0.84	1.62	0.83
	2	1.05	-	-	0.73	1.00	-	1.62	-
	3	0.90	0.73	1.13	0.65	1.01	0.98	1.18	0.84
	4	0.85	0.60	0.74	0.85	0.97	0.62	1.03	-
	5	1.05	-	0.87	0.67	0.92	0.84	0.85	1.47
North	6	0.80	0.79	0.84	0.61	-	0.82	0.91	0.80
	8	0.82	0.69	0.80	0.75	-	0.83	1.01	0.78
	9	0.77	0.83	0.94	-	-	0.84	0.90	0.99
	10	0.68	-	0.88	0.68	-	0.86	0.82	0.80
Central									
	7	0.88	0.62	0.82	0.91	-	0.79	0.91	0.74
	11	0.79	0.77	0.94	1.06	-	1.23	0.79	0.96
	12	0.85	0.82	0.86	0.61	-	0.77	1.10	0.86
	13	0.87	0.74	0.81	0.78	-	0.94	0.91	-
	14	0.90	-	-	-	-	-	-	-
	15	0.76	0.78	0.79	0.73	-	0.94	0.83	-
	16	0.82	-	0.99	0.78	-	-	0.82	-

In the northern region, cassava is the most efficient crop to produce in zone 6 while sugar cane, paddy and soyabeans are the best alternatives to cassava. Sugar cane is the best efficient crop to produce in zone 8. Cassava, maize and paddy are the first, second and third best alternatives to cassava in zone 8 accordingly. Paddy is the most efficient crop in zone 9 while sugar cane and mung beans are the best alternatives to paddy production. In zone 10, both paddy and cassava are the two most efficient crops to produce. Soyabeans and ground nuts are the best alternatives to paddy and cassava in this zone.

In the central region, cassava production is again the most economically efficient crop to grow in zones 12, 15 and 16, while sugar cane has the highest efficiency in production in zones 7, 11 and 13. Paddy production seems to dominate zone 14 since it is the only crop in this zone within the framework of this study. Soyabeans is the best alternative to sugar cane in zone 7; paddy and ground nuts are the best alternatives to sugar cane in zone 11. Mung beans and paddy are the best alternatives to cassava in zones 12 and 15 respectively. As for zone 16, both paddy and ground nuts are the best alternatives to cassava.

Sensitivity of Domestic Resource Cost

The results and conclusions in the preceding section are rather static in the sense that they are based on the 1977/78 to 1980/81 crop years world prices of output and the input-output structure of that particular period. It is interesting to examine what would happen to the DRC coefficients of these crops if the value of input-output coefficients were to change marginally. Hence, the following section will examine the effects of changes in one variable (land, labor, capital or yield) on DRC estimates, assuming that the values of all the other variables remain constant.

The DRC elasticity shows the percentage change in a particular variable needed to cause a one percent change in the DRC ratio. For each estimate, the lower the value of DRC elasticity, the more sensitive the DRC ratio is to the changes in the values of the variable, and conversely, the larger the value of the DRC elasticity, the less sensitive the DRC ratio.

DRC elasticity estimates with respect to labor, capital, land and yield per rai are presented for each crop year and the average values of all crop years in Table 6. Estimates were made only for zones 11 and 7 for wet season paddy and sugar cane respectively. Estimates of the elasticity for maize and mung beans were made for zone 6. Estimates of the elasticity for cassava and kenaf were made for zone 5. The DRC elasticity for ground nuts and soyabeans were made for zone 10.

For all commodities under study, the DRC elasticity with respect to yield was negative and highly significant. The average values ranged from -0.836 for mung beans to -1.02 for cassava. This indicates a high degree of sensitiveness of DRC to changes in yield. For example, an average of 0.84 percent increase in mung beans yield will lead to a one percent decrease in DRC coefficients.

Among the input components, DRC' for all commodities is more sensitive to changes in labor and land costs than to capital cost. DRC' of maize, kenaf, mung beans, ground nuts and soyabeans are most sensitive to changes in labor costs as indicate by the lowest elasticity compared to the other input components. This suggest that technological

Table 6 Domestic Resource Cost Elasticities With Respect to Various Cost Components and Yield.

Commodity and Agro-Economic Zone	Crop Year	Labor	Capital	Land	Yield
Wet Season Paddy					
Zone 11	77/78	2.835	9.416	1.528	-0.949
	78/79	2.672	8.623	2.066	-0.909
	79/80	2.114	10.046	4.649	-0.825
	80/81	3.848	12.982	1.769	-0.934
	Average	2.867	10.267	2.503	-0.904
Sugar Cane					
Zone 7	77/78	-	-	-	-
	78/79	-	-	-	-
	79/80	-	-	-	-
	80/81	3.102	8.013	2.083	-0.948
	Average	3.102	8.013	2.083	-0.948
Maize					
Zone 6	77/78	1.805	4.735	3.917	-0.959
	78/79	2.098	6.264	3.077	-0.964
	79/80	2.484	21.363	3.548	-0.892
	80/81	2.363	5.865	1.718	-1.037
	Average	2.1875	9.557	3.065	-0.963
Cassava					
Zone 5	77/78	2.802	37.191	2.365	-0.994
	78/79	2.268	10.283	2.668	-1.040
	79/80	4.757	14.546	1.522	-1.031
	80/81	2.932	11.767	2.072	-1.013
	Average	3.190	18.447	2.157	-1.0195
Kenaf					
Zone 5	77/78	1.985	9.741	2.817	-0.996
	78/79	1.250	10.297	0	-0.937
	79/80	1.192	7.244	0	-0.960
	80/81	1.311	5.081	13.480	-1.017
	Average	1.4345	8.091	8.149	-0.9775

Table 6 (continued)

Commodity and Agro-Economic Zone	Crop Year	Labor	Capital	Land	Yield
Mung beans					
Zone 6	77/78	2.732	9.600	2.126	-0.839
	78/79	-	-	-	-
	79/80	1.966	9.370	2.891	-0.881
	80/81	1.906	7.510	3.957	-0.789
	Average	2.201	8.827	2.991	-0.836
Ground nuts					
Zone 10	77/78	1.409	14.977	18.293	-0.895
	78/79	1.264	8.483	19.246	-0.866
	79/80	1.532	32.990	9.989	-0.859
	80/81	1.324	5.731	5.178	-0.941
	Average	1.382	15.545	13.1765	-0.890
Soyabeans					
Zone 10	77/78	1.753	11.444	4.896	-0.869
	78/79	1.868	24.959	4.359	-0.901
	79/80	1.997	38.314	3.292	-0.872
	80/81	1.496	7.124	6.372	-0.894
	Average	1.7785	20.460	4.730	-0.884

Note: DRC elasticities are calculated according to the formula:

$$E = \frac{C_1 - C_o}{C_o} \bigg/ \frac{DRC'_1 - DRC'_o}{DRC'_o}$$

where E is the elasticity

C represents either labor, land, capital or yield

DRC' is the domestic resource cost at the shadow price of foreign exchange

the subscripts o and 1 refer to the original and new value after a 10 percent change in the cost components or yield, respectively.

change will be necessary to preserve levels of economic efficiency as economic growth gradually causes the relative price of labor to rise.

The rent from the best alternative crop is used in determining the opportunity cost of land. Hence, changes in prices and profitabilities of alternative crops affect the efficiency of the crop being examined. DRC' of paddy, sugar cane and cassava are most sensitive to changes in land cost (compared to labor or capital costs)

For inter-crop comparison, the elasticity of DRC' with respect to labor is in the range of three for paddy, sugar cane and cassava; two for maize, mung beans and soyabeans; and about 1.5 for kenaf and ground nuts. This means that a 1.5 percent increase in labor cost of kenaf and ground nuts will cause a one percent increase in DRC', etc. The elasticity of DRC with respect to each variable depends upon the significance of that variable in determining the value of DRC.

The elasticity of DRC' with respect to land is in the range of two or three for all crops except kenaf, ground nuts and soyabeans. The rate is equal to 8, 13 and 5 for kenaf, ground nuts and soyabeans respectively. Take paddy for example, a 2.5 percent increase in the opportunity cost of land will lead to one percent increase in the value of DRC' and vice versa.

The DRC' of all crops are least sensitive to changes in capital costs than the other two cost components. For example, a one percent increase in the DRC' of paddy, sugar cane, maize, kenaf and mung beans will required about 10 percent increase in capital cost. The capital costs have to increase by about 20 percent in order to cause the DRC' of cassava, ground nuts and soyabeans to increase by one percent.

VI SOME IMPLICATIONS

The most obvious policy implication is that the expansion of all crops under study is justified on the grounds of economic efficiency. The value of the DRC's will be the indicator for the choice of commodities in which each area should specialize. Normally, the area with the lowest DRC' for a specific commodity is the most efficient area to expand the production of that commodity.

The knowledge of the DRC elasticity with respect to various cost components and yields can be used to provide economic parameters for evaluating development programs. High elasticities (low numerical values) imply that the program should avoid using more of those inputs.

Regardless of the efficiency of production and export, the government policy pursued for a long period explicitly discriminated rather heavily against the rice sectors and implicitly discriminated against all agricultural exports through the overvaluation of the Thai currency. Internal or domestic prices were held below world prices because of these policies. This means that farmers received considerably less for their product than they would have if trade had been freer and the exchange rate closer to the equilibrium rate. These policies most likely resulted in lower incomes to rural people, especially those rice farmers who account for more than 75 percent of the Thai farmers. The disincentive provides to the rice farmers make them change to produce some other crops as evidence by the decreasing rate of rice output expansion. There was also a disincentive to investment in agriculture.

Although the rice consumers have gained in the short run, they have probably lost over the long run because the country was not able to exploit a downward sloping demand curve in world markets. Output and export earnings were less than if free trade had been practiced. The essence of development policy should be oriented towards output expansion. The amount of exchange earnings sacrificed due to production disincentive could have financed a higher rate of economic growth.

Extracting revenue through export taxes, as in the case of rice, became necessary largely because Thailand does not have effective income or other tax systems. Taxes collected by either of these alternative means would appear to have less deleterious effects on output and exports.

If a low rice price for consumers was the goal of government intervention, then an alternative strategy would have been to use some portion of foreign exchange earnings to finance expanded research efforts in rice on the grounds that the increased output that would result would drive the price down. However, this approach would have been effective only if Thailand faced a downward sloping demand curve in the world market. Further, it would have taken a longer time period before the benefits of the development would have been realized. Policy makers obviously had a short-term bias in their decision-making framework, and consumers clearly received a greater weight in the decision-making process than producers.

Sugar is the most controversial crop both domestically and internationally recently. The world sugar market has been quite unstable despite the presence of governments intervention. In the case of Thailand, the government policies seem to favor both the sugar cane growers and the exporters more than the consumers. Take 1980/81 crop year as an example, the government set a sugar cane support price far above the equilibrium price. The incentives offered to sugar cane growers and the disincentives offered to rice farmers simultaneously result in a relatively high private profitability of sugar cane production compared to rice production despite the fact that these two crops have almost the same degree of efficiency as indicates by the DRC' coefficients. Hence, more farmers change to grow sugar cane and this results in the low sugar price problem in the following year. One can see that the magnitude of incentives offered to sugar cane producers is such that private profitability is an unreliable guide to the efficient allocation of resources and this should also be avoided.

In the case of maize, the private windfall loss to exporters (prior to December 1981) which translated directly into lower farm prices, provides a disincentive to produce on the maize farmers despite the fact that maize production is efficient in most of the production areas. The abandon of the quota system and the bilateral agreements in late December, 1981 seems to be a good sign for maize exporters and maize farmers. Since the quota system and the bilateral agreements have long outlived their initial purpose, which was to stabilize an infant industry.

As for cassava, every effort should be made to try to negotiate with the EEC and maintain the EEC export markets. At the same time, the exporters should look for new markets in case of the possibility of the EEC banning Thai exports. The evidence clearly showed that cassava was the most efficient commodity to produce in most of the cassava-producing areas, so the country should try to gain from this advantage. Mindless intervention in the form of price or market intervention, such as quotas, should be strongly avoided.

Kenaf production was not highly socially profitable as evidenced by the around unity DRC'. However, DRC can be reduced by reducing the input cost or increasing the yields. Efforts could be made either to reduce the cost of production by improving the technology, or by finding substitute crops for farmers or substitute products for consumers.

The production of mung beans, ground nuts and soyabeans should be promoted in the agro-economic zones with less than unity DRC'. The exporters should look for new markets for these three crops besides the existing markets. The production of mung beans, ground nuts and soyabeans can be major cash crops to the farmers and another major foreign exchange earners for the country. The country should try to gain from the advantage of production efficiency. It is appreciated that the government does not intervene in the price setting or trade of these three products. But at the same time government assistance in seeking external market is urgent and desirable.

The broad, overall, policy direction arising from this study is that a policy of freer trade should be encouraged. The pattern of production should be dictated by the extent of economic efficiency, not by government interventions. Emphasis should be put more on agricultural research programs which would lead to a higher growth rate in the aggregate. An efficient tax system that has less deleterious effects on output and exports should be adopted.

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