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An empirical study of policy incentives and comparative advantage in the fisheries industry of Thailand

Jitsanguan, Thanwa, Ph.D.

University of Hawaii, 1988

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AN EMPIRICAL STUDY OF POLICY INCENTIVES AND COMPARATIVE ADVANTAGE IN THE FISHERIES INDUSTRY OF THAILAND

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN ECONOMICS

MAY 1988

By

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ABSTRACT

This dissertation is a case study analysis of the relationship between trade policy and renewable resource utilization in the fisheries industry of Thailand. The main research objective is a determination whether protection policy has been directed to support the utilization of resources in an industry where the internationally comparative advantage lies. The theories of effective protection are combined with comparative advantage analysis using models of domestic resource cost and revealed comparative advantage to serve this purpose.

The study indicates that the fisheries industry in Thailand is economically advantageous both in terms of foreign exchange earned compared to domestic resource cost spent, and in terms of export performance in the world market. The selected Thai fisheries activities in this study show the substantial degree of export potential. Thailand's protection system with regard to the fisheries industry, however, does not provide neutral incentives to either production or processing. In fact, a penalty of negative protection still exists in this industry. The indicators estimated from both the industrial survey data and the input-output structure exhibit similar conclusions. The growth of the Thai fisheries production and exports, therefore, cannot be attributed to the protection policy, rather it is the potential of the industry in terms of comparative advantage in resource use that enables it to survive and succeed.

The study recommends the identification and measurement of the market failures that impede industrialization, and implementation of

effective strategies to overcome these failures. The economic incentive system should be rationalized and strengthened to offset the negative protection. The problem regarding the proper management of the fishery resources in the future should also be urgently taken into consideration in order to maintain the degree of comparative advantage that the Thai fisheries industry currently holds in international trade.

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CHAPTER I

INTRODUCTION

1.1 Nature of the Study

This study is concerned in general with the role of a sector in the economic development of an open economy. It is a case study to analyze the relationship between trade policy and renewable resource utilization. The attempt of this research is, basically, to provide information for policy makers to justify their decisions regarding production, industrialization and trade in an economic sector. The main research objective is to discover if the trade policies currently employed are appropriate and if the use of domestic resources is efficient. This study focuses on the fisheries industry of Thailand.

The investigation will cover facts and figures of the fisheries industry regarding the extent of fisheries resource utilization and trade promotion policies. With the idea that trade is an input to economic development, export promotion policies have been adopted in Thailand since 1970 in order to stimulate the economic growth of the country. Many domestic products, both agricultural and manufactured, have been promoted in the world market.

The Thai fisheries industry has been one of the more successful cases of transforming a domestic natural resource into an important export commodity. Fish in this study, therefore, can be considered both as a renewable resource to be explored and exploited and as a commodity to be produced and distributed.

Under open-access conditions, a common property resource such as fisheries will be freely harvested until the excess profit becomes exhausted. As this process goes on, fisheries may become an increasingly scarce resource due to a disequilibrium between expanding fishing efforts and a shrinking stock of fish. Since Thai fisheries can be considered in a variety of respects such as sources of nutrition, employment and foreign exchange earning, the policies implemented in this industry, therefore, have many impacts, socially and economically, on the fisheries industry itself and on the Thai economy as a whole. At this juncture, economic justification in allocating resources should be taken into consideration. The efficient utilization of fisheries resources based on the appropriate economic policies is the primary concern in this research.

The study is a partial equilibrium analysis because it is involved basically with only one sector of the economy. A sector analysis, however, can be related directly or indirectly with other sectors of the same economy through the use of some economic variables, such as shadow prices of factors of production, a shadow exchange rate, and the input-output table. This will broaden the scope of the study toward a general equilibrium analysis to a limited extent.

Most of this study is based, moreover, on the static type of analysis due mainly to the nature of the data and coefficients, which are taken from only one period of time. The interpretation of the results of this study may thus be partly validated only on the assumption that the significant variables in this study have not considerably changed.

1.2 Statement of the Problem and Methodologies

International trade theory does not guarantee that the level of welfare attained in an open economy will always be higher than that of a closed economy. It can be proved only that an economy with free international trade can obtain a higher level of welfare than an economy with no trade if there is a neutral redistribution system. However, under perfect free trade assumptions, not all equilibrium points in the economy will simply be assumed to be better than those points in a no trade economy. This partly results from the variety of trade restriction policies in use.

The crucial problem is, therefore, to find the best trade level. An awareness of this state has made every country prescribe various kinds of trade policies in order to control the level of trade the country should have and to determine what kinds of products that country should export or import.

Trade policy, therefore, plays a very important role in economic development of an open economy. Many significant shifts and changes with respect to the direction that trade in developing countries should follow have been emphasized over time. The instability of export earnings and adverse tendencies of terms of trade was formerly a main focus of attention in trade. Foreign exchange constraints in the two-gap model later became the major discussion for economic motivation. The well-known import substitution strategy came to be the crucial policy during the 1960s and 1970s. Finally, the promotion of manufactured exports and selection of import substitution projects with

a view to potential comparative advantage or viability under competitive conditions are perhaps the approaches stressed most at present.

In fisheries, as in other industries, trade policy is becoming a more interesting issue when the world begins to realize that the existing fisheries resources may now be in a situation of decline. The exploitation of fish stocks has been placed under tighter controls and consequently the limited supplies of fish have to be allocated more efficiently in both domestic consumption and international trade.

Due to the common property characteristics of fisheries resources, the fisheries in Thailand are now facing the problems of disequilibrium between biological and economic conditions. There is some evidence of a decline of fisheries resources as a result of overexploitation in recent years. Despite the fluctuation in the domestic fish supply, however, the fisheries sector has in general experienced an impressive increase in terms of trade.

The focus of this study is to evaluate trade policies that are supposed to be one of the key factors in bringing about successful export promotion. Policy incentives have been used to encourage investment in the industry and to support Thai exporters in coping with production and trading problems. Since such policies involve directly or indirectly a cost to the rest of the Thai economy, this study, therefore, attempts to answer the question of whether the trade policies as they have been formulated are efficient in generating foreign exchange. The theories of effective protection and comparative advantage will be applied to serve this purpose.

The fundamental hypothesis is that even if the industry is economically advantageous, market failures and other influences may still impede optimal industrial growth. Unfortunately, among these other influences are the government policies themselves and, therefore, some justifications about the promotion of industry are needed.

The explanation of trade performance generally appears in many trade theories. The economics of classical trade theories includes the theory of absolute advantage, which states that a country will export the goods it can produce at a relatively lower cost than any other country. The theory of comparative advantage extends this principle to the broader scope stating that a country will produce and export those goods that it can produce at a relatively lower cost and will import those goods that it would otherwise be producing at a relatively higher cost.

The modern trade theories explain trade phenomena by the theory of resource endowment or differences in endowment of factors of production which accordingly will determine the different production possibilities and hence the potential of each country's trade. The country with relatively abundant labor will tend to produce and export labor-intensive goods and vice versa for the country with a relative abundance of capital, land or management. The theory of scale economics, on the other hand, concludes that if the national market is large, the production of goods under the condition of increasing returns to scale is conducive to the export of those goods. And, if the national market is small, goods tend to be exported by industries which realize at best constant returns to scale. The preference similarity theory concentrates on the differentiation of products when one country begins

to produce a differentiated product for the domestic market, consumers in another country will become aware of this product and desire to import it.

This study will evaluate trade performance not on the basis of all the theories mentioned, but only through the concept of comparative advantage in particular. The selected analytical tools here are the domestic resource cost and the revealed comparative advantage models. Both of these methodologies are designed to observe the export performance of a commodity in which a country presumably has the comparative advantage over the period of exporting. On the other hand, these methodologies are premised on the assumption that the allocation of resources for the export production of a country should be made on the basis of comparative advantage.

The domestic resource cost model is an application of the cost-benefit analysis to the international trade. This economic model may be used to show whether a country really has export potential in its industries, when social cost and social benefit of domestic resources used in producing the commodities are taken into consideration. When applied to the export promotion policy, comparative advantage occurs if the total social cost of producing a commodity is less than the social value of the net foreign exchange earned from exporting such a commodity.

The revealed comparative advantage model, on the other hand, rests on the assumption that the imports of a country will indicate international non-competitiveness of the counterpart domestic industries whereas exports will imply that the counterpart domestic industries are comparatively competitive. This relative export performance can

be measured by considering the relative share of a country in total world exports of the studied commodities.

A conclusion of the overall policy evaluation to be drawn from this study is a determination whether protection policy has been directed to support the utilization of resources in the industry where the internationally comparative advantage lies. An assessment of policy in fisheries resource use and trade can then be made based on the above considerations. The concluding recommendations for the fisheries industry will be drawn from the findings at the end of the study.

1.3 Selection of the Studied Industry

In selecting an industry to study, one should have at least one reason, or more, to explain why that industry comes into attention and is worth being further investigated. The fisheries industry is deliberately selected for this study because of its uniqueness in many interesting aspects.

First, the fisheries industry has shown impressive development from a small subsistence part of the Thai economy supplying fish for domestic consumption to an immense commercial sector producing one of the top eight foreign exchange earning commodities of the country. This expansion has also made Thailand the most developed fishing country in the Southeast Asia region and also one of the ten leading producers and exporters of fisheries products in the world. These remarkable changes occurred, moreover, within the span of only two decades.

Second, the fisheries industry in Thailand covers a broad scope of activities from the production of fish as a simple primary output

to the processing of various fish products in the manufacturing sector. The growth of this industry hence can possibly give a relatively large forward and backward linkage effect to the rest of the economy.

Third, the fisheries resource, unlike crops and livestock, is by its nature a common property resource in the sense that the utilization is theoretically always open to everyone. This inevitably brings about many problems unique to the industry, such as the overexploitation of the resource which, in turn, results in the fluctuation or even the decline of fisheries production later on.

Fourth, fisheries products are comparatively new major export items unlike most other important commodities such as rice, maize, rubber and tapioca, which have been the traditional exports of Thailand. The promotion of non-traditional exports like fisheries products is one of the major factors to improve the balance of payments and to sustain the growth of the economy. Although the fisheries industry is at present a considerable source of foreign exchange, employment and food supply for the country, little study has been undertaken on this industry. For these reasons, a large number of questions still remain to be answered.

1.4 Objectives of the Study

This study will attempt to answer the following specific questions.

1. What are the major factors contributing to the development of the industry both in the past and at present? What are the trade structure and the trade performance of the fisheries industry? How have the fisheries products developed and performed in international trade?

2. Do the fisheries exports really have a comparative advantage in terms of social cost and benefit of the resources used? What are the value added and the foreign exchange generated from the export of these products? What are the likely effects of variation in factors related to production and export on the comparative advantage?

3. How can policy incentives in terms of production and subsidies affect the export of fisheries products? Are the policy incentives and comparative advantage mutually beneficial in overall consideration? What should the optimal policies include with regard to trade and development of the fisheries industry in Thailand?

1.5 Empirical Data

Since the fisheries industry basically consists of many sub-industries in terms of different productions and processings, this study will cover only the most important production patterns and export products. Fisheries production will be analyzed through the marine fisheries employing the popular fishing methods, including trawl net and purse seine, and coastal aquaculture represented by shrimp cultivation. Fisheries processings will be investigated by three major products, including frozen shrimp, canned tuna and fish meal. In terms of trade performance, export of fisheries products to the selected six major markets will be examined.

The empirical data regarding the benefit-cost structure of the fisheries industry used in this study are derived from two main sources: the industrial survey and the input-output structure of Thailand. The industrial survey data include those of the Department of Fisheries (for the fisheries production and aquaculture), the Division of

Industrial Economics (for the fish meal processing) and the author (for the frozen shrimp and the canned tuna processings). Analyses of the industrial survey data and the input-output structure will be made separately.

1.6 Content of the Study

This dissertation consists of seven chapters. Following the introduction in Chapter I, Chapter II describes the general background of the fisheries industry in Thailand to provide information on how the industry has been developed. Production and trade aspects of the Thai fisheries will be investigated to disclose facts and figures needed for further analyses in subsequent chapters.

Chapter III reviews the literature and theoretical framework of economic theories employed in the study, including the protection theory and the comparative advantage models.

Chapter IV examines the social valuation of economic parameters required in the analytical models. The concept and empirical measurement of shadow prices will be discussed.

Chapter V presents and explains the empirical results from the application of economic models, regarding policy evaluation and comparative advantage, to the survey data of the fisheries industry.

Chapter VI shows the empirical measurements with an application to input-output structure of Thailand as an overall evaluation.

Chapter VII provides the summary and conclusion as well as the policy recommendations drawn from the empirical results.

CHAPTER II

FISHERIES INDUSTRY IN THE THAI ECONOMY: PRODUCTION AND TRADE

The first part of this chapter will be devoted to a brief introduction of the fisheries industry in Thailand. Development of the industry and management of fisheries as a renewable resource will be discussed with descriptions of the past and present situation of Thai fisheries. Policy recommendations regarding the use of fisheries resources will be included to help explain the production aspect of the industry.

In the second part, trade in fisheries will be discussed in terms of export structure, market and performance of fisheries products. This study will also put special emphasis on the selected fisheries products, namely, frozen shrimp, canned tuna and fish meal. Production and exports of these export items will be taken into consideration in this chapter as the general background for the policy evaluation in the next chapters.

2.1 The Country, the Fisheries and the Fish

Situated in mainland Southeast Asia with an area of 513,115 square kilometers, Thailand in 1986 was estimated to have a population of 53 million with the growth rate of 1.7 percent and approximately 70 percent of the national labor force engaged in the agricultural sector. The per capita income was approximately 20,000 Baht or about 755 U.S.

dollars (1 U.S. dollar was 26.5 Baht). The average annual economic growth rate was 7 percent during the 1960s-1970s and 4 percent during 1985-86.

Thailand's fertile coastline extends for 1,900 kilometers around the Gulf of Thailand and another 700 kilometers border the Andaman Sea. Coastal provinces account for 23 out of the country's 73 provinces. Most of the coastline is characterized by a gradual inclination of the continental shelf slope and the shallowness of the seabed. The Gulf of Thailand, which is the main domestic area for harvesting marine resources, covers an area of 350,000 square kilometers with a mean depth of 45 meters and a muddy bottom. Such geographical characteristics of Thai waters then give rise to the effectiveness of the fishing methods that employ dragging the seabed, particularly the trawl net. Taking into account the estimated 5,000 square kilometers of the total inland water resource area as well as 1,500 square kilometers of the feasible space for aquaculture along the coastal mangrove forestry, Thailand has very good potential in both the capture and the culture fisheries.

The structure of Thai fisheries is rather complicated as it involves multi-species, multi-gear, marine and inland fisheries which altogether produce over two million tons of catch per year. Marine fisheries account for more than 90 percent of the total production while the rest is from inland fisheries and aquaculture, which are found in various parts of the country.

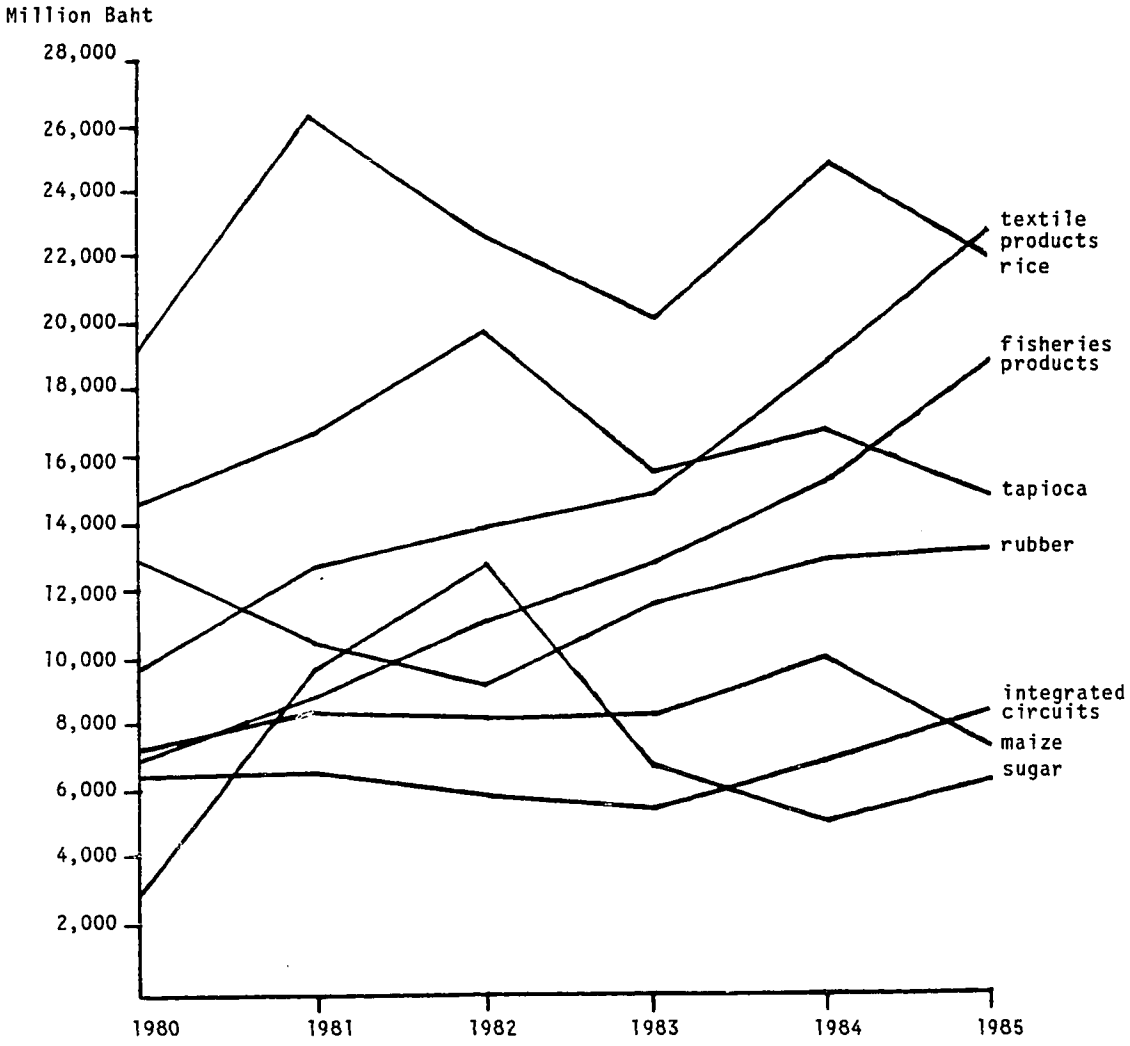
As a sector of the Thai economy, the fisheries sector is the main source of protein food for most of Thailand's population. The per capita fish consumption is approximately 20 kilograms which, in terms

of nutrition in Thailand, is more than all other meats combined, 15 kilograms.

There were 15,968 fishing boats registered in Thailand in 1985 of which approximately 80 percent are powered and 52 percent are boats with trawl nets. More than 500,000 people estimated from 57,526 fishing households and 26,875 fishing employees' households are directly or indirectly involved in the fisheries sector (National Statistical Office, 1985). The majority of them, about 70 percent, are small-scale fishermen who land less than 30 percent of the total catch whereas the rest or 30 percent are considered as large-scale fishermen who account for 70 percent of the total catch.

Despite the rather insignificant contribution to GDP, 12,651 out of 1,047,564 million Baht (1.21 percent) in 1985, the fisheries industry has increasingly contributed in terms of foreign exchange earning. Export of fisheries products makes up almost 10 percent of the total export revenue. The total export value of all fisheries products, 18,527 million Baht in 1985, was the third highest among the export earning commodities of Thailand after textile products, 23,578 million Baht, and rice, 22,524 million Baht (see Figure 1).

The Thai fisheries sector is basically a multi-species fisheries comprised of two main fish groups: demersal and pelagic fish (fish that live near the bottom part and the surface part of the sea). Catch proportions of these two main fish groups are respectively 65 and 35 percent. The difference in dwelling and feeding behaviors of marine species results in the use of different fishing gear such as trawl net for the demersal species and purse seine for the pelagic species.



Source: Department of Business Economics, Trade Statistics Year Book, various issues, Ministry of Commerce, Thailand.

Figure 1. Export Earnings from the Top Eight Commodities of Thailand during 1980-1985

The maximum sustainable yield (MSY)[1] of the Thai fisheries has been estimated in average at about 1.2-1.5 million tons per year (Murdoch, 1978; Panayotou, 1980; and ADB, 1985). The major fish caught by the Thai fishermen, however, is the so-called "trash" fish, which consists basically of a variety of species too small in size for human consumption. In 1985, trash fish accounted for more than 37 percent of the total marine catch or 69 percent of the total catch by trawl nets.

Since the late 1970s, Thailand has produced a total catch of about 2 million tons annually, which makes it the most developed fishing country in Southeast Asia and places it among the top ten fishing nations in the world.[2] To sum up, fisheries play at least three major roles in the Thai economy as a source of nutrition, employment and foreign exchange earning.

2.2 Development of the Thai Fisheries Industry

For a long period of time prior to 1960, fisheries in Thailand were basically the artisanal type along the area boarding the sea and mostly for domestic consumptive purposes. The rapid development of the Thai fisheries began in 1960 when the trawling method was introduced

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[1]The theoretical discussion about fisheries resource management and concept of maximum sustainable yield (MSY) can be found in Hannesson (1975) and Anderson (1977).

[2]In 1984, the top ten marine fishing countries were as follows (with catch in tons): Japan (12,021,195), USSR (10,592,937), China (5,926,793), USA (4,814,295), Chile (4,499,262), Peru (2,996,984), India (2,858,914), Korea Rep. (2,477,080), Norway (2,455,959), and Thailand (2,249,808). The total world production was 82,769,800 tons (Source: FAO, Yearbook of Fishery Statistics, Vol. 58, 1984).

and shown to be effective through the experiment of the German and Thai governments. The so-called "otter board trawl"[3] was generally considered the most efficient type of fishing gear for the demersal fish resources in Thai waters.

Resulting from this successful experiment, Thai fishermen rapidly responded to the innovation by increasing the number of trawling boats from 99 in 1960 to 3,450 in 1970 and an annual marine catch increasing from 146,472 to 1,335,000 tons. The major portion of the catch, about 70 percent, was caught by the otter board trawl.

From 1960 to the early 1970s was the golden period for the Thai fisheries as a result of the combination of richness in resources and the effectiveness of a new fishing method. Other than harvesting in domestic waters, Thai commercial trawlers and government research vessels have begun to explore and exploit many new fishing grounds. These include areas off the coasts of Kampuchea and South Vietnam (from 1963), Malaysia and Indonesia (from 1965), Burma (from 1966), Borneo (from 1968) and the Bay of Bengal (from 1972). In relation to such expansion, marine fisheries production increased to 1.5 million tons in 1972-73 (see Table 1).

With the structure of industry becoming more capital intensive along the development path, the oil crisis in 1973 posed the first

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[3]Otter board trawl is a fishing gear with a large conical net dragged along the sea bottom to gather fish and other marine creatures. This fishing method is considered a "movable gear" since it works differently from the "stationary gears" that are fixed in location and operated via the tides of the sea.

Table 1

Production of the Thai Fisheries Sector

Units: quantity: thousand tons
value: million Baht

year	marine fisheries quantity	marine fisheries value	inland fisheries quantity	inland fisheries value	total quantity	total value
1961	233	n.a.	72	n.a.	305	n.a.
1962	269	n.a.	70	n.a.	339	n.a.
1963	323	n.a.	95	n.a.	418	n.a.
1964	494	n.a.	82	n.a.	576	n.a.
1965	529	n.a.	86	n.a.	615	n.a.
1966	635	n.a.	85	n.a.	720	n.a.
1967	762	n.a.	85	n.a.	847	n.a.
1968	1,004	n.a.	90	n.a.	1,094	n.a.
1969	1,179	n.a.	112	n.a.	1,291	n.a.
1970	1,335	n.a.	116	n.a.	1,451	n.a.
1971	1,470	4,554	117	974	1,587	5,528
1972	1,548	4,936	131	1,371	1,679	6,307
1973	1,538	6,562	140	1,647	1,678	8,209
1974	1,351	4,093	159	1,890	1,510	5,983
1975	1,394	5,102	161	2,092	1,555	7,194
1976	1,552	5,968	147	2,153	1,699	8,121
1977	2,067	8,622	122	2,038	2,189	10,660
1978	1,958	11,458	141	2,370	2,099	13,828
1979	1,813	11,318	133	2,866	1,946	14,004
1980	1,647	10,507	145	3,560	1,792	14,067
1981	1,824	13,213	165	3,920	1,989	17,133
1982	1,986	14,246	134	4,685	2,120	18,931
1983	2,100	15,236	155	4,002	2,255	19,238
1984	1,973	14,541	161	3,796	2,134	18,337
1985	2,058	15,650	167	4,135	2,225	19,785

n.a.: non-available data

Source: Department of Fisheries, Fisheries Record of Thailand, various issues, Ministry of Agriculture and Cooperatives, Thailand.

obvious threat to the growth of Thai fisheries. An increase in oil price, which accounts for about 30 percent of the total fishing cost, forced many distant-water fishing boats back into the domestic waters, where the resources were already overexploited. Annual production after 1973 thus suddenly decreased from 1.5 to 1.3 million tons during 1974-75.

Immediately after the country recovered from the oil crisis, major coastal states in Southeast Asia, as well as many in other parts of the world, agreed to extend the new exclusive economic zone to 200 nautical miles according to the new Law of the Sea: Burma and Vietnam in 1977, Kampuchea and the Philippines in 1978, Indonesia and Malaysia in 1980.

Thailand, on the other hand, is a semi-enclosed sea state bordering on both the Andaman Sea and the Gulf of Thailand. The country automatically becomes a zone-locked state with no direct access to the high seas after its neighboring countries' new economic zone announcements. With no better alternatives, Thailand belatedly joined its neighbors in declaring its new economic zone in February 1981, the last country in Southeast Asia to do so.

It should be noted here that many sections of this sea region are claimed by more than one nation, causing many difficulties in the implementation of cooperative schemes among nations. As a consequence, fishing operations in disputed areas can easily bring about problems of poaching as well as international relation problems.

For the Thai fishing grounds, the new proclamation of international waters brought approximately 300,000 square kilometers of former Thai

fishing grounds or potentially 660,000 tons of catch within the national jurisdiction of neighboring states. The total catch then declined during 1978-80.

Along with the successful story of the Thai fisheries industry, it has been accepted that there still remains at least two negative impacts in that rapid development. First, the marine resources in Thailand have been used under the open-access condition and have become gradually overexploited. This can be witnessed by certain indicators such as the decrease in catch per unit of fishing effort (CPUE) from 294.9 to 49.8 kilograms during 1964-1981 and the substantial ratio of trash fish, 70 percent of catch by trawl nets (Boonyubol and Pramokchutina, 1982).

Second, the Thai fishermen are a dualistic structure of the small-scale and the large-scale fishermen due to the difference in ability to employ fishing modernizations and the competition in harvesting the same resources. For example, trawlers and other commercial fishing vessels encroach into the three kilometer coastal zone reserved by Thai law for local Thai fishermen.

In the 1980s, Thailand's marine fisheries are still fluctuating around a mean production of 2 million tons per year. This level of production has recovered from the decrease after 1977 for several reasons: the increase in extra-territorial fishing, international joint fishing projects, increased fishing effort compensating for the decline in the real cost of fuel, further development of the Andaman Sea fishing grounds, and the relative resilience of the Gulf of Thailand stocks to overfishing.

2.3 Policies in Fisheries Resources Management

In order to sustain or improve the status of the fisheries industry, Thailand is in great need of effective fisheries policies.

Panayotou (1980) calls for an immediate freeze on the number, size and configurations of fishing vessels, especially trawlers, an effective halt to the construction of new trawlers, and compulsory registration and licensing of all existing vessels as the necessary conditions for the Thai fisheries policies. Until the amount of fishing effort is reduced to the optimal level, the present fishing license should be made nontransferable and retracted upon retirement. Buying back and canceling the license of those fishermen who choose to leave the sea will help speed up the fishing effort reduction scheme.

Regulations of the Department of Fisheries regarding the use of trawl nets in sensitive areas, such as spawning areas or the three-kilometer coastal zone reserved for local fishermen, should be enforced more rigidly and be subject to greater penalties. Training for alternative employment as well as development of other opportunities in coastal areas such as aquaculture and fresh water fisheries will also help increase the policy's chances of success.

The Department of Fisheries has encouraged the Thai fishermen to adapt their fishing methods more to the pelagic species, which still have better potential for increased exploitation rather than to the demersal species which are already overfished.

In the short run, the international joint fishing agreement, under the cooperation between the Department of Fisheries and the private sector, is still one of Thailand's great prospects. The international

waters in the Indian and the Pacific Oceans also offer some scope for further exploration and exploitation by Thai fishermen. This fishing cooperation at the same time will help improve the reputation of Thai fishermen, who have often been accused of poaching in the neighboring countries' waters. Because of the ethnic, religious and political diversity among Thailand's neighbors, the international fishing cooperation in this region may also depend upon more appropriate diplomatic policies.

In the longer term, the resilience of domestic waters is still considered an important issue for the fisheries policy. The other sources of fish supplies such as inland fisheries and coastal aquaculture (for example shrimp cultivation), are among those with high prospects, especially if research and feasibility studies are done in advance. Improving the coastal environments, through the control of various industrial pollution and maintenance of ecological conditions, will help in many ways to provide the greater possibilities for the increase of fisheries production in the future.

2.4 Trade in Fisheries

The utilization of the fish supply in Thailand during the decade 1975-1985 can be summarized as follows: domestic consumption 46.01 percent, fish meal 40.40 percent and export 13.59 percent. Although the general production trend has been sustained in the 1980s, the trade pattern has changed significantly. The increase in export from less than 100,000 tons in 1975 to more than 400,000 tons in 1985 was an impressive growth trend. Among the major export commodities of Thailand, fisheries products are among the very few that are not

confronting lower export prices and excess supply problems but, to the contrary, they face the limitation of supply.

2.4.1 Structure of Fisheries Trade

Thailand has maintained a trade surplus in fisheries products since 1963, although the amount of trade that year was still relatively small. In almost every subsequent year, exports have increased in quantity and especially in value. Imports of fisheries products, on the other hand, only slightly increased during the 1960s and 1970s. Both imports and exports, however, have been increasing more rapidly in the 1980s. It can also be noticed that the value of exports tends to increase at a higher rate than the quantity (see Table 2).

Fisheries exports can be classified structurally into four main categories: (1) fresh, chilled, or frozen products, (2) preserved or canned products, (3) fish meal products, and (4) dried, salted, smoked, or miscellaneous products (see Table 3).

In terms of export value, canned products appear to be the most foreign exchange earning among all fisheries products, accounting for 7,347 million Baht or 42.68 percent of total export value in 1985. Canned fish, particularly canned tuna, is the main item in this category with the export value increasing from 603 to 5,204 million Baht during 1980-85.

Frozen products are the second major export category of fisheries products from Thailand at the present time. Frozen shrimp was the foremost export item among frozen products for a long time because of its relatively higher unit price. Out of total export value from

Table 2

Trade Balance of the Fisheries Products

Units: quantity: thousand tons
value: million Baht

	import		export		trade balance	
year	quantity	value	quantity	value	quantity	value
1960	9.28	70.18	8.96	34.26	-0.32	-35.92
1961	10.23	63.06	10.64	42.49	0.41	-20.57
1962	7.86	55.74	9.07	41.24	1.21	-14.50
1963	6.57	48.64	9.04	72.72	2.47	24.08
1964	8.34	55.21	10.91	95.75	2.57	40.54
1965	11.87	69.09	17.25	149.95	5.38	80.86
1966	10.13	63.88	18.63	234.97	8.50	171.09
1967	10.02	65.25	17.39	286.55	7.37	221.30
1968	9.33	64.13	16.18	309.00	6.85	244.87
1969	12.19	88.48	21.75	324.10	9.56	235.62
1970	14.22	85.60	44.95	369.81	30.73	284.21
1971	15.93	82.32	55.11	497.55	39.18	415.23
1972	15.13	83.69	82.38	807.16	67.25	723.47
1973	19.54	92.55	104.13	1,649.93	84.59	1,557.38
1974	19.96	93.54	88.22	1,548.97	68.26	1,455.43
1975	19.62	123.71	98.00	2,106.70	78.38	1,982.36
1976	24.93	149.81	133.45	3,097.74	108.52	2,947.93
1977	18.63	138.61	180.33	3,590.90	161.70	3,452.29
1978	28.70	176.30	235.38	5,086.12	206.68	4,909.82
1979	79.96	432.02	277.89	7,326.24	197.93	6,894.22
1980	43.56	483.25	262.56	7,250.81	219.00	6,467.56
1981	47.17	549.95	300.03	8,775.74	252.86	8,225.79
1982	46.21	725.53	316.67	11,230.73	270.46	10,505.20
1983	58.94	1,093.08	344.89	12,677.17	285.95	11,584.09
1984	119.06	2,119.33	411.72	15,080.89	292.66	12,961.56
1985	152.71	3,857.46	466.21	18,527.66	313.50	14,670.20

Source: Department of Fisheries, Fisheries Record of Thailand, various issues, Ministry of Agriculture and Cooperatives, Thailand.

Table 3

Export Structure of Fisheries Products from Thailand

Units: quantity: tons
value: million Baht

Products	1980	1981	1982	1983	1984	1985
1. frozen products						
quantity	97,991	115,432	116,010	112,882	137,506	167,735
value	3,643	4,239	5,237	5,487	5,509	6,995
1.1 shrimp						
quantity	17,915	18,761	20,138	20,150	19,428	24,041
value	1,961	2,136	2,764	3,164	2,799	3,439
1.2 fish						
quantity	41,435	56,867	53,216	53,410	75,255	96,444
value	381	767	689	686	1,017	1,377
1.3 cuttle fish						
quantity	38,641	39,804	42,656	39,322	42,823	47,250
value	1,301	1,336	1,784	1,637	1,693	2,179
2. canned products						
quantity	31,197	43,621	64,428	69,527	110,467	132,486
value	1,590	2,118	3,144	3,780	5,858	7,346
2.1 fish						
quantity	14,159	28,371	43,706	49,947	81,419	102,944
value	603	1,109	1,665	2,116	3,696	5,204
2.2 crustaceans						
quantity	17,038	15,250	20,722	19,580	29,048	29,542
value	987	1,109	1,479	1,664	2,162	2,142

Table 3 (continued) Export Structure of Fisheries Products from Thailand

Units: quantity: tons
value: million Baht

Products	1980	1981	1982	1983	1984	1985
3. fish meal						
quantity	114,343	113,771	85,074	93,246	85,487	74,791
value	972	1,014	701	785	743	605
4. others						
quantity	19,037	27,212	53,167	69,244	78,262	91,207
value	1,045	1,404	2,148	2,625	2,970	3,582
5. total						
quantity	262,568	300,036	316,679	344,899	411,722	466,219
value	7,250	8,775	11,230	12,677	15,080	18,528

Source: Customs Department, Ministry of Finance, Thailand.

fisheries products of 17,213 million Baht in 1985, 6,936 million or 40.30 percent was contributed by frozen products of which about half is from frozen shrimp.

With great possibilities to increase supplies of raw materials, other products such as frozen cuttle fish and canned crustaceans also deserve special attention since they are gradually gaining more importance. The export value of each of these products was about 2,100 million Baht in 1985. Although the export value is still comparatively minor, Thailand is also the leading exporter of canned crabmeat, baby clams, and shrimp.

Fish meal, on the other hand, is the largest single product in terms of export quantity, 74,791 tons in 1985, but ranks very low in terms of value, only 605 million Baht. It is then rather significant to look at fish meal in terms of natural resource utilization more than its export value. In other words, the fish meal industry is always criticized for its misuse of the fishery resources since about 47.70 percent of its raw material (trash fish) consists of the premature economic fish species (Meemeskul and Iemsa-art, 1985).

There are many other miscellaneous fish products with export values between 300-700 million Baht annually. The export potential of such small products is, nevertheless, relatively limited due to the demand constraint in the international market.

It is noteworthy in considering the structure of fisheries exports from Thailand that the export of major fisheries products developed in different periods of time and from different types of resources: frozen products in the 1960s from demersal species, fish meal in the

1970s from trash fish, and canned products in the 1980s from pelagic species.

2.4.2 Export Market and Trade Performance

The major export markets of fisheries products can be separated into three groups according to different products. The United States is the most important market for canned products. Japan appears to be the major importer of frozen products. These two countries import annually more than half of all fisheries exports from Thailand by value. For example, the export shares to these countries in 1985 were 31.42 and 25.95 percent respectively. Finally, some of Thailand's neighboring countries such as Singapore and Malaysia are the biggest importers of Thailand's fish meal. Except for the United States and Japan, export shares of the other importing countries, however, are less than 10 percent (see Table 4).

The United States in particular has become the largest export market of Thailand since 1984. Out of the total 1985 export value of 38,016 million Baht, fisheries products accounted for 5,821 million Baht or 15 percent. Most of these fisheries products were canned tuna and sardines which accounted for almost 70 percent of the total production of these items in Thailand. The United States also imports a lot of Thailand's frozen products, but less than Japan does. It should be noted that the success of canned tuna exports during the past few years has played a key role in placing the United States ahead of Japan as the foremost trade partner of Thailand.

Japan, on the other hand, had been for a long time the principal export market of Thai fisheries products. Due to the market demand

Table 4

Export Direction of Fisheries Products from Thailand, 1985

Unit: million Baht

importers	frozen products	canned products	fish meal	others[a]	total	%
USA	1,324.72	4,014.08	-	482.24	5,821.04	31.42
Germany	105.63	650.78	-	39.77	796.18	4.30
Malaysia	620.98	237.80	163.51	105.67	1,127.96	6.09
Japan	3,197.60	66.00	0.56	1,543.40	4,807.56	25.95
Italy	583.31	12.27	-	1.27	596.85	3.22
Hong Kong	141.06	3.71	27.85	234.08	406.70	2.19
Singapore	406.66	37.27	205.01	73.23	722.17	3.90
Australia	228.05	190.89	-	524.16	943.10	5.09
France	165.61	460.77	-	60.41	686.79	3.70
Canada	33.06	483.95	-	47.50	564.51	3.05
others[b]	188.88	1,188.50	208.19	469.23	2,054.80	11.09
total	6,995.56	7,346.02	605.12	3,580.96	18,527.66	100.00
%	37.76	39.65	3.26	19.33	100.00.	

Notes: [a]Included mainly are salted and smoked products, and other preserved fish and cuttle fish not in airtight containers.

[b]Included mainly are Indonesia, United Kingdom, Denmark and the Netherlands.

Source: Customs Department, Ministry of Finance, Thailand.

for seafood, Japan prefers to import fresh and frozen products, notably frozen shrimp, from Thailand.

For many years, Japan has been importing at least 50 percent of total frozen shrimp export. Imports of other fisheries products such as canned products into Japan still remains insignificant. Out of the total export earning from Japan in 1985, 25,828 million Baht, fisheries products accounted for 4,807 million Baht or 18 percent.

The other important trading partners are Singapore and Malaysia, which imported 33 and 27 percent, respectively, of total fish meal by value in 1985. There is, moreover, some potential for expanding the Thai export markets for canned fish and canned mollusks, notably, in Canada and the European countries especially Italy, German Fed. Rep. and France. Quality control is usually the major concern regarding the export of fisheries products into these countries. Relatively less competition from other exporters due to lack of raw material and quality standards helps provide greater opportunities for Thailand to expand its export markets more rapidly.[4]

2.5 Case Studies of the Selected Fisheries Products

This study will select as case studies some of the most important products. Considering the export structure of fisheries products shown

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[4] In 1984, the top ten exporters were as follows (with export value in million U.S. dollars): Canada (1,237), the United States (923), Norway (902), Denmark (898), Japan (881), Korea Rep. (776), Thailand (632), Iceland (509), Netherlands (500) and Mexico (468). The total world export was 15,981 million U.S. dollars (Source: FAO, Yearbook of Fishery Statistics, Vol. 59, 1984).

in the previous section, the most significant export items in terms of export value are frozen shrimp and canned fish. Frozen shrimp has long been a major export item of the fisheries industry while canned fish, in particular canned tuna, is a non-traditional export product and has been recently developed. In order to highlight the use of fisheries resources in Thailand, fish meal will also be included in the case studies. Fish meal is arbitrarily chosen here to provide some insights into a product that is processed from 30-40 percent of the total annual catch or about half of all fish caught domestically. Its significance is then in terms of quantity rather than value.

2.5.1 Frozen Shrimp

Due mainly to the nature of the relationship between fishing method and demersal species, the success of the trawling technique since 1960 has resulted in a rapid increase of shrimp production, and by extension of frozen shrimp exports. Approximately 15 percent of Thailand's annual shrimp production will be processed for export purpose.

Thailand so far has been among the leading countries in the world either in terms of production or export of shrimp. Some of the others are China, India, the United States, Mexico, and Indonesia. The market share of Thailand is merely 5 to 7 percent, however.

Resulting primarily from the increase in production, export of shrimp was materially expanded when Japan started importing Thai frozen shrimp in the early 1960s. Exports to Japan began with only 42 tons in 1962 but rapidly rose to more than 5,000 tons in 1967, making Japan the most important market for frozen shrimp from Thailand.

The acceptance of the cold storage industry into the investment promotion plan under the Thai industrial development policy in 1963 gave rise to the improvement of quality and standardization of frozen shrimp. The success of the cold storage industry has also encouraged some private firms to vertically integrate various activities, from fishing and processing to exporting, in order to achieve a complete line in the fisheries business.

Like the trend of overall fisheries production, the catch of shrimp in recent years seems to be stable resulting in a relatively low rate of increase in export. Because of the scarce supply of and increasing demand for shrimp, the export value of frozen shrimp has been increasing mainly from a comparatively high price. Changes in consumption patterns toward lower cholesterol foods in many countries have made the supply of shrimp, like other seafood products, even more limited in comparison to the growing demand.

Annual per capita shrimp consumption in Japan in 1985 was estimated at 2.12 kilograms while that of the United States during 1976-81 was on average 0.66 kilograms (ADB/FAO, 1983b). Trends of shrimp consumption in both of these major shrimp importing countries were increasing slightly during the past decade. With stagnant domestic production of shrimp in the two countries, part of the rising shrimp demand has been filled by imported supply.

Although shrimp production tends to be sustained in recent years, exports of frozen shrimp from Thailand have been increasing in general. There were fluctuations only in some periods, particularly after the oil crises.

In terms of international trade, the export of frozen shrimp from Thailand to Japan accounted for more than 60 percent of the total export quantity until the early 1970s and gradually declined to 30-40 percent in the early 1980s. In 1985, for example, Japan imported 31.82 percent of the total frozen shrimp exports from Thailand. On the other hand, the United States appeared to be the new major export market for Thai frozen shrimp since its imports increased from less than 15 percent in the 1970s to 29.52 percent in 1985. This resulted from various reasons: the decrease in imports of shrimp from Latin American countries especially Mexico, the failure to satisfy standardization and quality control of shrimp from other major exporters such as India, and the weakness of the Japanese market in 1983.

As compared to the previous two decades, it seems that the export market of Thai frozen shrimp since 1980 has been more diversified among many countries. With a market share at 6 and 5 percent of the frozen shrimp import into Japan and the United States, Thailand is then considered a small country in the international shrimp trade. There is still a lot of export potential to enlarge its market share in the world market, especially considering demand. However, the possibility may be somewhat limited by the constraint of available supply according to the present trend, or until the fisheries resources in the domestic waters are brought under better management. More substantial development of shrimp cultivation along the coastal zones may also help foster the growth of shrimp exports and is expected to have a significant impact on the shrimp supply in the future.

2.5.2 Canned Tuna

The tuna industry is relatively new to the fisheries sector in Thailand, since only the late 1970s has it become of more importance. Due to the limited domestic consumption, and also tiny production, tuna was for a long time neglected and always treated as a miscellaneous fish. The first tuna processing plant was established in 1972 by a joint Thai-Australian trading firm which produced exclusively for the foreign market. Along with the slow increasing trend of tuna production, the Thai tuna industry has rapidly expanded since 1978 from the entry of many large-scale tuna canneries.

Within five years of the early 1980s, Thailand has become the third largest processor, after the United States (including American Samoa and Puerto Rico) and Japan, and the largest exporter of canned tuna in the world. The successful development of the Thai tuna industry can be mainly attributed to several reasons, especially external factors such as changes in production and trade in major fishing countries.

Since tuna is a highly migratory fish species that is distributed throughout the world's oceans, tuna production was formerly dominated by two major fishing countries: the United States and Japan. Extension of new exclusive economic zone according to the new Law of the Sea since the late 1970s has made many countries more aware of the tuna resources in their domestic waters. This gave rise to an increase in tuna production for countries like Australia, Indonesia, the Philippines and Micronesia, and tuna processing for the countries like Taiwan, the Philippines and Thailand.

Consequently, the catch of tuna in the United States and Japan, which was derived from many distant-waters that were previously international seas, started to decrease. During 1980-81, retail prices of canned tuna in the United States, which was the largest canned tuna market in the world, increased considerably. This led to the consumer resistance and finally the reduction in demand for canned tuna. The canned tuna industry in the United States has gradually declined since then, at the same time as the imports of canned tuna began to increase significantly in 1982.

The world's tuna industry came to the critical level when prices of frozen tuna were particularly low due to various reasons, especially the embargo by the United States of the imports of tuna from Mexico and some other countries. This effectively resulted in the dumping of large volumes of Mexican-produced tuna on the world market.[5] Also, there has been the continuing build-up of tuna fishing vessels among many other countries. Together with the weakness in consumer demand and the rapid increase of canned tuna imported from the Asian-Pacific region, the higher labor cost in the United States and the increase in value of the U.S. dollar made the domestic tuna industry even worse. As a result, nearly all of the tuna canneries in the United States had to close down by the end of 1985. It was also believed that the Japanese canneries would be in similar trouble because of competition

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[5]Embargo imposed under the Marine Mammal Protection Act (Peru: all species, Senegal: albacore, Congo: yellowfin), the Tuna Convention Act (Spain: yellowfin), or in retaliation for the seizure of United States tuna vessels of Mexico (all species), and Ecuador (all species).

from low labor cost countries in buying frozen tuna and selling canned tuna.

Taking advantage of the oversupply of frozen tuna, relatively lower labor cost, the availability of industrial infrastructure and technology know-how, Thailand has rapidly increased its exports of canned tuna to the world market. Import of Thailand's canned tuna into the United States impressively rose from a market share of 10 percent in 1980 to 32, 58, and 64 percent in 1983, 1984, and 1985, respectively.

The rise of the Thai tuna industry is in fact reinforced partly from the decline of the Philippine tuna industry which used to be the major shareholder in the United States market. The Philippine economic and political problems during the early 1980s considerably hurt the production of many export products, including canned tuna. A lot of tuna once caught by foreign vessels in the Pacific Ocean and imported into the Philippines then switched to the next available buyer, Thailand. The geographical location of Thailand in the center of the Indian and Pacific Oceans is therefore another important factor to help explain the success of the Thai tuna industry. It provides easy access to the supply of raw materials.

The tuna processing industry in Thailand comprises about 40 canneries in which only 10 are the major producers. Most of these main canneries are basically the "co-packers" or "contract-packers" since the products made in Thailand will be generally sold under the well-established brand names of foreign companies, especially in the United States market. The Thai brand names are also being more

recognized in the international market such as in German Fed. Rep. and the United Kingdom. As a result of changes in the consumer pattern towards anti-cholesterol foods in many countries over the years, most of the canned tuna from Thailand is thus packed in brine or water, instead of in oil.

It should be noted here that, according to the nature of production, tuna processing is relatively labor intensive and can hardly be substituted by the capital factor, such as in separating tuna meat for the production of canned tuna, fish meal and pet food. Labor cost in Thailand (71 Baht per day, 1 U.S. dollar = 26.5 Baht) which is much lower than in other tuna exporters, including the United States (3.35 U.S. dollar per hour), Japan and Taiwan, is then one of the decisive elements for the profitability of the tuna industry. Also, the Thai tuna industry in Thailand has benefited substantially from those by-products of the tuna processing as well as the processing of other seafood products in the tuna canneries.

As the industry grows and still the catch of domestic tuna remains limited and with some quality problems, the Thai tuna industry has to rely heavily upon the imported frozen tuna as the raw material. Increasing rapidly since 1980, approximately 80-90 percent of the total frozen tuna used in the Thai canneries is at present imported from various suppliers such as the United States, Japan, Indonesia, Maldives, Papua New Guinea and Micronesia.

With the rapid increase in the export of canned tuna from Thailand, protectionism in international trade then appears to be one of the major problems. In 1984, the local canneries in the United States

requested the United States International Trade Commission (USITC) to perform an intensive study on the effect of canned tuna import on the tuna industry so that tariff increases or imposition of quotas could be introduced. The USITC, however, finally decided that imported canned tuna was not a substantial cause of serious injury to the United States tuna industry, and later on rejected a proposal to increase tariff on imported canned tuna.

In 1985, two pieces of legislation (Anderson's and Young's Bills) aimed to impose a tariff increase on tuna import were again proposed and have been pending in Congress since. The main proposed idea of both bills is to control the import of tuna packed in brine or water which is now increasingly imported and the largest market shareholder is Thailand.

The future of Thailand's canned tuna industry, therefore, may rely to some extent on the international trade policies of the importing countries. Due to the structure of industry, the Thai tuna industry may also have to be dependent for some time on the foreign supply of raw materials, until the domestic tuna fisheries, which are still in need of fishing technology and experience, become more developed. The fluctuation of imported tuna, if it occurs, can also bring about the problem of excess capacity to the Thai canneries. The transfer of technology for tuna processing may also make the present frozen tuna exporters attempt to develop their own tuna canneries in the future.

2.5.3 Fish Meal

As mentioned earlier, on the average 40 percent of the total catch or 70 percent of the catch from the trawl nets is always regarded as fish of low value or trash fish, and it is basically this trash fish that gave rise to the development of the fish meal industry in Thailand. The considerable production of fish meal processed from trash fish was then initiated when the trawling operation, which produced a substantial amount of trash fish, became very extensive in the early 1960s. Most of the fish meal was first produced in order to serve the growing domestic poultry production as the protein ingredient, about 10 percent, of animal foodstuff.

With the relatively low price of trash fish and the less sophisticated production techniques, the number of fish meal factories increased steadily to 104 in 1982 before decreasing to 86 in 1985. Such reduction resulted mainly from the declining supply of trash fish and the excess capacity of the factories themselves, combining to cause an increase in the price of trash fish as well as causing problems in control of externalities of waste and polluted water after production.

Other than effects of the overfishing situation in domestic waters and the extension of new exclusive economic zones into international seas, the declining trend of trash fish catch was also partly influenced by changes in fishing methods. In response to the growing demand for raw materials in the canned fish industry, some fishermen have switched from catching the demersal species, which account for most of the trash fish, to the pelagic species.

Due primarily to the stagnation of the trash fish production of which more than 95 percent is used for the fish meal industry, production and export of fish meal during recent years both show slightly declining trends. Since the domestic use of fish meal has been rather stable in the past few years, export as percentage of production then has been reduced, i.e., from 46.55 percent in 1977 to 35.61 percent in 1985.

Fish meal may thus be considered as a supply constrained commodity and is not likely to be produced more than at the present level as long as sources of raw materials still remain unchanged. Although the by-products from the fish processing industry can also be used to produce fish meal, their amounts are relatively trivial when compared to that of trash fish.

Despite the fact that Thailand is among the top ten fish meal exporters of the world, exports of Thai fish meal are still far behind the leading fish meal producers and exporters, Chile and Peru. Moreover, thus far export directions are only concentrated on the neighboring countries such as Singapore, Malaysia, and Indonesia, while an insignificant amount is exported to the major fish meal markets such as Japan and some European countries. The limitation of fish meal export not only results from the constraint in production, but also from the quality of fish meal itself. The quality control of trash fish (with protein content not less than 60 percent) and production technology improvement in terms of extraction of oil and sand from the meal will potentially be key factors in the success of export expansion.

It should be noted that fish meal from Japan, Peru and Chile are processed from a small number of industrial species for the meal manufacture, mostly the pelagic, and by-products of fish processing which will produce the high quality fish meal with a protein content of about 60-70 percent.

Accordingly, most of the Thai fish meal has been exported within the region where the quality control is comparatively more flexible and it will be sold to feed compounders or farmers who mix feeds on various standards. As long as the trawl operations in other Southeast Asia countries are not so extensive and these countries have to rely upon the imported fish meal, Thailand will still be able to maintain its position as the major fish meal exporter in this region.

In addition to the low cost of raw material, labor and technology, as well as the suitable pattern of demand for fish meal in the region, the fish meal industry in Thailand is also favored by government policy that restricts the import of soy beans which can be substituted for fish meal in feed manufacture.

As far as the pattern of fisheries production remains unchanged with no opening of major new industrial fisheries, the trend of fish meal production in Thailand shows no sign of increasing. The large-scale exploitation of mesopelagic fish usually cited as a potential base for the fish meal production also still remains not so economically feasible in the near future.

CHAPTER III

TOWARD THEORETICAL FRAMEWORKS OF POLICY EVALUATION AND COMPARATIVE ADVANTAGE

The theoretical discussion is the main concern of this chapter. Rationale and review of literature in trade theory will be briefly summarized in the beginning. The methodology in evaluating policy incentives in terms of protection, including nominal protection rate, effective protection rate, and net effective protection rate, will be presented. As measures of the degree of comparative advantage, the domestic resource cost and the revealed comparative advantage models will be set out.

3.1 Rationale and Review of International Trade Theories

Trade basically occurs from the principle of mutual benefit. Different people with different abilities and resources are supposed to be better off from trading with each other the different goods and services. According to classical and neoclassical trade models, comparative advantage in factor endowment of a country will determine the pattern of trade and then the structure of the economy. Theories of international trade certainly support the idea that trade is an important stimulator or an "engine of economic growth" (Lewis, 1955 and 1980). Many arguments, however, have emerged to criticize those ideologies about the free trade theories, questioning if they are appropriate in the real world, especially with regard to a number of assumptions in the neoclassical Heckscher-Ohlin model.

Myrdal (1971) denied the conclusion that the neoclassical theory would lead to factor price equalization and more income equality. The theory known as the vent-for-surplus developed by Adam Smith and expounded more recently by a Burmese economist, Hla Myint (1958), explains about the utilization of unemployed and underemployed resources and allows for a developing country to expand production without any sacrifice of the production of other goods and services. Leontief (1956) worked on an empirical model of the United States economy and found that the pattern of trade which was supposed to be compatible with the resource endowment of a country appeared in reverse (the Leontief paradox).

Constant technology, international immobility of capital and skilled labor, and distribution of gain from trade to benefit the nation, which are the central ideas of the traditional theory of trade also have been seriously questioned about their feasibility. Most importantly, the traditional trade theory assumes the absence of national government in international trade which is the situation opposite from the real world where the government intervention has been found to be a key factor in the development of modern trade.

Nurkse (1959) particularly recommended the balanced growth approach to industrialization based on developing the domestic market and paying less attention to export. The strategy of this inward-looking idea is known as the import substitution strategy. The fundamental of this policy is to promote domestic industrialization in order to produce commodities to replace those formerly imported and to help solve the problem of trade deficit at the same time as the domestic economy is growing. The typical strategy by the government

intervention is to set up the tariff barriers or quotas on the importation of the imported goods and, afterwards, to promote local industries to produce those goods.

Early contributors to the theory of protection which is the main scheme of the policy are Barber (1955), Humphrey (1962), and Corden (1963). The complete concept is discussed in the fullest exposition by Corden (1966 and 1971), while elaboration and application for many countries is conducted by Johnson (1965 and 1969) and Balassa (1965a and 1967).

The import substitution strategy was widely adopted and adapted in many developing countries during 1950-early 1960s. This policy seems to achieve more significant results at the beginning of the policy implementation by saving foreign exchange. However, since it discriminates against exports, the potential of the policy is thereby limited. In the late 1960s, there was a significant change in many nations from the inward-looking policy to the outward-looking policy or, in other words, the strategy of export promotion. Such a significant change was first evident during the United Nations conference on trade and development in the report and recommendations of the Secretary General, Raul Prebisch (United Nations, 1964).

The essential reason for changing from the import substitution strategy to the export promotion strategy is mainly from the negative external effects of the former strategy itself. First, with the structure of input dependent upon the imported capital, many industries have been more costly in producing domestically than importing the same kind of commodity. Second, the domestically promoted "infant"

industries are very competitive in the domestic market but may not be able to operate competitively in the international market.

Third, the benefit from import substitution strategy is also debatable as it usually has gone to the promoted foreign companies or to their parent companies abroad, while the domestic labor sector cannot be expanded due to the capital-intensive structure of the production. Fourth, the overvaluation of domestic currency due to tariff barriers and trade policy incentives can also penalize the export industries in the world market. The export of agricultural products of many developing countries will become less profitable since these products are now more expensive in terms of foreign currency than its true value. It then seems that the promotion of import-competing industries in developing countries has been done by the taxation of the export sector.

The export promotion strategy, on the other hand, will directly give the widespread linkage effect to the rest of the economy while export has been proven to have a positive relationship with the economic growth (Choi, 1983). The economy of scale in the promoted industries can also be possibly practiced through this strategy while it may not be simply applied under the import substitution strategy due to the limitation of domestic demand. The direct subsidy to production and export of a commodity is the main instrument of this strategy. This export-led growth strategy has become more accepted as the general solution to solve the problem of trade deficits and for viable long-run economic development.

Many studies pointed to the failures of inward-looking industrialization and suggested the benefits of export promotion strategy (Little, Scitovsky, and Scott, 1970; Balassa, 1971; Power and Sicat, 1971; Bautista and Power, 1979). The studies in the case of Thailand include Akrasanee (1973a); Akrasanee, Naya, and Vichit-Vadakan (1977); and the World Bank (1980).

3.2 Evaluation of the Policy Incentives

This study attempts to investigate trade policy in terms of export incentives prevailing in the fisheries industry. The evaluation of policy incentives or, in other words, the measurement of the degree of trade distortion will be indicated by three main economic indicators: the nominal protection rate (NPR), the effective protection rate (EPR), and the net effective protection rate (NEPR).

3.2.1 Nominal Protection Rate

The nominal protection rate (NPR) or final product protection is an analytical method which can be used to measure distortions from tariff and other policies in the price of a product. It can thus be used to evaluate the incentive (or disincentive) impact of trade policy. It is expressed as the percentage difference between the domestic price and border price.

$$NPR_j = (P_j^d - P_j^b)/P_j^b \qquad (1)$$

where P_j^d = domestic price of commodity j

P_j^b = border price of j expressed in domestic currency at official exchange rate, i.e., f.o.b. price for export commodity in terms of U.S. dollar

multiplied by official exchange rate in terms of Baht (1 U.S. dollar is equal to 26.5 Baht).

3.2.2 Effective Protection Rate

The effective protection rate (EPR) takes into account the effect of protection and subsidy on tradable inputs which is ignored in the NPR. The amount of protection to the domestic industry is therefore better measured by EPR since, in a production process, there are many steps in which different rates of tariff and subsidy may be applicable. Normally, the tariff indicates the increased cost to the user in the protected market by imposing a tariff on the imported commodity and giving advantage to the import-competing commodity which is domestically produced. EPR is then an indicator of the difference between the domestic value of factors used in a protected industry and the potential value added in the absence of protection.

The proportion of EPR provided to industry j is defined as follows:

$$EPR_j = (V_j^d - V_j^b)/V_j^b \quad \text{or} \quad (V_j^d/V_j^b) - 1 \qquad (2)$$

where V_j^d = value added at domestic price, which is protected.

V_j^b = value added at border price, in domestic currency at the official exchange rate.

If a_{ij} is defined as the value of the input factor i per dollar value of output j in the absence of all tariffs, the free trade value added per dollar can be expressed in terms of inputs as:

$$V_j^b = 1 - \Sigma a_{ij} \qquad (3)$$

But if tariff t_j and t_i are applied to output j and tradable input i, price of j and i can rise by the amount of the tariff in the domestic market. Therefore,

$$V_j^d = 1+t_j-\Sigma a_{ij}(1+t_i) \tag{4}$$

$$V_j^d = 1+t_j-\Sigma a_{ij}-\Sigma a_{ij}t_i$$

$$V_j^d = V_j^b+t_j-\Sigma a_{ij}t_i \tag{5}$$

Therefore, from equation (2), it will be

$$EPR_j = [(V_j^b+t_j-\Sigma a_{ij}t_i)/(1-\Sigma a_{ij})]-1$$

$$EPR_j = (t_j-\Sigma a_{ij}t_i)/(1-\Sigma a_{ij}) \tag{6}$$

The relationship between the tariffs on inputs and on output can also yield some conclusions about EPR as follows:

$$\text{if } t_j = t_i, \text{ then } EPR_j = t_j = t_i$$
$$\text{if } t_j > t_i, \text{ then } EPR_j > t_j > t_i$$
$$\text{if } t_j < t_i, \text{ then } EPR_j < t_j < t_i$$
$$\text{if } t_j = 0, \text{ then } EPR_j = -\Sigma a_{ij}t_i/(1-\Sigma a_{ij})$$
$$\text{if } t_i = 0, \text{ then } EPR_j = t_j/(1-\Sigma a_{ij})$$

Usually the input coefficients which are typically observed are those already distorted by tariff on the intermediate inputs and final product or the coefficients at domestic price (a_{ij}^d). To find the free trade coefficients, or the coefficients at border price (a_{ij}^b), the observed coefficients (a_{ij}^d) must be deflated by the tariffs on inputs and the final product.

When P_i and P_j are defined as representing prices of input i and output j in the free trade situation, then the tariff on input i (t_i) and output j t(j) will be dP_i/P_i and dP_j/P_j respectively. In other words, dP_i and dP_j are the proportions of price increased due to tariff on input i (t_iP_i) and output j (t_jP_j). If b and b' are the physical ratio of material input i to output j (or the input coefficients) at border and domestic prices respectively, it can be written as:

$$a^b_{ij} = b(P_i/P_j),\ a^d_{ij} = b'(P_i+dP_i)/(P_j+dP_j)$$

and $$a^d_{ij} = b'(1+dP_i/P_i)P_i/(1+dP_j/P_j)P_j$$

Since $P_i/P_j = a^b_{ij}/b$ and $t_j = dP_j/P_j$, $t_i = dP_i/P_i$, then

$$a^d_{ij} = b'(a^b_{ij}/b)(1+t_i)/(1+t_j) \qquad (7)$$

If b'/b or the ratio of the input coefficients at domestic and border prices is assumed to be 1, the equation (7) will be

$$a^d_{ij} = a^b_{ij}(1+t_i)/(1+t_j) \qquad (8)$$

or, $$a^b_{ij} = a^d_{ij}(1+t_j)/(1+t_i) \qquad (9)$$

Thus, if substitute (9) into (6), EPR will finally become

$$EPR_j = (1-\Sigma a^d_{ij})/[(1/1+t_j)-(\Sigma a^d_{ij}/(1+t_i))]-1 \qquad (10)$$

It is also important to note that effective protection rate for a product is not influenced by tariffs on inputs into its traded inputs. This implies that only one step backward in the input-output structure is taken into account for generating this concept.

The concept of EPR is also expanded to include the government-induced incentives, or subsidies, on non-tradable inputs. With the subsidy included, equation (6) will be

$$EPR_j = (t_j - \Sigma a_{ij} t_i + \Sigma a_{ij} S_i - \Sigma a_{ij} T_i)/(1 - \Sigma a_{ij}) \quad (11)$$

where S_i = subsidy

T_i = tax on subsidized input i

i = non-tradable input, i = 2.....n,

while i=1 is the tradable input

For simplicity, this formula if concerned with only one particular subsidy, i.e., credit subsidy (C_j), will be modified to

$$EPR_j = [(V_j^d + C_j)/V_j^b] - 1 \quad (12)$$

where C_j = annual subsidy per unit of commodity j

and, if C_j' = fraction of credit subsidy to domestic value added

EPR_j will then become

$$EPR_j = [(V_j^d + C_j' V_j^d)/V_j^b] - 1 \quad (13)$$

$$EPR_j = [(V_j^d/V_j^b)(1+C_j')] - 1$$

$$EPR_j = EPC_j(1+C_j') - 1 \quad (14)$$

where EPC_j = effective protection coefficient

3.2.3 Net Effective Protection Rate

Since the concept of EPR involves the foreign exchange rate of two countries, the estimation of EPR becomes dependent on the price of foreign exchange. The overvaluation of domestic currency relative

to foreign currency makes the free trade exchange rate very different from the official exchange rate which includes the effect of protection.

$$V_j^b = V_j^w SER \quad (15)$$

$$V_j^d = V_j^w OER(1+EPR_j) \quad (16)$$

where V_j^w = the world price expressed in foreign currency

SER = free-trade equilibrium exchange rate or shadow exchange rate

OER = official exchange rate

$$\text{then, } NEPR_j = (V_j^d/V_j^b)-1 = [V_j^w OER(1+EPR_j)/V_j^w SER]-1 \quad (17)$$

$$NEPR_j = [OER(1+EPR_j)]/SER-1$$

$$\text{or } NEPR_j = EPR_j-[(SER/OER)-1] \quad (18)$$

If EPR_j is coincidentally equal to overvaluation of domestic currency [(SER/OER)-1], the $NEPR_j$ will be zero.

3.3 Treatment of the Non-Traded Inputs

Non-traded inputs are those inputs normally not entering into the international trade such as water, electricity, transport, banking, insurance, communication and other services. In estimating the effective protection, the concept of non-traded input has been treated in two different manners. First, it is assumed that a non-traded input can be treated in the same way as any tradable input with a zero tariff or subsidy. The total effective protection is then derived from the value added per unit in the industry under consideration when all

traded and non-traded inputs are excluded from value added. This concept has been generally known as the Balassa's method.

The alternative approach supported by Corden considers non-traded inputs in the same way as primary factors, since it is argued that protection in any tradable industry does not represent only protection for those primary factors of that industry but also represent protection for its non-traded input industries and their primary factors. The effective protection rate is thus the sum of value added in processing and value added in production of non-traded goods.

When these two concepts are compared, it, therefore, can be seen that Corden's method will yield the larger value added than that of Balassa's method which includes value added in processing alone. Consequently, the absolute value of an effective protection rate in the case of Balassa is always larger than that in the case of Corden.

From the general formula of protection rate in equation (2), if superscripts B and C are put on terms to express the distinction between the methods of Balassa and Corden, they will be:

$$EPR_j^B = (V_j^{dB} - V_j^{bB})/V_j^{bB}$$

$$EPR_j^C = (V_j^{dC} - V_j^{bC})/V_j^{bC}$$

If assume that

$$A_{nj} = A_{nj}r_{mn} + A_{nj}r_{vn}$$

$$r_{mn} + r_{vn} = 1$$

where A_{nj} = the input-output coefficient of non-traded goods used in producing export commodity j

r_{mn} = proportion of all material inputs used in the production of non-traded goods

r_{vn} = proportion of value added or non-material inputs in the production of non-traded goods

Then $V_j^{dC} = V_j^{dB}+A_{nj}r_{vn}$ and $V_j^{bC} = V_j^{bB}+A_{nj}r_{vn}$

and, $EPR_j^C = [(V_j^{dB}+A_{nj}r_{vn})-(V_j^{bB}+A_{nj}r_{vn})]/(V_j^{bB}+A_{nj}r_{vn})$

$$EPR_j^C = (V_j^{dB}-V_j^{bB})/(V_j^{bB}+A_{nj}r_{vn}) \qquad (19)$$

The term $A_{nj}r_{vn}$ (the cumulated value added elements of non-traded inputs) is always positive, the formula in (19) then indicates that Corden's method will give the smaller value of effective protection rate than that of Balassa's method.

The significance of these two concepts is that while EPR measured by Corden's method is to evaluate the overall domestic resource cost of protecting both the processing and non-traded goods industry, EPR measured by Balassa's method is to evaluate the effect of incentives provided to the primary factors of production used in the processing only of a particular industry. Since the non-traded inputs are not so substantial in this study, the Balassa's method is chosen primarily for the analysis. It then should be noted that the effective protection rate in this study is rather biased upward or exaggerated from the absolute value of effective protection. This is because using Balassa's method always gives the larger rate of effective protection than Corden's method.

3.4 The Domestic Resource Cost Model

The domestic resource cost (DRC) model is basically an application of cost-benefit analysis to international trade problems under both import substitution and export promotion policies. Comparative advantage is identified by looking at an economic activity that produces commodities and services to see if the total resource cost spent per unit of foreign exchange earned or saved is less than the shadow price of foreign exchange. When applied to an import substitute, the benefits are identified as the foreign exchange saved, and the costs are the sum of the social value of domestic resources used in production of the goods that are being substituted. When applied to an export product, on the other hand, the benefits are the net foreign exchange earned on the exported goods, and the costs are social value of all domestic resources necessary to produce those goods.

The domestic resource cost technique was first developed by Bruno (1963 and 1972) and later discussed by Krueger (1966 and 1972), Balassa and Schydlowsky (1972), and Findlay (1971). The DRC has been used as the economic indicator in evaluating various policies by Pearson and Cownie (1974); Pearson, Akrasanee and Nelson (1976); Koomsup (1981), and Bautista, Power and Associates (1979). The DRC has also been used as an indicator in evaluating the project as well as the internal rate of return (IRR) and the net present value (NPV) in Dasgupta, Marglin and Sen (1972), Squire and van der Tak (1975), and Ray (1984).

3.4.1 Domestic Resource Cost Ratio and Social Profitability

An activity that produces a good j is said to be viable if the net benefit generated by the production of one unit of such a good j is positive.

The net benefit B_j for the production of one unit of j is defined as

$$B_j = P_j - \Sigma a_{ij} P_i - \Sigma f_{sj} V_s \qquad (20)$$

where P_j = the shadow price of good j

a_{ij} = the amount of non-primary input i necessary to produce one unit of j

P_i = the shadow price of non-primary input i

f_{sj} = the amount of primary input s necessary to produce one unit of j

V_s = the shadow price of primary input s.

Let us assume that product j is an export good, such as fisheries products, and shadow price of j, P_j, can be replaced by the $U_j d_0$, where U_j is the f.o.b. value of j expressed in foreign exchange, i.e., dollars, and d_0 is the shadow price of foreign exchange or shadow exchange rate (SER) expressed in terms of Baht per dollar. The shadow price of foreign exchange is used here because it is assumed that the benefits are in terms of foreign exchange. Thus, using the above definitions, the formula can be expressed as

$$B_j = U_j d_0 - \Sigma a_{ij} P_i - \Sigma f_{sj} V_s \qquad (21)$$

In producing commodity j, let us further suppose that there will be one imported input necessary for such production in which a_{1j} is the input-output coefficient due to that imported input and m_{1j} is the dollar value of imports of good per unit of j. The formula will then have to be modified such that the domestic intermediate inputs will be from i = 2.....n where i = 1 is the imported input.

$$B_j = (U_j - m_{1j})d_0 - \Sigma a_{ij}P_i - \Sigma f_{sj}V_s \tag{22}$$

$(U_j - m_{1j})$ is the net foreign exchange currency and is supposed to be positive.

From (21), it can be rewritten again as

$$B_j/(U_j - m_{1j}) = d_0 - (\Sigma a_{ij}P_i + \Sigma f_{sj}V_s)/(U_j - m_{1j}) \tag{23}$$

Given $d_j = (\Sigma a_{ij}P_i + \Sigma f_{sj}V_s)/(U_j - m_{1j})$

d_j is called the domestic resource cost (DRC) ratio since it is expressed in terms of total domestic resources, both intermediate and primary inputs, used in producing one unit of output j as compared to the net foreign exchange earned per one unit of output j.

Then it will be

$$B_j/(U_j - m_{1j}) = d_0 - d_j \tag{24}$$

and $B_j/(U_j - m_{ij}) > 0$ if and only if $d_0 > d_j$

$B_j/(U_j - m_{ij}) < 0$ if and only if $d_0 < d_j$

That is, the net benefit $B_j/(U_j - m_{ij})$ will be positive if the shadow price of foreign exchange is greater than the total cost of

domestic resources in earning one unit of foreign exchange. Since the concept of DRC involves the social cost and benefit through the use of shadow prices of inputs and output, the net benefit $B_j/(U_j-m_{ij})$ is usually called the net social profitability per unit of foreign exchange earned or NSP_j. It then can be concluded that:

comparative advantage occurs if $NSP_j > 0$ or DRC/SER < 1

comparative disadvantage occurs if $NSP_j < 0$ or DRC/SER > 1

3.4.2 Sensitivity Analysis

Since the DRC concept is considered a static analysis, the empirical results will then be able to be explained efficiently only when the related factors in the model remain unchanged. It is difficult to incorporate the effects of dynamic changes in the DRC measurement.

In order to solve this problem, the DRC sensitivity analysis is constructed to investigate the relationship between the DRC coefficient and changes in the related parameters. This study proposes two ways to look at the DRC sensitivity: first, to find the percentage change of the DRC coefficient due to a one percent change in value of each input or output where the other factors remain constant, and, second, to estimate the maximum percentage change in value of each input or output where the comparative advantage still exists or when the DRC coefficient is equal to one. The DRC sensitivity will then imply the relative effect each factor will have on the comparative advantage in the production of particular commodities.

Since the DRC concept basically is measured upon the past performance of the industry, the sensitivity analysis therefore will be

the way to incorporate the effect of future performance into the model. In this study, effects of change in various factors including cost of capital, labor, foreign input, and export value, will be taken into consideration.

3.5 A Discussion on Domestic Resource Cost and Effective Protection Measures

There have been criticisms and comparison between the concepts of DRC and EPR by many economists (for example, Balassa and Schydlowsky, 1972). The main argument is that the DRC approach may be erroneous as a guide to whether the industry should be expanded to or contracted without considering the degree of effective protection required by each industry.

Krueger (1972), on the other hand, shows that the DRC and EPR will give the same evaluation under four conditions: (1) all goods are traded or tradable, (2) there are no transportation costs, (3) factors of production are perfectly mobile within the domestic economy but perfectly immobile internationally, and (4) all domestic markets are perfectly competitive.

This study will support Krueger's idea by presenting another discussion between the DRC and EPR concepts based upon Findlay (1971).

From Figure 2 (2A and 2B), let us assume an economy with two factors of production, labor (L) and capital (K), and four goods to be produced, A, B, C, and D. Assume further that A and B use C and D respectively as the nonprimary input in addition to K and L which are the only required inputs for C and D. Figure 2A shows the production levels of A and B, and C and D. We can see that the production cost

to earn one dollar, given the free trade relative prices of labor and capital, is lower in A and D (K_1L_1), than B (K_2L_2) and C (K_3L_3). The economy potentially will produce and export A and D and import B and C.

The comparison between the domestic resource cost per unit of foreign exchange (DRC ratio) of these goods, for example between that of A and B, can be mathematically expressed as follows:

$$(\Sigma f_{sA}V_s)/(U_A-C_A) < (P_DD_B+\Sigma f_{sB}V_s)/U_B \qquad (25)$$

where C_A = imported input C per unit of A

D_B = domestic input D per unit of B

P_D = world price of input D

It should be noted here that all prices used in the formula are valued at free-trade conditions. Therefore, when tariff or other trade distortions are imposed on the imported input C in order to promote the domestically produced input, the results may be shown as:

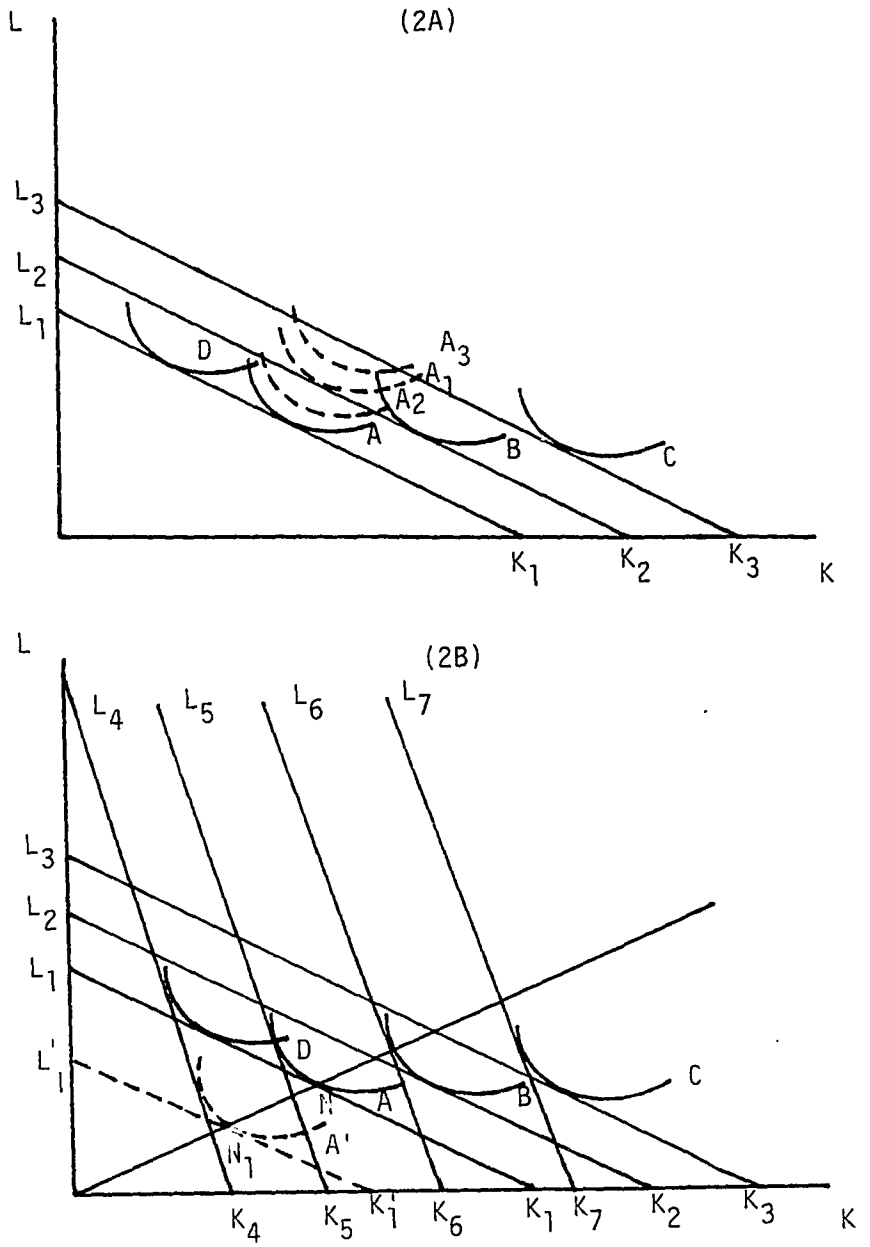
$$\text{either } [C_AP_C(1+t_C)+(\Sigma f_{sA}V_s)]/U_A < (P_DD_B+\Sigma f_{sB}V_s)/U_B \qquad (26)$$

$$\text{or } [C_AP_C(1+t_C)+(\Sigma f_{sA}V_s)]/U_A > (P_DD_B+\Sigma f_{sB}V_s)/U_B \qquad (27)$$

where P_C = world price of input C

t_C = tariff rate

This implies that if the condition in (26) holds, A is considered to be more efficient than B in terms of domestic resource cost in earning one unit of foreign exchange. And, if the condition in (27) holds, A will appear to be relatively inefficient as compared to B in using resources. The dotted lines in Figure 2A illustrate the different production costs of A after tariff protection which does



Source: Applied from Findlay (1971).

Figure 2. Relationship between Domestic Resource Cost and Effective Protection

not allow one to know exactly if A is now more or less efficient than B or even C.

In the case that production cost of A is higher than the domestic cost (K_2L_2) at A_3, domestic production of A would become viable only if sufficient effective protection is given to offset that excess cost. Protection is given to offset that excess cost. Protection in this sense is then imposed to the minimum extent necessary to induce domestic production, so that the factor price ratio remains the same as under free trade. In other words, the industry with higher domestic resource cost per unit of foreign exchange will need a higher effective protection in order to survive domestically.

Since free-trade value added data are not available, attempts to measure the effective protection have to depend upon value added data that is already distorted by tariff. In Figure 2B effective protection is computed using the relative factor prices observed in the economy, which are represented by K_4L_4, K_5L_5, K_6L_6 and K_7L_7. These lines are with the higher slopes due to the rental-wage ratio increases or, in other words, the tariff protects the relatively capital-intensive goods.

With these distorted prices, production of A appears to be realtively less efficient (using more domestic resource cost in earning foreign exchange) than D despite the fact that it is as efficient as D under the free-trade prices. Production of A, however, still retains a comparative advantage in earning foreign exchange that is greater than B or C.

The degree of protection can be considered from the distance between production under free trade and distorted prices. We can see that if protection is given to A to such a degree that the factor price ratio becomes the line K_4L_4 instead of K_5L_5, NN_1 will be the amount of protection given to A. Also, at K_4L_4, if there is no protection offered to B, it will not be produced domestically. Then if B is accorded sufficient protection to shift its isoquant in until it becomes tangential to K_4L_4, there will be three industries with positive output, D (with no protection), A (with some protection) and B (with most protection). Also, if the domestic production of C is also desired, the protection given to this industry will be even more than that given to B.

The use of these two measures will therefore help select the industries which have the comparative advantage in terms of resource use and, at the same time, deserve the protection from the government if the economy desires to promote the domestic production and export of those products. Ranking of the productions or industries is still the same using either the criteria of domestic resource cost per unit of foreign exchange or degree of effective protection.

On the other hand, under the assumptions that the shadow and market prices are the same and there is no protection redundancy, the relationship between the domestic resource cost (DRC) of which the value added is in the shadow prices, and the effective protection rate (EPR) of which the value added is in the market prices can be expressed as follows:

DRC = W/V and EPR = (W/V)-1

where W = the value added in domestic prices

and V = the value added in border prices.

3.6 Revealed Comparative Advantage of International Trade

3.6.1 The Relative Export Performance

The concept of revealed comparative advantage was originally introduced by Balassa (1965b). The fundamental idea behind the theory is that the commodity pattern of trade will reflect the relative costs as well as the differences in non-price factors which, in brief, are all influences determining the comparative advantage.

The revealed comparative advantage rests on the assumption that the export of domestic products will reflect the internationally comparative competitiveness of the domestic industries, and vice versa for the import case. There are two main measures for evaluating comparative advantage, the relative export performance index and the export-import ratio. The first one indicates that the comparative advantage would be expected to determine the structure of exports, while the second one, under the assumptions of uniformity in tastes and a uniform incidence of duties in every industry within each country, will also imply the relative advantages.

However, besides the fact that the assumptions of the second measure are not generally consistent with the real world, the fisheries products imports into Thailand are rather insignificant when compared to exports. Only the relative export performance indicated by the export share ratio will simply represent the revealed comparative advantage in this study.

3.6.2 Measurement of the Revealed Comparative Advantage

The export performance of individual industries in a particular country can be evaluated either by comparing the relative shares of a country in the world exports of individual commodities or by indicating changes in relative shares over time. In both instances, the data have to be made comparable through normalization which is, in this case, the country's total share in the world exports.

The measurement of revealed comparative advantage can be expressed as follows:

$$RCA^0 = (X^0_{ij}/X^0_{nj})/(X^0_{it}/X^0_{nt}) \quad (28)$$

$$RCA^0 = x^0_{ij}/x^0_i \quad (29)$$

where X^0_{ij} = export value of commodity j from country i in period 0

X^0_{nj} = export value of commodity j from n countries in period 0

X^0_{it} = total export value from country i in period 0

X^0_{nt} = total export value from n countries in period 0

x^0_{ij} = export share of commodity j from country i in the international market, i.e., share of the Thai fisheries products in the U.S. market

x^0_i = export share of country i in the international market, i.e., total export share of Thailand in the U.S. market

If RCA is taken place in period 1, then index will become

$$RCA^1 = (X^1_{ij}/X^1_{nj})/(X^1_{it}/X^1_{nt}) \quad (30)$$

$$RCA^1 = x^1_{ij}/x^1_i \quad (31)$$

And, if equation (31) is divided by equation (29), it will be

$$RCA^{01} = (x^1_{ij}/x^1_i)/(x^0_{ij}/x^0_i) \quad (32)$$

which indicates the ratio of relative share of country i's export of commodity j over time, RCA^{01}.

The revealed comparative advantage will be applied to the export of commodity j, the fisheries products, from country i, Thailand, in the major importing countries in the case of each product. For example, the revealed comparative advantage of fisheries products from Thailand in the U.S. market will be the ratio of Thailand's export of fisheries products into the U.S. market over the total import of fisheries products from all countries into the U.S. market, normalized by Thailand's overall share of export into the U.S. market. An index number of more than 1, i.e., 1.5, will indicate that Thailand's share of the export of fisheries products is 50 percent higher than its share in the total exports.

However, in evaluating such relative advantages in the exportation of commodity j, the relative shares observed in the most recent period will pertain to the future and the trend factor is neglected. On the other hand, relative growth ratios can give a misleading impression of comparative advantage since high growth rates are compatible with small exports in absolute terms, while a country that has a large

segment of the export market of commodity j may obtain a very low growth rate and can hardly be expected to further increase its share.

The possible solution to this problem can be made from the combination of the two indicators for comparative advantage. Balassa suggested two more indicators by multiplying equation (31) and (32) as shown in equation (33) as the geometric progression form or RCA*, and the average of equation (31) and (33) as shown in equation (34) as the arithmetical mean or RCA'. Balassa himself preferred equation (34) more than equation (33) since it reflects the presumption that while past trends in relative shares can be expected to continue, this will take place at a declining pace as compared to the past.

These new indicators are as follows:

$$RCA^* = (x^1_{ij}/x^1_i)(x^1_{ij}/x^1_i)/(x^0_{ij}/x^0_i) \tag{33}$$

$$RCA' = 1/2[(x^1_{ij}/x^1_i)+(x^1_{ij}/x^1_i)(x^1_{ij}/x^1_i)/(x^0_{ij}/x^0_i)] \tag{34}$$

In this study, therefore, the standard RCA in equation (28) and the Balassa's adjusted RCA' in equation (34) will be applied to measure the revealed comparative advantage.

CHAPTER IV

SOCIAL VALUATION OF ECONOMIC PARAMETERS

This chapter presents the valuation of parameters needed in the measurement of the employed economic models. As observed from the objectives of this study that the major part of the analysis is related to the social evaluation, data which usually are valued at the market price or under the distorted domestic market conditions then will have to be revalued at the social price. These parameters include shadow prices of capital, labor, land, and foreign exchange. Conceptual framework regarding the shadow price will be briefly introduced and then the empirical measurement.

4.1 Data and the Social Valuation

The social valuation is normally made possible through the use of shadow price which is the means that policy impacts to and from the rest of the economy can be brought into the sectorial analysis. The shadow price basically is indicated by the value in use of goods or services. On the other hand, it also implies the opportunity cost of producing or consuming a commodity, or the benefit forgone by using a scarce resource for one purpose instead of its next best alternative use.

The social consideration will apply to this study in most of the important data, including those related to production, processing, and export of the fisheries products. Information about social

valuation in developing countries is generally limited and difficult to estimate. This study also does not attempt to compute every economic parameter, particularly with regard to the social pricing system, it will only employ the secondary data already estimated by other sources. The shadow price theories and concepts will be briefly reviewed in order to provide the introductory idea to the empirical data, however.

There are many approaches in obtaining the value of shadow prices, either directly calculated for itself or indirectly estimated through the adjustment of the market price. A few well-known works with special emphasis on the social benefit-cost analysis and shadow price estimation are Little and Mirrlees (1974), Dasgupta, Sen and Marglin (1972), and Squire and van der Tak (1975).

In brief, the first one proposes that the world prices could be simply used as appropriate shadow prices while the second one, also known as the UNIDO (United Nations Industrial Development Organization) approach, adds the concern of quantitative restrictions on trade policies in the case of developing countries to the world prices. The last one advocates the other two, and also introduces the income distribution consideration in the derivation of shadow price.

Various methods and extensions by taking into account more economic factors in estimating the shadow prices have been proposed. The concern of shadow price in an application to the case of Thai economy appeared in the studies of UN ESCAP (1975), Bruce (1976), and McCleary (1976). With the difference in methodology employed, the analyses in these three works use respectively the method of Little and Mirrlees, Squire and van der Tak, and the UNIDO. Ahmed (1983),

which is in fact an application of Squire and van der Tak method, also estimates the shadow prices from the more recent data (see Table 5).

4.2 Value of Traded Commodities

The first economic variable to be adjusted at the social price is the benefit from trade. The border price of output is used here as the social price of output, because it represents the opportunity cost of a tradable commodity. The f.o.b. price of the export product will thus approximate the social value of the product in this study. The private value of production or the domestic price, on the other hand, is the price received by the exporter after deduction from the f.o.b. price of all direct and indirect taxes at the border including export duty, business and municipal tax, or the equivalent tax in forms of premium plus the export subsidy if there is any.

In the case of the fisheries products in this study, the social and private prices will imply the average export price of the products before and after deduction of all government interventions in the domestic market. Export tax is exempted for the fisheries products and only the normal business tax (1.5 percent of f.o.b. price) and municipal tax (10 percent of business tax) are charged. There is no direct subsidy for the export production in Thailand.

4.3 Primary Factors of Production

4.3.1 Capital

The estimation of the shadow price of capital is diversified among many concepts and with various assumptions. A number of economic variables is assumed from different viewpoints to approximate the

Table 5

Summary of Conversion Factors in the Case of Thailand

parameters	sources (1)	(2)	(3)	(4)
standard conversion factor (SCF)	0.86	0.79	0.87	0.92
consumption goods conversion factor (CGCF)	0.92	0.96	-	0.95
intermediate goods conversion factor (IGCF)	-	0.86	-	0.94
capital goods conversion factor (KGCF)	0.88	0.82	-	0.84
construction conversion factor (CCF)	-	0.74	-	0.88
electricity conversion factor (ECF)	1.03	1.28	-	0.90
transportation conversion factor (TCF)	-	-	-	0.87
labor conversion factor (LCF)	-	0.38	1.03	0.92
marginal productivity of capital (q)	0.15	-	0.22	0.16
rice conversion factor (RCF)	-	1.48	-	1.11

Sources:

(1) Colin Bruce, Social Cost-Benefit Analysis: A Guide for Country and Project Economists to the Derivation and Application of Economic and Social Accounting Prices, World Bank Staff Working Paper, No. 239, Washington, D.C., 1976.

(2) UN ESCAP, Guidelines for the Economic Appraisal of Projects in the Lower Mekong Basin, Vol. II: Calculation of Conversion Factors for Thailand, Bangkok, 1975.

(3) William McCleary, Equipment Versus Employment: A Social Cost-Benefit Analysis of Alternative Techniques of Feeder Road Construction of Thailand, ILO, Geneva, 1976.

(4) Sadiq Ahmed, Shadow Prices for Economic Appraisal of Projects: An Application to Thailand, World Bank Staff Working Paper, No. 609, Washington, D.C., 1983.

shadow price of capital. According to Dasgupta, et al. (1972), the simple estimation shadow price of capital (SPK or q) or shadow price of investment (p^{inv}) can be estimated from the annual return of one unit of investment which is equal to the contribution to consumption $(1-s)q$ and the contribution to investment ($p^{inv}sq$). The present value of these returns is equal to the shadow price of investment, that is:

$$p^{inv} = \Sigma[(1-s)q+p^{inv}sq]/(1+i)^t$$

$$p^{inv} = [(1-s)q+p^{inv}sq]/i$$

then, $$p^{inv} = (1-s)q/(i-sq)$$

Accordingly, three parameters are involved in estimating the shadow price of capital: the marginal productivity of capital (q), the marginal propensity to reinvest (s), and the social rate of discount (i).

In the simplest case by assuming that all returns from marginal investment will be immediately consumed, $p^{inv}$is then equal to q/i, and the social marginal productivity of capital is also q.

An alternative approach is to assume that the use of capital or an investment will not be judged acceptable if it earns less than that can be earned at the margin in the rest of the economy. The appropriate rate of discount for the investment is therefore approximated by the marginal productivity of capital. In other words, the social rate of discount can be also equal to the social marginal productivity of capital.

According to Ahmed (1983), estimation of marginal productivity of capital (MPK) is estimated through the aggregate production function approach as follows:

From $Y = AK^{\alpha}L^{1-\alpha}$

where Y, A, K, L, α , and $1-\alpha$ are output, constant term, capital, labor, share of capital in the output, and share of labor in the output. Marginal productivity of capital (MPK) will be derived as follows:

$$dY/dk = \alpha AK^{\alpha-1}L^{1-\alpha}$$

$$dY/dK = \alpha AK^{\alpha}L^{1-\alpha}/K$$

$$dY/dK = \alpha Y/K$$

From various studies (Kuznets, 1965; Harberger, 1973; and the World Bank, 1980), the estimated α and Y/K are found 0.50 and 0.36 respectively. MPK is therefore derived at value of 0.50 x 0.36 = 0.18. MPK at this level, however, is likely to be greater than the traditional cut-off value of 12 percent used in the world bank financial projects. Considering 18 percent as the central value for the range of MPK values in domestic price terms, the value of MPK in border price terms, or the social MPK, can now be derived by adjusting MPK with the capital goods conversion factor (KGCF) and the standard conversion factor (SCF) as follows:

$$\text{social MPK} = q \times \text{KGCF/SCF}$$

$$\text{social MPK} = 0.18 \times 0.84/0.92 = 0.16$$

The social marginal productivity of capital or, in other words, the opportunity cost of capital due to Ahmed's work is then 16 percent. The values of KGCF, SCF, and MPK are already shown in Table 5.

Due to various conceptual and empirical problems involving the estimation of opportunity cost of capital, this study, as in many empirical researches, will use a domestic entrepreneur's borrowing rate as the proxy for this variable. The average interest rate of

loanable funds at 15 percent will be assumed to be the price of capital. The rate of 15 percent not only conforms to the domestic interest rate in Thailand, but is also usually employed by many other sources including the National Economic and Social Development Board (NESDB) of Thailand and recommended for project evaluation and appraisal by the World Bank regarding the opportunity cost of capital in the case of Thailand (Bruce, 1976).

4.3.2 Labor

In the neoclassical model where there is no unemployment, the shadow price or the opportunity cost of labor is approximated by the market wage rate. In the real world situation, however, the assumption underlying the neoclassical model is often invalid, the shadow wage rate then may possibly be different from the market wage rate. Since the use of labor in an activity can prevent its use elsewhere, the forgone output of labor in its best alternative use thus appears to be the major component of the social cost of that labor.

The methodology of UNIDO estimates the shadow wage rate in surplus-labor economy such as when a project is to draw labor from rural areas. This approach derives shadow wage rate (w*) from the adjusting market wage rate (w) with saving fraction (s), direct opportunity cost of labor (Z), and marginal income of unit investment or price of investment (p^{inv}) (Dasgupta, et al., 1972). This can be expressed as:

$$w^* = Z+s(p^{inv} - 1)w$$

In a similar manner to the UNIDO approach, Little and Mirrlees (1974) also use the concept of private consumption and saving to estimate the shadow wage rate (w*) as follows:

$$w^* = c' - (1/s)(c - m)$$

where c, c', and m are consumption of the wage earner, additional consumption and marginal productivity of wage earner respectively.

Squire and van der Tak (1975) estimate shadow wage rate with the concept of forgone output from the use of labor in the best alternative. The calculation of w* is based upon many different types and conditions of labor. Accordingly, w* is not equivalent to only forgone output at the market prices, but also includes the other elements such as social cost of increased consumption and social cost of reduced leisure. The value of w* then can be changeable according to the variation of each contributing factor and will be estimated for each particular type of labor.

In Thailand, especially in the industrial sector, the labor market, however, is very competitive. There is also no evidence of significant unemployment in the agricultural sector where the demand for labor is very high during the peak agricultural season or the rainy season and relatively low during the dry season or the rest of the year. Labor migration between the rural and urban areas particularly during the dry season always takes place due to the convenience of modern highways and transportation facilities. Various kinds of work in the urban sector, for example construction and manufacturing work, are usually the main sources of employment to substitute for agricultural activities.

In most of the manufacturing sector, labor moving and searching for the best alternative work among different factories is very normal and not so difficult. Regional and sectorial wage differentials of

unskilled labor are not very great and not as large as those in many other developing countries. Information regarding wages and working conditions are generally known to laborers. There is significant labor mobility in response to wage incentives, which in turn respond to forces of demand and supply of labor. This study, therefore, will employ the minimum wage rate, 71 Baht per day (1 U.S. dollar = 26.5 Baht), which is the prevailing rate in most of the industrial sector or in the medium-scale and the large-scale productions to approximate the shadow wage rate.

4.3.3 Land

Land is more important as a factor of production in the agricultural sector than in the manufacturing sector. Land cost in the social consideration basically is the opportunity cost of using land to produce the best alternative product. The input-output table for industry does not present a specific entry value added due to land. In the case that land cost cannot be explicitly defined, the return to entrepreneur after all returns to capital, labor, and intermediate inputs are deducted from the total return will be treated as land cost.

The cost of land component will be assumed in all processing industries to be omitted since it is not considered to seriously affect the pattern of estimation. However, it is the limitation which must nevertheless be borne in mind as well.

Land cost is included in the analysis of coastal shrimp cultivation which considers land as one of the major primary factors of production. The best alternative use of land next to shrimp cultivation is found to be for salt farming and for mangrove plantation respectively. In

this study, the opportunity cost of land used for the calculation of shrimp cultivation will be the difference between the gross value of salt production and the total cost of non-land input, inclusive profit if any, used in producing salt. According to the different production patterns, the net return of the salt production has to be adjusted for the equal period of production time as that of shrimp cultivation.

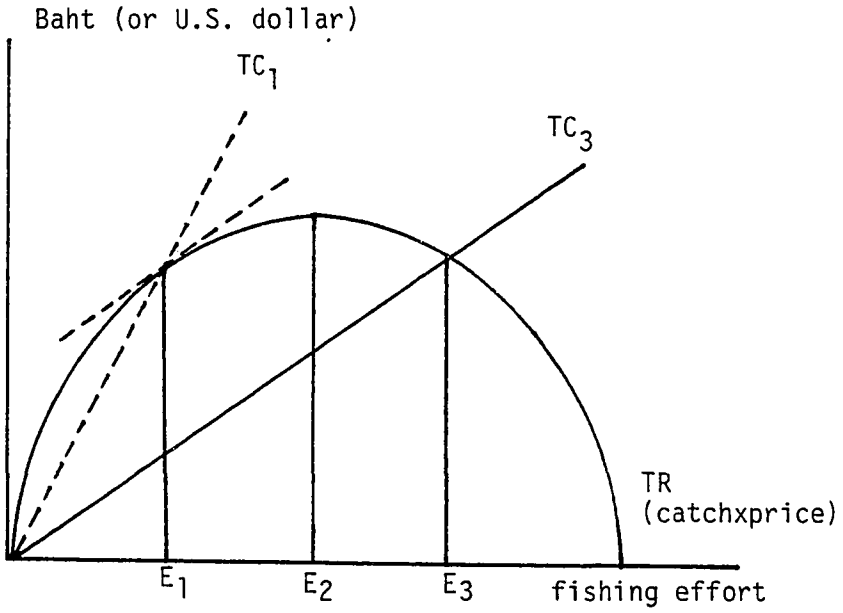
In the case of marine fisheries production, cost of land (or cost of the resource base) may be represented to some extent by the cost of the sea or cost to exploit the fishery resources. Due to the nature of the fishery resources as a common property type of resource, such cost is basically supposed to be omitted. Considering fisheries as a scarce resource of which the social cost exists, this study, however, assumes the cost of the fishing license charged to the Thai fishermen to be the proxy for some part of the cost of fishery resources, or the cost of "land" for the marine fisheries production.

The fishing license ideally should reflect the cost of the market failure in the fisheries production which, in turn, represents the social cost of the fishery resources. In this study, the market failure therefore implies the overfishing situation or the fisheries production at the level beyond the economic equilibrium point. Figure 3 illustrates that at the total cost TC_3 and total revenue TR, the fisheries production is in economic equilibrium at level of fishing effort E_1, or when price (P) is equal to marginal cost (MC) and marginal revenue (MR).

The fishing effort at any level beyond E_1 is then, economically, overfishing. In order to correct such market failure, for example

to reduce E_3 (the last point to fish) to the equilibrium E_1, the policy measure will be required.

The charge in terms of fishing license for the Thai fisheries industry, however, is too small to correct the market failure. In other words, it cannot represent the whole social cost of fishery resources (by raising TC_3 to TC_1). Despite the fact that it is an undercorrection, cost of license will still be included in this study to recognize the bias of the fishery resource cost. This also implies the inconsistency in the fisheries policy regarding the control of fishing effort through the licensing measure.



Note: The overfishing can be considered from any point beyond E_1 (economically) or E_2 (biologically).

Source: Applied from Anderson (1977).

Figure 3. Overfishing and the Social Cost of Fishery Resources

4.4 Intermediate Inputs

Intermediate inputs are those variable inputs in the production process while they themselves are final products of other firms or industries and can be either material or non-material inputs. These inputs are broadly classified into two main groups: traded and non-traded inputs. According to this study, inputs of the first group are, for example, fuel, lubricant, can, fishing net, packing supplies, etc., while inputs of the second group are water, electricity, transportation, marketing costs and services.

However, most of the intermediate inputs are not considered fully traded or fully non-traded, since each input is usually embodied with the domestic components: capital and labor, and the foreign component. In measuring the social benefit-cost and international comparative advantage, these components will then have to be decomposed according to the origin of factor costs.

Capital and labor embodied in these intermediate inputs are considered the "indirect" capital and labor and will also be accounted in the domestic cost. The breakdown components are assumed either fully domestic or fully foreign factors since the decomposition is made through only one step backward of the input-output chain. It is noteworthy that such decomposition of factors can also be done more than once if assumed that factor components derived from the first breakdown procedure are not yet fully domestic or foreign components.

Table 6 presents the breakdown components of the intermediate inputs involved in this study.

Table 6

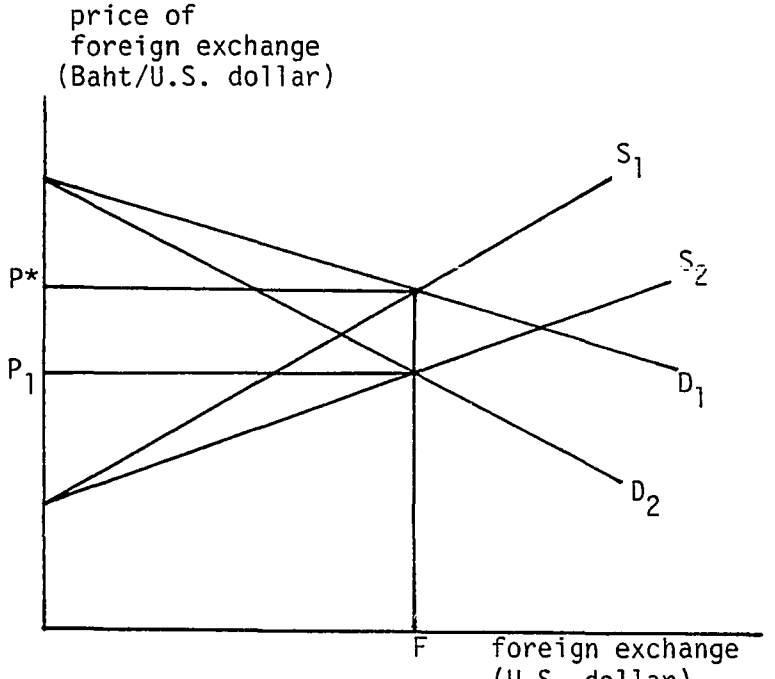
Allocation of Domestic and Foreign Components
in Primary Factors and Intermediate Inputs

primary factors and intermediate inputs	domestic components			foreign component	tax
	capital	labor	total		
Primary Factors					
capital	0.85	0.00	0.85	0.15	0.00
labor	0.00	1.00	1.00	0.00	0.00
land	0.00	0.00	1.00	0.00	0.00
Intermediate Inputs					
firewood	0.70	0.30	1.00	0.00	0.00
shrimp seed, fish	0.71	0.18	0.89	0.10	0.01
content	0.65	0.26	0.91	0.07	0.02
ice	0.70	0.13	0.83	0.09	0.08
feed	0.63	0.21	0.84	0.15	0.01
packing supplies	0.54	0.24	0.78	0.21	0.01
pesticide	0.41	0.16	0.57	0.41	0.02
fuel	0.07	0.01	0.08	0.62	0.30
lubricant	0.44	0.14	0.58	0.38	0.04
container	0.31	0.28	0.59	0.33	0.08
can	0.35	0.10	0.45	0.51	0.04
maintenance & repair	0.52	0.19	0.71	0.27	0.02
electricity	0.45	0.09	0.54	0.45	0.01
water	0.70	0.18	0.88	0.11	0.01
transportation	0.48	0.21	0.69	0.28	0.03
marketing	0.55	0.21	0.76	0.20	0.04
food	0.50	0.50	1.00	0.00	0.00
others	0.45	0.45	0.90	0.10	0.00

Source: Estimated from the input-output structure of Thailand.

4.5 Foreign Exchange Rate

In the social evaluation, the rate of foreign exchange must also be measured under the shadow exchange rate or the exchange rate when all barriers to trade are assumed to be removed and the foreign sector is in equilibrium. Shadow exchange rate (SER) mainly differs from the official exchange rate (OER) because of two reasons: the deficit in balance of payment and the protection in the domestic market (see Figure 4).



P* = equilibrium price
P_1 = undervalued price
D_1-D_2 = effect of tariff protection
S_1-S_2 = effect of payment imbalance

Figure 4. Overvaluation of the Domestic Currency

First, payment imbalance implies an official exchange rate (OER) that equates demand for foreign exchange with a supply that is temporarily augmented by foreign borrowing at a higher than desired level or permitting the growth of international reserves to fall below the desired rate or both. These temporary supplements to foreign exchange supply keep the price of foreign exchange below an equilibrium level.

Second, relative price distortion from the protection of the domestic market implies an exchange rate that affects the social value of foreign exchange by reducing the demand for foreign exchange from protection in the domestic market. The derived price of foreign exchange is then below the equilibrium price without protection. Also, with the full balance of payment equilibrium, there may be an undervaluation of foreign exchange from the distortion of domestic price away from the border price because of import duties, or taxes and subsidies on export.

Accordingly, the foreign currencies are usually undervalued in relation to the domestic currency or, in other words, the domestic currency is being overvalued. The situation will be in favor of the imported commodity but against the exported commodity of that country in the international market. Therefore, in order to pursue the social evaluation of the government policy incentives, the OER which is the rate prevailing with all distortions in the market will have to be adjusted, or the SER itself will have to be estimated.

There are two general approaches in estimating the SER. The first one, known as the UNIDO formula, proposes that the SER should reflect the value of an additional unit of foreign exchange in terms of welfare to the economy. The SER should be the value of incremental consumption

due to a marginal increase in foreign exchange (Dasgupta, et al., 1972). The other one advances the concept of SER to the free trade equilibrium exchange rate. This view assumes that the economy will move to the free trade or the optimal equilibrium position requires equality between the world and the domestic relative prices (Bacha and Taylor, 1971).

The formulas to obtain the SER of these two concepts can be respectively expressed as follows:

from Dasgupta's:

$$p^f = (1+S)(E_f X)/(E_f X+n_m M) + (1+T)(n_m M)/(E_f X+n_m M)$$

and, from Bacha and Taylor's:

$$r^*/r = (1+S)^a(1+T)^{1-a}$$

$$\text{or, } dr/r = (E_f X/E_f X+n_m M)(dS/1+s) \;/\; (n_m M/E_f X+n_m M)(dT/1+T)$$

where

E_f = elasticity of supply of foreign exchange from export

n_m = elasticity of demand for foreign exchange for import

X, M = export, and import

T, S = implicit tariff, and subsidies

$a = E_f X/(E_f M+n_m M)$

dr/r = proportional adjustment of exchange rate

r = actual exchange rate

r^* = free trade equilibrium exchange rate

and p^f = shadow price of foreign exchange as a proportion of the actual exchange rate, or r^*/r

With an application of Little and Mirrlees, and the UNIDO methods, respectively, the standard conversion factor (SCF) or OER/SER at 0.86

and 0.87 estimated by Bruce (1976) and McCleary (1976) will be averaged to approximate the shadow price of foreign exchange in this study. The SCF at 0.865, in fact, is also an average of all SCFs estimated for the case of Thailand as shown in Table 4. Accordingly, the degree of undervaluation of SER will be judged from SER/OER = 1/.865 = 1.156 implying that the SER should be 15.60 percent above the OER. This will give rise to the SER (Baht/U.S. dollar) at 30.63 as compared to 26.5 at the OER.

The methodologies employed by Bruce and McCleary, however, refer only to the undervaluation of foreign exchange due to the protection effect (D_1-D_2 in Figure 4). This study assumes the balance of payment undervaluation (S_1-S_2) is equal to zero after the recent devaluation in Thailand. In other words, the SER will be equal to the OER corrected for the undervaluation of foreign exchange due to protection.

CHAPTER V

POLICY INCENTIVES AND COMPARATIVE ADVANTAGE IN THE THAI FISHERIES INDUSTRY

This chapter contains the empirical results from the application of the protection theories and the comparative advantage models to the Thai fisheries industry. The analysis will employ the survey data regarding production and processing of the fisheries industry. Findings from the economic measurement will be shown and discussed.

5.1 Resource and Input Use in the Fisheries Industry

As described earlier, two aspects of the fisheries industry will be analyzed in this study: production and processing. The fisheries production is represented by the two most important fishing methods (otter-board trawl and purse seine) and a coastal aquaculture (shrimp cultivation). The fisheries processing will cover the production of three major fisheries products: frozen shrimp, canned tuna (from domestic and foreign raw materials), and fish meal.

The cost structure can be seen in two main categories: the domestic and the foreign resources. The domestic resources are summarized from the direct capital and labor in the production process, the indirect capital and labor which are embodied in the intermediate inputs, and land. The foreign inputs include all foreign inputs needed in the production. The rest of the total cost is left for tax. The results of all input classifications in terms of number and percentage distribution are shown in Tables 7 and 8.

Table 7

Domestic and Foreign Resources used in Production and Processing of the Thai Fisheries Industry, 1985

Unit: Baht

sub-industry	domestic source: capital	domestic source: labor	domestic source: land	foreign source	tax	total resource
marine fisheries production (per month)						
otter-board trawl fisheries						
small scale	11,167.52	10,118.66	82.92	11,889.83	4,782.96	38,041.89
medium scale	53,737.25	43,143.48	234.87	48,406.09	18,764.74	164,286.43
large scale	98,198.83	62,334.57	319.32	82,500.99	30,597.16	273,950.87
average	54,367.86	38,533.23	212.37	47,598.97	18,048.29	158,760.72
purse seine fisheries						
small scale	35,611.24	55,296.49	252.23	26,472.71	8,814.22	126,446.89
medium scale	57,422.47	96,477.61	705.47	31,140.19	10,432.81	196,178.54
average	46,777.34	76,147.53	478.85	28,864.34	9,623.51	161,891.58
coastal shrimp aquaculture (per rai or 0.40 acre)						
traditional	323.56	510.16	711.00	256.78	91.90	1,893.40
intensive	4,059.18	2,137.52	711.00	1,011.71	159.72	8,079.13
fish processing industries						
frozen shrimp (per kilogram)	177.59	53.70	-	26.45	2.67	260.41
canned tuna (d)[1] (per carton)	329.70	129.00	-	93.99	8.67	561.36
canned tuna (f)[2] (per carton)	66.00	62.15	-	428.25	4.96	561.36
fish meal (per kilogram)	6.22	2.04	-	1.36	0.24	9.86

Notes:

[1]Canned tuna (d) is the product with domestic raw material.

[2]Canned tuna (f) is the product with imported raw material.

Sources: Table 4 and Appendix A-D.

Table 8

Percentage Distribution of Domestic and Foreign Resources used in Production and Processing of the Thai Fisheries Industry, 1985

Unit: percent

sub-industry	domestic source			foreign source	tax	total resource
	capital	labor	land			
marine fisheries production						
otter-board trawl fisheries						
small scale	29.36	26.60	0.22	31.25	12.57	100.00
medium scale	32.71	26.26	0.14	29.47	11.42	100.00
large scale	35.87	22.75	0.12	30.12	11.16	100.00
average	34.25	24.27	0.13	29.98	11.37	100.00
purse seine fisheries						
small scale	28.16	43.73	0.20	20.94	6.97	100.00
medium scale	29.27	49.18	0.36	15.87	5.32	100.00
average	28.89	47.04	0.30	17.83	5.94	100.00
coastal shrimp aquaculture						
traditional	17.09	26.95	37.55	13.56	4.85	100.00
intensive	50.24	26.46	8.80	12.52	1.98	100.00
fish processing industries						
frozen shrimp	68.20	20.62	-	10.16	1.02	100.00
canned tuna (d)	58.73	22.98	-	16.74	1.55	100.00
canned tuna (f)	11.76	11.07	-	76.29	0.88	100.00
fish meal	63.08	20.69	-	13.79	2.44	100.00

Source: Table 5

The structure of the resources used in marine fisheries production, especially in trawling, which is the most important fishing method in Thailand, is very similar among three production scales. Shown in Table 8, percentages accounted for total capital, labor, resource cost, foreign input, and tax are, respectively, 34.25, 24.27, 0.13, 29.98, and 11.37 in average. The total capital is thus the largest cost item followed by foreign input and labor. The total domestic resources are still the largest proportion of the cost structure as compared to the foreign cost. It is almost needless to mention the cost of licensing which is supposed to play the more important role in today's world of increasingly scarce marine resources. The cost of licensing which is less than one percent of the total cost implies that the fishery resource cost is almost nil to the Thai fishermen.

The purse seiner which is potentially another major fishing gear of the Thai fisheries, due to appropriate economic and resource environments, is found to have the different cost structure from the trawler. The average of labor cost at 47.04 percent and capital reduced to only 28.89 percent simply show that this type of fishing method is relatively more labor intensive than the trawler.

The relative concentration in labor cost is due mainly to the nature of purse seine operation which requires more skilled fishermen, especially in catching the highly migratory fish species like tuna. Such a pattern of production is also hardly modified by the substitution of labor and capital as possibly done in the case of the trawlers. Skilled labor then appears to be the important factor in influencing the success of purse seine fisheries. Also, most of the purse seine

laborers often prefer to have their own share in revenue from the catch rather than the fixed wage and salary as is always practiced in the trawling fisheries. This system of sharing then helps make the proportion of labor cost greater than the proportion of capital.

The resource cost in terms of licensing the purse seiner though it is twice as much as that of the trawler still remains more or less insignificant as compared to the total cost. It again confirms the fact that cost paid to exploit the fishery resources in the Thai waters can be overlooked. The control of the fishing effort if done through the charge of fishing license, then can be said to be relatively ineffective.

By assuming the same opportunity cost of land for either the traditional or intensive type of shrimp cultivation, land cost is found to be the most significant factor for the first type of cultivation, 37.55 percent of the total cost. On the other hand, capital is predominantly the major cost item for the intensive shrimp cultivation, 50.24 percent of the total cost.

The different structure of the two types of shrimp cultivation can be simply explained by the addition of shrimp seeds and feed, in which their components are considered more capital than labor, into the intensive cultivation. Since those two additional inputs are relatively high priced, the total cost per unit of area is then very different, 8,079.13 Baht/rai in the case of intensive cultivation and 1,893.40 Baht/rai in the case of the traditional type. However, the proportion of labor and foreign inputs used in both cultivation types are almost equal to each other.

Except for the processing of canned tuna that uses the imported raw material (tuna fish), the other selected fish processing industries in this study are found to have a similar cost structure. It is obvious again that capital appears to be the most influential factor cost, accounting for 68.20, 58.73 and 63.08 percent for frozen shrimp, canned tuna with domestic raw material, and fish meal. On the other hand, labor cost is estimated at only 20-23 percent of the total cost while foreign inputs are even less, approximately 10-17 percent for all processing industries. Land cost is assumed nil in this case.

Since the majority of raw tuna fish used in the Thai tuna canneries is derived from foreign countries, canned tuna processed from the imported raw material is then classified in another category. The cost structure of canned tuna with imported raw material is also found to be very different from canned tuna with domestic raw material. Imported tuna fish, in terms of foreign input cost, is shown to be the highest cost of the processing with a share risen to 76.29 percent of the total cost. Proportions of capital and labor in this case are very close to each other, 11.76 and 11.07 percent of the total cost. Raw material is therefore the important factor to differentiate the cost structure of the canned tuna industry and, potentially, might affect the degree of comparative advantage in the export of canned tuna as well.

In this study, domestic tuna is treated separately from imported tuna according to the difference in the actual sources of tuna. Domestic tuna will not be considered tradable and the domestic value will be assumed the social value. On the other hand, if the tuna is treated

due to the potential sources, not the actual sources, both the domestic and imported tuna will be considered tradable and the border price will be assumed the social price. Accordingly, the difference between these two types of tuna can be omitted.

To summarize, the structure of resources used in the Thai fisheries industry varies among various fisheries activities. There are both capital and labor intensives in the marine fisheries production depending upon types of fishing method: more capital intensive for trawlers and more labor intensive for purse seiners. Factor intensity is also different in shrimp cultivation of traditional and intensive types. Land is found to be the major primary factor for the first type of shrimp cultivation while capital is the key factor for the second type. Finally, the selected fish processings are mostly capital intensive if it is assumed all raw materials are derived from the domestic source.

In general, the foreign input cost accounts for between 10-30 percent of the total cost in all fisheries activities. The majority of production cost in the Thai fisheries industry, therefore, still remains the domestic resources.

5.2 Structure of Protection and Subsidies

5.2.1 Protection Measure in the Fisheries Production

LIke most of the primary productions in Thailand, the fisheries has received no direct protection from the government sector. Fish from the Thai fishing vessels, as well as fish products are excluded from export and import tariff, however. Only the business and municipal taxes which are summed up to 1.65 percent of export price are charged. In other words, the nominal protection rate (NPR) is then the negative

value, -1.65 percent. This study assumes that all fish and fish products are export commodities, the NPR is then more or less the rate of export tax. The result of estimation, shown in Table 9, implies that the fisheries industry's final products are generally not protected since the domestic value is at the average of 1.65 percent below the world value.

The NPR, however, does not include all impacts from incentive policies especially those on the inputs. Since the structure of fisheries production requires many tradable inputs, the degree of protection for the output is likewise dependent upon prices of those inputs as well. The effective protection rate (EPR) which includes all of these effects will then be more appropriate to measure the policy incentives for the whole production process. Taking into account the intermediate inputs, the EPRs of fisheries productions show even the higher negative protection rate.

The degree of protection under the measurement of EPR starts from -2.50 percent for intensive shrimp cultivation to -16.09 percent for the medium scale trawling fisheries. The return to domestic primary factors or domestic value added is then lower than what it should have earned in the free trade situation. The higher negative rate of EPR than the NPR implies the higher implicit tariff on the tradable inputs used in the fisheries production than the NPR on the fisheries products.

The trawling fisheries which is the main part of the industry in terms of production is faced with the highest negative rate of protection, followed by purse seine and the shrimp cultivation. The difference in those values might result mainly from the variation of

Table 9

Structure of Protection in the Fisheries Production

Unit: percent

production	NPR	EPR	NEPR
marine fisheries production			
otter board trawl			
small scale	-1.65	-15.75	-27.10
medium scale	-1.65	-16.09	-27.40
large scale	-1.65	-11.31	-23.26
average	-1.65	-12.91	-24.65
purse seine			
small scale	-1.65	-4.73	-17.57
medium scale	-1.65	-4.74	-17.58
average	-1.65	-4.74	-17.58
coastal aquaculture			
shrimp cultivation			
traditional	-1.65	-5.44	-18.19
intensive	-1.65	-2.50	-15.65

Source: Calculated from Table 7

cost structures. For example, the relatively more frequent use of foreign inputs in trawling and more labor in purse seine seem to help explain the difference in EPRs. It should be noted again that labor is assumed wholly domestic throughout this study, the effect of distortion by input tariff, thus, has nothing to do with the increase of labor in the production process.

The considerable earning as compared to the small percentage of foreign input used also reduce the degree of penalty from protection in the shrimp cultivation. The increase in earning resulted from the

addition of shrimp seeds and feed, which contain more of the domestic than the foreign component and then do not increase much of the distortion effect, leads to the greater proportion of value added and then the lower protection in the intensive shrimp cultivation.

In order to correct the exchange rate distortion due to the undervaluation of foreign currency, the shadow price of foreign exchange or shadow exchange rate (SER) has to be taken into consideration. The EPR would then be even lower when such disincentive effect from the correction of exchange rate is included in the measurement, or the net effective protection rate (NEPR).

As described earlier, the estimated 15.60 percent of overvaluation of domestic currency will be used in this study. The NEPR is found from -15.65 to -27.40 percent in all activities. Since this correction for overvaluation of domestic currency will give a similar effect to all tradable inputs, the relative protection among different fisheries productions will be unchanged.

The fisheries production either in marine fisheries or aquaculture are seen more penalized from the protection system. The highest penalty is conferred upon the trawling fisheries, which is the major source of the fisheries production. Thus, it can be concluded that the protection policy in the case of the fisheries production is, in fact, not biased in favor of, but biased against itself.

5.2.2 Export Incentives in the Fish Processing Industry

Due to the same business and municipal taxes charged and export tax exempted, all of the fish processings including frozen shrimp, canned tuna, and fish meal are under the same NPR at -1.65 percent.

With the tariff system of input structure taken into consideration, EPR for all fisheries products are in the greater negative protection, from -2.58 percent for frozen shrimp to -7.63 percent for canned tuna. In fact, such disincentive rates can be said to be the small values, due to the tiny difference between the domestic and world value added of the processing. In other words, in processing those fisheries products, the major components of input structure are generally the domestic inputs rather than the foreign inputs, as already seen from Tables 7 and 8.

Raw material which is the main cost item of the processing structure is also faced with no tax since it is to be processed for export purpose. The import of tuna fish as raw material then does not have much effect on the protection of canned tuna processing. The EPR for canned tuna with imported raw material is -7.63 percent which is, in the absolute value, a little bit higher than canned tuna with the domestic raw material, -3.56 percent.

As mentioned earlier, there are no direct subsidies for the fisheries production and aquaculture in Thailand. Neither is there any explicit export subsidy nor the additional incentive specifically for the export processing of the fisheries products. All export industries including fish processing are basically treated on the equal basis of incentive measures. The important export incentives included in this study are tax drawback incentive and credit policy incentive. The total subsidies as the proportion of total domestic value added, are estimated at 4.30 percent for fish meal, 5.16 percent for frozen

shrimp, 5.97 and 12.86 percent for canned tuna with domestic and foreign raw materials (see Appendix E).

With the provided subsidies included, the effective protection rates (EPR*) are found mostly in positive value. The EPR* for frozen shrimp and canned tuna with the domestic and foreign raw materials are estimated at 2.44, 2.20, and 4.24 percent respectively. Fish meal is the only fish processing that still remains with the negative protection, at the rather insignificant rate -0.73 percent (see Table 10).

Table 10

Structure of Protection and Incentive for the Fish Processing Industries

Unit: percent

processing	NPR	EPR	EPR*	NEPR	NEPR*
frozen shrimp	-1.65	-2.58	2.44	-15.71	-11.37
canned tuna (d)	-1.65	-3.56	2.20	-16.56	-11.58
canned tuna (f)	-1.65	-7.63	4.24	-20.08	-9.82
fish meal	-1.65	-4.82	-0.73	-17.65	-14.11

*The inclusion into economic measurements of credit subsidies and tax incentives.

Source: Calculated from Table 7

After adjustment for the overvaluation of domestic currency, both NEPR and NEPR* of the fisheries products are in negative values. The average value of NEPR (and NEPR*) ranks from -15.71 (-11.37) percent

of frozen shrimp to -20.08 (-9.82) percent of canned tuna with foreign raw material.

As far as those results are concerned, the fish processing industry in Thailand can thus be considered penalized by the protection system.

In general, the exemption of export tax is important to the extent that it also helps reduce the degree of negative protection. The export subsidies with such a small percentage can offset only up to the penalty from the protection system, but still cannot lead to the neutral incentive for the industry when taking into account the distortion of exchange rate. After the adjustment with the overvaluation of domestic currency, the fisheries production and processing are still under the penalty from the negative protection.

5.3 The Domestic Resource Cost Analysis

5.3.1 The Degree of Comparative Advantage in Earning Foreign Exchange

The principle of comparative advantage is applied in this section to find out whether the fisheries industry is producing its output with lower domestic resources spent than foreign exchange earned. The degree of comparative advantage is supposed to take place when the total domestic resource cost (DRC) to earn one unit of foreign exchange is less than the shadow exchange rate (SER). There are two parts of DRC analysis in this study: the estimation of the degree of comparative advantage or the DRC coefficient, and the effect of variation in inputs on DRC coefficient or the DRC sensitivity.

The DRC coefficients are estimated from cost structure and allocation components between domestic and foreign resources. The

results of estimation as presented in Table 11 reveal that all fisheries activities are being operated under the comparative advantage. The DRC coefficients are found to be less than unity implying that in order to gain one unit of foreign exchange from the export of fisheries products, Thailand spends less than one unit of foreign exchange in terms of social value of domestic resources.

For example, in terms of marine fisheries production, the average DRC/SER coefficients for trawlers and purse seiners are respectively 0.5568 and 0.3770. This implies that in earning foreign exchange for 1 U.S. dollar, Thailand has to spend 17.0547 and 11.5475 Baht of domestic resources at the shadow exchange rate (1 U.S. dollar = 30.63 Baht at SER). The fisheries industry then shows a substantial profitability for the Thai economy.

Trawling fisheries, even with the substantial comparative advantage degree, still seem to have less advantage than the purse seine fisheries. This might partly result from the difference in both cost structure and, especially, the revenue from catch. Benefit per unit of fishing effort is higher in purse seine than that of trawling, due mainly to the relative concentration and higher value of the pelagic fish as compared to the demersal fish.

However, with the relatively low and declining rate of catch from trawling fisheries, the existence of comparative advantage is one of many good explanations for the excess of fishing effort in terms of fishermen or boats in the Thai waters.

Intensive shrimp cultivation has a higher comparative advantage as compared to that of traditional cultivation in which the coefficients

Table 11

Domestic Resource Cost Coefficient
of the Thai Fisheries Industry

production	DRC/SER	DRC/OER
marine fisheries production		
otter board trawl		
small scale	0.6049	0.6992
medium scale	0.7170	0.8288
large scale	0.4860	0.5618
average	0.5568	0.6437
purse seine		
small scale	0.3039	0.3513
medium scale	0.4358	0.5037
average	0.3770	0.4358
coastal aquaculture		
shrimp cultivation		
traditional	0.6097	0.7048
intensive	0.3326	0.3845
fish processing		
frozen shrimp	0.6955	0.8039
canned tuna (d)	0.8568	0.9904
canned tuna (f)	0.6372	0.7366
fish meal	0.9976	1.1532

Source: Calculated from Table 7

at SER are 0.3326 and 0.6097 respectively. The difference in the comparative advantage of shrimp cultivation seems to be attributed mainly to the yield of production. The addition of shrimp seeds and feed into the traditional cultivation has raised the revenue of the intensive shrimp cultivation much higher than the increase in production cost.

In terms of fish processing, though the comparative advantage exists for all selected fisheries products, the DRC coefficients are seen to be relatively higher than for the marine fisheries and aquaculture. The DRC coefficients at SER are estimated at 0.6955 for frozen shrimp, 0.8568 and 0.6372 for canned tuna with the domestic and foreign raw materials, and 0.9976 for fish meal.

There are at least two interesting conclusions to be drawn from the comparative advantage analysis of fish processing. First, in processing canned tuna, it is found that canned tuna with the imported raw material offers the higher degree of comparative advantage than canned tuna with the domestic raw material.

This fact seems to well justify the present situation of the Thai canned tuna industry in which at least 70-80 percent of the raw material is derived from abroad. While the purse seine fisheries in Thailand is still in the stage of developing, there is no tendency that the import of tuna fish will decline. In other words, as far as this estimation is concerned, the DRC coefficient then confirms that the Thai canned tuna industry is on the right track by importing raw material for the export processing. Taking advantage of lower production cost, the canned tuna industry is therefore only to capture the

value added from production for the Thai economy. The domestic tuna fisheries despite the fact that it contributes only 10-20 percent to the total tuna raw material is very important in terms of the employment creation and, potentially, the independent source of tuna supply for the Thai canneries in the future.

The second significant point is the relatively high DRC coefficient in the fish meal processing. The degree of comparative advantage evaluated at SER in fish meal processing, though it exists, is very slim.

As described earlier that the fish meal industry has been operated to make use of the low quality fish (trash fish), the tiny comparative advantage of fish meal production then helps call for the reconsideration of the fish meal industry or, in fact, the production of trash fish. The restraint in catch of trash fish will do at least two good things simultaneously: to preserve the fisheries resources for the greater economic value and to control the less comparative advantage industry. The promotion of fish meal processing will only bring about the great misuse of fishery resources and reduce the effectiveness of resource allocation as a whole.

On the other hand, fish meal should be produced only at the appropriate amount for domestic use, such as to serve the domestic livestock industry.

In general, the DRC estimation indicates that the comparative advantages of the fisheries industry of Thailand exist to a great degree. In spite of the declining domestic fishery resources, Thailand at present still earns substantial value added to its economy when

comparing, at the social opportunity cost, the foreign exchange obtained and the domestic resources used in the fisheries industry.

5.3.2 The Domestic Resource Cost Sensitivity

In order to incorporate the effect of changes in various economic parameters to the degree of comparative advantage, two DRC sensitivities are included in this study. The first DRC sensitivity analysis simply means the percentage change in DRC coefficient due to a one percent change in each DRC coefficient component. Those components to be considered in this study include capital cost, labor cost, foreign input cost, and export value. The more percentage increase in the DRC coefficient due to a one percent increase of each particular parameter implies the more domestic resources used to earn one unit of foreign exchange or, in other words, the less degree of comparative advantage.

The second DRC sensitivity analysis indicates the maximum percentage change in the DRC component to sustain the comparative advantage. In other words, this is to estimate the percentage change in each DRC component when the DRC coefficient is equal to one.

The results of these two analyses are shown in Tables 12 and 13. It is found that DRC coefficients in most of the fisheries activities are relatively more sensitive to changes in export value than to changes in costs. For example, in the trawling fisheries, Table 12 shows that a one percent increase in export value will result in 1.1384 percent decrease in the DRC coefficient (or the increase in comparative advantage). On the other hand, Table 13 implies that only 34.50 percent decrease in export value will be able to terminate the degree of comparative advantage in the trawling fisheries.

Table 12

DRC Sensitivity Analysis due to Variation in
Domestic Resource, Foreign Resource, and Export Value

Unit: percent

production	capital cost	labor cost	foreign input	export value
marine fisheries production				
otter board trawl				
small scale	0.5226	0.4735	0.3483	-1.1790
medium scale	0.5533	0.4442	0.3706	-1.1952
large scale	0.6105	0.3875	0.2557	-1.1105
average	0.5839	0.4138	0.2930	-1.1384
purse seine				
small scale	0.3906	0.6066	0.0890	-0.9814
medium scale	0.3714	0.6240	0.0886	-0.9811
average	0.3791	0.6171	0.0890	-0.9814
coastal aquaculture				
shrimp cultivation				
traditional	0.2095	0.3303	0.1024	-0.9921
intensive	0.5876	0.3094	0.0490	-0.9492
fish processing				
frozen shrimp	0.7678	0.2322	0.0802	-0.9744
canned tuna (d)	0.7188	0.2812	0.1787	-1.0519
canned tuna (f)	0.5150	0.4850	2.7054	-2.3835
fish meal	0.7530	0.2470	0.1670	-1.0428

Note: DRC sensitivity implies the percentage change in DRC coefficient due to one percent increase in each component.

Source: Calculated from Table 7.

Table 13

Maximum Percentage Changes in Domestic Resource, Foreign Resource, and Export Value to Sustain the Comparative Advantage

Unit: percent

production	capital cost	labor cost	foreign cost	export value
marine fisheries production				
otter board trawl				
small scale	124.97	137.92	117.38	-29.56
medium scale	71.32	88.83	79.17	-20.85
large scale	173.22	272.89	206.18	-41.14
average	136.34	192.37	155.73	-34.50
purse seine				
small scale	586.43	377.67	788.87	-63.97
medium scale.	348.56	207.46	642.75	-51.87
average	435.93	267.79	706.46	-57.25
coastal aquaculture				
shrimp cultivation				
traditional	305.58	193.81	385.05	-35.44
intensive	341.48	648.47	1,370.07	-63.64
fish processing				
frozen shrimp	57.01	188.53	382.76	-28.20
canned tuna (d)	23.26	59.44	81.58	-12.18
canned tuna (f)	110.56	117.41	17.04	-11.59
fish meal	0.32	0.98	1.47	-0.21

Source: Calculated from Table 7.

The DRC sensitivity due to changes in capital and labor are found to be different among various fisheries activities. The trawler, intensive shrimp cultivation, and fish processing tend to be more sensitive to capital, while purse seiner and traditional shrimp cultivation appear to be more sensitive to labor.

All fisheries activities except in the case of canned tuna with the foreign raw material are seen relatively less sensitive to foreign input. In the latter case, a one percent increase in foreign input will cause the DRC coefficient increase up to 2.7054 percent. Put another way, the degree of comparative advantage in processing canned tuna with foreign raw material will be eliminated, if the foreign input cost increases up to 17.04 percent. The change in price of imported raw tuna is then one of the key factors to determine the success of the canned tuna industry in Thailand.

It should be noted here that the cost of fishing license is not included in this analysis, since its effect is supposed to be very insignificant. Also, the sensitivity due to the export value can be influenced by either the change in export quantity (or catch rate) or the change in export price.

In overall consideration, the variation in DRC sensitivity results mainly from the difference in the cost structure of each activity. The change in export value is the most important factor to the DRC coefficient or the degree of comparative advantage. This analysis adds significance to the problem stated earlier, the overfishing, which results mainly from the excessive fishing effort in relation to the fishery resources. As long as such a problem continues, Thailand then

may tend to lose some of its comparative advantage in trading fisheries products with the international market. Also, the market competition and the fluctuation of world price will play an important role in affecting the comparative advantage of the Thai fisheries industry. This includes both in exporting the fisheries products to the world market and in importing the raw material for the export processing.

This study, however, considers the comparative advantage only from the standpoint of the Thai fishery resources. If the overfishing situation is assumed to be in all fishing countries, the relative comparative advantage of the Thai fisheries industry may not be changed. The decline in fishery resources can then be compensated by the rise of the world price of fish and the comparative advantage in international trade of Thailand will be maintained. This also assumes that the fisheries industry everywhere has the same degree of overfishing.

5.4 Export Performance of the Fisheries Industry

The index of revealed comparative advantage (RCA) and the adjusted index according to Balassa's idea (RCA') for the export of Thai fisheries products are estimated in selected major importing countries including the United States, Japan, Australia, German Fed. Rep., Singapore, and Malaysia.

The first two countries are the largest export markets for fisheries products, as well as other commodities, of Thailand. Australia and German Fed. Rep. are selected as the potential markets in which the export of Thai fisheries products can be expanded. German Fed. Rep. also represents the other European markets that are presently becoming important export markets for the Thai fisheries products.

Singapore and Malaysia are included here, because they both are major markets and part of the Asian countries in which regional trade is being promoted.

Table 14 shows indices of the estimated RCA and RCA' which are sometimes also referred to as the export performance indices.

The export of fisheries products are found to have an impressive performance in all selected countries. During the 15 years of analysis, Thailand's share in the export of fisheries products is much higher than its share in total exports, implying that there is a strong comparative advantage in this commodity. Both indices of RCA and RCA' give similar results. More importantly, the export performance indices in the United States, Australia, German Fed. Rep. and Singapore even have an increasing trend. This means that the export of fisheries products from Thailand to those countries are expanding at an increasing rate, as compared to the total exports of Thailand.

The export of fisheries products into Japan and Malaysia markets are also shown with excellent export performance for the past 15 years. The RCA and RCA', however, suggest that the degree of comparative advantage in terms of export expansion of the fisheries products, when compared to the total exports, are more constant rather than increasing, as they are in other countries. This might partly result from the trend of the fisheries trade of Thailand in recent years that has been declining in the traditional markets, especially Japan.

It should be noted here that Japan and Malaysia have been the major export markets for the fisheries products from Thailand for a long time while the other countries such as the United States,

Table 14

Revealed Comparative Advantage of the Thai Fisheries Products
in Six Major Importing Countries

year	USA		Japan		Australia		German Fed. Rep.		Singapore		Malaysia	
	RCA	RCA'	RCA	RCA'	RCA	RCA'	RCA	RCA'	RCA	RCA'	RCA	RCA'
1971	2.8213	-	4.8263	-	*	-	1.3532	-	3.6792	-	5.2711	-
1972	3.7643	4.3934	5.4313	5.7718	*	-	1.7283	1.9677	2.3165	1.8876	4.9477	4.7959
1973	3.2029	2.6640	4.7693	4.4786	1.3446	-	1.5248	1.4350	2.0336	1.9094	4.6996	4.5818
1974	3.8527	4.2435	3.8749	3.5115	4.9480	11.5779	1.6489	1.7160	2.8619	3.4447	8.4204	11.7537
1975	3.1526	2.8661	4.7015	5.2030	5.8828	6.4386	1.5695	1.5317	3.2735	3.5089	10.3104	11.4675
1976	3.4604	3.6294	4.1892	3.9610	4.9958	4.6191	2.4912	3.2226	3.8726	4.2270	11.2526	11.7667
1977	3.7313	3.8773	3.6368	3.3970	8.3518	11.1570	3.6290	4.4578	3.6528	3.5491	9.5650	8.8478
1978	4.3424	4.6981	3.5909	3.5683	9.9405	10.8859	2.9767	2.7092	2.7798	2.4477	10.7235	11.3728
1979	6.6756	8.4690	4.0856	4.3670	8.7511	8.2276	2.8413	2.7767	2.9281	3.0062	13.0974	14.5471
1980	5.2778	4.7252	5.2929	6.0749	13.6341	17.4380	3.8168	4.4721	4.5999	5.9131	12.1184	11.6655
1981	5.0502	4.9413	5.9796	6.3675	15.8318	17.1078	5.3989	6.5179	5.3336	5.7590	11.7245	11.5340
1982	5.6849	6.0421	5.9139	5.8814	18.4406	19.9600	8.7134	11.3879	6.3732	6.9943	10.5069	9.9613
1983	9.2403	12.1298	5.2788	4.9954	17.4936	17.0445	10.4731	11.5391	6.8656	7.1308	11.7641	12.5680
1984	11.4492	12.8176	5.1347	5.0646	16.0732	15.4206	11.3935	11.8912	6.7499	6.6930	9.2343	8.2414
1985	12.5554	13.1620	n.a.	n.a.	16.7897	17.1640	13.7115	15.1063	7.6368	8.1386	n.a.	n.a.

RCA = Revealed Comparative Advantage
RCA' = Adjusted Revealed Comparative Advantage

* : Insignificant value
n.a.: Non-available data

Source: Appendix F.

Australia, or German Fed. Rep. are relatively new markets. Moreover, Thailand's latest important fisheries product, canned fish, is not imported very much into Japan and Malaysia, as most of it has been shifted to the United States and European countries.

Especially in the United States and Japan markets, fisheries products are also found to have a very strong export performance as compared to the total structure of export commodities from Thailand. By using the Standard International Trade Classification (SITC) of which the fisheries products (or fish and preparations as classified) are included in group 0 (foodstuffs), the estimations in Table 15 show that fish and preparations are the commodity with the exceptionally strong export performance among all Thai export commodity groups.

In the United States market in particular, fish and preparations clearly are the commodity group that has the strongest export performance. In other words, the export share of fish and preparations is not only larger than the share of total export from Thailand, but also larger than the relative shares of all of the other export commodity groups from Thailand. The success in export performance of fish and preparations in the United States is mainly attributed to the sharp increase in the export of canned fish, mainly canned tuna, as well as frozen shrimp during recent years.

The other commodities exhibiting the relatively strong comparative advantage in terms of export performance in the United States market are cereal, vegetables, fruits, and sugar. All of those products are included in the category of foodstuffs which has the highest comparative advantage among the export commodity groups.

Table 15

Revealed Comparative Advantage of Overall Thai Export Commodities in the United States and Japan Markets

country	commodities	RCA^{1983}	RCA^{1984}	RCA'
the United States				
0	foodstuffs	3.7839	3.9861	4.0926
	01 meat & preparations	*	0.0245	*
	02 diary products	*	*	*
	03 fish & preparations	9.2403	11.4492	12.8176
	04 cereal & preparations	8.4319	7.5195	7.1126
	05 vegetables & fruits	5.0776	4.3514	4.0403
	06 sugar & preparations	1.4114	2.9839	4.6463
	07 coffee, tea, etc.	1.1828	0.7269	0.5868
	08 feedstuffs for animals	0.2542	0.1937	0.1706
	09 miscellaneous	5.7953	4.7158	4.2765
1	beverage & tobacco	1.0605	1.2585	1.3761
2	crude material, exc. fuels	2.2263	1.9118	1.7767
3	mineral fuels	*	0.0619	*
4	animal & vegetable oils	2.0363	1.0751	0.8214
5	chemical	0.2710	0.2511	0.2419
6	basic manufactures	2.0155	1.5378	1.3556
7	machine & transport equip.	0.4688	0.5105	0.5332
8	miscellaneous	1.6697	1.8815	2.0009
9	goods not classified	0.4357	0.3816	0.3579
Japan				
0	foodstuffs	3.7166	3.3620	3.2016
	01 meat & preparations	2.9082	3.9978	4.7467
	02 diary products	*	*	*
	03 fish & preparations	5.2788	5.1347	5.0646
	04 cereal & preparations	0.3295	0.3053	0.2942
	05 vegetable & fruits	3.1784	3.1375	3.1173
	06 sugar & preparations	32.7673	28.0350	26.0106
	07 coffee, tea, etc.	1.0946	0.9553	0.8945
	08 feedstuffs for animals	1.7240	2.5216	3.1049
	09 miscellaneous	1.1940	0.9837	0.8970
1	beverage & tobacco	1.7731	1.0138	0.7967
2	crude material, exc. fuels	2.4461	2.6283	2.7262
3	mineral fuels	*	*	*
4	animal & vegetable oils	0.7954	0.5569	0.4734
5	chemical	0.3932	0.5365	0.6342
6	basic manufactures	1.9912	1.6767	1.5442
7	machine & transport equip.	0.1732	0.4973	0.9628
8	miscellaneous	0.5287	0.4584	0.4280
9	goods not classified	0.3151	0.2566	0.2328

*: Insignificant value

Source: Appendix G.

Fish and preparations also appear to be the second strongest export commodity to Japan. Sugar in which Thailand holds a 20 percent share in the Japan market happens to be the strongest export commodity. As mentioned earlier, the export of fisheries products in recent years has tended to switch from Japan to the United States and European countries. This makes the export share of fish and preparations rather constant in the Japan market.

As in the United States market, foodstuffs happen to be the strongest in terms of relative export share among the export commodity groups from Thailand in the Japan market. Most of the commodities also have a similarly relative degree of comparative advantage in both the United States and Japan. There are only some commodities that exhibit controversial performance. For example, cereal and miscellaneous groups which have a relatively strong comparative advantage in the United States are relatively disadvantaged in Japan. This reflects, to some extent, the difference in the relative structure of production and trade of the two importing countries.

CHAPTER VI

OVERALL EVALUATION OF THE FISHERIES INDUSTRY FROM THE INPUT-OUTPUT STRUCTURE

This chapter provides another investigation into the fisheries industry by the application of input-output structure. Overall evaluation in terms of policy incentive and comparative advantage will be analyzed. Results in this chapter can be compared to the analysis in the last chapter which is based on the industrial survey data.

6.1 Input-Output Relationship in the Fisheries Sector

According to the input-output structure, the Thai economy is divided into 180 important sectors in which three are classified in relation with the fisheries industry, including marine fisheries, inland fisheries, and canning and preservation of fish. The first two categories deal with the production level of fisheries while the third category includes all processings of fish.

The fundamental idea lying behind the input-output relationship is the interdependence among sectors in the same economy. An increase or decrease in production or consumption of any sector will therefore have an effect on the other sectors in the input-output chain. The relationship thus can be applied to various economic measurements, such as the determination of structure and performance of an economy, the backward or forward linkage effect, and the benefit-cost analysis. In this study, the input-output structure will be applied to evaluate

the structure of protection and the degree of comparative advantage in the fisheries sector.

Due to the social benefit-cost characteristics, input-output structure is defined as the relationship of input-output in the absence of all tariffs and subsidies, or with free trade conditions. The observed input-output coefficients or the coefficients at the domestic price (a^d_{ij}) which are usually distorted by various tariffs on the intermediate inputs and final products, have to be adjusted to be those at the free trade price. In other words, the coefficients must reflect the border price (a^b_{ij}). This procedure can be done by deflating a^d_{ij} for all distorting factors in the Thai customs system such as import duty, business tax, municipal tax, and standard profit. Put another way, the protection induced increase in the domestic price of a product may be assumed to be equal to all of the amount of tariffs and taxes paid on it (Akrasanee, 1973b).

Thus, if the c.i.f. price is equal to 1, the domestic price with tariff (t_i), business tax and municipal tax (10 percent of business tax) (b_i), and standard profit (s_i) will be as follows:

$$P_i = (1+t_i)[1+b_i(1+s_i)]$$

and $$a^b_{ij} = a^d_{ij}/(1+t_i)[1+b_i(1+s_i)]$$

where P_i = domestic price if assumed c.i.f. price equal to one

By deflating the domestic input-output coefficients (a^d_{ij}) with a protection induced increase in the price term, the free trade input-output coefficient (a^b_{ij}) will be obtained as seen in Tables 16-18.

Table 16

Input-Output Coefficients of Marine Fisheries

code	inputs	a_{ij}^{d}	a_{ij}^{b}
26.1	charcoal	0.0015	0.001321
26.2	fuel wood	0.0039	0.003435
27.0	other forest product	0.0015	0.000965
28.0	marine fish	0.0193	0.019300
57.0	ice	0.1445	0.130193
61.0	feeds	0.0019	0.001696
74.0	jute mill products	0.0073	0.005059
79.0	wood & cork	0.0010	0.000644
84.0	basic chemicals	0.0021	0.001719
93.4	L.P.G.	0.0044	0.003952
93.6	high diesel	0.2057	0.176712
93.7	low diesel	0.0016	0.001375
94.0	other petro products	0.0065	0.004712
98.0	plastic wares	0.0120	0.006727
99.0	ceramic wares	0.0001	0.000050
103.0	concrete & cement	0.0002	0.000129
106.0	steel products	0.0005	0.000393
111.0	fabricated metal	0.0048	0.002703
112.0	engines & turbines	0.0027	0.002118
113.0	agr. machinery	0.0001	0.000078
117.0	elec. indus. machine	0.0001	0.000082
121.0	elec. accumulators	0.0004	0.000225
122.0	other elec. supplies	0.0002	0.000129
134.0	other manufactured	0.0034	0.002188
	total tradable	0.4257	0.365905
123.0	ship build. & repair	0.0101	-
127.0	motor vehicle repair	0.0005	-
135.0	electricity	0.0003	-
160.0	banking services	0.0132	-
180.0	unclassified	0.0004	-
	total non-tradable (services)	0.0245	-
	material	0.0066	0.005553
	non-material	0.0179	-
190.0	total intermediate	0.4502	-
201.0	wages and salaries	0.1418	-
202.0	operating surplus	0.3222	-
203.0	depreciation	0.0729	-
204.0	taxes less subsidies	0.0129	-
209.0	total value added	0.5498	-

Source: Appendix H.

Table 17

Input-Output Coefficients of Inland Fisheries

code	inputs	a^d_{ij}	a^b_{ij}
25.0	log	0.0001	0.000097
26.2	fuel wood	0.0005	0.000421
28.0	marine fish	0.0801	0.080100
29.0	inland fish	0.0854	0.085400
38.0	salt	0.0010	0.000784
49.2	rice husk	0.0004	0.000377
61.0	animal feed	0.0123	0.010982
74.0	jute mill products	0.0004	0.000277
79.0	wood & cork	0.0004	0.000257
84.0	basic chemicals	0.0001	0.000082
88.0	drugs & medicines	0.0079	0.007055
93.2	regular gasoline	0.0037	0.002688
93.5	kerosene	0.0195	0.016752
93.6	high diesel	0.0097	0.008333
94.0	other petro products	0.0003	0.000217
97.0	rubber products	0.0001	0.000060
98.0	plastic wares	0.0001	0.000056
99.0	ceramic wares	0.0001	0.000050
102.0	cement	0.0002	0.000150
110.0	metal products	0.0004	0.000277
112.0	engine & turbine	0.0003	0.000235
113.0	agr. machinery	0.0002	0.000157
134.0	other manufactured	0.0036	0.002317
	total tradable	0.2268	0.217124
24.0	agr. services	0.0001	-
49.1	rice milling	0.0186	-
123.0	ship build & repair	0.0007	-
127.0	motor vehicle repair	0.0005	-
160.0	banking services	0.0159	-
180.0	unclassified	0.0003	-
	total non-tradable (services)	0.0361	-
	material	0.0097	0.007908
	non-material	0.0264	-
190.0	total intermediate	0.2629	-
201.0	wages and salaries	0.0461	-
202.0	operating surplus	0.6688	-
203.0	depreciation	0.0207	-
204.0	taxes and subsidies	0.0015	-
209.0	total value added	0.7371	-

Source: Appendix I.

Table 18

Input-Output Coefficients of Fish Processing

code	inputs	a^d_{ij}	a^b_{ij}
28.0	marine fish	0.5071	0.507100
29.0	inland fish	0.0149	0.014900
38.0	salt	0.0004	0.000314
48.0	animal oil	0.0001	0.000069
55.1	sugar	0.0016	0.000874
57.0	ice	0.0006	0.000541
58.0	monosodium glutamate	0.0010	0.000563
60.0	other food products	0.0078	0.004394
66.0	tobacco products	0.0001	0.000075
71.0	knitting	0.0001	0.000076
79.0	wood & cork	0.0005	0.000322
81.0	pulp & paper	0.0002	0.000179
82.0	paper products	0.0001	0.000064
84.0	basic chemicals	0.0021	0.001719
89.0	cleaning preparation	0.0009	0.000507
93.2	regular gasoline	0.0054	0.003923
93.4	L.P.G.	0.0054	0.004850
93.7	low gasoline	0.0001	0.000086
93.8	fuel oil	0.0005	0.000430
98.0	plastic wares	0.0009	0.000505
100.0	glass products	0.0001	0.000073
107.0	non-ferrous metal	0.0002	0.000168
108.0	hand tools	0.0008	0.000601
111.0	fabricated metals	0.0224	0.012614
115.0	industrial machinery	0.0012	0.000940
117.0	elec. indus. machinery	0.0001	0.000082
133.0	recreation equipment	0.0002	0.000162
134.0	other manufactured	0.0003	0.000193
	total tradable	0.5751	0.556322
83.0	printing & publishing	0.0003	-
127.0	motor vehicle repair	0.0001	-
135.0	electricity	0.0013	-
139.0	building construction	0.0002	-
147.0	restaurant & drinking	0.0042	-
148.0	hotel & lodging	0.0008	-
150.0	road transport	0.0003	-
158.0	storage & warehouse	0.0008	-
159.0	post & communication	0.0001	-
160.0	banking services	0.0015	-
164.0	business services	0.0002	-
177.0	repair unclassified	0.0007	-

Table 18 (continued) Input-Output Coefficients of Fish Processing

code	inputs	a^d_{ij}	a^b_{ij}
180.0	unclassified	0.0016	-
	total non-tradable (services)	0.0121	-
	material	0.0033	0.002692
	non-material	0.0088	-
190.0	total intermediate	0.5872	-
201.0	wages & salaries	0.0930	-
202.0	operating surplus	0.2837	-
203.0	depreciation	0.0261	-
204.0	taxes less subsidies	0.0100	-
209.0	total value added	0.4128	-

Source: Appendix J.

6.2 Classification of Input-Output Coefficients

Since this study deals with only one step backward in the input-output chain, each intermediate input will thus be treated either as fully tradable or as fully non-tradable. An intermediate input that can be partially traded is also assumed to be a fully tradable input. Only the fully non-traded input, mostly from various services, is classified as non-tradable inputs. In this study, the non-tradable inputs are found in relatively small proportion as compared to the tradable inputs.

In order to differentiate the measurements by Balassa (B) and Corden (C), the non-tradable inputs (A_{nj}) have to be separated into material ($A_{nj}r_{mn}$) and non-material ($A_{nj}r_{vn}$) proportions as shown in Chapter III that:

$$A_{nj} = A_{nj}r_{mn}+A_{nj}r_{vn}$$

and from equation (9)

$$EPR_j^C = (V_j^{dB}-V_j^{bB})/(V_j^{bB}+A_{nj}r_{vn})$$

In the case of Thai input-output structure, the proportion of r_{mn} and r_{vn} are estimated to be 27 and 73 percent respectively. The results of summation are shown in Table 19.

6.3 Overall Evaluation of Policy Incentive and Comparative Advantage

As already expected, the EPRs of both Balassa's and Corden's methods for all fisheries activities are found to be negative values.

Table 19

Input Structure Classified into Tradable and Non-Tradable

inputs	marine fisheries	inland fisheries	fish processing
domestic value			
intermediate inputs			
tradable	0.4257	0.2268	0.5751
non-tradable	0.0245	0.0361	0.0121
material	0.0066	0.0097	0.0033
non-material	0.0179	0.0264	0.0088
value added B	0.5369	0.7356	0.4028
C	0.5548	0.7620	0.4116
tax less subsidies	0.0129	0.0015	0.0100
output	1.0000	1.0000	1.0000
world value			
intermediate inputs			
tradable	0.3659	0.2171	0.5563
non-tradable	0.0235	0.0343	0.0115
material	0.0056	0.0079	0.0027
non-material	0.0179	0.0264	0.0088
value added B	0.6271	0.7651	0.4487
C	0.6450	0.7915	0.4575
output	1.0165	1.0165	1.0165

Notes: Value added (B) = value of output - total intermediate inputs - tax less subsidies

Value added (C) = value added (B) + non-material part of non-tradable inputs ($A_{nj}r_{vn}$)

Source: Calculated from Tables 16-18.

However, the different results from the two estimations are not very substantial because of the relatively small non-tradable proportion (see Table 20).

The EPRs from B and C (in the parentheses) for marine fisheries, inland fisheries, and fish processing are as follows: -14.38 (-13.98), -3.85 (-3.72), and -10.23 (-10.03) percent, respectively.

The NEPRs are also estimated to have higher negative values, about 16-25 percent. These results when compared to the set estimated in Chapter V can be said to be in the same direction. More importantly, they both give the same implication that there is no protection in the fisheries industry of Thailand, either in production or processing. On the other hand, this industry has always suffered a penalty from the protection system.

Taking into consideration the credit subsidy and tax exemption incentives, both EPR* and NEPR* in fish processing are found in greater but still negative values, approximately -2 and -15 percent, respectively. The subsidies therefore do not really have a protective effect for the processing of fisheries products. The fisheries industry is still penalized by having less domestic value added than the world value added. The degree of unprotection is found here to be slightly greater than the previous estimation (Chapter V). Both Balassa's and Corden's methods give narrowly different results.

For the comparative advantage, the DRC coefficients are all less than unity, implying that there is some degree of comparative advantage in the fisheries industry. The DRC coefficients, used as the indicator of comparative advantage, reveals that it takes 0.8613, 0.9630, and

Table 20

Estimation of Protection Structure and Comparative Advantage in the Thai Fisheries from the Input-Output Coefficient

economic indicators	marine fisheries	inland fisheries	fisheries processing
Effective Protection Rate (EPR)			
B	-14.38	-3.85	-10.23
C	-13.98	-3.72	-10.03
Effective Protection Rate* (EPR*)			
B	-	-	-2.14
C	-	-	-1.92
Net Effective Protection Rate (NEPR)			
B	-25.92	-16.81	-22.33
C	-25.57	-16.70	-22.16
Net Effective Protection Rate* (NEPR*)			
B	-	-	-15.33
C	-	-	-15.14
Domestic Resource Cost (DRC)			
DRC/SER	0.8613	0.9630	0.9003

Note: *Credit subsidies and tax incentives are included.

Source: Calculated from Table 19.

0.9003 unit of foreign exchange in terms of domestic resources to earn one unit of foreign exchange in the cases of marine fisheries, inland fisheries, and fish processing, respectively.

Despite the fact that comparative advantage exists, the levels of comparative advantage are generally a little bit lower than the former DRC estimations. It is possible that the input-output table takes into account a greater number of samples and many of them exhibit the comparative disadvantage. It should be noted again that the types of marine production, aquaculture, and fish processing included in this study are only the major and potentially major ones of their categories.

The analysis has shown overall that although the fisheries industry receives negative protection from the government incentive policies, it still retains the comparative advantage in export production and processing.

It should be borne in mind again that many other government supports in terms of extension, research and development cannot be quantified and incorporated in the measurement. The degree of overall protection otherwise might have been more substantially modified.

To a great extent, however, it might still be fair to state that the fisheries industry in Thailand is successful according to its own potential of comparative advantage. There is some negative effect from the protection system on the export production and processing in the fisheries industry. The estimations in terms of EPR and DRC from both the specific industrial survey data and the general input-output structure agree offering similar explanations.

CHAPTER VII

SUMMARY AND CONCLUSION

The Thai fisheries industry has been developed mainly from three factors: the effectiveness of the fishing method particularly the trawl net, the abundance of fishery resources and the suitable geographical characteristics of the Gulf of Thailand, and the expansion of new fishing grounds. The fisheries industry presently plays an important role in the Thai economy as the country's major sources of protein food, foreign exchange earning, and employment. Fisheries products have become the third highest foreign exchange earning commodity of the country. Thailand is also considered one of the top ten fisheries countries in the world, in terms of either production or export.

In the case of Thailand, the fisheries industry is one of the successful sources in transforming natural resources into major export products. Export of the fisheries products has shown impressive growth during the past many years. As the country has recently practiced more outward-looking policies, export promotion is then the key factor. Enhancement of the important foreign exchange earning export commodity like the fisheries products is considered to be very necessary and must be continued. The need to promote the non-traditional export products like the fisheries products is clear when considering the trade deficit and the payment imbalance of the country. With relatively better export potential, due to high demand in the world market and

increasing price trends, than other export commodities, fisheries products produce earnings that are increasingly important to Thailand.

Because of increasing scarcity of the fishery resources and competition in alternative uses between domestic consumption and export, this study attempts to make the justification that the export promotion of fisheries products is compatible with the economic rationale of comparative advantage, both at the production and the export levels.

The structure of the Thai fisheries industry is complicated since it consists of many independent productions and processings. In terms of the resources used, this study finds that the cost structure in the fisheries industry is diversified among the different activities. Evaluated at the social opportunity cost, the major factor cost can be either capital or labor depending upon the type of fishing method. However, capital, foreign input, and labor are respectively the significant cost items in the case of the trawler, the most extensive fishing method of the Thai marine fisheries.

Land appears to be the major cost for the traditional shrimp cultivation while capital is still the significant cost for the intensive type. Processings of the selected fisheries products, however, have similar cost structures to one another. Capital is clearly the most influential factor in the processing of frozen shrimp, canned tuna (with domestic raw material), and fish meal. Labor and foreign input are in very similar proportion for all processings. If assumed in the case of canned tuna with imported raw material, foreign input cost is of course the major cost.

The policy evaluation in terms of the protection system indicates that, in fact, there is no protection in the fisheries industry. The nominal protection rate (NPR) resulting from the business and municipal taxes is found in the negative value for all fisheries activities. Note that the export tax is exempted in this case. Taking into account import tariffs in the input structure and the overvaluation of domestic currency, the effective protection rate (EPR) and the net effective protection rate (NEPR) also exhibit negative values.

Marine fisheries is generally faced with the higher rate of negative protection than coastal aquaculture and processing. Trawling, which is the main production part of the Thai fisheries, is conferred the highest disincentive rate. This partly results from the use of a relatively higher proportion of foreign inputs in the production process. What can be inferred is that not only the fisheries industry has not benefited from the prevailing protection policy, but at the same time it is being penalized by the protection policy itself. In other words, return to the domestic value added is even lower than what it would be in the free trade regime.

There are no explicit export subsidies or additional support provided specifically for the export of fisheries products. All export industries are treated basically on the same export incentive policies. This study includes the two important incentive measures, the credit subsidy and the tax drawback schemes, which are applicable for export processing.

The impact of such subsidies, nevertheless, is not enough to offset the penalty imposed by the protection policy. The NEPR shows at last

that the fisheries products are still under negative protection. The exemption of export tax is important in the sense that it may implicitly help reduce the degree of negative protection. The subsidies can only partially offset some penalty from the protection policy, but still cannot lead to neutral incentives. The subsidies, therefore, are not effective to the degree that all of the penalty of negative protection is eliminated. As a consequence, the export of the fisheries products is still under the distorted trade system.

In terms of the comparative advantage, the domestic resource cost (DRC) analysis reveals that the Thai fisheries industry is producing its output with a substantial degree of comparative advantage. In spite of the higher penalty from the protection policy, the marine fisheries production appears to have a relatively greater comparative advantage than the fish processing. The intensive shrimp cultivation and the potential fishing method, purse seine, happen to be the activities with the maximum comparative advantage. In other words, they can produce one unit of foreign exchange with the lowest domestic resource cost spent. Fish processings are proven to have relatively lower comparative advantage, especially fish meal and canned tuna with domestic raw material.

The comparison of canned tuna with raw material from different sources reveals that the canned tuna with imported raw material is the better alternative in earning the foreign exchange. With a greater degree of comparative advantage, processing canned tuna by using foreign raw material, which is in fact the ongoing situation in the case of Thailand, is therefore the rational choice for producing value added to the domestic economy.

Fish meal processing is found with almost no comparative advantage at all. The total domestic resource cost spent is approximately the same as the foreign exchange earned. This estimation provides another justification to call for the reconsideration in catching of trash fish and the production of fish meal. The control in trash fish production will bring about effectiveness of resource allocation in the sense that premature fishery resources are preserved while the lower comparative advantage industry will be promoted with greater awareness.

In the DRC sensitivity, the change in export value appears to be the most important factor to the comparative advantage in the export of fisheries products. The declining of fishery resources, the fluctuation of export price of fisheries products, as well as the import price of raw material are then in this analysis the influential factors affecting the net foreign exchange earned. The variation in opportunity cost of primary factors and foreign inputs also change some degree of comparative advantage in the fisheries industry.

Considered in terms of the revealed comparative advantage or the relative export performance of the fisheries products to the total export products from Thailand, the results show strong performance. In all selected major markets, the shares of export in fisheries products are proven to be much higher than the share of total exports of Thailand. The relative shares are increasing even in relatively new markets such as the United States and German Fed. Rep. Though the export performances are still strong, the relative shares are rather stable in the traditional markets such as Japan.

The fisheries products compared to all Thai export commodities for the United States market is the commodity group with the highest relative share. It is also the second strongest export commodity for the Japan market. In terms of the revealed comparative advantage analysis, the export of fisheries products has a distinguished performance when compared to the other Thai commodities during recent years.

Overall, the study indicates that the fisheries industry in Thailand is economically advantageous either in terms of foreign exchange earned compared to domestic resource cost spent, or in terms of relative export performance in the world market. Evaluated at the social opportunity cost, the fisheries products are found to have great export potential.

The protection system in Thailand with regard to the fisheries industry, however, does not provide neutral incentives to either production or processing aspects. In fact, a penalty of negative protection still exists in this industry. The growth of the Thai fisheries exports, therefore, is not attributed to the provided protection policy, but it is the potential of the industry in terms of comparative advantage in resource use that enables it to survive and even succeed at this point in time.

Regarding the policy recommendation for the protection system, what should be the major element in the incentive policy in this case is then a more rational protection policy. Penalty in terms of implicit export tax should be corrected through the credit financing or through subsidies. The identification and measurement of the market failures

that impede industrialization are the major problems that need to be overcome. The subsidy system currently in effect in Thailand should be rationalized and strengthened with its focus on identifiable market failures. The protection by direct subsidy should be promoted to replace the protection by tariff or the combination of tariff and subsidy because tariffs create the market discrimination for the so-called "infant industry" and penalize export products from the over-valuation of domestic currency. In general, the subsidy measure should be made substantial enough to offset the penalty from the negative protection.

The present set of export incentives appears to fall short of what is actually needed to offset the bias against exports resulting from the protection system. There should be an improvement regarding the rebate-drawback system for the export, including substantially higher rates and streamlining of administrative procedure. Due mainly to the limitations of the present credit rediscounting facility, a new credit institution specifically to take care of the export finance may also be needed. The export industry proven to have the comparative advantage should be given greater priority in the investment and export promotion plan. At the same time, Thailand should be alert to every possibility for gaining new export markets. This will benefit the country not only in export expansion but also in the liberalization of protection that results from trading with only a few major markets.

Regarding the fisheries production, the future of the Thai fisheries will depend upon how the fishery resources are further exploited. The market failure in terms of overfishing should be

urgently corrected in order to maintain the degree of comparative advantage that the Thai fisheries industry holds in the international trade. The fisheries policy regarding the control of fishing effort should be strengthened, such as a higher rate of license fee. In other words, the social cost of fishery resources should be more substantially recognized and included in the decision making about the fisheries production.

However, if the supply condition in the world market is assumed to be similar to that of the Thai fisheries, the comparative advantage of the Thai fisheries industry may or may not change. This is because there will be an offset between the decline in fish supply and the rise in price.

Thailand has been in the process of industrialization with more emphasis recently placed on export promotion policy. The promotion of the non-traditional exports, such as the fisheries products, is selected as a key element in the program to improve the balance of payments and sustain the growth of the economy through increase of efficiency in resource allocation. The promotion of export products that are based on strong natural resource advantage will help reduce the need for foreign exchange and improve the relative price distortion created by the tariff structure. Therefore, it will finally overcome the problems of the undervaluation of foreign currency and the penalty for the export commodities in the world market.

This study shows a good example of a successful industry that transforms the natural resources into the export product. The fisheries industry is proved here to have comparative advantage either

in the level of production or export. If rational incentive measures for the export promotion are provided, Thailand can expect even more value added from this industry. With the right climate and conditions of international trade, the country will then be able to sustain its economic growth in the competitive world market while following the right path to the industrialized stage.

APPENDIX A

COST STRUCTURE AND REVENUE OF OTTER-BOARD TRAWL FISHERIES, 1985

Unit: Baht/month

cost/revenue	scale of operation			average	%
	small	medium	large		
cost structure					
license	82.92	234.87	319.32	212.37	0.13
capital					
depreciation	1,212.04	6,830.15	9,394.88	5,812.36	3.66
interest	5,071.70	23,944.95	47,195.60	25,404.08	16.00
labor					
wage & salary	3,860.69	15,057.81	35,635.00	18,184.50	11.45
share of catch	3,947.31	18,096.86	7,642.73	9,896.63	6.23
intermediate inputs					
fuel	15,000.30	57,094.39	93,643.75	55,246.15	34.80
lubricant	586.39	2,334.76	2,785.00	1,902.05	1.20
ice	1,847.95	11,493.07	16,276.63	9,872.55	6.22
container	340.33	2,126.74	1,765.06	1,410.71	0.89
transportation	25.00	2,388.10	1,125.00	1,179.37	0.74
food	1,712.36	5,426.66	9,501.00	5,546.67	3.50
marketing	31.08	299.70	484.27	271.68	0.17
maintenance	4,117.83	18,490.86	44,808.88	22,472.52	14.16
others	205.99	467.51	3,373.75	1,349.08	0.85
total cost	38,041.89	164,286.43	273,950.87	158,760.72	100.00
revenue					
quantity (kgs.)	7,069.45	34,810.95	65,762.15	35,880.85	
value	46,436.04	180,813.01	406,633.45	211,294.16	

Source: Department of Fisheries, Ministry of Agriculture and Cooperatives, Bangkok, Thailand.

APPENDIX B

COST STRUCTURE AND REVENUE OF PURSE SEINE FISHERIES, 1985

Unit: Baht/month

cost/revenue	scale of operation		average	%
	small	medium		
cost structure				
license	252.23	705.47	478.85	0.30
capital				
depreciation	8,377.73	11,305.12	9,841.43	6.10
interest	8,945.68	22,114.80	15,530.24	9.63
labor				
wage & salary	16,118.72	13,721.56	14,920.14	9.25
share of catch	29,808.81	69,793.64	49,801.22	30.87
intermediate inputs				
fuel	26,323.40	29,505.07	27,914.23	17.30
lubricant	1,745.55	1,987.31	1,866.43	1.16
ice	3,843.60	12,886.16	8,364.88	5.19
container	482.60	833.26	657.93	0.41
transportation	4,000.00	1,371.76	2,685.88	1.67
food	5,089.20	9,880.24	7,484.72	4.64
marketing	506.80	140.07	323.44	0.20
maintenance	18,050.51	17,874.33	17,962.42	11.13
others	2,902.06	4,059.76	3,480.91	2.15
total cost	126,446.89	196,178.55	161,312.72	100.00
revenue				
quantity (kgs.)	39,012.07	51,236.53	45,124.30	
value	321,081.76	379,532.79	350,307.27	

Source: Department of Fisheries, Ministry of Agriculture and Cooperatives, Bangkok, Thailand.

APPENDIX C

COST STRUCTURE AND REVENUE OF SHRIMP CULTIVATION

Unit: Baht/rai (0.40 acre)

cost/revenue	traditional type		intensive type	
cost structure				
land	711.00	(37.55)	711.00	(8.80)
capital				
depreciation	140.29	(7.41)	826.22	(10.23)
interest	115.58	(6.10)	87.73	(1.09)
labor				
wage	204.66	(10.81)	523.90	(6.48)
salary	228.18	(12.05)	576.00	(7.13)
intermediate inputs				
shrimp seeds	-	-	2,255.54	(27.92)
feed	-	-	2,390.85	(29.59)
fuel	302.62	(15.98)	370.60	(4.59)
lubricant	15.93	(0.84)	15.50	(0.19)
pesticides	23.28	(1.24)	72.89	(0.90)
others	151.86	(8.02)	248.90	(3.08)
total cost	1,893.40	(100.00)	8,079.13	(100.00)
revenue				
quantity (kgs.)	48.23		117.88	
value	2,744.19		21,421.15	

Notes: The traditional shrimp cultivation covers all shrimp species while the intensive type is only of Black shrimp (Penaeus monodon). Figures in parentheses are in percentage.

Sources: 1. Calculated from Department of Fisheries, Annual Report 1984, Ministry of Agriculture and Cooperatives, Bangkok, 1985.

2. Calculated from Office of Agricultural Economics, Economics of Marine Shrimp Production, Staff Paper No. 11, Ministry of Agriculture and Cooperatives, Bangkok, 1984.

APPENDIX D

COST STRUCTURES OF SELECTED FISHERIES PRODUCT MANUFACTURES

cost items	frozen shrimp (Baht/kg)[a]		canned tuna (Baht/carton)[b]		fish meal (Baht/kg.)[c]	
cost structure						
capital						
depreciation	0.22	(0.08)	0.29	(0.05)	0.19	(1.93)
interest	0.65	(0.25)	0.87	(0.15)	0.29	(2.94)
labor						
wage	4.50	(1.73)	18.00	(3.21)	0.43	(4.36)
salary	4.00	(1.54)	22.00	(3.92)	-	-
raw material	242.15	(92.99)	371.40	(66.16)	6.68	(67.75)
intermediate inputs						
ice	1.25	(0.48)	-	-	-	-
water	0.45	(0.17)	-	-	-	-
packaging supplies	2.50	(0.96)	12.25	(2.18)	0.29	(2.94)
transportation	0.30	(0.12)	4.20	(0.76)	-	-
electricity	1.75	(0.67)	5.40	(0.96)	0.27	(2.73)
maintenance & repair	0.35	(0.13)	8.95	(1.59)	0.36	(3.65)
content	-	-	12.00	(2.14)	-	-
can	-	-	84.00	(14.96)	-	-
firewood	-	-	-	-	0.77	(7.82)
fuel & lubricant	-	-	-	-	0.53	(5.37)
marketing	2.29	(0.88)	22.00	(3.92)	0.05	(0.51)
others						
total cost	260.41	(100.00)	561.36	(100.00)	9.86	(100.00)
revenue	353.06		618.99		9.48	

[a] 1 kg. of output (frozen shrimp), conversion ratio of output/input = 0.60.

[b] 1 carton = 48x6.5 oz. cans, conversion ratio = 0.35
cost/can = 549.41/48 = 11.45 Baht

[c] 1 kg. of output (fish meal), conversion ratio = 0.25

- : insignificant value or none.
Figures in parentheses are in percentage.

Sources: The survey (for frozen shrimp and canned tuna); Division of Industrial Economics, Ministry of Industry, Thailand.

APPENDIX E

ESTIMATED TAX INCENTIVES AND CREDIT SUBSIDY
FOR THE FISHERIES INDUSTRY, 1985

type of subsidy	amount (million Baht)	percent of total domestic value added
1) tax rebate	127.29	1.25
2) import duty refund	87.37	0.85
3) credit rediscount		
- frozen products	238.40	3.06
- canned products	197.90	3.87 (10.76)
- fish meal	12.97	2.20
total subsidy		
- frozen products		5.16
- canned products		5.96 (12.86)
- fish meal		4.30

Notes: 1) Due mainly to the lack of data, this study uses an average rate from the total tax rebate and import duty refund given to the fisheries export to represent the rate of individual product.

2) Figures in parentheses are in the case of canned products with the foreign raw material.

Sources: 1) Calculated from Fiscal Policy Office, Ministry of Finance, Thailand.

2) Calculated from Customs Department, Ministry of Finance, Thailand.

3) Calculated from Bank of Thailand.

APPENDIX F

EXPORT OF FISHERIES PRODUCTS FROM THAILAND
IN MAJOR IMPORTING COUNTRIES

Unit: Thousand U.S. dollars

country	year	total import		import of fisheries		market share	
		total	from Thailand	total	from Thailand	total	fisheries
the United States							
	1971	45,562,785	96,757	878,789	5,265	0.0021	0.0060
	1972	55,563,365	115,639	1,205,223	9,442	0.0021	0.0078
	1973	69,475,727	140,538	1,391,907	9,018	0.0020	0.0065
	1974	100,997,269	186,389	1,499,153	10,659	0.0018	0.0071
	1975	96,903,527	216,740	1,354,520	9,551	0.0022	0.0071
	1976	121,794,635	277,004	1,853,960	14,591	0.0023	0.0079
	1977	147,862,419	350,356	2,055,275	18,171	0.0024	0.0088
	1978	183,092,938	477,225	2,336,550	26,446	0.0026	0.0113
	1979	218,858,272	646,024	2,769,197	54,567	0.0030	0.0197
	1980	252,997,355	866,246	2,739,720	49,509	0.0034	0.0181
	1981	273,352,214	1,007,403	3,108,351	57,852	0.0037	0.0186
	1982	254,862,297	956,248	3,291,590	70,209	0.0038	0.0213
	1983	269,859,176	1,035,267	3,763,683	133,418	0.0038	0.0354
	1984	341,176,775	1,425,596	3,859,133	184,621	0.0042	0.0478
	1985	361,585,723	1,542,592	4,201,571	225,052	0.0043	0.0536
Japan							
	1971	19,711,747	230,084	398,923	22,473	0.0117	0.0568
	1972	23,470,711	252,057	567,308	33,090	0.0107	0.0588
	1973	38,313,416	394,159	989,070	48,529	0.0103	0.0491
	1974	62,094,360	685,138	1,022,653	43,723	0.0110	0.0428
	1975	57,840,162	723,527	1,197,084	70,402	0.0125	0.0588
	1976	64,798,968	848,041	1,762,000	96,602	0.0131	0.0548
	1977	70,808,654	748,201	2,195,507	84,369	0.0106	0.0384
	1978	79,342,976	842,662	3,016,550	115,043	0.0106	0.0381
	1979	110,672,248	1,169,396	3,957,355	170,838	0.0106	0.0432
	1980	140,527,652	1,119,485	3,025,746	127,580	0.0080	0.0422
	1981	143,289,675	1,061,093	3,653,080	161,760	0.0074	0.0443
	1982	131,931,214	1,040,695	3,917,568	188,753	0.0079	0.0466
	1983	126,393,051	1,018,657	3,884,334	165,256	0.0081	0.0425
	1984	136,503,049	1,039,647	4,096,182	160,190	0.0076	0.0391
	1985	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

* = non-significant value
n.a.= non-available data

Source: United Nations, Commodity Trade Statistics, various issues.

country	year	total import		import of fisheries		market share	
		total	from Thailand	total	from Thailand	total	fisheries
Australia							
	1971	4,632,108	6,886	47,184	*	0.0015	*
	1972	4,555,602	8,102	54,711	*	0.0018	*
	1973	6,811,812	11,883	76,312	179	0.0017	0.0023
	1974	11,086,520	20,248	110,548	999	0.0018	0.0090
	1975	9,831,134	22,463	72,164	970	0.0023	0.0134
	1976	11,095,114	29,962	113,484	1,531	0.0027	0.0135
	1977	12,153,915	33,068	125,158	2,844	0.0027	0.0227
	1978	14,017,966	36,875	142,109	3,716	0.0026	0.0261
	1979	16,350,872	47,822	150,226	3,845	0.0029	0.0256
	1980	19,910,764	68,878	201,484	9,503	0.0035	0.0472
	1981	23,516,787	79,729	234,040	12,562	0.0034	0.0537
	1982	23,699,247	78,206	208,766	12,704	0.0033	0.0609
	1983	19,144,807	91,826	236,037	19,805	0.0048	0.0839
	1984	22,659,000	121,265	213,045	18,326	0.0054	0.0860
	1985	23,157,809	120,781	233,796	20,473	0.0052	0.0876
German Fed. Rep.							
	1971	34,341,270	53,944	161,830	344	0.0016	0.0021
	1972	39,763,365	52,209	190,817	433	0.0013	0.0023
	1973	54,495,637	84,192	286,538	675	0.0015	0.0024
	1974	68,975,276	121,976	302,472	882	0.0018	0.0029
	1975	74,207,750	136,135	345,226	994	0.0018	0.0029
	1976	87,782,903	199,969	390,844	2,218	0.0023	0.0057
	1977	100,700,865	275,834	471,110	4,683	0.0027	0.0099
	1978	121,308,957	381,384	593,259	5,552	0.0031	0.0094
	1979	158,542,088	483,434	699,115	6,057	0.0030	0.0087
	1980	187,469,664	609,414	802,258	9,954	0.0033	0.0124
	1981	163,639,863	517,295	646,803	11,039	0.0032	0.0171
	1982	155,155,254	532,308	625,948	18,712	0.0034	0.0299
	1983	152,694,740	534,564	628,123	23,041	0.0035	0.0367
	1984	152,872,052	548,381	588,614	24,057	0.0036	0.0409
	1985	158,360,786	521,156	628,161	28,345	0.0033	0.0451

country	year	total import		import of fisheries		market share	
		total	from Thailand	total	from Thailand	total	fisheries
Singapore							
	1971	2,827,286	56,984	24,678	1,830	0.0202	0.0742
	1972	3,382,809	95,529	29,212	1,911	0.0282	0.0654
	1973	5,069,689	126,545	39,657	2,013	0.0250	0.0508
	1974	8,343,926	221,879	45,912	3,494	0.0266	0.0761
	1975	8,134,982	171,504	55,584	3,836	0.0211	0.0690
	1976	9,069,590	209,024	51,372	4,585	0.0230	0.0893
	1977	10,471,750	234,303	66,964	5,473	0.0224	0.0817
	1978	13,048,560	359,137	76,448	5,849	0.0275	0.0765
	1979	17,638,018	499,818	94,461	7,838	0.0283	0.0830
	1980	24,002,667	476,363	121,052	11,051	0.0198	0.0913
	1981	27,571,568	472,201	144,397	13,190	0.0171	0.0913
	1982	28,167,474	529,191	157,998	18,918	0.0188	0.1197
	1983	28,158,406	505,492	180,739	22,276	0.0180	0.1232
	1984	28,711,585	634,439	200,387	29,888	0.0221	0.1492
	1985	26,286,226	543,884	188,124	29,726	0.0207	0.1580
Malaysia							
	1971	1,442,357	42,770	18,093	2,828	0.0297	0.1563
	1972	1,484,154	63,125	17,012	3,580	0.0425	0.2104
	1973	2,440,676	109,304	25,334	5,332	0.0448	0.2105
	1974	4,110,629	145,857	30,812	9,206	0.0355	0.2988
	1975	3,524,645	139,462	34,501	14,075	0.0396	0.4080
	1976	3,814,202	159,380	35,889	16,875	0.0418	0.4702
	1977	4,537,807	210,681	39,587	1,580	0.0464	0.4441
	1978	5,896,567	250,332	45,689	20,800	0.0425	0.4553
	1979	7,848,509	282,157	58,897	27,732	0.0360	0.4709
	1980	10,763,526	319,750	62,239	22,406	0.0297	0.3600
	1981	11,549,484	394,342	72,125	28,873	0.0341	0.4003
	1982	12,400,205	453,687	87,283	33,553	0.0366	0.3844
	1983	13,240,800	458,250	96,047	39,105	0.0346	0.4071
	1984	14,069,041	563,720	141,945	52,520	0.0401	0.3700
	1985	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

APPENDIX G

EXPORT OF PRODUCTS FROM THAILAND IN THE JAPAN
AND THE UNITED STATES MARKETS

Unit: Thousand U.S. dollars

market and commodities	1983		1984		market share	
	total import	import from Thailand	total import	import from Thailand	1983	1984
					(percent)	
the United States						
0 foodstuffs	16,678,726	242,113	19,412,520	323,330	1.45	1.67
01 meat & preparations	2,242,018	*	2,233,513	229	*	0.01
02 dairy products	438,778	*	471,308	*	*	*
03 fish & preparations	3,763,683	133,418	3,859,133	184,621	3.54	4.78
04 cereal & preparations	340,118	11,002	458,882	14,418	3.23	3.14
05 vegetables & fruits	3,357,556	65,403	4,415,612	80,286	1.95	1.82
06 sugar & preparations	1,446,870	7,834	1,742,510	21,726	0.54	1.25
07 coffee, tea, cocoa, spice	4,142,390	18,797	5,082,727	15,437	0.45	0.30
08 feed stuffs for animals	165,086	161	187,833	152	0.10	0.08
09 miscellaneous	241,625	5,372	327,182	6,447	2.22	1.97
1 beverage & tobacco	3,709,699	15,092	4,006,457	21,069	0.41	0.53
2 crude material, excl. fuels	10,400,995	88,832	12,082,735	96,520	0.85	0.80
3 mineral fuels	60,073,122	*	63,139,278	16,326	*	0.03
4 animal & vegetable oils	541,102	4,227	745,023	3,347	0.78	0.45
5 chemical	11,269,340	11,716	14,284,684	14,990	0.10	0.10
6 basic manufactures	36,983,113	285,954	49,357,278	317,158	0.77	0.64
7 machine, transport equip	89,035,312	160,135	123,219,482	262,829	0.18	0.21
8 miscellaneous	33,458,198	214,312	45,064,528	354,297	0.64	0.79
9 goods not classified by kind	7,709,568	12,887	9,864,790	15,729	0.17	0.16

market and commodities	1983 total import	1983 import from Thailand	1984 total import	1984 import from Thailand	market share 1983 (percent)	market share 1984 (percent)
Japan						
0 foodstuffs	14,051,191	420,889	15,190,933	388,982	3.00	2.56
01 meat & preparations	1,771,560	41,522	1,697,018	57,761	2.34	3.04
02 dairy products	242,883	*	227,701	*	*	*
03 fish & preparations	3,884,334	165,256	4,096,182	160,190	4.25	3.91
04 cereal & preparations	4,190,968	11,129	4,743,274	1,031	0.27	0.23
05 vegetables & fruits	1,612,753	41,312	1,827,925	43,680	2.56	2.39
06 sugar & preparations	541,918	143,113	449,390	95,955	26.41	21.35
07 coffee, tea, cocoa, spice	973,302	8,586	1,128,819	8,213	0.88	0.73
08 feed stuffs for animals	547,857	7,612	538,922	10,350	1.39	1.92
09 miscellaneous	245,347	2,361	240,392	1,801	0.96	0.75
1 beverage & tobacco	844,900	12,074	835,762	6,453	1.43	0.77
2 crude material, excl. fuels	18,482,754	364,372	19,737,572	395,104	1.97	2.00
3 mineral fuels	59,090,976	*	60,514,068	*	*	*
4 animal & vegetable oils	268,144	1,719	372,272	1,579	0.64	0.42
5 chemical	7,008,330	22,211	8,112,305	33,148	0.32	0.41
6 basic manufactures	9,634,035	154,608	11,397,605	145,548	1.60	1.28
7 machine, transport equip.	8,907,008	12,431	10,286,035	38,961	0.14	0.38
8 miscellaneous	5,671,067	24,163	6,600,244	23,045	0.43	0.35
9 goods not classified by kind	2,434,647	6,182	3,456,253	6,755	0.25	0.20

Source: United Nations, Commodity Trade.

APPENDIX H

ADJUSTMENT OF INPUT-OUTPUT COEFFICIENTS IN MARINE FISHERIES

sector/code	input	a^{d}_{ij}	ti	si	t_{di}	a^{b}_{ij}
26.10	charcoal	0.0015	7.00	11.00	5.00	0.001321
26.20	fuel wood	0.0039	7.00	11.00	5.00	0.003435
27.00	other forest product	0.0015	40.00	11.00	9.00	0.000965
28.00	marine fish	0.0193	0.00	0.00	0.00	0.019300
57.00	ice	0.1445	0.00	11.00	9.00	0.130193
61.00	feeds	0.0019	10.00	10.50	1.50	0.001696
74.00	jute mill products	0.0073	30.00	11.00	9.00	0.005059
79.00	wood & cork	0.0010	40.00	11.00	9.00	0.000644
84.00	basic chemicals	0.0021	20.00	8.50	1.50	0.001719
93.40	L.P.G.	0.0044	10.00	11.00	1.00	0.003952
93.60	high diesel	0.2057	15.00	11.00	1.00	0.176712
93.70	low diesel	0.0016	15.00	11.00	1.00	0.001375
94.00	other petro products	0.0065	30.00	11.00	5.00	0.004712
98.00	plastic wares	0.0120	60.00	16.00	9.00	0.006727
99.00	ceramic ware	0.0001	80.00	11.00	9.00	0.000050
103.00	concrete & cement	0.0002	40.00	11.00	9.00	0.000129
106.00	steel products	0.0005	25.00	6.50	1.50	0.000393
111.00	fabricated metal	0.0048	60.00	11.00	9.00	0.002703
112.00	engines & turbines	0.0027	20.00	13.00	5.00	0.002118
113.00	agr. machinery	0.0001	20.00	16.00	5.00	0.000078
117.00	elec. indus. machine	0.0001	15.00	13.00	5.00	0.000082
121.00	elec. accumulators	0.0004	60.00	11.00	9.00	0.000225
122.00	other elec. supplies	0.0002	40.00	11.00	9.00	0.000129
123.00	ship build. & repair	0.0101	0.00	0.00	0.00	0.010100
127.00	motor vehicle repair	0.0005	0.00	0.00	0.00	0.000500
134.00	other manufactured	0.0034	40.00	11.00	9.00	0.002188
135.00	electricity	0.0003	0.00	0.00	0.00	0.000300
160.00	banking services	0.0132	0.00	0.00	0.00	0.013200
180.00	unclassified	0.0004	0.00	0.00	0.00	0.000400
190.00	total intermediate	0.4502	684.00	259.50	136.50	0.390407
201.00	wages and salaries	0.1418				0.141800
202.00	operating surplus	0.3222				0.322200
203.00	depreciation	0.0729				0.072900
204.00	taxes less subsidies	0.0129				0.012900
209.00	total value added	0.5498				0.549800

Notes: $a^{b}_{ij} = a^{d}_{ij}/(1+t_i)[1+b_i(1+s_i)]$

a^{b}_{ij} = coefficient at the border price

a^{d}_{ij} = coefficient at the domestic price

t_i = import tariff

t_{di} = business tax

b_i = business tax and municipal tax (10% of t_{di})

s_i = standard profit

Source: National Economic and Social Development Board, Input-Output of Thailand, Office of the Prime Minister, 1985.

APPENDIX I

ADJUSTMENT OF INPUT-OUTPUT COEFFICIENTS IN INLAND FISHERIES

sector/code	input	a^d_{ij}	t_i	s_i	t_{di}	a^b_{ij}
24.00	agr. services	0.0001	0.00	0.00	0.00	0.000100
25.00	logging	0.0001	1.00	11.00	1.50	0.000097
26.20	fuel wood	0.0005	7.00	11.00	9.00	0.000421
28.00	marine fish	0.0801	0.00	0.00	0.00	0.080100
29.00	inland fish	0.0854	0.00	0.00	0.00	0.085400
38.00	salt	0.0010	15.00	10.50	9.00	0.000784
49.10	rice milling	0.0186	0.00	11.00	5.00	0.017530
49.20	rice husk	0.0004	0.00	11.00	5.00	0.000377
61.00	animal feed	0.0123	10.00	10.50	1.50	0.010982
74.00	jute mill products	0.0004	30.00	11.00	9.00	0.000277
79.00	wood & cork	0.0004	40.00	11.00	9.00	0.000257
84.00	basic chemicals	0.0001	20.00	8.50	1.50	0.000082
88.00	drugs & medicines	0.0079	0.00	21.00	9.00	0.007055
93.20	regular gasoline	0.0037	36.00	11.00	1.00	0.002688
93.50	kerosene	0.0195	15.00	11.00	1.00	0.016752
93.60	high diesel	0.0097	15.00	11.00	1.00	0.008333
94.00	other petro products	0.0003	30.00	11.00	5.00	0.000217
97.00	rubber products	0.0001	50.00	16.00	9.00	0.000060
98.00	plastic ware	0.0001	60.00	16.00	9.00	0.000056
99.00	ceramic ware	0.0001	80.00	11.00	9.00	0.000050
102.00	cement	0.0002	30.00	11.00	2.00	0.000150
110.00	metal products	0.0004	30.00	11.00	9.00	0.000277
112.00	engine & turbine	0.0003	20.00	13.00	5.00	0.000235
113.00	agr. machinery	0.0002	20.00	16.00	5.00	0.000157
123.00	ship build & repair	0.0007	0.00	0.00	0.00	0.000700
127.00	motor vehicle repair	0.0005	0.00	0.00	0.00	0.000500
134.00	other manufactured	0.0036	40.00	11.00	9.00	0.002317
160.00	banking services	0.0159	0.00	0.00	0.00	0.015900
180.00	unclassified	0.0003	0.00	0.00	0.00	0.000300
190.00	total intermediate	0.2629	549.00	265.50	124.50	0.252154
201.00	wages and salaries	0.0461				0.046100
202.00	operating surplus	0.6688				0.668800
203.00	depreciation	0.0207				0.020700
204.00	taxes less subsidies	0.0015				0.001500
209.00	total value added	0.7371				0.737100

APPENDIX J

ADJUSTMENT OF INPUT-OUTPUT COEFFICIENTS IN FISH PROCESSING

sector/code	input	a^d_{ij}	t_i	s_i	t_{di}	a^b_{ij}
28.00	marine fish	0.5071	0.00	0.00	0.00	0.507100
29.00	inland fish	0.0149	0.00	0.00	0.00	0.014900
38.00	salt	0.0004	15.00	10.50	9.00	0.000314
48.00	animal oil	0.0001	30.00	10.50	9.00	0.000069
55.10	sugar	0.0016	65.00	10.50	9.00	0.000874
57.00	ice	0.0006	0.00	11.00	9.00	0.000541
58.00	monosodium glutamate	0.0010	60.00	10.50	9.00	0.000563
60.00	other food products	0.0078	60.00	10.50	9.00	0.004394
66.00	tobacco products	0.0001	30.00	21.00	1.50	0.000075
71.00	knitting	0.0001	30.00	4.00	1.50	0.000076
79.00	wood & cork	0.0005	40.00	11.00	9.00	0.000322
81.00	pulp & paper	0.0002	10.00	11.00	1.50	0.000179
82.00	paper products	0.0001	40.00	11.00	9.00	0.000064
83.00	printing & publishing	0.0003	40.00	11.00	9.00	0.000193
84.00	basic chemicals	0.0021	20.00	8.50	1.50	0.001719
89.00	cleaning preparation	0.0009	60.00	11.00	9.00	0.000507
93.20	regular gasoline	0.0054	36.00	11.00	1.00	0.003923
93.40	L.P.G.	0.0054	10.00	11.00	1.00	0.004850
93.70	low diesel	0.0001	15.00	11.00	1.00	0.000086
93.80	fuel oil	0.0005	15.00	11.00	1.00	0.000430
98.00	plastic ware	0.0009	60.00	16.00	9.00	0.000505
100.00	glass products	0.0001	30.00	5.50	5.00	0.000073
107.00	non-ferrous metal	0.0002	17.00	7.00	1.50	0.000168
108.00	hand tools	0.0008	20.00	11.00	9.00	0.000601
111.00	fabricated metals	0.0224	60.00	11.00	9.00	0.012614
115.00	industrial machinery	0.0012	20.00	16.00	5.00	0.000940
117.00	elec. indus. machinery	0.0001	15.00	13.00	5.00	0.000082
127.00	motor vehicle repair	0.0001	0.00	0.00	0.00	0.000100
133.00	recreation equipment	0.0002	10.00	21.00	9.00	0.000162
134.00	other manufactured	0.0003	40.00	11.00	9.00	0.000193
135.00	electricity	0.0013	0.00	0.00	0.00	0.001300
139.00	building construction	0.0002	0.00	0.00	0.00	0.000200
147.00	restaurant & drinking	0.0042	0.00	0.00	0.00	0.004200
148.00	hotel & lodging	0.0008	0.00	0.00	0.00	0.000800
150.00	road transport	0.0003	0.00	0.00	0.00	0.000300
158.00	storage & warehouse	0.0008	0.00	0.00	0.00	0.000800
159.00	post & communication	0.0001	0.00	0.00	0.00	0.000100
160.00	banking services	0.0015	0.00	0.00	0.00	0.001500
164.00	business services	0.0002	0.00	0.00	0.00	0.000200

sector/code	input	a^{d}_{ij}	t_i	s_i	t_{di}	a^{b}_{ij}
177.00	repair unclassified	0.0007	0.00	0.00	0.00	0.000700
180.00	unclassified	0.0016	0.00	0.00	0.00	0.001600
190.00	total intermediate	0.5872	848.00	307.50	161.50	0.568315
201.00	wages & salaries	0.0930				0.093000
202.00	operating surplus	0.2837				0.283700
203.00	depreciation	0.0261				0.026100
204.00	taxes less subsidies	0.0100				0.010000
209.00	total value added	0.4128				0.412800

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