INDUSTRIAL PROTECTION AND INCOME DISTRIBUTION IN THAILAND

Isra Sarntisart

A thesis submitted for the degree of
Doctor of Philosophy
of the Australian National University.

September, 1993

DECLARATION

Unless otherwise indicated
this thesis is my own work.

Isra Sarntisart
September 1993

To my Mother and
to the Memory of My Father

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge my indebtness to many people for all of their assistance during the years of my PhD study.

My particular appreciation is to my supervisor, Prof. Peter G. Warr, whose support and guidance has been unfailing, and to my advisors - Drs. Medhi Krongkaew, George Fane, and Kali Kalirajan - whose encouragement and advice has been very helpful.

Members of and visitors to the Department of Economics, Research School of Pacific Studies also allowed me to interrupt their valuable time. I especially appreciate Prof. Ross Garnaut, Drs. Ross McLeod, Chris Manning, Hal Hill, and S. Mahendrarajah, for their valuable suggestions, and Dr. Premachandra Athukorara, whose short visit to the Department was very helpful.

I am indebted to many people at the Australian National University. My special thanks go to Dr. Trevor Breusch, Ross Cunningham, and Christine Donnelly, whose suggestions and assistance have been encouraging and helpful; and to Dr. P.N. Junankar, Dr. Rod Tyers, participants in PhD workshop, and my fellow PhD students, with whom discussion has been most constructive. I have also benefitted from discussion with members of the Australia-Thai ACIAR project.

The success of my field work was facilitated by the great assistance of many people in Bangkok. My sincere thanks go to friends and officials at the Thailand Development Research Institute Foundation, the Department of Business Economics, the National Economic and Social Development Board, the National Statistical Offices, the Office of Agricultural Economics, and the Rubber Research Institute.

I am also grateful to the Department of Economics in the Research School of Pacific Studies, for financial support during my PhD study, and to the Winrock Foundation for the initial sponsorship for my Masters study.

I wish to express my sincere thank to Carol Kavanagh. Her editorial assistance has been very helpful.

Finally, my special thanks go to my mother, brother, and sisters for their thoughful encouragement and data collection, and to my family for being understanding and patient.

ABSTRACT

During the past three decades, economic growth in Thailand has been marked by the growing dominance of the manufacturing sector. The share of manufacturing in GDP and in total exports has increased markedly. At the same time, there has been a sluggish increase in the share of manufacturing employment in the total labour force. Consequently, the gap between output per worker in agriculture and the manufacturing sector has widened. Concurrently, the distribution of income in Thailand has become more unequal.

The role of industrial protection in industrial development is well-known. Many studies have estimated the degree of industrial protection in Thailand during the past three decades. Many have also attempted to establish the impact of a move from an import substitution regime towards an export promotion regime. However, no previous studies have examined the impact of trade liberalisation on income distribution, which is very important in policy decisions.

Based on a computable general equilibrium (CGE) model, this thesis attempts to answer the question: 'What would be the income distribution impact of a move from the 1987 system of industrial protection towards free trade?' The answer to this question contributes to empirical knowledge in the area of protection and income distribution in Thailand.

This thesis also offers methodologies to estimate the size distribution of income, and to incorporate income distribution into a general equilibrium framework. The methodologies enhance the analysis of poverty incidence, as well as income inequality. The methodologies are applied to analyse the income distribution impact of a move from the 1987 system of industrial

protection towards free trade, at the national, community, and regional levels.

As part of the database construction, the thesis also constructs a Social Accounting Matrix (SAM) for Thailand, and estimates a system of consumer demand. SAM provides some important information for the CGE model, such as production technology and a factor ownership matrix. The estimation of consumer demand consists of demand for ten commodities by ten types of households, enriched by price information. This is the most detailed estimation of consumer demand everdone for the Thai economy.

Results from simulations using the CGE model confirm the argument in support of free trade. They show that while the move towards free trade would lead to a more equal distribution of income, it would also lead to a government budget deficit. The government might choose to borrow or raise more revenue, through an across the board increase in indirect tax rates or direct tax rates, to finance its budget deficit. The decision of the government has important consequences for income distribution.

CONTENTS

FIGURES

TABLES

Page

Page

GLOSSARY

-	Not Available.
Baht	Thai Currency, about 25.50 Bahts/US$.
ERP	Effective Rate of Protection.
ESAN	Esan, the Northeast.
FGT^2	Foster, Greer, and Thorbecke Index of Order 2.
HCR	Head-Count Ratio.
LES	Linear Expenditure System.
NESDB	Office of the National Economic and Social Development Board.
NRP	Nominal Rate of Protection.
NSO	National Statistical Office.
OAE	Office of Agricultural Economics.
SCV	Square of Coefficient of Variation
SES	Household Socio-economic Survey.

- CHAPTER 1 -

INTRODUCTION

Higher productivity and economic growth are not the only objectives of industrialisation. Industrialisation is a means of achieving at least four more basic objectives (United Nations, 1974, quoted in Meier, 1976). First, it is viewed primarily as a means of improving working conditions and living standards for the poor. Second, it has to be closely involved with the development of all other sectors in the economy. Third, the income generated by economic growth has to be distributed sufficiently widely to promote perceptible improvements in general living standards. Fourth, it should also promote a greater sense of confidence and self reliance of the country.

The arguments for protection in industrial development are well known. Temporary protection may assist a young industry to compete with foreign industry and develop its latent strength. It also allows the transfer of resources from agriculture to the manufacturing industry required for industrialisation. In addition, industrial protection turns terms of trade against agriculture. It, therefore, maintains low manufacturing wage rates by providing cheap food for the manufacturing workers.

On the other hand, protection allows domestic industry to produce at a higher cost and be inefficient. Because prices are distorted by protection, resources are redirected away from more productive uses. Subsidy or special priviledge for export also affects firms' decisions to sell in domestic or world markets. Because industrial protection attracts productive resources out of agriculture, the development of agricultural technology and productivity are hampered. As a result, differences in the productivity of the two sectors do not converge and spatial income distribution is not improved.

The problem of income distribution can be viewed in both absolute and relative terms. In relative terms, income inequality is primarily concerned with the income position of individuals or households in relation to each other. Changes in income inequality indicate how the benefits of economic growth are distributed among individuals and households. Changes in inequality are socially subjective, however, and are tolerable as long as the process of change involves Pareto improvement - absolute gains for all - and does not preclude future and more desirable distributional changes (Adelman and Robinson, 1989). Poverty incidence is primarily concerned with the minimum level of income needed to maintain a given standard of living. Increases in poverty incidence incur hardship. When income becomes so low that people cannot survive or maintain normal activity, their poverty indirectly creates problems for those who are not poor, and becomes a cost to the whole community.

1.1. Background of the Problem

The last three decades have witnessed impressive economic growth in the Thai economy. Industrial development, an outward looking strategy, and the world economic environment are behind the success. However, despite the high growth record, Thailand has failed to distribute the benefits of economic growth equitably. Income inequality has been worsening since industrialisation began, while poverty incidence has improved. There has been increasing concern with the problem of income distribution. In the seventh development plan (1992-1996), the Thai government has given priority to the problem, by focusing on the reduction of poverty and an increase in income of the targetted groups, particularly poor farmers and farm workers.

Beginning with a relatively small and basic industrial sector, Thailand initially opted for an import substitution regime, and then moved towards an export promotion regime. The advantages and disadvantages of the two regimes have been well discussed in the literature. In sum, import substitution is expected to supply domestic demand, especially for consumer goods, initially to foster industrialisation and improve the balance of payments. Provided that it is not over subsidized, export promotion has three main supports. First, the domestic resource cost of earning one unit of foreign currency by export promotion is said to be less than the domestic resource cost of saving one unit of foreign currency by import substitution. Second, the process of industrialisation through export promotion rests on exogenous world demand, and is not limited by a narrow domestic market, as is import substitution. Third, it is likely to have more linkages to agriculture and can upgrade the skill of labour. Because export industries are relatively labour intensive, it is also expected to utilize the country's labour surplus, increase employment, and improve the distribution of income.

Many empirical studies have attempted to establish a relationship between income distribution and a change in policy from an import substitution strategy to an export promotion strategy, especially through employment and the functional distribution of income. Narongchai (1975) asserts that import protection policies in Thailand induced capital intensive investment and have not created sufficient non-agricultural employment. Narongchai (1977) also supports the move towards export promotion strategy by showing that it would increase employment in every sector. Kim and Vorasopontaviporn (1989) show that, if national income increases exogenously, not only the export sector but also the non-traded sector in Thailand can create more employment than the import competing sector. However, Phornphen (1987) and Wattananukit and Bhongmakapat (1989 in Teerana, 1990), both based on a computable general equilibrium model, point to the unfavourable income distribution impact of export expansion. Phornphen points out that a (negative) shock of world demand for Thai export leads to a reduction in income of farmers and casual labourers. Thus, income inequality is worsened. Wattananukit and Bhongmakapat, in assessing the impact of export expansion on income distribution, found that export led growth did not encourage overall income equality, and increased income inequality. They maintain that the expansion of agricultural exports has a favourable income distribution impact, since it has better forward linkages, requires less imported machinery and raw materials, and benefits the lower income classes, especially farmers. Whereas, manufacturing export only benefits non-agricultural households.

The relationship between industrial protection and income distribution has been of considerable interest to economists. Generally, the literature focuses on the functional distribution of income, i.e., returns to labour and capital. In the neoclassical world of two countries, two mobile factors, and two sectors, the Stolper-Samuelson theorem states that an increase in the relative price of a commodity will increase the return to factor used intensively in the production of that commodity in relation to both commodity prices and will reduce the return to the other factor. Thus, protection will benefit the factor used intensively in the protected sector. However, Magee (1978) shows that the theory is not supported by empirical evidence, since all factors of production in protected industries support protection. The so-called Ricardo-Viner-Jones specific factors model focuses on a short run impact, in which a factor is specific to sectors of production. The model states that the income distribution impact of protection depends on the consumption basket of consumers.

The implications of these two sector models are limited by the simplicity of their assumptions since the reality is more complicated. Other studies attempt a multi-sectoral model (e.g., Jones, 1975). But, most of them focus on partial equilibrium analyses, that fall short of capturing the behaviour of economic agents in the general equilibrium framework, and lack emphasis on the impact of protection on the size distribution of income. Empirical studies on the effect of trade liberalisation show that many developing countries experience average annual positive growth rates in the post-liberalisation era (Michaely et al., 1991). As also pointed out by the same study, there is no evidence that lower income groups benefit from liberalisation nor there is any confirmation that liberalisation leads to a deterioration of income distribution.

In the case of Thailand, the impact of industrial protection on poverty incidence and income inequality has not been satisfactorily investigated. No previous studies have examined the impact of the system of protection on the size distribution of income, which is very important in policy decisions, both in terms of economic growth and welfare.

Available studies on industrial protection and income distribution in Thailand are limited and fall into two categories. Firstly, Corden (1967), Chalongphob, Pranee, and Tienchai (1988), and Overbosch et al. (1988) are studies in which the overall income distribution impact of protection is seen to be ambiguous. Corden points to the progressive effects of import duties, since imports are consumed mainly by the better-off sections of the community. He also points to the regressive effects of an export tax on rice, since it is a transfer of income from rice producers, especially poor rice growers in the Northeast, (possibly) traders, and millers to the government. Chalongphob, Pranee, and Tienchai, based on a CGE model, found that the impact of replacing import taxes with a proportional tax on household income, to generate exactly the same total tax revenue, was unclear. Their results depended on the closure of the model. With fixed investment, inequality of real household income worsens. With a fixed current account, inequality improves. Overbosch et al., based on THAM-2 CGE model, found that the income distribution impact of government intervention in agriculture is inconclusive. On the other hand, Fabers and Kennes (1982, quoted in O'mara and Le-si, 1985), based on a multi-sectoral macro-economic model, point to the resource allocation effect of a reduction in import tariffs, since the share of agriculture in GDP significantly increases. Therefore, their results indicate that the income distribution impact of a reduction in import tariffs is favourable.

The impact of industrialisation and trade policy in Thailand has not yet been fully investigated and clarified. In particular, the impact of industrial protection on poverty and income inequality has not been examined by any past studies.

1.2. General Equilibrium and Income Distribution

Because of the interrelationship of all sectors of the economy, especially between agriculture and manufacturing, the problem of industrial protection and income distribution requires a general equilibrium analysis. The theoretical structure of a computable general equilibrium (CGE) model is well known. Based on the traditional Walrasian equilibrium, a CGE model consists of a system of equations which explain the behaviour of various economic agents in the economy. General equilibrium is similar to partial equilibrium, in that it assumes all producers to be profit maximisers; consumers to be utility maximisers; and production factors paid according to their marginal revenue products. It differs from a partial equilibrium model in that, whereas in a partial equilibrium model all prices other than the price of a good under consideration are assumed to remain constant, in a general equilibrium model all prices are variables, and quantity adjusts accordingly. By making profit and utility maximisation feasible and consistent, the solution set provided by the CGE model clears all factor and goods markets simultaneously.

With the relatively large size and complicated nature of the CGE model, four different approaches have been developed in order to solve for the solution (Robinson, 1989). The approach used in this thesis, the linearized Johansen type CGE model, which was introduced by Johansen in 1960, involves the linearization of all equations in the model and then solving them by a matrix inversion. Although this approach has been used in many applications in many countries, its application to income distribution has not been fully explored.

Generally, income distribution in CGE is measured by the functional distribution of income - distributive shares among factors of production - and the socio-economic or class distribution of income. The functional distribution of income is partly explained by the distribution rigidity of production functions employed by the model. Typical is the well-known Cobb-Douglas production function, which implies constant factor shares in the total production cost, while the Leontief, the constant elasticity of transformation (CET), and the constant ratios of elasticities of transformation and homothetic (CRETH) production functions imply that factor shares are functions of the return to those factors. Based on the functional distribution and a factor ownership matrix, the class distribution can be determined. The factor ownership matrix explains how each class derives its income from various factors of production. The distribution of income within each class explains how equal income is distributed among members of the class.

All other elasticities also affect income distribution in the model, particularly various elasticities of consumer demand. Based on the disaggregation of consumers, the elasticities of demand allows consumers to have different responses to a policy shock through changes in income and prices. It can also illustrate how a policy shock affects the welfare of consumers differently. This thesis estimates these important parameters.

CGE modellers can measure the distribution impact of a policy shock in several ways. Generally, the focuses are on the functional distribution of income and economic welfare by means of the compensating variation and the equivalent variation. Some modellers use the changes in utility indices of consumer groups to show the distribution impact of policy being simulated (Sierra-Puche, 1984). Some modellers transform the class distribution of income into the size distribution of income by using a parametric probability density function such as lognormal and uniform distributions (Adelman and Robinson, 1978, de Melo and Robinson, 1980, and Narayana et al., 1987). Following the estimation of a parametric probability density function, the impact of policy shocks on poverty and inequality can be measured.

The use of a parametric density function has some theoretical weaknesses, especially the fitness of the function to data. Another alternative, a non-parametric density function, has many strengths which will be discussed in Chapter Six. Most importantly, it can be used in a general equilibrium model and, particularly in a linearised model. With an appropriate understanding of the measurement of poverty and income inequality, it can also be used to explore and detail the impact of shock on income distribution in a general equlibrium framework at disaggregated levels. This thesis is the first that attempts to do so.

1.3. Organisation of the Thesis

The thesis attempts to answer the question: ***What would be the income distribution impact of a move from the 1987 system of industrial protection towards free trade?*** The answer to this question will contribute to empirical knowledge in the area of protection and income distribution in Thailand.

The thesis is organized into four main parts - background (Chapters Two and Three), modelling and parameter estimation (Chapters Four, Five, and Six), simulation results (Chapter Seven), and main conclusion (Chapter Eight).

Chapter Two presents the historical background of industrialisation in Thailand, including economic growth and structural change, and industrial protection policies during the 1960s, 1970s, and 1980s. The chapter also reviews the literature on the estimates of nominal and effective rates of protection during the period. Based on the allocation of resources, changes in productivity, and industrial location, the chapter points to a relationship between protection, and the functional and regional distribution of income.

Chapter Three examines changes in poverty incidence and income inequality during the three decades. Although the chapter presents the long run trend of poverty incidence and income inequality, the main focus is the mechanism behind these changes.

To answer the central question of the thesis, Chapter Four constructs a general equilibrium model for the Thai economy within a consistent framework of a Social Accounting Matrix (SAM). The model, in the tradition of the linearized Johansen class of multi-sectoral models, is designed to reflect the main features of the Thai economy. The chapter constructs a 1988 SAM, which provides some important information on the circular flow of the Thai economy, production technologies, and income distribution such as a factor ownership matrix. The chapter also discusses the rationale behind the parameterization of the CGE model.

Chapter Five deals with the theory and an estimation of consumer demand. Unlike estimates from past studies, these estimates do not presume that all households face the same price. In the model, the estimates explain how ten types of households adjust their demand for ten consumer goods, when prices and their total consumption expenditure are changed by a policy shock.

The methodological contribution of the thesis is in Chapter Six. The chapter offers methodologies to estimate the size distribution of income, and to incorporate income distribution into a general equilibrium framework. The methodologies enhance the analysis of poverty incidence and income inequality both at the national and disaggregated level. The chapter also estimates parameters used in the modelling of income distribution in the general equilibrium model.

Chapter Seven presents and analyses the impact of a move towards free trade. The move towards free trade leads to a government budget deficit. The analysis in the chapter is designed to capture the differences in the impact of the way the government chooses to finance the deficit. The impact on income distribution, the primary concern of this thesis, is examined at regional and community levels. The chapter also analyses the sensitivity of the results when the CGE model departs from some critical assumptions.

Chapter Eight summarizes the thesis. The chapter also presents the main findings, and makes suggestions for policy implementation and future research.

- CHAPTER 2 -

INDUSTRIALISATION AND PROTECTION DURING THE 1960s, 1970s, and 1980s

2.1. Introduction

Economic growth in Thailand has been marked by the growing dominance of the manufacturing sectors. Expansion of manufacturing in the 1960s was dominated by protected industries, which were geared toward the domestic markets for consumer goods. At the beginning of the 1970s, when domestic markets were saturated, the country moved toward an export oriented strategy. Manufactured exports have gradually taken the place of the export of primary products. The economic importance of agriculture has been declining, not only in GDP share, but also in its share of Thailand's international trade.

Industrial protection has played an important role in the performance of Thai manufacturing, raising the domestic price of manufactured products above world prices and attracting resources from agriculture and other sectors. Thus, the growth of agriculture, the biggest pool of employment, has been restrained. With accelerating and sustained economic growth, demand for food commodities shows a declining trend in relation to demand for non-food commodities.

Estimates of the level of industrial protection during the past three decades are reported by many studies. These studies focus on the estimation of measures, such as the nominal rate of protection (NRP), and the effective rate of protection (ERP), by which the resource allocation impact of protection could be analysed. However, none of the studies discuss directly the impact of industrial protection on income distribution, which is very relevant in terms of policy decisions. Although it is well understood that the present situation of poverty incidence and income inequality cannot be solely explained by industrial protection policies, the pattern of industrial protection may have some dimensions which could shed some light on the impact of protection policies on income distribution in Thailand.

This chapter seeks to examine these dimensions. The first section provides a broad picture of the Thai economy. The second presents industrialisation and the systems of industrial protection during the 1960s, 1970s, and 1980s. The third section examines productivity differences, and the regional dimension of industrialisation and industrial protection, which might have some distributional impact. The final section summarizes the chapter.

2.2. Economic Growth and Structural Change

The Thai economy has grown rapidly during the past three decades. The annual average growth rate was approximately 8% in the 1960s, and declined to 7% in the 1970s. During the first half of the 1980s, the growth rate fell to 5.7%, but rose dramatically to nearly 10% in the second half. With an annual population growth rate of about 2%, the growth of per capita GNP reached 8% in that period.

During the past three decades of modern industrialisation, the manufacturing sector has increasingly become a dominating sector. The structure of the Thai economy has been changing from an agricultural to a manufacturing base. The growth rate of the manufacturing labour force was extremely high, although the absolute level was not enough to shift the structure of employment. The majority of labour was still in agriculture. The share in GDP of the agricultural sector sharply declined from nearly 40% in 1960 to 16.7% in 1985, and 12.4% in 1990. The shares of two major crops, paddy and rubber, in GDP declined from 10.5% and 3.4% to 3.4% and 0.9%, much faster than other agricultural products. These reductions accompanied a more than 100% expansion of the manufacturing sector from 12.5% to 26.1% of GDP. The share of other sectors gradually increased from about 48% to more than 60% in the same period.

TABLE 2.1: Structure of Gross Domestic Product and the Composition of Manufacturing at Current Prices, by Industry: 1960-1990

Industry	1960	1970	1980	1985	1990
GDP (billion Baht)	54	147	659	1014	2051
Total Share (%)	100	100	100	100	100
Agriculture	39.8	25.9	23.2	16.7	12.4
Manufacture	12.5	15.9	21.3	22.1	26.1
Others	47.7	58.2	55.5	61.2	61.5
Manufacturing (%)	100	100	100	100	100
Food & beverages	42.8	31.9	20.1	24.8	18.7
Tobacco & snuff	14.5	7.4	5.3	5.1	3.0
Wearing apparel & leather	8.4	11.3	12.1	16.1	18.9
Textiles	4.7	7.5	12.2	9.9	10.5
Petroleum refining	.04	5.7	8.2	6.8	4.5
Non-metallic minerals	4.0	4.3	3.7	4.7	4.6
Electrical machinery	0.6	1.9	2.4	2.6	3.4
Transport equipment	4.9	5.2	8.2	4.9	9.4
Others	20.1	24.8	27.8	25.1	27.0

Note: There are two series of the National Income of Thailand - old and new series. Differences between the two series are definition, method of calculation, and the base years. Data at constant prices in the old series are based on 1962 prices while those in the new series are based on 1972 prices. In this table, 1960 data are from the old series. The ten year average annual growth rate in 1970 is also based on the old series. The remaings are based on the new series.
Source: National Income of Thailand (various issues), NESDB.

A shift away from simple processed agricultural based industries, which were discriminated against, to highly processed and protected industries, has also characterised the rapid expansion of the manufacturing sector. Typical is the total share of food, beverages, tobacco, and snuff in total manufacturing products, which decreased from more than 57% in 1960, to about 22% in 1990, while the total share of wearing apparel, leather, and textiles increased from 13% to 29%. The share of other protected industries, such as electrical machinery and transport equipment also increased.

TABLE 2.2: Import, by Economic Classification: 1960-90

Types	1960	1970	1980	1985	1990
Import value (billion Baht)	10	27	189	251	842
Average Growth (%)	-	11.0	22.4	6.4	28.9
Total Share (%)	100	100	100	100	100
Consumer goods	35.0	19.4	10.2	9.5	9.0
Non-durable	26.6	12.9	6.5	5.1	3.8
Durable	8.4	6.5	3.7	4.4	5.2
Intermediate and raw materials	18.1	24.9	24.0	30.2	33.3
for Consumer goods	10.7	15.3	14.9	20.4	22.2
for Capital goods	7.4	9.6	9.1	9.8	11.1
Capital goods	24.6	34.7	24.4	30.0	38.8
Other imports	22.3	21.0	41.4	30.3	18.9

Note: 1990 data are predicted figures.
Source: Quarterly Bulletin (various issues), Bank of Thailand.

The high growth rates were dominated by world demand for Thai products, particularly manufacturing products (UNIDO, 1985). The importance of the primary sector in trade is gradually declining. Export of manufactured goods, machinery, and miscellaneous manufactured goods, which had very low share of about 1% of total exports in 1960, emerged as major exports with a total share of more than 60% by 1990. The total share of food and crude materials decreased from more than 95% in 1960 to only about 34% in 1990. The share of consumer goods in total imports sharply declined from nearly 35% in 1960, to 9% in 1990, while the share of intermediate products and raw materials for the production of consumer goods, and the share of capital goods, increased from 10.7% and 24.6% in 1960 to 22.2% and 38.8% in 1990, respectively.

TABLE 2.3: Export, by End Use: 1960-90

Types	1960	1970	1980	1985	1990
Export Value (billion Baht)	9	15	133	193	587
Average Growth (%)	-	5.9	25.8	8.2	25.1
Total Share (%)	100	100	100	100	100
Food	45.4	47.1	44.6	44.8	28.2
Beverages and tobacco	0.3	1.4	1.0	0.9	0.4
Crude materials	50.0	28.9	14.3	10.1	5.5
Mineral fuel and Lubrication	0.0	0.3	0.1	1.3	0.8
Animal & vegetable oils & fat	0.0	0.1	0.2	0.3	0.0
Chemicals	0.1	0.2	0.7	1.3	1.4
Manufactured goods	1.1	14.8	22.1	18.5	18.4
Machinery	0.0	0.1	5.7	8.8	22.3
Miscellaneous manufactured	0.2	0.4	6.4	12.4	21.5
Miscellaneous	0.7	3.2	2.8	0.7	1.2
Re-export	2.2	3.5	2.1	0.9	0.3

Note: 1990 data are predicted figures.
Source: Quarterly Bulletin (various issues), Bank of Thailand.

2.3. Industrialisation and Protection

The crucial role of Thailand's industrial protection policies in the expansion of manufacture has been accepted in the literature. Conventional explanation of the impact of protection is that protection raises domestic prices above world prices, bids up the return to mobile factors of production, and redirects resources from the unprotected sectors to the highly protected sector. Consequently, protected sectors, e.g., manufacturing or highly processed industries, expand at the expense of non-protected sectors, e.g., agriculture or simple processed industries. Other sectors, such as the non-traded sectors, are also affected but to a lesser degree.

During the past three decades of industrialisation, expansion of manufacturing has been characterised by the reallocation of resources in favour of manufacturing and at the expense of agriculture. Between 1970 and 1989, capital stocks in the agricultural sectors expanded at decreasing rates, while those of manufacturing and other sectors are quite steady (Table 2.4). Direk (1990), by showing that the lowest return to capital is in agriculture and the highest return to capital is in manufacturing, points to the same conclusion. The manufacturing labour force also expanded at a much faster rate than agricultural labour (Table 2.5). The average annual growth of the agricultural labour force, at around 2-3%, can be considered a result of natural growth rather than resource allocation. The average annual growth rate of the labour force in manufacturing and other sectors was more than double that of agricultural labour. However, the share of agricultural labour in the total labour force, which was about 82% in 1960, was still more than 65% in 1990.

TABLE 2.4: Net Capital Stock at 1972 Prices, by Sector: 1970, 1980, 1985, and 1989. (Million Baht)

Industry	1970	1980	1985	1989
Total	299854	696556	990197	1287499
(Share in %)	(100.00)	(100.00)	(100.00)	(100.00)
Agriculture	25694	47484	61698	68807
	(8.57)	(6.82)	(6.23)	(5.34)
Manufacturing	70674	189948	266189	356721
	(23.57)	(27.27)	(26.88)	(27.71)
Others	203486	459125	662310	861971
	(67.86)	(65.91)	(66.89)	(66.95)
Average Growth Rate (%)	-	8.79	7.29	6.78
Agriculture	-	6.33	5.38	2.76
Manufacturing	-	10.39	6.98	7.59
Others	-	8.48	7.60	6.81

Source: Unpublished Data, National Economic and Social Development Board.

2.3.1. Development of Industrial Protection

Modern industrialisation in Thailand did not start until around the late 1950s and the beginning of the 1960s. Since 1958, the policy of the government has been to promote and guarantee private investment, and to provide infrastructure. In its first development plan (1961-66), the Thai government encouraged industrial expansion in the private sector, mainly by granting privilege and protection to import competing industries. After years of import substitution, Thailand moved to limit import substitution with a gradual change to export promotion. The aims of the second plan (1967-71), emphasized both agricultural and manufacturing export. The plan also focussed on the quality of export products. However, export was not actively promoted during this plan.

TABLE 2.5: Labour Force, by Industry: 1960, 1970, 1980, and 1990

Industry	1960	1970	1980	1990
Labour Force (Thousand)	13772.1	16652.3	23281.4	31724.3
(Share in %)	(100.0)	(100.0)	(100.0)	(100.0)
Agriculture	11334.4	13201.9	16820.6	20635.1
	(82.30)	(79.28)	(72.25)	(65.04)
Manufacturing	471.2	682.6	1308.5	2248.7
	(3.42)	(4.10)	(5.62)	(7.09)
Others	1966.5	2767.7	5152.4	8840.5
	(14.28)	(16.62)	(22.13)	(27.87)
Average Growth Rate (%)	-	1.92	3.41	3.14
Agriculture	-	1.54	2.45	2.06
Manufacturing	-	3.78	6.72	5.56
Others	-	3.48	6.41	5.55

Note: In 1960, 1970, and 1980, labour force is defined as employed population aged 11 years and over. In 1990, it is defined as employed population aged 13 years and over, which is on average about 4-5% lower than the former definition.
Source: Report of the Population and Housing Census (various issues), National Statistical Office.

Since the third development plan (1972-1976), the government has attempted to promote export industries. The aims of the third plan were to promote the export of agricultural and manufacturing products, using locally available raw materials. The two following plans still focused on the export sector, but with more emphasis on marketing, industrial decentralization, and promoting heavy industry. Different rates of special privilege were granted to promoted firms located in provincial areas. The aim was to decentralize industrial location away from Bangkok and surrounding provinces. More export industries were added to the list of promoted industries. Protection for export industries increased. However, import competing industries were still heavily protected.

The motives behind industrial protection policies in Thailand are difficult to verify. Generally, there were four objectives for protection.

The initial objective was to raise revenue (Ingram, 1971). Trade tax is an important source of government revenue. Between 1972 and 1981, trade tax contributed about 25%-31% of government revenue. Of this, nearly 90% was revenue from import tax (Tables 3.7-3.8, Narongchai and Juanjai, 1986). In the 1980s, it was still an important source of government revenue.

Protection has been regarded as an appropriate means to stimulate industrialisation. The so-called infant industry argument asserts that temporary protection may be required for a young industry to be able to compete with foreign industry and to develop its latent strength. However, many industries that were receiving high protection in the 1960s and the 1970s were still heavily protected in the 1980s. Nishimizu and Page, Jr. (1986), studied the comparative advantage of 22 industries, and concluded that infant industry arguments for protection in Thailand, based on improvement in total factor productivity and international competitiveness, are only supported empirically in a minority of protected industries.

The infant industry argument is often accompanied by the employment argument. In the case of Thailand, the relationship between labour intensity and the level of protection rejects this argument. Table 2.6 presents OLS estimates of the relationship between the level of protection and labour intensity in the protected sectors. The level of protection is based on the 1987 system of protection estimated by Paitoon et al. (1989). Due to the availability of data, the sectoral labour intensity, the ratio between the wage bill (wL) and the total non-wage bill (rK), is based on the 1985 input-output table. Empirical evidence shows that there is a negative relationship between labour intensity and the level of protection (NRP or ERP). Although the regression coefficients are quite low, the result of NRP is significant while that of ERP is insignificant. Most importantly, they indicate that protection tends to be lower for labour intensive industries.

TABLE 2.6: Regression Analysis of a Relationship between the Level of Protection and Labour Intensity: 1987.

Variables	Coefficient	t-statistics
Dependent Variable: ERP		
Constant	0.3848	3.6790
wL/rK	-0.0575	-1.6104
Dependent Variable: NRP		
Constant	0.2163	7.6220
wL/rK	-0.0255	-2.6303

Note: Based on models: ERP = constant+β(wL/rK), and NRP = constant+β(wL/rK).
Sources: 1) Input-output Table of Thailand 1985, NESDB.
2) Tables 3.13-3.14, Paitoon et al. (1989).

In an attempt to relieve difficulties of trade deficit, a high tariff was placed on consumer goods considered to be luxurious. Since foreign exchange savings, due to the substitution of imported goods by locally produced goods, was more than foreign exchange dissavings, induced by the import of raw materials and intermediates used in domestic production; Chaiyut (1978) points to the success of import substitution policies between 1958 and 1971. Nevertheless, except in 1961, the import substitution regime in the 1960s was still characterised by a balance of trade deficit. The same pattern continued in the 1970s and 1980s. This can be explained by a study by Jansen (1990) who points out that that the majority of manufactured exports are the products of industries depending on imported inputs.

2.3.2. Protective Measures

The system of industrial protection in Thailand is attributed to many measures. These are tariffs, import and export licenses, business taxes, and excise taxes. Detailed documentation is well presented in the literature (e.g., Narongchai, 1973 and Pairote, 1975). In brief, tariffs are the most extensively used measures.

Ingram (1971) points out that in 1926, when tariffs steadily increased, their protective effects began to be felt. However, most rates were modest. From the 1950s onward, protection for domestic industry became a more important objective of tariff policy.

Following the 1960 major revision of Customs Duty Acts and the Announcements of Revolutionary Parties, issued between 1935-1959, non-durable consumer goods and transportation equipment were subjected to high rates, while duties on imports of intermediate products and durable consumer goods were generally lower. During the first half of the 1960s, except for metal scrap, raw silk, and silk yarn, most exports were subjected to low rates of duty of around 10% or less.

Since the 1960s, there have been many important customs duty revisions which reflect changes in government policy. Customs duty revisions in the early 1970s supported domestic industry by controlling export of domestic inputs and providing cheaper imported inputs. The 1970 revisions aimed at solving a severe current account deficit, by the means of limiting imports of consumer goods and supporting import competing industries. Export industries, especially those using agricultural raw materials, were also promoted through the exemption of import duties on raw materials. A 1982 revision was more export oriented, when import duties on a wide range of consumer goods were reduced substantially.

The protective effects of other measures are also notable. Import licensing is used as a measure to safeguard domestic industries producing consumer goods and intermediate products. Export licensing is used in compliance with international trade agreements on some products such as sugar, coffee, and textiles. The protective effects of business tax began in 1973, when different rates of business tax were placed on imported and locally produced goods. On average, most imported goods are subjected to higher tax rates than those which are domestically produced. In 1986, business tax rates on locally produced food, or food products, and various inputs for agriculture were reduced in order to support agriculture and labour intensive industries. The municipal tax rate, 10% of business tax, enlarges the protective effect of the business tax. Some products are subjected to excise tax. The excise tax protects domestic producers of alcoholic beverages and tobacco since higher rates were placed on imported products. Cement, petroleum products, lighters, and matches were subjected to the tax only if they were domestically produced. However, the tax on cement exports was refundable.

2.3.3. Degree of Protection

Various measures can be used to measure the degree of protection during these periods. The two most often used measures are the nominal rate of protection (NRP) and the effective rate of protection (ERP). NRP measures the extent to which domestic prices have been raised above or pressed under world prices by tariffs and other trade restrictions. ERP takes into account the effect of input price distortions as well as output price distortions. It measures the effect of protection policies on value added in the industry of interest.

Many studies report the estimates of NRP and ERP in the past three decades. In most cases, the discussion has focused on aspects of the trade regime, and the resource allocational impact of protection. Despite differences in methodology and definition, these studies have similar findings.

The discussion in this chapter is based on the estimates of NRP and ERP reported by Pairote (1975) and Paitoon et al. (1989)[1]. Pairote reports estimates of the degree of protection for 58 industries in 1964, and for 82 industries in 1971 and 1974 (Tables 2.7, 2.8, and 2.9). Paitoon reports estimates of the degree of protection for 111 input-output traded sectors,

1) These differences are classifications of industries by trade orientation and aggregation methods. For their classifications, readers are referred to the original papers. For aggregation method, in Pairote's estimates, NRP of a group of industries is the average value of individual industries' NRP weighted by their domestic sales valued at world prices. In Paitoon et al.'s study, NRP of a group of industry is the average value of industries' NRP weighted by their export or import shares.

agriculture and non-agriculture, in 1981, 1984, and 1987 (Tables 2.10, 2.11, and 2.12). Because of two fundamental differences between the past studies, this thesis does not attempt to compare their results across time.

TABLE 2.7: Realized Nominal Rate of Protection for Manufacturing Industries: 1964, 1971, and 1974.

Industry	Realized Nominal Rate of Protection (%)		
	1964	1971	1974
A. Classified by trade orientation			
Exports	-21.3	-12.7	-31.5
Import Competing	33.1	27.2	13.0
Non-import Competing	64.0	12.1	-13.7
B. Classified by end uses			
Processed Food	10.7	2.8	-33.1
Beverages & Tobacco	170.0	23.1	12.0
Construction Materials	0.0	0.0	-22.5
Intermediate Products I	4.3	8.1	4.4
Intermediate Products II	21.2	30.5	2.4
Consumer Nondurable	31.0	23.8	4.8
Consumer Durable	27.2[a]	23.2	25.6
Machinery	40.8[a]	10.2	2.5
Transport Equipment	41.9	58.8	62.9

Note: a. Simple average from Pairote's results.
Source: Tables 4.1-4.12, Pairote (1975).

Based on the two studies, protection structures in the past three decades are characterised by five common features.

First, in comparison with neighbouring ASEAN countries, Thailand's protection policy is more inward oriented (Tables 2.13 and 2.14). Protection for export industries has been relatively lower than for import competing industries. In the 1980s, Thailand took steps toward protectionism, while other ASEAN countries, especially Indonesia, tended to liberalize trade.

Second, protection structures, especially the 1980 structure, increasingly protected the manufacturing sector and discriminated against agriculture. For the manufacturing sector, ERPs were higher than NRPs and vice versa for the agricultural sector. Thus, both output and input price distortions contributed to the contraction of agriculture.

Third, although an export oriented strategy has been attempted since the beginning of the 1970s, based on the nominal and effective system of protection, this has been far from successful. Protection for import competing industries is still relatively higher than for export industries. During the past decade, protection for export industries increased slightly, while those for other industries nearly doubled. Export promotion was put on top of existing policies to protect import competing industries. The focus on heavy protection for import competing consumer goods led to a change in the structure of imports, which were predominantly consumer goods (in 1960), to intermediate products and raw materials for the production of consumer goods, and capital goods (in 1990).

TABLE 2.8: Effective Rate of Protection for Manufacturing Industries: 1964, 1971, and 1974.

Industry	Effective Rate of Protection (%)		
	1964	1971	1974
A. Classified by Trade Orientation			
Exports	-41.90	-24.29	-72.46
Import Competing	39.42	39.68	5.06
Non-import Competing	25.81	15.68	-32.27
B. Classified by End Uses			
Processed Food	-23.32	-0.31	-71.92
Beverages & Tobacco	49.99	107.41	4.42
Construction Materials	-5.66	-16.13	-41.11
Intermediate Products I	4.05	5.30	-0.86
Intermediate Products II	36.06	44.95	-12.76
Consumer Nondurable	16.31	20.53	-6.92
Consumer Durable	18.86[a]	17.19	28.12
Machinery	7.09[a]	7.58	-10.46
Transport Equipment	121.69	146.45	181.10

Note: a. Simple average from potential effective rates of protection.
Source: Tables 4.1-4.12, Pairote (1975).

TABLE 2.9: Realized Nominal Rate of Protection for Some Industries: 1964, 1971, and 1974.

Industry	Realized Nominal Rate of Protection (%)		
	1964	1971	1974
Some Non-protected Industries			
1.Sugar	26.3	0.0	-50.0
2.Rice Millings	-32.4	-12.7	-32.8
3.Cement	0.0	0.0	-24.9
4.Lumber	-10.0	-18.7	-18.7
5.Fruit Canning	188.5	-2.0	-2.0
6.Tapioca Flour	-5.0	-2.0	-2.0
7.Vegetable Fibres	-1.5	-2.0	-2.0
8.Frozen Seafoods	-1.5	-2.0	-1.5
9.Gunny Bags	14.9	0.0	0.0
10.Cigarettes	71.0	12.6	0.0
Some Highly Protected Industries			
1.Car Assembly	55.0	91.2	102.5
2.Perfumery & Cosmetics	80.0	95.0[a]	95.0
3.Whisky	334.0	79.1	72.5
4.Beer	238.0	35.7	52.6
5.Pottery, China & Earthenware	-	47.8	47.8
6.Glass Products	27.3	40.7[a]	45.4
7.Motor-vehicle Parts	30.3[a]	38.4	43.7
8.Truck Assembly	33.8	40.0	40.0
9.Motor-cycles and Parts	27.2	37.8	37.8
10.Pigment, Paint & Varnishes	24.4	27.1	37.0
11.Wheat Flour	88.0	74.6	30.0
12.Radio, Television, and Household Appliances	26.3[a]	41.7	27.1
13.Chemical Materials	-	31.4	14.6
14.Electric Bulbs	48.5	0.0	14.3
15.Textile Fabrics	34.4	44.2	0.0
16.Rubber Tires & Tubes	24.7	26.9	0.0
17.Pharmaceutical Products	13.8	36.8	0.0
18.Other Textile Articles	27.2	37.0	0.0
19.Vegetable Oils	28.5	0.0	0.0
20.Flashlight Batteries	50.2	73.2	0.0
21.Leather Goods	29.0	44.2	0.0

Note: a. Potential rate.

Source: Tables 4.1-4.12, Pairote (1975).

TABLE 2.10: Nominal Rate of Protection: 1981, 1984, and 1987.

Industry	Nominal Rate of Protection (%)[a]		
	1981	1984	1987
Every Industry			
Export (E)	6.6	7.0	8.4
Import Competing (IC)	14.2	16.1	19.5
Mixed E-IC	10.6	12.1	16.1
Manufacturing Sector			
Export (E)	7.1	7.6	9.3
Import Competing (IC)	14.9	17.0	20.7
Mixed E-IC	12.2	13.7	17.7
Agricultural Sector			
Export (E)	4.2	4.2	4.2
Import Competing (IC)	6.2	6.5	6.8
Mixed E-IC	2.7	4.3	7.9

Note: a. Simple average from individual industries.
Source: Table 3.13, Paitoon et al. (1989).

TABLE 2.11: Effective Rate of Protection: 1981, 1984, and 1987.

Industry	Effective Rate of Protection (%)[a]		
	1981	1984	1987
Every Industry			
Export (E)	9.4	9.5	11.0
Import Competing (IC)	18.0	19.7	26.3
Mixed E-IC	18.3	32.5	36.2
Manufacturing Sector			
Export (E)	10.6	10.7	12.8
Import Competing (IC)	19.1	20.9	28.2
Mixed E-IC	21.7	38.3	42.0
Agricultural Sector			
Export (E)	3.7	3.8	2.9
Import Competing (IC)	6.0	6.5	5.6
Mixed E-IC	1.4	3.5	7.2

Note: a. Simple average from individual industries.
Source: Table 3.14, Paitoon et al. (1989).

TABLE 2.12: Nominal Rate of Protection for Some Industries: 1981, 1984, and 1987.

Industry	Nominal Rate of Protection (%)		
	1981	1984	1987
Some Non-protected Industries			
Rice Milling	-8.9	-8.9	-6.4
Chemical Fertilizer Minerals	-2.0	-2.0	-2.8
Some Highly Protected Industries			
Motor Vehicles	16.4	27.7	69.7
Made-up Textile Goods	42.6	61.4	64.3
Cosmetics	43.2	62.1	59.6
Bakery Products	48.2	48.2	51.4
Structural Clay Products	44.4	44.4	49.3
Soap and Cleaning Preparations	36.9	31.1	41.1
Office and Household Machinery	25.4	31.6	37.7
Household Electrical Appliances	28.6	38.6	36.1
Electrical accumulator and Batteries	32.9	26.0	35.3
Insulator Wire and Cable	29.0	29.0	33.6
Motor Cycles and Bicycles	25.6	26.2	33.5
Saw Mills	20.3	30.0	33.3
Other Chemical Products	24.2	33.1	32.3
Basic Industrial Chemicals	24.1	32.2	30.4
Paper Products	21.7	23.5	29.9
Monosodium Glutamate	38.4	38.4	29.8
Engines and Turbines	33.9	32.8	29.6
Drugs and Medicines	23.0	28.0	28.9
Breweries	0.9	0.6	10.4

Source: Table 3.13, Paitoon et al. (1989).

Despite being discriminated against, the industries with the highest growth potential were export oriented industries, and industries producing their intermediate inputs (Paitoon et al., 1989).

Fourth, in terms of protection policies, Thailand is a patchwork of conflicting regional interests. On one hand, industrial protection increases the market price of manufacturing products, produced mostly in the Central region and Bangkok, forcing buyers in other regions to pay higher prices for manufactures. On the other hand, discrimination or negative protection decreases the market price of agricultural goods and subsidizes non-agricultural consumers at the expense of farmers.

Fifth, the protection structure tends to be biased in favour of highly processed products. Also, protection for agricultural primary products was less than the protection for their processed products.

TABLE 2.13: International Comparison of Nominal Rate of Protection

Industry	Nominal Rate of Protection (%)			
	Total	Export	Import	Others
Thailand				
1964[1]	-	-21.3	33.1	64.0
1971[1]	-	-12.7	27.2	12.1
1974[1]	-	-31.5	13.0	-13.7
1981[2]	-	6.6	14.2	10.6
1984[2]	-	7.0	16.1	12.1
1987[2]	-	8.4	19.5	16.1
Malaysia[3]				
1973	28.2	9.1	4.3	35.4
1978	18.8	12.5	12.7	21.7
Singapore[4]				
1979	0.5	0.2	0.5	0.9
Indonesia[5]				
1975	70.0	56.0	74.0	20.0
1980	33.0	27.0	37.0	9.0

Note: Except for Thailand, export industries (import industries) were those that exported or imported at least 20% of apparent consumption.

Sources: 1) Tables 4.1-4.12, Pairote (1975).

2) Table 3.13, Paitoon et al. (1989).

3) Table 4.3, Hock, L.K. (1985).

4) Table 5.6, Nga, T.B. (1985).

5) Table 1.7, Pangestu, A. and Boediono (1985).

TABLE 2.14: International Comparison of Effective Rate of Protection

Industry	Effective Rate of Protection (%)			
	Total	Export	Import	Others
Thailand				
1964[1)]	-	-21.3	39.4	25.8
1971[1)]	-	-24.3	39.7	15.7
1974[1)]	-	-72.5	5.1	-32.3
1981[2)]	-	9.4	18.0	18.3
1984[2)]	-	9.5	19.7	32.5
1987[2)]	-	11.0	26.3	36.2
Malaysia[3)]				
1973	37.4	6.4	8.8	48.6
1978	34.2	-17.0	23.0	55.9
Singapore[4)]				
1979	2.3	3.4	4.5	0.04
Indonesia[5)]				
1975	67.0	61.0	80.0	17.0
1980	33.0	29.0	39.0	7.0
The Philippines[6)]				
1974	36.0	4.0	37.0	148.0

Note: Except for Thailand, export industries (import industries) were those that exported or imported at least 20% of apparent consumption. For Thailand, the rates are realized effective rates calculated by Corden's method.

Sources: 1) Tables 4.1-4.12, Pairote (1975).
2) Table 3.14, Paitoon et al. (1989).
3) Table 4.3, Hock, L.K. (1985).
4) Table 5.6, Nga, T.B. (1985).
5) Table 1.7, Pangestu, A. and Boediono (1985).
6) Table 2.4, Tan, N. A. (1985).

The regional bias of the protection for various manufacturing industries benefitted Bangkok and the Central region. Before 1972, the nominal and effective systems of protection discriminated against processed food and construction materials. In the 1980s, effective protection for industries using agricultural raw materials was mostly negative. Nominal and effective protection for food industries was relatively lower than protection for other manufacturing industries. In 1960, more than 50% of the products of the processed food industry originated from outside Bangkok and the Central region. Conversely, except for rubber products, the highly protected industries - intermediate products, consumer goods, machinery, and transport equipment - were mostly located in Bangkok and the Central region. In the 1970s and the 1980s, these highly protected manufacturing industries still agglomerated in Bangkok and surrounding provinces.

2.4. Productivity and Regional Income

As mentioned in Chapter One, there have been a limited number of empirical studies on the income distribution impact of protection in Thailand. Some previous studies have discussed the distribution impact of industrialisation (Suganya and Somchai, 1988; Teerana, 1990; and Pranee, 1992). Basically, their explanation is based on the fact that the share of manufacture in Gross Domestic Product increased faster than the share of manufacturing labour in the total labour force. Consequently, output per worker increased more slowly in agriculture than in manufacture, and the agricultural labour force was left with lower incomes. At the same time, income distribution deteriorated.

This section further explores these explanations. The following discussion on the distribution impact of protection takes two dimensions. The first is differences in productivities across sectors. The second is widening regional income disparities.

2.4.1. Productivity Differences

Productivity indicates how efficiently inputs are used to produce outputs. It can be measured in terms of labour productivity, capital productivity, and total factor productivity. The level of productivity reflects the prosperity of owners of factors of production.

Empirical evidence indicates that there have been different changes in labour and capital productivities in agriculture and manufacture. The overall productivity of manufacturing labour significantly increased in relation to the productivity of labour employed by agriculture and other sectors (Table 2.15). Direk (1990) also found that the annual return to agricultural capital decreased faster than those of other sectors, from 14% in 1972 to 4% in 1987, while those of manufacture and services decreased from 34% to 24%, and from 31% to 15%, respectively. The decline in agricultural terms of trade (Figure 2.1), of which industrial protection is a part, enlarged the adverse impact of changes in factor productivities on income distribution.

Theoretically, an increase in labour productivity can be the result of the installation of more physical capital, and an increase in human capital - more educated and skilled labour. Empirical evidence supports the theory. The previous section shows that capital increased in the manufacturing sector faster than in agriculture. It is also well-known that, during the past thirty years, the share of educated labour in the non-agricultural labour force increased, while those of the agricultural labour force remained almost unchanged. By the end of the 1980s, agriculture still absorbed more than 65% of the total labour force. This was unskilled labour those who did not finish lower secondary education. However, only about 12% of total value added (GDP) originated from agriculture.

The role of protection in these productivity changes is not clear. In terms of resource allocation, protection for manufacture attracts resources to manufacture. It also obstructs technological development and a move towards higher productivity in agriculture. In terms of efficiency, protected industries are not encouraged to be more efficient and, thus, remain inefficient.

Protection for manufacturing is equivalent to a tax on agriculture or negative protection, which constrains the increase in farmers' productivity and income. Martin and Warr (1990) show that, between 1960-85, technology contributed an estimated 49% of the reduction in agriculture's share in GDP. Bertrand (1969 quoted in Lam, 1977) states that rice premium is an obstruction to the modernisation of Thai agriculture, by chaining rice farming to low productivity technology. On the one hand, negative protection, e.g., rice premium, was an important means of raising government revenue, securing domestic consumption, and supporting industrialisation by suppressing food prices. On the other hand, it was a major obstacle to technological development in agriculture, and adversely affected farmers' productivity and income.

TABLE 2.15: Output-Labour Ratio, by Industry: 1960, 1970, 1980, and 1990

(Thousand Baht)

Industry	1960	1970	1980	1990
Per Capita Output[a]	4.0712	7.1974	-	-
(Average Growth in %)	(-)	(5.86)	(-)	(-)
Agriculture	1.8880	2.7409	-	-
	(-)	(3.80)	(-)	(-)
Manufacturing	15.5346	29.4401	-	-
	-	(6.60)	(-)	(-)
Others	13.9078	22.9687	-	-
	-	(5.14)	(-)	(-)
Per Capita Output[b]	-	9.3497	12.8631	19.9093
(Average Growth in %)	(-)	(-)	(3.24)	(4.47)
Agriculture	-	3.1862	3.6723	4.3960
	(-)	(-)	(1.43)	(1.82)
Manufacturing	-	36.4658	49.6645	69.3925
	(-)	(-)	(3.14)	(3.40)
Others	-	32.0613	33.5218	43.5333
	(-)	(-)	(0.45)	(2.65)

Notes: a. Output at constant 1962 prices, based on old series, divided by sectoral employed population.

b. Output at constant 1972 prices, based on new series, divided by sectoral employed population.

Sources: 1) Report of the Population and Housing Census (various issues), NSO.

2) National Income of Thailand (various issues), NESDB.

Despite empirical evidence suggests that protection not only constrained technological development and an increase in productivity in un-protected agriculture, it also adversely affected the growth of factor productivity and long run factor income in the highly protected manufacturing sector. Nishimizu and Page, Jr. (1986) found that the increase in total factor productivity in highly protected import competing industries was less than in those of less protected import competing and export industries. Their results indicate that protection induces inefficient allocation of resources, and does not encourage a move towards more efficient production technology.

FIGURE 2.1: Agricultural Terms of Trade (P_a/P_{na}).
Source: National Income of Thailand, NESDB.

2.4.2. Regional Income Disparities

During the past three decades, regional income disparities have been widening. Table 2.16 shows that the change in the Gross Regional Products (GRP) of Bangkok and vicinities is sharply in contrast with those of other regions. In 1960, per capita gross regional product, at current prices, of the Central region (including Bangkok) was 3,358 Baht, about three times the 1,164 Baht of the poorest Northeastern region. In 1973, the gap widened. The per capita GRP was 2,410 Baht for the Northeastern region, while it was 10,217 Baht for the Central region. Nearly half of the gross regional product of the Central region went to Bangkok, for which the population share was only about 32%. In 1988, the per capita GRP of Bangkok (104,475 Baht) was much higher than the per capita GRP of other regions, such as the Central region (27,844 Baht), and the Northeastern region (9,493 Baht).

TABLE 2.16: Gross Regional Product at Current Prices, by Industry and Region: 1960, 1973, and 1988. (Million Baht)

Year and Industry		Total	Central	Bangkok	Northeast
1960		55190	27873	-	10472
	Agriculture	20652	6965	-	5506
	Manufacturing	5883	3988	-	682
	Others	28655	16920	-	4284
	Per Capita GRP (B)	2090	3358	-	1164
1973		216453	67862	57135	33724
	Agriculture	73233	26026	1134	17720
	Manufacturing	35614	14926	14294	2391
	Others	107606	26910	41707	13613
	Per Capita GRP (B)	5455	8101	14813	2410
1988		1506977	254833	754652	179498
	Agriculture	250384	57325	23600	57280
	Manufacturing	373326	46490	291010	15931
	Others	883267	151018	440042	106287
	Per Capita GRP (B)	27632	27844	87032	9493

Note: In 1988, the gross regional product (GRP) of Samut Prakarn, Pathum Thani, Samut Sakhon, Nonthaburi, and Nakhon Pathom are excluded from the Central region, and included in Bangkok. The per capita GRP of these provinces are 92,555; 60,931; 48,224; 22,533; and 21,091 Baht, respectively. The per capita GRP of Bangkok was 104,475 Baht. The total GRPs of Northern and Southern regions is the total GRP less the GRPs of Central region, Bangkok, and Northeastern region.
Source: National Income of Thailand: Gross Regional Products (various issues), NESDB.

The causes of regional income disparities are difficult to document. They can be attributed to many factors, i.e. spatial immobility of labour, transportation costs, the endowment of natural resources, and productivity differences. Because of the differences in industrial mix across regions, productivity differences can also be regarded as a determinant of regional income disparities. A region with a large proportion of high productivity sectors, e.g., manufacturing and highly processed industries, has high average productivity and income. Conversely, a region with a large proportion of low productivity sectors, e.g., agriculture and simple processed industries, has low income.

Productivity does not only differ between agriculture and manufacturing. It is well-known that manufacturing in Bangkok and surrounding provinces is more capital intensive than manufacturing in other parts of Thailand (Somsak, 1991). Thus, productivity and income of manufacturing labour in Bangkok and surrounding provinces is also higher. This fact, together with the conglomeration of manufacturing in Bangkok and surrounding provinces, points to regional income disparities.

The differences in industrial mix between Bangkok and surrounding provinces, and other regions, have been increasing. During the past three decades, the rapid expansion of the manufacturing sector, mostly allocated in Bangkok and the Central region, has characterised the high growth rates of the regions (Table 2.16). Between 1960 and 1973, the share for Bangkok and the Central region of total manufacturing products increased from 67.8% to 81.5%. By 1988, the share of gross manufacturing product for Bangkok and vicinities2), and the Central region, accounted for more than 90% of the country's gross manufacturing products. Of the 90%, 78% was shared by Bangkok and vicinities3).

2.5. Conclusion

This chapter has examined protection policies in Thailand during the 1960s, 1970s, and 1980s. During these three decades, export industries were discouraged by the protection system, while import competing and non-import competing industries were promoted. Thus, the policy led to rapid

2) The 1980 statistics provided by the national income account are for Bangkok and vicinities and are not for Bangkok.

3) Bangkok and vicinities include Bangkok and five surrounding provinces: Samut Prakarn, Pathum Thani, Samut Sakhon, Nonthaburi, and Nakhon Pathom.

expansion of the highly protected industries. Some of these industries, which had latent comparative advantage, emerged as Thailand's principal exports in the later periods.

During the 1980s, there was protection for, instead of discrimination against, export industries. However, the degree of protection was relatively low, when compared with protection for mixed (export and import competing) and import competing industries. The structure of protection also supported industries using agricultural raw materials, but, discriminated against important agricultural sectors, such as paddy and upland crops.

The resource allocation impact of industrial protection is clear. Manufacturing and other sectors expand, while agriculture contracts. Since the manufacturing sector continues to conglomerate in Bangkok, and surrounding provinces in the Central region, protection structures have been in favour of well-off Bangkok and surrounding provinces.

So far, the levels of protection have been discussed in terms of NRP and ERP. The limitations of these measures are well known. They do not take into account the roles of other factors in the economy. A better alternative, a general equilibrium approach, will be discussed in subsequent chapters. However, there is a tendency for industrial protection policies to be related to the widening regional income disparities through industrial location and productivity differences. The following chapter examines and details the change in income distribution during the past three decades of industrialisation.

- CHAPTER 3 -

INCOME DISTRIBUTION DURING THE PAST THREE DECADES

3.1. Introduction

Chapter Two shows that industrial protection systems in Thailand have been biased, not only in favour of the manufacturing sector at the expense of agriculture, but also in favour of Bangkok and surrounding provinces at the expense of other regions. Productivity differences among sectors are affected by the protection systems. At the same time, sectoral factor income disparities, as well as regional income disparities, have deteriorated. The spatial imbalance in industrial development - between regions, urban and rual areas - has been seen as one of the major causes.

During the same period, there has been a dramatic change in functional distribution of income, as reflected by the distribution of national income. The distribution of national income was characterised by two main features (Table 3.1). First, a 50% increase in the share of wages and salaries, from 22.73% in 1970 to 33.49% in 1989, and this, in turn, was dominated by an increase in wages and salaries in the manufacturing sector. Second, a decrease from 65.03% to 47.23% in the share of income from farm and other unincorporated profit, which is mainly explained by the reduction in farm income. At the same time, the proportion of labour employed in the agricultural sector also decreased, to a lesser degree, from 74.3% in 1973 to 58.4% in 1988.

This chapter examines the size distribution of income in Thailand, which explains how equal income is divided among households or individuals. Based on a minimum level of income (poverty line), the size distribution of income can also explain the proportion of poor in the total population, and the extent of poverty in Thailand. The focus on income distribution arises from the increasing concern that rapid economic growth and structural change in the Thai economy did not sufficiently reduce poverty and income inequality. Large proportions of the Thai population were not benefiting from the growth.

TABLE 3.1: Percentage Distribution of National Income at Current Prices: 1970, 1980, and 1989.

Distribution	1970	1980	1989
Compensation of Employees	24.32	30.73	35.16
Wage and Salaries	22.73	28.06	33.49
Others	1.59	2.67	1.67
Income from Farm and Unincorporated Profit	65.04	59.47	47.23
Farm Income	23.46	17.81	-
Others	41.58	41.66	-
Property Income	8.13	8.68	10.66
Savings	2.57	1.54	6.56
Direct Taxes	0.82	1.75	2.92
General Government Income from Property and Enterprise	0.86	0.78	1.52
Others	-0.05	-2.95	-4.05

Source: National Income of Thailand (various issues), NESDB.

Following this introductory section, section 3.2 discusses poverty incidence during the past three decades, and the common features of these changes. The discussion is based on results from previous studies which allow comparability across time. Similarly, changes in income inequality are discussed in section 3.3. Section 3.4 summarizes this chapter.

3.2. Poverty Incidence

3.2.1. Changes in Poverty

This thesis focuses on the absolute concept of poverty lines, calculated from a nutritional approach[1]. The earliest two studies on poverty in Thailand, based on this concept, are Oey (1979) and Suphawadi (1980). In both studies, the Household Socio-economic (Expenditure) Surveys of the National Statistical Office were the source of data. Because of the way her poverty lines were constructed, and the additional number of years included in her study, Oey's results are highlighted in this section (Table 3.2). However, her results are supported by Suphawadi's results.

Two absolute poverty lines, urban and rural poverty lines, were used to calculate poverty incidence on an individual basis. Head count ratio, or HCR, was used as a measurement of poverty. The HCR shows the number of poor as a proportion of the total population. The poor are individuals whose income was below the poverty lines.

Oey found significant reductions in poverty in Thailand between 1962/63 and 1975/76, and between 1968/69 and 1975/76. Between 1962/63 and 1975/75, the reductions were at both national and regional levels. In 1962/63, 57% of urban Thais were in poverty, while in 1975/76, the figure was only 33%. This was a reduction of approximately 42% in thirteen years. However, Oey adds that, although the number of poor over the total population decreased, the number of poor was almost the same when population growth was taken into account.

---

1) See Medhi, Pranee, and Suphat (1991) for new poverty lines.

TABLE 3.2: Poverty Incidence, by Region and Community: 1962/63, 1968/69, and 1975/76.

Region and Community	1962/63	1975/76	1968/69	1975/76
Whole Kingdom	57	33	39	31
Rural	61	37	43	35
Urban	38	22	16	14
Northeast	74	46	65	44
Rural	77	48	67	45
Urban	44	38	24	20
North	65	35	36	33
Rural	66	36	37	34
Urban	56	31	19	18
South	44	33	38	31
Rural	46	35	40	33
Urban	35	29	24	22
Central	40	16	16	14
Rural	40	15	16	15
Urban	40	20	14	12
Bangkok	28	12	11	12

Notes: a) In 1975/76, urban poverty line is 2,961 Baht/person/year and rural poverty line is 1,981 Baht/person/year. Consumer price indices were used to adjust price differences between the periods concerned and the base year 1975/76.

b) Urban areas mean municipal areas and sanitary districts for the first two columns and municipal areas for the second two columns. Rural areas mean villages for the first two columns and sanitary districts and villages for the second two columns.

c) Nonthaburi, Pathum Thani, and Samut Prakarn are in the central region, except in 1975/76 in which they are included in Bangkok.

Source: Table 3.1, Oey (1980).

Two studies on poverty incidence in the late 1970s and 1980s are Suganya and Somchai (1988); and Medhi, Pranee, and Suphat (1991). Both employed Oey's poverty lines. The former calculated HCR in 1975/76, 1980/81, and 1985/86, while the latter calculated HCR in 1988. Their results are summarized in Table 3.3.

TABLE 3.3: Poverty Incidence, by Region and Community: 1975/76, 1980/81, 1985/86, and 1988.

Region and Community	1975/76 1)	1980/81 1)	1985/86 1)	1988 2)
Whole Kingdom	30.02	23.04	29.51	21.18
Villages	36.16	27.34	35.75	26.30
Sanitary districts	14.76	13.47	18.55	12.17
Municipal areas	12.53	7.51	5.90	6.11
Northeast	44.92	35.93	48.17	34.56
Village	48.54	37.92	50.49	36.77
Sanitary districts	24.66	20.81	33.25	18.60
Municipal areas	20.90	17.99	18.67	18.62
North	33.20	21.50	25.54	19.95
Village	36.37	23.32	27.74	21.61
Sanitary districts	19.23	16.16	20.19	15.14
Municipal areas	17.84	8.03	6.87	10.53
South	30.71	20.37	27.17	19.43
Village	33.84	22.16	31.17	21.72
Sanitary districts	18.14	6.75	8.07	10.20
Municipal areas	21.69	15.20	8.61	10.81
Central	12.99	13.55	15.63	12.91
Village	14.26	14.16	17.37	15.04
Sanitary districts	7.99	11.62	11.36	5.90
Municipal areas	11.45	11.74	8.87	7.73
Bangkok	7.75	3.89	3.54	3.48
Fringes	11.97	9.15	8.83	6.58
Suburbs	6.00	2.58	2.51	-
City core	6.90	3.70	3.11	2.66

Notes: Rural poverty lines are 1981, 3454, 3823, and 4076 Baht/person/year in 1975/76, 1980/81, 1985/86, and 1988, respectively. Urban poverty lines of the years are 2961, 5151, 5834, and 6203 Baht/person/year. Rural poverty lines are applied to sanitary districts.
Source: 1). Table 2.15, Suganya and Somchai (1988).
2). Table 2.10, Medhi, Pranee, and Suphat (1991).

In 1980/81, poverty incidence in most parts of the country was less than in 1975/76, apart from the Central region where poverty incidence increased - especially in sanitary districts and municipal areas[2]. However, this improving trend was reversed. Poverty incidence increased in 1985/86 in all villages and most sanitary districts, although there was less poverty in Bangkok and most municipal areas.

Suganya and Somchai asserted that poverty incidence in 1980/81 was better than in 1985/86, because of the effect of the extra high crop prices that year. This can be seen from the 4.6% decrease of the average income per capita of all agricultural workers between 1980/81 and 1985/86. This period of worsening poverty incidence was the first time since 1960 in which the average welfare of Thai people significantly deteriorated (Suganya and Somchai, 1988).

In 1988, Medhi, Pranee, and Suphat (1991) show that there was a lower percentage of rural Thais in poverty in almost every region. Except for Bangkok and the Central region, poverty incidence in municipal areas either increased or insignificantly decreased. They assert that this situation was similar to that in 1980/81. The major determinant of the reduction in 1988 poverty was crop prices which were at a peak among adjacent years. Despite that fact, this change had very significant consequences on changes in inequality which will be discussed in section 3.3.

3.2.2. Features of Changes

Although, the changes in poverty incidence over the past three decades have been impressive, it is remarkable that, for almost three decades, Bangkok has been insulated from poverty deterioration, while the Northeast has been the poorest region in the country. These can be explained by some common features of poverty incidence as follows.

Poverty incidence is a rural phenomenon. Table 3.4 shows that the rank of HCR by region is exactly the same as the rank of the size of the rural sector in each region, and the Northeast has the biggest rural sector. Moreover, Bergemeier and Hoffman (1988) studied the striking characteristic

---

2) For Thailand, sanitary districts mean small towns and municipal areas mean cities. Villages can be referred to as rural areas.

of poverty concentration in Thailand in 1981, pointing out that poverty incidence had a rural bias. Only 16.2% of urban residents were living in poverty, compared to 26.5% of rural residents. However, if Bangkok is excluded, the proportion of urban residents living in poverty rises to 25.7%, nearly the same as for rural areas. The wealth of Bangkok, and bordering subregions on the fertile central plains, is increasingly and sharply contrasted with average living standards, especially in the Northeastern and upper Northern regions.

TABLE 3.4: Rank of Poverty and Size of Rural Sector, by Region: 1988.

Area & Region	Rank of Poverty[1)]	% of Village Household[2)]
Northeast	1	86.42
North	2	79.03
South	3	76.92
Central	4	73.10
Bangkok	5	10.92

Sources: 1) Rank from Table 3.3.
2) Household Socio-economic Survey 1988, National Statistical Office.

Changes in poverty incidence were closely related to the performance of agriculture, especially crops. In 1985/86, agriculture recorded a very poor performance of nearly zero growth (Table 3.5). This was mainly caused by the negative growth rates of most major crops. Moreover, in 1985/86, the agricultural terms of trade was the lowest in three decades (Figure 2.1). Thus, between 1980/81 and 1985/86, poverty increased in village areas in every region. Poverty also increased in sanitary districts in almost every region except the Central region.

The Northeast not only has the largest rural sector, but also the poorest land quality in the country. About 38% of agricultural land in this region is salty, and only 8.64% is irrigated (Narong, 1989). Ammar et al. (1989) point out that the poor quality of land adversely affects the productivity of the agricultural labour force in the Northeast. Table 3.6 shows that the Northeast has the lowest paddy yield per rai, about 40% lower than the average of other regions. This affects the income of at least 80% of farmers in this region. Narong (1989) also concludes that land quality is one of the causes of poverty in this region.

TABLE 3.5: Economic Growth, by Industry: 1962/63, 1968/69, 1972/73, 1975/76, 1980/81, 1985/86, and 1988.

Area & Region	1962/63	1968/69	1972/73	1975/76
Economic Growth (%)	8.4	9.6	9.9	9.4
Agriculture	8.9	10.1	9.4	6.0
Crops	9.2	9.5	14.3	6.6
Manufacture	9.0	10.7	15.7	15.3
Other sectors	7.8	8.9	8.1	8.7

TABLE 3.5: Continued.

Area & Region	1980/81	1985/86	1988
Economic Growth (%)	6.3	4.9	13.2
Agriculture	5.4	0.3	10.2
Crops	5.8	-4.5	14.4
Manufacture	6.3	10.8	16.8
Other sectors	6.7	4.4	12.7

Source: National Income of Thailand (various issues), NESDB.

Poverty is a problem of human capital. Suganya and Somchai (1988) found that in almost all poor families the household head did not have more than an elementary education. Thus, high poverty is expected among unskilled labour. Medhi, Pranee, and Suphat (1991) also found a very high poverty incidence among households whose heads were agriculturalists, labourers, or economically inactive people.

TABLE 3.6: Land Ownership, Percentage of Paddy Farmers, and Average Yield per Rai of Paddy, by Region.

Region	Land Owned by Farmer[1] (%)	Paddy Land per Farmer[1] (Rai)	Paddy Yield[2] (Kgs./Rai)	Land Share[2] (%)
Northeast	95.62	18.08	235	37.63
North	85.33	13.93	402	30.18
Central	78.98	22.45	386	26.82
South	96.08	8.39	288	5.37

Notes: Major Bangkok is included in Central region. Paddy yields are average yields of major rice, 1986/87-1989/90. Land shares are regional share of paddy land.
Sources: 1) Report of the 1988 Intercensus Survey of Agriculture, National Statistical Office.
2) Agricultural Statistic of Thailand, Crop Year 1989/90, Office of Agricultural Economics.

3.3. Income Inequality

This section discusses income inequality in Thailand. Based on the Household Socio-economic Surveys of the National Statistical Offices, most previous studies used Gini index to measure income inequality in Thailand. Gini index provides a summary picture of the extent to which the actual distribution of income deviates from the perfectly equal distribution of income. The index ranges between zero (perfect equality) and one (perfect inequality).

3.3.1. Changes in Inequality

Medhi (1977) studied income inequality in three periods, 1963, 1969, and 1972[3]. He used both money income, and adjusted income, which already included income in kind and net corporate retained earnings. Based on household income, his finding was severe income inequality during all

3) These are equivalent to Household Socio-economic (Expenditure) Survey in 1962/63, 1968/69, and 1971/73.

periods. One half of the households in Thailand shared less than 20% of the country's income. The income share of the bottom 20% of households was less than 3.5%, while the share of the top 20% of households was nearly two-thirds. Medhi concluded that income equality had clearly deteriorated during all periods. As shown in Table 3.7, the top 20% income class was the only one to gain a greater income share during the periods, and, of these, the top 1% benefited the most. Where poor households were larger than rich households, in terms of per capita basis, the worsening inequality was even more severe.

TABLE 3.7: Income Inequality: 1963, 1969, and 1972.

Income Distribution	1963	1969	1972
Income share (%) of			
20% First (lowest)	2.9	3.4	2.4
20% Second	6.2	6.1	5.1
20% Third	10.5	10.4	9.7
20% Fourth	20.9	19.2	18.4
20% Fifth (top)	59.5	60.9	64.4
1% Highest	9.6	10.5	15.0
Gini Indices 1)	.5627	.5550	.6051
Gini Indices 2)	.4559	.4822	.5348

Notes: 1) Based on money income.
2) Based on adjusted income.
Source: Tables 9 and 10, Medhi (1977).

Suganya and Somchai (1988) studied income inequality in 1975/76, 1980/81, and 1985/86. The difference between this and Medhi's study is that Suganya and Somchai used per capita basis rather than household basis. In terms of Gini indices, income inequality was 0.426 in 1975/76; 0.453 in 1980/81; and 0.500 in 1985/86. The degree of worsening inequality was more severe between 1980/81 and 1985/86 than between 1975/76 and 1980/81. This could also be the effect of agricultural terms of trade and the performance of agriculture. As shown in Table 3.8, the income share of the top 20% of the population in 1975/76 was 49.26%. In 1980/81 and 1985/86, this share increased to 51.47% and 55.63%, respectively. On the opposite side, the share of the bottom 20%, which was already low, reduced from 6.05% to 5.41% and then to 4.55%. Again, the top 20% income class was the only one that gained, and the top 10% class gained the most. One could ask whether all of the gain went to the top 1% class.

Using the same methodology as that of Suganya and Somchai, Teerana (1990) calculated income inequality in 1988. He found that the share of the lowest quintile insignificantly decreased, while the share of the middle three classes increased at the expense of the share of the top income class. Moreover, the major loser was the top 10% income class. In terms of Gini index, inequality decreased from 0.500 in 1985/86 to 0.478 in 1988. His results are reported in Table 3.8.

TABLE 3.8: Income Inequality: 1975/76, 1980/81, 1985/86, and 1988.

Income Distribution	1975/76[1)]	1980/81[1)]	1985/86[1)]	1988[2)]
Income share (%) of				
20% First (lowest)	6.05	5.41	4.55	4.52
20% Second	9.73	9.10	7.87	7.98
20% Third	14.00	13.38	12.09	12.20
20% Fourth	20.96	20.64	19.86	20.30
20% Fifth (top)	49.26	51.47	55.63	54.98
10% Highest	33.40	35.44	39.15	37.98
Gini Index	0.426	0.453	0.500	0.478

Sources: 1) Table 2.2, Suganya and Somchai (1988).
2) Table 6, Teerana (1990).

It is notable that this is the first time in thirty years that Thailand recorded a decrease in inequality. This improvement in inequality coincided with the increase in poverty between 1985/86 and 1988, which was an urban phenomenon. In that period, municipal areas in almost every region experienced an increase in poverty, except for Bangkok and municipal areas of the Central region, which were insulated from these increases. Thus, this decrease in inequality was at the expense of the non-poor people in urban areas who became poor.

Inequality reduction was predicted by Chalongphob et al. (1988) who show that there is some relationship between the level of economic development and the level of income inequality in Thailand. This can be explained by many factors, one of which is GDP per capita and the large scale of labour in the agricultural sector. Their study also shows that Thailand was on the rising trend of the curve. The major key to reversing the trend of inequality is a rising real wage and a shift of labour from the traditional sector to the modern sector. Their conclusion confirms Kuznets' inverted U-curve.

3.3.2. Features of Changes

In comparison to poverty incidence, the change in income inequality is not impressive. Except in 1988, the distribution of income has become more unequal. Suganya and Somchai (1988) study the important features of the changes in equality. Their analysis can be summarized as follows.

Firstly, by using multiple regression, Suganya and Somchai conclude that employment related factors are the major cause of income inequality. Other important factors are locational (community and region), and personal (human capital) variables.

Secondly, based on their inequality disaggregation, the dynamism of these causes of inequality can be analysed. Basically, the overall (national) inequality can be separated into two parts, inequality within each subgroup and inequality among different subgroups. Subgroup can be defined as region, community, sector of production, or any socio-economic variable. Over time, changes in the contribution of the two types of inequality show their relative importance in explaining the overall inequality. The contribution also indicates how balanced development is across sub-groups.

TABLE 3.9: Factor Disaggragation of Income Inequality: 1975/76, 1980/81, and 1985/86. **(%)**

Factor Disaggregation	1975/76	1980/81	1985/86
Inequality (Shorrocks index)	0.304	0.347	0.427
Region			
Between group	16.18	19.87	24.90
Within group	83.82	80.13	75.10
Location			
Between group	15.01	18.86	24.98
Within group	84.99	81.14	75.02
Community type			
Between group	20.20	21.77	28.15
Within group	79.80	78.23	71.85
Sex of head			
Between group	0.28	0.52	0.76
Within group	99.72	99.48	99.25
Age of head			
Between group	0.47	0.62	0.27
Within group	99.53	99.38	99.73
Education of head			
Between group	-	15.14	20.00
Within group	-	84.86	80.00
Socio-economic class			
Between group	25.57	26.97	33.82
Within group	74.43	73.03	66.18
Occupation of head			
Between group	22.62	24.02	31.31
Within group	77.38	75.97	68.68
Sector of production			
Between group	21.19	23.94	28.53
Within group	78.81	76.06	71.47

Source: Table 2.7, Suganya and Somchai (1988).

Suganya and Somchai (1988) disaggregated inequality, as measured by the Shorrock index[4], by various subgroups (Table 3.9). Their results show that development has been increasingly unbalanced. Inequality amongst people living in different locations, different communities, and different regions has been relatively increasing compared to inequality amongst people living in the same location, the same community, and the same region, respectively. Inequality amongst people in different socio-economic classes, different occupations, different sectors of production, and with different education levels has also relatively increased.

The regional, community, and sectoral inequality disaggregations confirm the widening income disparities across region, urban and rural settings, and sectors of production, as already discussed in the previous chapter. As an example, in 1975/76, 83.82% of the national inequality was caused by inequality amongst people living in the same region, while the remaining 16.18% was caused by inequality amongst people living in different regions. In 1980/81 and 1985/86, the contribution of inequality amongst people living in the same region decreased to 80.13% and 75.10%, respectively. At the same time, inequality amongst people living in different regions increased to 19.87% and 24.90%.

3.4. Conclusion

This chapter has examined the changing pattern of income distribution in Thailand during the past three decades of industrialisation. The movement of poverty incidence and income inequality has been in opposite directions. Generally, poverty incidence improved along the trend of increasing national income, while income inequality deteriorated. However, in the late 1980s, there were both ambiguous changes in poverty and a turning trend in income inequality.

---

4) A major advantage of Shorrock index over Gini index is its aggregate decomposability which allows a decomposition of inequality.

Major contributing factors of poverty have been in the agricultural sector and rural areas, quality of land, and the output and prices of crops. Employment related factors, locational factors, and human capital variables have been seen as major contributing factors of income inequality in Thailand. The disaggregation of inequality analysis points to the widening income gaps amongst various sub-groups, especially amongst regions, amongst communities, and amongst sectors of production. Therefore, it indicates that economic development has been unbalanced during the period.

Through these factors, especially relative prices, industrial protection could have some distribution impacts which are not clearly addressed in the literature. This study opts for a general equilibrium approach to clarify the relationship between industrial protection and income distribution in Thailand. The general equilibrium approach is needed because it allows the interrelationships amongst various economic agents. It is capable of identifying and tracing the effects of policy shocks, both within and amongst all the major sectors of the economy. The framework of the general equilibrium model and its benchmark database are discussed in subsequent chapters.

- CHAPTER 4 -

COMPUTABLE GENERAL EQUILIBRIUM MODEL AND ITS PARAMETER SETTINGS

4.1. Introduction

Economic theory argues convincingly in support of free trade. However, Chapter Two has shown that the changes in the nominal and effective protection systems in Thailand were against the regime. The impact of these changes is important, both in terms of economic growth and welfare. An appropriate understanding of their impact is important for policy decisions. However, the issues are too complicated to be measured by any single measure such as NRP and ERP, since protection distorts not only the producing sectors, but also other parts of the economy.

The explanations of the impact of industrial protection policies on income distribution, briefly discussed in the Chapter Two, are limited. They cannot fully explain the impact of the protection policies on income distribution and the underlying mechanism behind the impact. As shown in Chapter One, some studies have attempted to explain, however, lack of emphasis on the impact of industrial protection on the problems of poverty incidence and income inequality in Thailand.

The aim of this chapter is to develop a model which can properly explain the income distribution impact of the change from the 1987 system of industrial protection towards free trade. The remainder of this chapter is organized as follows. Firstly, it describes the structure of a computable general equilibrium (CGE) model which is designed to analyse the effect of industrial protection policies on poverty incidence and income inequality in Thailand. This model is in the tradition of the Johansen-class of CGE models. Secondly, it describes the structure of a Social Accounting Matrix (SAM), which provides the economic environment of Thailand in the base year 1988. This SAM contains share parameters which are important for this class of CGE model. Thirdly, it reviews elasticity estimations from past studies and other relevant parameters. The rationale behind the choice of elasticities and other parameters is explained.

4.2. Computable General Equilibrium Model

This section describes the structure of a computable general equilibrium (CGE) model, which is in the tradition of the Johansen class of multi-sectoral models. The model is in the form of a system of linearized equations of percentage changes in variables. Basically, its structure is derived from the ORANI model of the Australian economy (Dixon et al., 1982).

This model is developed in order to investigate relationships between industrial protection policies and income distribution in Thailand. The Thai economy, represented in this model, is confined to product and factor markets in which perfect competition is assumed. There is no money market in the model. Production technology is constant return to scale. All economic agents are price takers and all markets are cleared. A relatively small, open economy is assumed, i.e. exogenous world prices prevail.

There are two mobile primary factors of production: skilled and unskilled labour. Education is arbitrarily used to divide labour into two types. Skilled labour are those who finished lower secondary education, and unskilled labour those who did not. Both types of labour are internationally immobile. Unskilled labour is perfectly mobile across industries, while skilled labour is perfectly mobile across non-agricultural industries, i.e. skilled labour is not a factor of production in agricultural industries. Skilled labour and un-skilled labour are assumed to be imperfect substitutes.

It will be more reasonable to have two types of capital, fixed capital and variable capital. Because of time and resource constraints, this model assumes that there is only one type of capital which is specific to industry. Land is also an industry specific factor. Since Northeastern land is less fertile than land in other regions of the country, land is divided into two types: ESAN (Northeastern) land, and non-ESAN land. This issue was discussed in Chapter Three. In brief, the average paddy yield per unit area of ESAN land is about 40% lower than that in other regions. Yields of other crops do not significantly differ by region. It is also well-known that Northeastern rural Thais are amongst the poorest in the country. In order to highlight these facts, agriculture is divided into two industries, i.e. ESAN and non-ESAN agricultural industries. Thus, by definition, land is specific to each agricultural industry.

There are eight industries and ten producer goods. The first two industries, ESAN and non-ESAN, are multi-output agricultural industries producing four goods - paddy, MCS (maize, cassava, and sugar-cane), rubber, and other agricultural products. The remaining six industries are single-output industries namely agro-industry, other export oriented industries, petroleum industry, other import-competing industries, EWTC (electricity, water supply, transport, and communication), and services. The ten producer goods, which are locally produced, can also be supplied from overseas. There are ten consumer goods: rice and cereal, meat and fish, fruit and vegetables, other foods, non-alcoholic beverages, clothing and footwear, house and housing expenditure, transport and communication, medical expenses, education and entertainment, and other non-food expenditure. Each consumer good is produced from producer goods.

The aggregation of 180 input-output sectors into the ten producer goods is based on many criteria, such as their linkages to other sectors, shares in GDP, and labour employment. They are also classified by trade orientation. Sectors for which import-production and export-production ratios are both less than 2% are non-traded sectors. The remaining traded sectors are classified as export oriented sectors if exports are greater than twice that of imports, otherwise they are classified as import competing sectors. The classification of the ten producer goods is given in Appendix 4.1.

There are three types of institutions: households, government, and transfer pool. Households are divided into ten expenditure classes - five quintiles for urban households and five quintiles for rural households. The classification of households into these ten quintiles is detailed in Chapter Five. These households derive income from their ownership of primary factors. Assistance payment from other households and government transfer also form part of their income. The transfer pool is included as a medium of income transfer among households, and from government to households.

The detailed structure of the model consists of ten main parts: producer goods industries, margin sector, investment and savings, production of consumer goods, household behaviour, export demand, government behaviour, zero pure profit, market clearing conditions, and miscellaneous equations. In the following paragraphs, the levels of variables are written in upper case (e.g. X) while their percentage changes are written in lower case (e.g. $x = 100dX/X$)[1]. Appendix 4.2 presents the overall system of linearized equations in this model. Appendices 4.3 and 4.4 define variables and parameters. Appendix 4.5 presents a typical list of exogenous variables. The diagrammatic explanation of the model is in Appendix 4.6.

4.2.1. Producer Goods Industries

Producers in the eight industries are profit maximisers. They choose a combination of inputs that minimizes their costs and a combination of output(s) that maximizes their revenues. Effective primary factor and effective intermediate inputs are used in fixed proportions, i.e. Leontief technology, to produce a level of activity. Effective primary factor is the aggregate of effective labour, capital, and land which are imperfect substitutes. Effective labour is the aggregate of the two types of labour. Effective intermediate inputs are the aggregates of domestically produced

---

1) Suppose that initially $X = K.Y$, where $K > 0$. By writing $x = y$ it implies $k = 0$. Thus, as an example, if X is demand and Y is supply then $x = y$ simply means that the ratio between demand and supply is constant at K. Market could be cleared but is not necessary.

and imported producer goods. Substitution between the two types of labour, amongst primary factors, and between producer goods from the two sources are imperfect, and are governed by the Armington elasticities of substitution.

There is no substitution amongst these effective inputs. A change in output price induces a change in output supply and, thus, changes in demands for effective inputs. A relative change in returns to unskilled and skilled labour induces substitution between the two types of labour (4.1). Similarly, a relative change in returns to primary factors induces substitution among primary factors (4.2), and a relative change in the prices of producer goods from different sources induces substitution between intermediate inputs from the sources (4.3).

(4.1) $f_{1qj} = f_{1j} - \sigma^0_{1qj}.[r_{1qj} - \sum_q A^0_{1qj}.r_{1qj}]$.

(4.2) $f_{nj} = z_j - \sigma^0_{nj}.[r_{nj} - \sum_n A^0_{nj}.r_{nj}]$.

(4.3) $x^1_{isj} = z_j - \sigma^1_{ij}.[pr^1_{isj} - \sum_s H^1_{isj}.pr^1_{isj}]$.

Where f_{1qj} and r_{1qj} are the percentage changes in demand for and the return to labour, type q. f_{nj} and r_{nj} are the percentage changes in demand for and the prices of primary factors employed by industry j (effective labour: n = 1, capital: n = 2, and land: n = 3). x^1_{isj} and p^1_{isj} are the percentage changes in industry j's demand for, and the price of intermediate input i from source s (domestic, s = 1; and import, s = 2). z_j is the percentage change in activity level. σ^0_{1qj}, σ^0_{nj}, and σ^1_{ij} are the elasticities of substitution between two types of labour, among primary factors, and between intermediate inputs from different sources. A^0_{1qj}, A^0_{nj}, and H^1_{isj} are the share of labour type q in total labour cost, the share of each primary factor in total cost of primary factors, and the share of intermediate input i from source s in the total cost of intermediate input i. For multi-output industries, A^0_{nj} in Equation 4.2 is replaced by the modified cost share (A^*_{nj}) which is defined as follows.

(4.4) $A^*_{nj} = A^0_{nj}.\sigma^0_{nj} / \sum_n A^0_{nj}.\sigma^0_{nj}$ for all j.

Generally, pr^1_{isj} is equal to p^1_{isj}, defined by Equation 4.53. However, for export industries, i.e. j = 5 and 6, pr^1_{isj} is defined by Equation 4.54.

For single-output industries, the supplies of producer goods are equal to industries' activity levels (4.5). For multi-output industries, the combination of goods produced is determined by their relative prices (4.6). The total supply of each producer good is equal to the weighted sum of industry supplies of that good (4.7).

(4.5) $x^0_{j1} = z_j$.

(4.6) $x^0_{i1j} = z_j+\tau^0_{i1j}.[p^0_{i1}-\sum_i H^*_{i1j}.p^0_{i1}]$.

(4.7) $x^0_{i1} = \sum_j D^0_{i1j}.x^0_{i1j}$ for all i.

Where τ^0_{i1j} is the CRETH elasticity of transformation. x^0_{i1j} is the percentage change in the output i produced by industry j. x^0_{i1} and p^0_{i1} are the percentage changes in the output and the basic price of good i. D^0_{i1j} is the share of producer good i produced by industry j in the total production of producer good i. If H^0_{i1j} is the value share of producer good i in the total output value of industry j, the modified value shares, H^*_{i1j}, is defined as follows.

(4.8) $H^*_{i1j} = H^0_{i1j}.\tau^0_{i1j}/\sum_j H^0_{i1j}.\tau^0_{i1j}$ for all j.

If τ^0_{i1j} is equal to τ^0_{1j}, i.e. constant elasticity of transformation (CET), then H^*_{i1j} is equal to H^0_{i1j}.

4.2.2. Margin Sector

The role of the margin sector - transport, wholesale, and retail trade - is to facilitate the flow of producer goods from industries to users. This model assumes that margin is required in a constant proportion to facilitate the flow of a unit of output. Thus, the share of margin in each purchase price differs across users. The following Equations 4.9, 4.10, 4.11, 4.12, and 4.13 relate demands for margin to intermediate demand and final demands. Equation 4.14 implies that the total demand for margin is equal to the sum of various demand for margin. Equation 4.61 in Sub-section 4.2.9 will show that the total supply of margin is made available by outputs of industries 7 and 8.

(4.9) $m^1_{isj} = x^1_{isj}$

(4.10) $m^2_{is} = x^2_{is}$

(4.11) $m^3_{isk} = x^3_{isk}$

(4.12) $m^4_{i1} = x^4_{i1}$

(4.13) $m^5_{is} = x^5_{is}$

(4.14) $m = \sum_i \sum_s \sum_j A^1_{isj}.m^1_{isj} + \sum_i \sum_s A^2_{is}.m^2_{is} + \sum_i \sum_s \sum_k A^3_{isk}.m^3_{isk} + \sum_i A^4_{i1}.m^4_{i1} + \sum_i \sum_s A^5_{is}.m^5_{is}.$

Where x^1_{isj}, x^2_{is}, x^3_{isk}, x^4_{i1}, and x^5_{is} are changes in industry j demand for intermediate input i from source s, capital creation demand for input i from source s, consumer goods production's demand for input i from source s, export demand for producer good i, and government demand for producer good i from source s. m^1_{isj}, m^2_{is}, m^3_{isk}, m^4_{i1}, and m^5_{is}, are changes in their demand for margin, respectively. A^1_{isj}, A^2_{is}, A^3_{isk}, A^4_{is}, and A^5_{is} are their shares in total margin, respectively.

4.2.3. Investment and Savings

This thesis assumes that, in the short run, policy shocks have no impact on savings-investment decisions of economic agents, as expressed in real terms, deflated by capital price index (*pik*). All economic agents view these shocks as permanent phenomena. Thus, there is no real change in all components of national savings and the inflow of foreign direct investment. If household savings are set constant in real terms, the remaining changes in disposable income are converted to present consumption. Equation 4.28 in Sub-section 4.2.5. expresses these relationships in nominal terms. There is also no real change in aggregate investment, through Equation 4.20. In a medium to long run model, the role of savings and investment can be incorporated. However, this is not in the scope of this thesis.

Equation 4.15 implies that total savings are equal to the sum of household savings (s^h_h), government savings (s^g), industry savings (s^j_j), and foreign direct investment (s^w). Equations 4.16 and 4.17 define nominal and real savings. By setting v^j_j and v^w at zero, industry savings and the inflow of foreign direct investment are constant in real terms and are un-affected by policy shocks. By assuming that v^w is zero, the nominal inflow of foreign direct investment is not zero, i.e. s^w and net export is not zero and depends on changes in prices. However, to avoid this weakness by assuming that s^w is zero, it follows that real investment is not constant and, therefore, the impact of policy shock on the future benefit of a change in real investment is a waste in this model. Between these two choices, this thesis elects to assume that v^w is zero, i.e. no real change in the inflow of foreign direct investment.

$$(4.15)\ s = \sum_h H^s_h.s^h_h + H^s_g.s^g + \sum_j H^s_j.s^j_j + H^s_w.s^w.$$

$$(4.16)\ s^j_j = v^j_j + pik.$$

$$(4.17)\ s^w = v^w + pik.$$

Where H^s_h, H^s_g, H^s_j, and H^s_w are the base year shares of household savings, government savings, industry savings, and the inflow of foreign direct investment in total savings, respectively.

The 1985 input-output table does not disaggregate investment demand for producer goods used in the creation of specific capital by industry. Thus, the availability of data limits this thesis to consider the aggregated investment demand for each producer good. Effective units of producer goods are used in fixed proportions, i.e. Leontief technology, to produce a level of real investment. Effective units of each producer good are the aggregate of producer goods from the two sources which are imperfect substitutes (4.18). By assuming zero profit condition, the change in capital price index can be explained as the weighted sum of the cost of inputs used in capital creation (4.19). Equation 4.20 defines real aggregate investment in terms of nominal savings (nominal investment) and capital price index. Equations 4.18, 4.19, and 4.20 ensure that all savings are invested in the creation of capital.

(4.18) $x^2_{is} \quad = v+\sigma^2_i.[p^2_{is}-\sum_s H^2_{is}.p^2_{is}],$

(4.19) $pik \quad = \sum_i\sum_s G^2_{is}.p^2_{is}.$

(4.20) $s \quad = v+pik.$

Where v is the percentage change in total investment, σ^2_i is the Armington elasticity of substitution between domestic and imported producer goods, p^2_{is} is the percentage change in the purchase price of producer good i from sources used in capital creation, and H^2_{is} is the cost share of producer good i from source s in the total cost of producer good i used in capital creation. G^2_{is} is the cost share of producer good i from source s in capital creation.

4.2.4. Production of Consumer Goods

The approach to household demand of this model is based on Coxhead and Warr (1991a). The ten producers of consumer goods are also profit maximisers. Inputs for producing consumer goods are the ten producer goods, both domestic and imported. There are no primary factor inputs, margin demand, and tax burden at this stage of production. They are implicitly included in the purchase prices of producer goods. Leontief production technology is assumed, i.e. fixed proportions of the effective units of producer goods are used in producing a unit of consumer goods. Each producer first chooses effective units of producer goods that are required for the production of a level of consumer goods. Demands for the effective units of producer goods depend on demand for consumer goods, and there is no substitution amongst different producer goods. Based on the effective units of producer goods, each producer chooses a combination of producer goods from the two sources that minimize cost (4.21). Subsitution between producer goods from the sources, caused by a change in their relative prices, is explained by Armington elasticity of substitution (σ^3_{ik}). Equation 4.22 sums up demand for each producer good used in producing all consumer goods.

$$(4.21)\ x^3_{isk} = c^3_k - \sigma^3_{ik}.[p^3_{is} - \sum_s H^3_{isk}.p^3_{is}].$$

$$(4.22)\ x^3_{is} = \sum_k G^3_{isk}.x^3_{isk}.$$

Where x^3_{isk} is the percentage change in demand for producer good i from source s used in the production of consumer good k. x^3_{is}, and p^3_{is} is the percentage change in demand for and the price of producer good i from source s used in the production of consumer goods in general. c^3_k is the percentage change in total supply of consumer good k. H^3_{isk} is the cost share of producer good i from source s in the total cost of input i used in the production of consumer good k. G^3_{isk} is the share of producer good i from source s used in the production of consumer goods accounted for by the production of consumer good k.

4.2.5. Household Behaviour

Households derive most of their income from their ownership of factors of production. Assistance payment and transfers from government, through the transfer pool, are also sources of income. Equation 4.23 shows that household income is equal to income from their ownership of primary factors and the transfer pool. If u is zero, then there is no change in the transfer pool, i.e. no change in non-factor income.

$$(4.23)\ y_h = \sum_q O_{1qh}.[f^s_{1q} + r_{1q}].H_{fh} + \sum_j O_{2jh}.[f^s_{2j} + r_{2j}].H_{fh} + \sum_j O_{3jh}.[f^s_{3j} + r_{3j}].H_{fh} + u.H_{uh}.$$

Where y_h is the income of household h. H_{fh} and H_{uh} are the shares of factor incomes and non-factor incomes in total households' income, respectively. O_{1qh} is the share of return to labour type q in income of household h. O_{2jh} and O_{3jh} are similarly defined for household h' income from industry specific capital and land.

Household income is allocated to direct tax, assistance payments to other households, and disposable income (4.24). Percentage changes in direct tax payment and assistance payments can be exogenous. Equation 4.25 states that the percentage change in direct tax payment is equal to the percentage change in household income plus the percentage change in direct tax rate. In one simulation, the model assumes that households pay direct tax to government in fixed proportions, i.e. direct tax rates remain unchanged. This assumption is more reasonable for urban households than for rural households. However, the assumption is applied for both types of households.

(4.24) $y_h = H^d_h.y^d_h+H^g_h.d^r_h+H^u_h.u_h.$

(4.25) $d^r_h = y_h+t^d_h.$

(4.26) $u_h = \theta^u_h.y_h.$

Where y_h, y^d_h, d^r_h, and u_h are the percentage changes in household h's income, disposable income, direct tax payment, and assistance payments to the transfer pool. t^d_h is the direct tax rate on household h. H^d_h, H^g_h, and H^u_h are the shares of disposable income, direct tax payment, and assistance payments in the total income of household h. θ^u_h is the parameter explaining household assistance payments. In general, θ^u_h is set at zero, i.e. there is no change in household assistance payment.

There is household demand for the ten consumer goods and not for the producer goods. The estimations of expenditure, own prices, and cross prices elasticities of demand for consumer goods will be discussed in Chapter Five. In brief, household consumption behaviour follows the well-known linear expenditure system (LES). Each makes decisions in two steps. First, they allocate their disposable income to savings and consumption. Second, they allocate their consumption expenditure on the ten consumer goods. Equation 4.27 defines the real change in household savings. Equation

4.28 states that household disposable income is divided between savings and consumption expenditure. By Equation 4.29, household h's demand for each consumer good is governed by the own price and cross price elasticities of demand (η_{hkq}), and the expenditure elasticity of demand (η_{hk}).

(4.27) $s^h_h = v^h_h + pik.$

(4.28) $y^d_h = B^s_h.s^h_h + B^c_h.c_h.$

(4.29) $c^3_{kh} = \sum_q \eta_{hkq}.p^c_q + \eta_{hk}.c_h.$

Where c_h and s^h_h are the percentage changes in household consumption expenditure and nominal savings of households; and B^s_h and B^c_h are their shares, respectively. v^h_h is savings of household h in real terms. c^3_{kh} and p^c_k (p^c_q) are the percentage changes in household h's demand for and the price of consumer good k.

The percentage changes in the transfer pool is equal to the weighted sum of the percentage changes in household assistance payments and government transfer payment (4.30).

(4.30) $u = \sum_h G^u_h.u^h_h + G^u_g.u^g.$

Where u is the percentage change in the total transfer pool. u_h and u_g are the percentage changes in household, and government contributions to the transfer pool, respectively. G^u_h and G^u_g are the shares of household assistance payments and government transfers in the transfer pool. u_h and u_g could be excluded from this model. However, for computational purpose, they are included and set at zero.

4.2.6. Export Demand

The following Equation 4.31 explains export demand. p^w_{i1} and x^4_{i1} are the percentage changes in f.o.b. price in US\$ and the export of good i, respectively. γ_i is the reciprocal of elasticity of world demand for Thai export of producer good i. f^4_{i1} is a shift parameter which represents an exogenous change in world demand.

γ_i can be set flexibly. Under small country assumption, where Thai exports have no influence on world price, it is set at zero. However, as will be discussed in the subsequent section, Thai exports of rice and rubber have market power and can affect world price to some degree.

The role of (4.31) is very limited. In the case of export oriented producer goods, x^4_{i1} is endogenously determined by the model. In the cases of import competing and non-traded producer goods, x^4_{i1} is exogenously determined and set at zero. In both case, p^w_{i1} is accordingly explained by (4.31).

(4.31) $p^w_{i1} = -\gamma_i . x^4_{i1} + f^4_{i1}$, for all i.

4.2.7. Government Behaviour

Tariff revenue, indirect tax, direct tax, and property income are the four main sources of government revenue. Government property income is assumed to derive from ownership of non-agricultural specific capital. Equations 4.32-4.35 calculate changes in government revenue from trade taxes, indirect tax, direct tax, and properties, respectively. Equation 4.36 sums up the change in total government revenue.

(4.32) $t^w = \sum_i G^x_{i1}.(p^w_{i1}+g^4_{i1}+t^x_{i1}+x^4_{i1}+e^w) + \sum_i G^m_{i2}.(p^w_{i2}+t^m_{i2}+x^0_{i2}+e^w)$.

(4.33) $t^i = \sum_i \sum_s G^i_{is}.(p^0_{is}+t^i_{is}+x^0_{is})$.

(4.34) $t^d = \sum_h G^d_h.(y^d_h+t^d_h)$.

(4.35) $t^f = \sum_j O_{2jg}.(r_{2j}+f_{2j})$.

(4.36) $y^g = H^w.t^w+H^i.t^i+H^d.t^d+H^f.t^f$.

Where G^x_{i1} and G^m_{i2} are the shares of export tax revenue and import tax revenue in total tariff revenue. G^i_{js} is the share of indirect tax revenue from producer good j from source s in total indirect tax. G^d_h is the share of household h's direct tax payment in total direct tax. Similar to O_{2jh} in Sub-section 4.2.5, O_{2jg} refers to government income from industry specific capital. H^w, H^i, H^d, and H^f are the shares of revenues from trade taxes, indirect taxes, direct taxes, and property income.

Government expenditure on each producer good, from each source, is assumed constant in real terms (4.37). Thus, Government demand does not adjust according to the change in the relative prices of producer goods from different sources. Government also saves and transfers income to households, through the transfer pool. There is no theory to explain government savings, which fluctuated greatly during the past two decades (s^g). On one side, the government borrows to finance its budget deficit. On the other side, the government saves when the budget is in surplus. Equation 4.38 defines government savings in real terms (v^g). Equation 4.39 sets the percentage change in government transfer (u^g). If η^5_g is set at one, government transfer moves in line with government revenue. If η^5_g is set at zero, which is the case in this model, government transfer is fixed. Equation 4.40 sums up total government expenditure (c^g). Equation 4.41 defines the windfall effect of policy shocks on government budget (dG). In this model, dG can be financed by borrowing from overseas (-dG), or by taxation. The last term in the Equation 4.41 assumes that, by controlling the exports of non-export oriented goods, the government absorbs all consequences which is represented by a shift variable (g^4_{i1}). The role of this variable will be explained in the following section.

(4.37) $x^5_{is} = 0.$

(4.38) $s^g = v^g + pik.$

(4.39) $u^g = \eta^5_g . y^g.$

(4.40) $c^g = \sum_i \sum_s G^5_{is} . [x^5_{is} + p^5_{is}] + G^{5s} . s^g + G^{5u} . u^g.$

(4.41) $100dG = R^g . y^g - E^g . c^g - \sum_i E . S^e_{i1} . (e^w + g^4_{i1} + x^4_{i1})$, i ≠ export oriented good.

Where G^5_{is} is the share of government expenditure on good i from source s in total government expenditure. G^{5s} and G^{5u} are the shares of government savings and government transfers in total government expenditure. R^g and E^g are total government revenue and expenditure in the base year.

Indirect and direct tax rates can be set flexibly by (4.42) and (4.43). If tid_{is}, $tbar^i_s$, and $tbar^{is}$ are set at zero, indirect tax rates are fixed. Similarly, direct tax rates can be fixed if td_h and $tbar^d$ exogenously set at zero. The impact of trade liberalisation on the government budget deficit can be redistributed through endogenously determined indirect and direct tax rates subject to a government budget condition, e.g., dG = 0. A redistribution through a uniform change in direct tax rates ($tbar^d$) is implied by setting td_h, tid_{is}, $tbar^i_s$, and $tbar^{is}$ at zero. Similarly, a redistribution through a uniform change in indirect tax rates on all producer goods is implied by setting all other indirect tax and direct tax variables exogenous at zero, while leaving $tbar^{is}$ endogenously determined, and so on.

(4.42) $t^i_{is} = tid_{is}+tbar^i_s+tbar^{is}$.

(4.43) $t^d_h = td_h+tbar^d$.

4.2.8. Price Determination

The two types of labour are assumed perfectly mobile across industries. By Equation 4.44, the percentage change in return to labour type q employed by industry j (r_{1qj}) is equal to the percentage change in return to labour type q in general (r_{1q}) plus a wage differential factor (d_{1qj}). If d_{1qj} is zero, which is the case in this thesis, Equation 4.44 does not imply that the returns to labour type q are equal across industries. It simply means that their percentage changes are equal. Any existing wage gaps between labour employed by different industries are not examined by this model. Where H^1_{1qj} is the share of labour type q in the total wage bill of industry j, Equation 4.45 explains the percentage change in the unit returns to effective labour in each industry.

Equation 4.46 states that real wages are equal to nominal wages indexed by the consumer price index.

$$(4.44)\ r_{1qj} = r_{1q} + d_{1qj}.$$

$$(4.45)\ r_{1j} = \sum_{q} H^{1}_{1qj} . r_{1qj}.$$

$$(4.46)\ rw_{1q} = r_{1q} - cpi.$$

In the case of multi-output industries, the percentage changes in returns to capital (r_{2j}) and land (r_{3j}), industry specific factors of production, are implicitly set by Equation 4.2. This is rewritten in the form of Equation 4.47. If the elasticity of substitution, σ^{0}_{nj}, is equal to 1, then capital and land are assumed to maintain constant shares in the total return to industry specific factors.

$$(4.47)\ f_{2j} - f_{3j} = -\sigma^{0}_{2j} . (r_{2j} - r_{3j}).$$

There are three sets of product prices: basic prices, producer prices, and purchase prices. The basic prices are equal to the total cost used in producing one unit of output. The producer price of any producer good is the sum of its basic price and indirect tax including any trade tax in the case of imported goods. Due to the availability of data, indirect tax and margin costs are assumed uniform across sources of goods, i.e. domestic and imported. However, different users face different margin costs.

The basic price of each good is equal to the sum of its total cost, which consists of the cost of intermediate inputs, returns to the two types of labour, returns to capital, capital consumption allowance, and, in the case of agricultural industries, returns to land. Based on a zero profit condition, Equations 4.48 and 4.49 equate changes in the output and basic prices of the goods, produced by single output and multi-output industries, to changes in total cost of production. Equation 4.48 states that the total cost is equal to the total cost from all intermediate inputs and primary factors of production, less an import tax rebate from all imported inputs used in producing industry exports. Capital consumption allowance is part of the return to capital and assumed to be industry savings (s^j_j). This was discussed in Sub-section 4.2.3.

$$(4.48)\ p^0_{j1}+z_j = \sum_i\sum_s G^0_{isj}.(x^1_{isj}+p^1_{isj})+G^0_{1j}.(f_{1j}+r_{1j})+G^0_{2j}.(f_{2j}+r_{2j})+G^s_{2j}.s^j_j$$

$$-\sum_i H^*_{i2j}.(t^w_{i2}+p^w_{i2}+e^w+x^1_{i2j}+x^4_j-z_j)+,$$

$$(4.49)\ \sum_i B^0_{i1j}.(x^0_{i1j}+p^0_{i1}) = \sum_i\sum_s G^0_{isj}.(x^1_{isj}+p^1_{isj})+G^0_{1j}.(f_{1j}+r_{1j})+G^0_{2j}.(f_{2j}+r_{2j})$$

$$+G^s_{2j}.s^j_j+G^0_{3j}.(f_{3j}+r_{3j}),$$

where $\sum_i\sum_s G^0_{isj}+\sum_i G^0_{vj}-\sum_v H^*_{i2j}+G^s_{2j}.s^j_j = 1$, $\sum_i B^0_{i1j} = 1$. G^0_{isj}, G^0_{vj}, and G^s_{2j} are cost shares of intermediate inputs i from source s, primary factor v, and industry savings in total cost, net of import tax rebate (H^*_{i2j}). Apart from agro-industry and other export oriented industries, the term H^*_{i2j} is zero, i.e. no import tax rebate. $G^0_{3j}.r_{3j}$ is excluded from 4.48 because land is not a factor of production in the non-agricultural single-output industries. p^0_{i1} and B^0_{i1j} is the price and the value share of each producer good i produced by the multi-output industry j.

In this thesis, tariffs, as represented by NRP, are assumed to be the only one protective measure. Other protective measures are implicitly included in the NRP. The domestic prices of exported and imported goods are related to world prices by an exchange rate and tariffs. Equations 4.50 and 4.51 relate the percentage changes in producer good i's export price (p^4_{i1}) and import price (p^0_{i2}) to the percentage changes in exchange rate (ε^w), their trade taxes (t^x_{i1} and t^m_{i2}), and the world prices of their counterparts (p^w_{i1} and p^w_{i2}).

The g^4_{i1} is a shift variable. In the case of export oriented producer goods, it is set at zero. Thus, domestic price is determined by the world market through (4.31). In the case of import competing and non-traded producer goods, of which exports are minor, when compared with total domestic outputs, their exports are exogenously set at zero. g^4_{i1} is allowed to adjust (through 4.50) and, consequently, p^w_{i1} is unaffected by domestic conditions (through 4.31). This arbitrary setting has no distorting effect on any economic variables in the model. Without g^4_{i1}, p^w_{i1} would get an unrealistic non-zero value which implies that the export of Thai's import-competing and non-traded producer goods have some power in the world markets.

$$(4.50)\ p^w_{i1}+\varepsilon^w+g^4_{i1} = \beta_{i1}.p^4_{i1}+\alpha_{i1}.(p^w_{i1}+e^w+g^4_{i1}+t^x_{i1}),$$

$$(4.51)\ p^0_{i2} = \beta_{i2}.(p^w_{i2}+\varepsilon^w)+\alpha_{i2}.(p^w_{i2}+e^w+t^m_{i2}),$$

where β_{i1} and α_{i1} are the shares of export price and export tax in the world price of producer good i. β_{i2} and α_{i2} are the shares of world price and import tax in the import price of producer good i. α_{i1} is generally negative for i = 5 and 6, since exports of agro-industry and other export industries are subsidised by tax rebates. Then, for the export oriented industries (j = 5 and 6),

$$(4.52)\ t^x_{j1}+p^w_{j1}+e^w = \sum_i H^m_{i2j}.(x^1_{i2j}+t^m_{i2}+p^w_{i2}+e^w)-z_j.$$

Equation 4.52 implicitly states that the total rebate for an export industry is equal to the sum of total import tax on its imported input, weighted by the ratio between total export and total output of the industry. H^m_{i2j} is the value share of import tax paid by industry j accounted for by input i.

The percentage changes in purchase prices are explained by the changes in their basic prices, indirect tax, and the related cost of margin (4.53, 4.55, and 4.56). Equation 4.54 defines the purchase prices net of import tax rebate from imported inputs used in producing for export. For domestic inputs (s = 1) or non-export oriented industries, i.e. j ≠ 5 and 6, G^*_{ij} is one and K^*_{ij} is zero, i.e. no tax rebate. Equation 4.57 sets the prices of consumer goods. Tax and margin do not affect the percentage change in the price of consumer goods (p^c_k). An assumption is that they are already included in the purchase prices of producer goods used in producing each consumer good.

$$(4.53)\ p^1_{isj} = H^{01}_{is}.p^0_{is}+H^{g1}_{is}.(p^0_{is}+t^i_{is}) +H^{m1}_{isj}.(G^m_{71}.p^0_{71}+G^m_{81}.p^0_{81}).$$

$$(4.54)\ pr^1_{isj} = G^*_{ij}.p^1_{isj}-K^*_{ij}.(p^w_{i2}+t^m_{i2}+e^w+x^4_j-z_j).$$

$$(4.55)\ p^n_{is} = H^{0n}_{is}.p^0_{is}+H^{gn}_{is}.(p^0_{is}+t^i_{is}) +H^{mn}_{is}.(G^m_{71}.p^0_{71}+G^m_{81}.p^0_{81}),\ n = 2, 3, \text{and } 5.$$

$$(4.56)\ p^4_{i1} = H^{04}_{i1}.p^0_{i1}+H^{g4}_{i1}.(p^0_{i1}+t^i_{i1}) +H^{m4}_{i1}.(G^m_{71}.p^0_{71}+G^m_{81}.p^0_{81}).$$

$$(4.57)\ p^c_k = \sum_i\sum_s C^3_{isk}.p^3_{is}.$$

Where p^1_{isj} and p^n_{is} are the percentage changes in the purchase price of producer good i from source s for purpose n, n = 1, 2, 3, and 5. p^4_{i1} is the percentage change in the export price of good i. H^0_{is}, H^g_{is}, and H^{mn}_{is} are the (value) shares of basic price, indirect tax, and margin cost in the purchase price of good i from source s for each purpose n. $H^0_{is}+H^g_{is}+H^{mn}_{is} = 1$ for all i and s. G^m_{71} and G^m_{81} are the value shares of the outputs from industries 7 and 8 used in the services of margin. C^3_{isk} is the cost share of producer good i from source s in the unit cost of consumer good k and $\sum_i\sum_s C^3_{isk} = 1$.

4.2.9. Market Clearing Conditions

Equation 4.58 equates total supply of each type of labour to its total industry demand. By Equations 4.59 and 4.60, the industry specific factors (capital and land) are also fully employed.

$$(4.58)\ f^s_{1q} = \sum_j N_{1qj}.f_{1qj},$$

$$(4.59)\ f^s_{2j} = f_{2j},$$

$$(4.60)\ f^s_{3j} = f_{3j}.$$

Where f^s_{1q} is the change in total supply of labour type q. N_{1qj} and f_{1qj} are the share of industry j's demand in total demand for labour type q and percentage change in industry j's demand for labour type q, respectively. f^s_{2j}

and f^s_{3j} are percentage changes in total supply of industry specific capital and land. f_{2j} and f_{3j} are percentage changes in industry j's demand for capital and land.

Equation 4.61 implies that the domestic production of each producer good is equal to the sum of its intermediate demand, capital creation demand, demand for the production of consumer goods, export demand, government demand, and demand for the supply of margin. By Equation 4.62, the total supply of each imported producer good is equal to total demand, which consists of intermediate demand, capital creation demand, demand for the production of consumer goods, and government demand. Similarly, total supply of each consumer good is equal to total household demand for the consumer good (4.63).

$$(4.61)\ x^0_{i1} = \sum_j B^1_{i1j}.x^1_{i1j} + B^2_{i1}.x^2_{i1} + \sum_k B^3_{i1k}.x^3_{i1k} + B^4_{i1}.x^4_{i1} + B^5_{i1}.x^5_{i1} + B^m_{i1}.H^m_{i1}m.$$

$$(4.62)\ x^0_{i2} = \sum_j B^1_{i2j}.x^1_{i2j} + B^2_{i2}.x^2_{i2} + \sum_k B^3_{i2k}.x^3_{i2k} + B^5_{i2}.x^5_{i2}.$$

$$(4.63)\ c^3_k = \sum_h G^3_{kh}.c^3_{kh}.$$

where $\sum_j B^1_{i1j} + B^2_{i1} + \sum_k B^3_{i1k} + B^4_{i1} + B^5_{i1} + B^m_{i1} = 1$, $\sum_i H^m_{i1} = 1$,

$\sum_j B^1_{i1j} + B^2_{i1} + \sum_k B^3_{i1k} + B^5_{i1} = 1$, and $\sum_h G^3_{kh} = 1$.

x^0_{is} is the total supply of producer good i from source s. x^1_{isj}, x^2_{is}, x^3_{isk}, x^4_{i1}, x^5_{is}, c^3_{kh}, c^3_k, and m are as previously defined. B^1_{isj}, B^2_{is}, B^3_{isk}, B^4_{i1}, B^5_{is}, and G^3_{kh} are their demand shares, respectively. H^m_{i1} is the share of industry i in the total supply of margin. $H^m_{i1} > 0$ for i = 7 and 8, otherwise $H^m_{i1} = 0$.

4.2.10. Miscellaneous Equations

The remaining equations explain the percentage changes in consumer price index (ε^3), poverty line (ζ), import value (m), export value (e), and trade balance (dB). The concept behind the poverty line will be discussed again in

Chapter Six. The trade balance, 100dB, explains how policy shocks affect net exports of the Thai economy. Equation 4.69 defines the balance of payment (dBOP) which is equal to the sum of government borrowing (-100dG), the inflow of foreign direct investment (Fs^w), and the net export (Ee-Mm). Because SAM is based on the accounting convention, the overall balance of payments is initially zero. The percentage change in GDP (y) is set by (4.70).

$$(4.64)\ \varepsilon^3 = \sum_k G^c_k . p^c_k .$$

$$(4.65)\ \zeta = (1/S_f).\sum_k H^f_k . p^c_k,\ k = 1, 5;\ \text{i.e., food only.}$$

$$(4.66)\ e = \sum_i (x^4_{i1}+p^w_{i1}).S^e_{i1}.$$

$$(4.67)\ m = \sum_i (x^0_{i2}+p^w_{i2}).S^m_{i2}.$$

$$(4.68)\ 100dB = E.e\text{-}M.m.$$

$$(4.69)\ 100dBOP = -100dG+F.s^w+E.e\text{-}M.m.$$

$$(4.70)\ y = \sum_h S^0_h . y_h + S^0_g . t^f.$$

Where G^c_k is the value share of consumer k in total household consumption. S_f is the share of food expenditure in the poverty line. H^f_k is the cost share of consumer good k (k = 1,..,5) in the total poverty line. S^e_{i1} and S^m_{i2} are the shares of producer good i's export in total exports and producer good i's import in total imports. E and M are export and import values at base year. S^0_h and S^0_g are the shares of household h's income and government property income in GDP.

4.3. Social Accounting Matrix

This section describes a Social Accounting Matrix (SAM) of Thailand, which is the most important source of coefficients used in the CGE model. SAM provides a consistent framework for the construction of the CGE model, and ensures the consistence of macro-economic relationships in the base year of this study. In general, the base year should be the year that the Thai economy was stable and closest to equilibrium. However, 1988 is chosen as the base year because it is the most recent year for which data were available at the time of the field work done for this thesis.

The main sources of data for the construction of SAM are as follows.

1. The input-output table of Thailand, 1985.
2. National Income of Thailand, various issues.
3. Report of the 1988 Household Socio-economic Survey.
4. Report of the 1988 Labour Force Survey.
5. Report of the 1988 Intercensal Survey of Agriculture.
6. Report of the 1987 Industrial Survey.
7. Data from the Office of Agricultural Economics.
8. Publications from the Rubber Research Institute.
9. Quarterly Bulletin, Bank of Thailand, various issues.
10. Village Surveys, various issues.
11. Tax schedule from various studies and publications.

The structure of SAM can be described as follows. First, for every row (column) there is a corresponding column (row). Second, each element along a row is a receipt, and along a column an expenditure. Third, row-sum and corresponding column-sum are equal. There are ten main accounts in this 1988 SAM, i.e. ten rows and ten columns. These accounts are 1) primary factors of production, 2) institutions, 3) producing sectors, 4) producers of consumer goods, 5) domestic producer goods, 6) imported producer goods, 7) margin sector, 8) indirect tax, including tariff and subsidy, 9) capital account, and 10) the rest of the world.

This section will not detail how SAM was constructed. Concept and methodology are well discussed in the literature. Social Accounting Matrix Indonesia (1975) and King (1981) are particularly useful. In brief, three criteria are used in the construction of SAM - maintaining the production structure of the 1985 input-output matrix, adjusting many accounts according to the base year data, and focussing on various economic properties such as the adding-up and homogeneity properties of consumer demand. Where necessary, data from other sources were also incorporated into various accounts. Adjustment was based on discussion with experts. SAM was not initially in balance, i.e. row-sum is not equal to column-sum. Rather than using RAS technique, this thesis manually balances the receipts and expenditures of the accounts. Minimum departure from the initially un-balanced SAM was always a precondition.

If this SAM is defined as a 10x10 matrix S then each element or sub-matrix S_{ij} is the total receipt of an account i paid by an account j. Some of these sub-matrix are zero, i.e. zero flow between the accounts i and j. Each non-zero S_{ij} can be described as follows.

$\mathbf{S_{1,3}}$ is the functional distribution of income which explains how value added in each producing sector is divided among primary factors of production. These factors are skilled labour, un-skilled labour, industry specific capital, Northeastern (ESAN) land, and non-ESAN land.

$\mathbf{S_{1,10}}$ is income transfer from the rest of the world to primary factors of production. Generally, this is worker remittances from overseas. These remittances are assumed to be the return to skilled labour.

$\mathbf{S_{2,1}}$ is a factor ownership matrix, which explains how institutions derived their income from returns to primary factors. Institutions are divided into 3 categories - households, transfer pool, and government. There are ten households, five quintiles for urban and rural settings. Since data do not allow the construction of a two-way matching between transferor and transferee, the transfer pool is included as a media of income transfer among households. Although household ownership of industry specific capital can be disaggregated into agriculture and non-agriculture, because data are not available, it cannot be disaggregated by industry. This thesis assumes that the distribution of industry specific capital among households is the same as the distribution of agricultural and non-agricultural capital in general.

$\mathbf{S_{2,2}}$ is income transfer between institutions. There are two main types of transfer: transfer among households (assistance payment through transfer pool) and transfer between government and households (government transfer, direct tax, and fine).

$S_{2.8}$ is government revenue from indirect tax less subsidy. This includes trade tax (subsidy), which are mainly based on the 1987 nominal rates of protection.

$S_{2,10}$ is an income transfer from the rest of the world to institutions. In this case, it only explains transfer from the rest of the world to government. Transfers from the rest of the world to households are explained by $S_{1,10}$ and transfer from primary factors to the rest of the world $S_{10,1}$.

$S_{3.5}$ is the only non-zero sub-matrix along the third row. It is a diagonal matrix which simply transfers producer goods from producing sectors to its distributors, i.e. domestic goods.

$S_{4.2}$ is also the only non-zero sub-matrix of its row. It explains the consumption expenditure of each household. The expenditure is classified by types of consumer goods.

$S_{5.2}$ is Government consumption expenditure on domestic goods.

$S_{5.3}$ is intermediate demand for domestic goods by the producing sectors (industry).

$S_{5.4}$ is demand for domestic goods used in the production of consumer goods.

$S_{5.7}$ is margin sector's demand for domestic goods. It explains how margin sector uses outputs from producing sectors to facilitate the flows of producer goods to intermediate and final users.

$S_{5.9}$ is the investment demand for domestic goods. Due to the availability of data, it explains total investment demand but not investment demand by industry.

$S_{5,10}$ is the rest of the world demand for domestic goods, i.e. export demand.

Similarly, $S_{6.2}$, $S_{6.3}$, $S_{6.4}$ and $S_{6.9}$ are demand for imported goods by Government, producing sectors, consumer goods, and investment. $S_{6.7}$ and $S_{6,10}$ are zero, i.e. there is no demand for imported goods by margin sector, and there is no re-export.

$S_{7.2}$ is demand for margin to deliver goods to government.

$S_{7.3}$ is demand for margin to deliver intermediate inputs to the producing sectors.

$S_{7.4}$ is demand for margin to deliver producer goods, used in the production of consumer goods.

$S_{7.9}$ is demand for margin to deliver goods to the creation of capital.

$S_{7.10}$ is demand for margin to deliver export to Thai ports.

$S_{8.5}$ and $S_{8.6}$ are indirect tax less subsidy paid by the domestic and imported sectors, respectively. These indirect taxes consist of trade tax (subsidy) and other indirect taxes.

$S_{9.2}$ is savings by institutions, i.e. household savings and government savings.

$S_{9.3}$ is capital consumption or depreciation in each producing sector. This can be viewed as industry savings which will be available for investment anywhere in the economy.

$S_{10.1}$ is the return to foreign owned primary factors of production. For Thailand, foreign investment is mostly concentrated in non-agricultural sectors. An assumption is that this transfer is derived from non-agricultural capital only.

$S_{10.6}$ is the c.i.f value of total import from the rest of the world.

Table 4.1 presents the general structure of this SAM. The numerical presentation of some sub-matrices such as $S_{1.3}$, $S_{2.1}$, and $S_{4.2}$ are presented at the appropiate points in the following chapters. The two multi-output industries, ESAN and non-ESAN, are assumed to have the same technology as described by the 1985 input-output table.

TABLE 4.1: General Structure of the 1988 Social Accounting Matrix.

(i,j)	1	2	3	4	5	6	7	8	9	10
1	0	0	*	0	0	0	0	0	0	*
2	*	*	0	0	0	0	0	*	0	*
3	0	0	0	0	*	0	0	0	0	0
4	0	*	0	0	0	0	0	0	0	0
5	0	*	*	*	0	0	*	0	*	*
6	0	*	*	*	0	0	0	0	*	0
7	0	*	*	*	0	0	0	0	*	*
8	0	0	0	0	*	*	0	0	0	0
9	0	*	*	0	0	0	0	0	0	0
10.	*	0	0	0	0	*	0	0	0	0

<u>Notes</u>: * Non-zero submatrix,
1. primary factors of production,
2. institutions,
3. producing sectors,
4. producers of consumer goods,
5. domestic producer goods,
6. imported producer goods,
7. margin sector,
8. indirect tax, including tariff and subsidy,
9. capital account, and
10. the rest of the world.

4.4. Other Parameter Settings in the Model

In addition to the share parameters from SAM, the model requires the specification of a number of elasticities and income distribution parameters. Elasticities of consumer demand were estimated and are discussed in Chapter Five. Income distribution related parameters are discussed in Chapter Six, which also presents the theory and measurement of income distribution in a general equilibrium framework.

This section provides the rationale behind the choice of the remaining elasticities and share parameters used in the model. Due to limited time and resources, most of the following elasticities are either quoted or imputed from past studies. Ideally, preferred choices would be studies of which estimates were based on Thai data. However, in many cases, such estimates are not available, and empirical estimates of other countries are the only possible alternatives. These elasticities and share parameters can be classified into six categories as follows.

4.4.1. Base Year Nominal Rates of Protection

As discussed in Chapter Two, this thesis relies on the estimates of the 1987 nominal rates of protection by Paitoon et al. (1989). The nominal rate of protection (NRP) for each industry is equal to the sum of NRP for corresponding input-output sectors weighted by their export or import shares. However, the nominal rates of protection for export industries, especially other export industries, tend to be incredibly high (Table 4.2). By definition, the nominal rates of 10.21% for other export industries indicates that other export industries receive export subsidy, through tax rebate, 10.21 Bahts for every 100 Bahts that the industries earned from exports. Considering the industries' cost of imported inputs (8.96%), the nominal rate of 10.21% implies that other export industries can rabate more than the total cost of imported inputs. This is not to say that the share of import taxes in the total cost of agro-industry and other export industries is much less than this.

Table 4.2: Nominal Rate of Protection (NRP) and Cost Share of Imported Inputs, by Producer Good

Producer Good	NRP (%)	Adjusted NRP (%)	Share of Imported Inputs
1. Paddy	0.00	-	5.29
2. Maize, Cassava, and Sugar-cane	0.19	-	4.97
3. Rubber	0.00	-	6.77
4. Other Agricultural Products	7.74	-	5.27
5. Agro-industry Products	0.04	0.13	0.48
6. Other Exportable Products	10.21	1.49	8.96
7. Petroleum Products	1.40	-	68.65
8. Other Import-competing Products	18.93	-	24.56
9. Electricity, Water Supply, Transport, and Communication	0.00	-	15.78
10. Services	0.22	-	4.05

Sources: 1) Weighted average from 1987 figures in Table 3.13, Paitoon et al. (1989).
2) The input-output table of Thailand, 1985, NESDB.

Table 4.3: Tax Drawbacks, Rebates, and Total Export: 1985-1989

(Million Baht)

Year	Tax Drawback	Tax Rebate	Total Export
1985	2,992	1,754	245,251
1986	3,069	2,336	290,169
1987	3,916	3,417	375,596
1988	5,494	4,677	514,922
1989	6,230	4,250	650,030

Sources: 1. Table 2.6, Paitoon et al. (1989)
2. National Income of Thailand, NESDB.

There is an evidence that export subsidy, through tax drawbacks and rebates, are at very high rates. In 1987 and 1988, tax drawbacks and rebates accounted for about 1.7% and 2.0% of total exports of goods and services, respectively (Table 4.3). Paitoon et al. also state that, unless export firms are under the Customs Department Scheme, they are eligible for the full rebate rate. According to them, both the number of applicants for and the amount of tax exemption grew annually at the rate of around 25%; and most of these exporters produced textiles and textile products, garments, plastic products, ceramics, and electronic products. This thesis chooses to recalculate tax rebate of agro-industry and other export industries, based on the nominal rates of protection for all other industries and the cost structure from the 1985 input-output table. Based on an assumption that exporters rebate 100% of their import tax payment, the adjusted nominal rates of protection for agro-industry, and other export industries, are reported in the second column of Table 4.2.

4.4.2. Substitution Between Skilled and Unskilled Labour

There is no available empirical estimate of substitution parameter among classes of labour from Thai data. The preferred values used by this thesis follow Tinbergen (1975, quoted in Dixon et al., 1982), who concluded that the evidence is consistent with a unitary elasticity of substitution between different occupational groups of labour.

In this thesis, labour substitution parameters in non-agricultural industries are set at one. For the agricultural industries, in which only un-skilled labour is employed, the parameter is set at 0.001. This is for computational purpose and does not harm the structure of the model.

This unitary elasticity of substitution implies that the changes in relative return to the two types of labour are counter balanced by opposite changes in relative demand for the two types of labour. The shares of skilled and un-skilled labour in each industry wage bill are kept constant. Thus, a change in the distribution of wage income is explained by the un-balanced growth between labour intensive industry and non-labour intensive industry.

4.4.3. Substitution Among Primary Factors

Much of the literature disagrees on the degree of substitution among primary factors of production. Arrow et al. (1961 quoted in Fuchs, 1963), by using cross section data, concluded that the elasticity of substitution between capital and labour in manufacturing may typically be less than unity. But Fuchs (1963) points out that Arrow et al.'s conclusion was induced by the use of heterogeneous countries. When this heterogeneity was corrected, Fuchs' results show that the elasticity of substitution clustered around one. Caddy (1976), after a detailed review of the literature, also adds that the long run estimates of the elasticities of substitution between primary factors of production do not show any significant deviation from unity, while the short run estimates are lower and fall between 0 and 1.

Past studies also support the use of different values of the elasticity of substitution across industries. The values used by Whalley (1985), and the values estimated by Rimmer (1990, quoted in SALTER, 1991) indicate that the highest elasticity of substitution between labour and capital is in the service industries, and the lowest is in agriculture. Their results show that, for services, the elasticities are around 1. For the manufacturing sector, Whalley's estimates are 0.6-0.9, while Rimmer's estimate is 0.5. Yotopoulos and Nugent (1976 quoted in SALTER, 1991) assert that many studies found larger opportunities for substitution in agriculture than in manufacturing, and claim that modern technology tends to decrease substitution opportunities. Thus, they point out that the elasticities of substitution in agriculture should be larger in less developed countries.

Only one study based on Thai data is available. Paitoon (1975), by using cross section data, estimated the elasticities of substitution between labour and capital in fifty manufacturing sectors. Most of his estimates are significant, and are in the range of 0.5 and 1.5. The majority of his long run estimates cluster around 1 and, therefore, confirms Fuchs' and Caddy's conclusions.

Table 4.4 summarises the guessed value of the elasticities of substitution.

Based on the estimates of, and suggestions by, the mentioned studies, guesses for the elasticities of substitution between (effective) labour and capital in this model are as follows. For the two multi-output agricultural industries, the elasticities of substitution between labour and capital are set at 1. For the four single output manufacturing industries, the elasticities are set at 0.75. The value of 1 is also set for the two non-traded industries (EWTC and services).

TABLE 4.4: Elasticities of Substitution between Labour and Among Primary Factors.

Industry	Elasticities of Substitution		
	a	b	c
ESAN industry	0	1	1
Non-ESAN industry	0	1	1
Agro-industry	1	0.75	-
Other Export Industries	1	0.75	-
Petroleum Industry	1	0.75	-
Other Import-competing Industries	1	0.75	-
EWTC	1	1	-
Services	1	1	-

Notes: a Elasticity of substitution between skilled and un-skilled labour.
b Elasticity of substitution between labour and capital.
c Elasticity of substitution between land and capital, and land and labour.

The multi-output industries also require elasticities of substitution between labour and land, and capital and land. Again, unitary elasticity of substitution is guessed for labour and land. The assumption that capital and land are specific factors in short run, imply that the return to mobile factor of production is determined by the market, while the total return to specific factors is determined by residual. This thesis has no theory to explain the distribution of the total return to industry specific factors. A plausible assumption is that the shares of capital and land in the total return to industry specific factors are constant, i.e. the elasticity of substitution between capital and land is 1.

4.4.4. Substitution Between Domestic and Imported Goods

This CGE model requires elasticities of substitution between domestic and imported producer goods. Dixson et al. (1982), in the ORANI model, assume that the elasticity of substitution between domestic and imported goods is equal across end-uses. In defence of this assumption, they point out that most major Australian imports are mainly used for one end use. For Thailand, based on the 1985 input-output table, six out of seven Thai imports are predominantly for intermediate uses. Services, which has a very low import (export) output ratio, are mainly imported for government consumption. This fact also justifies the use of the same elasticity of substitution for all end-uses in this model.

Estimates of the elasticity of substitution by Alaouze et al. (1977), by using a rapid adjustment model and Australian data, are mostly between 0.5 and 2.5. The highest estimates are 4.366 for motor vehicles, and 3.354 for men's and boys' trousers and shorts. ORANI's elasticities of substitution between domestic and imported products are between 1 and 2 (Table 29.2 in Dixon et al., 1982). Somsak (1985) reports estimates of elasticity of substitution in ten manufacturing products. His estimates, based on Thai data, are mostly higher than 1.5. Reinert (1992) estimates the Armington elasticity of substitution between domestic and imported goods for the United States. The majority of his estimates are between 0 and 1. The highest significant estimate is 3.49 for wine and brandy. The lowest significant estimate is 0.06 for mill-work, wood kitchens, and cabinets.

TABLE 4.5: Armington Elasticity of Substitution and Reciprocal of Price Elasticity of World Demand for Thai Export.

Producer Goods	Elasticities	
	Armington	World demand[a]
Paddy	0.001	0.
MCS	0.001	0.
Rubber	0.001	0.
Other Agricultural Products	1.0	0.
Agro-industry Products	1.0	0.5
Other Export Oriented Products	1.0	0.0001
Petroleum Products	1.0	0.
Other Import Competing Products	1.0	0.
EWTC	0.001	0.
Services	0.001	0.

Note: a Reciprocal of price elasticity of world demand.

Mansur and Whalley (1984) show that, under certain assumptions, the own price elasticity of import demand is determined primarily by the elasticity of substitution. One of the pre-assumptions is that the elasticity of substitution is not too far from unity. This practice is also applicable for Thailand. The estimates of short run own price elasticities of import demand in Thailand fall into two categories. The first category found that the elasticities are close to one. Typical are estimates by Kriengsak (1972, quoted in Suwat, 1986), and Olarn et al. (1979, quoted in Suwat, 1986). Kriengsak's estimates are 1.131 for consumer goods, 1.124 for capital goods, 1.243 for petroleum. Olarn's estimates are 0.9934 for raw materials and petroleum products, 1.1903 for capital goods, 0.8609 for consumer goods, and 1.0958 for services. The second category found that the elasticity ranges from 0.5 to 1. Typical are Gosah's estimates (1976, quoted in Suwat, 1986) and Somsak's estimates (1985, quoted in Suwat, 1986).

Based on the above studies, the guessed values for the elasticities of substitution for the ten producer goods in this model are as follows. For paddy, MCS, rubber, EWTC, and services, the elasticity is set at 0.001, to say that they are non-traded goods, and a change in relative price of domestic and imported goods will not dramatically change their domestic demand in relation to their import demand. The value of 1.0 is set for all tradable products - exportable agro-industry products, other exportable products, other agricultural products, petroleum products, and other import competing products. Table 4.5 summarizes these guessed values. However, when different values were also set for exportable products and import competing products, differences in simulation results were negligible.

4.4.5. Price Elasticity of World Demand for Thai Export

CGE modellers heavily relied on Stern et al. (1976) for their choices of values of the price elasticity of world demand for export. Stern et al., after reviewing econometric evidence in many developed countries, suggest that the price elasticity of export demand varies between 0.5 and 2.0. They also suggest that, in order to capture inter-country and inter-commodity variations, it would be preferable to use a more detailed estimate that is available.

There are a limited number of available studies on the own price elasticities of world demand for Thai exports. This thesis has relied on the estimates of Kruaphant (1974), Rungsan (1983), and Direk and Vilai (1991).

An alternative for this thesis is to assume that Thailand is a small country in all world markets. Under small country assumption, the price elasticity of world demand for Thai export would be infinite, and its reciprocal would be zero. However, a common agreement among Thai economists is that for some products, especially rice, Thailand can exercise market power. The ground for this is Thailand's substantial share in the world rice market. However, the estimates of the own price elasticity of world demand for Thai rice exports vary significantly. Direk and Vilai estimated the price elasticity of rice export demand and supply. They found that the elasticity of demand for rice export is between 1.2 and 1.7. Their results are supported by a number of past studies (Kerdphibul, 1970; Chunanunthathum, 1977; and Tsujii, 1973, quoted in Direk and Vilai, 1991). However, they point out that, based on the majority of the literature, the elasticity is more than 2. Rubber is another product that Thailand has a substantial share in the world market. An estimate by Rungsan shows that the own price elasticity of demand for Thai rubber exports is as low as 0.072. These estimates for rice and rubber can be used to guess a value for the price elasticity of world demand for Thai exports of agro-industry products.

Manufacturing exports are expected to be price takers, because of their small shares in the world market. Kruaphant studies manufacturing export supply response of fifteen aggregated products by using time series data. She found that, except for paper products (0.2), all other manufacturing products have very high own price elasticities of export demand (3 to 33). Thus, her results indicate that demand for Thai manufacturing exports is perfectly elastic.

The guessed values in this thesis (Table 4.5) are based on the above studies. For non-traded goods, such as paddy, MCS, rubber, EWTC, and services, the reciprocal of the elasticity is set at zero. For agro-industry exports, which consist of rice and simple processed rubber, maize, and cassava, the value is set at 0.5. The reciprocal of elasticity is set at .0001 for other exportable products, while it is set at zero for petroleum products and other import competing products.

4.4.6. Elasticities of Transformation in Agriculture

The assumption that agricultural industries are multi-output industries requires the system estimation of supply response, which can be used to compute the product transformation parameters. But studies on supply response in Thai agricultural sectors are mostly single equation estimations, which ignore the ability of farmers to transform their output mixes in response to changes in the relative prices of outputs.

Only one available study (Phibul, 1988) uses the system estimation, however, paddy is not included in the study. Phibul's estimates are for seven major upland crops, and provide detailed analysis by agro-economic zone. According to his estimates, the own price elasticities of supply of many upland crops are very low. The elasticity is 0.247 for cassava. The elasticity ranges from 0.233 to 0.624 for maize while those of other upland crops are between 0.233 to 1.651.

TABLE 4.6: Own Price Elasticities of Supply of Major Crops.

	1)	2)	3)	4)
Agriculture	0.90	-	-	-
Paddy				
Irrigated	-	-	0.65	-
Non-irrigated	-	-	0.50	-
Maize	-	-	0.20	0.42
Cassava	-	-	0.22	0.25
Sugar-cane	-	-	0.27	-
Rubber	-	0.22	-	-
Other Crops	-	-	-	0.28

Sources: 1) Table 31, Kumphol and Panayotou (1985).
2) Table 5.2, Rungsan (1983).
3) Table 48, Kumphol and Panayotou (1985).
4) Simple average from Tables 6, 8, and 10; Phibul (1988).

Two other studies for which analytical frameworks come close to the system estimation are Adulavidhaya et al. (1979 quoted in Kumphol and Panayotou, 1985) and Kumphol and Panayotou (1985). Adulyavidhya et al. estimate the supply response of agriculture in general. Their results show that agricultural output is highly sensitive to price change (the own price elasticity of supply is 0.898). Kumphol and Panayotou's (1985) estimates, hereafter KPTP, are based on survey data in 1979-80. There are four crops: paddy (irrigated and non-irrigated), maize, cassava, and sugar-cane; three variables inputs - seed, fertilizer, and labour; and two fixed inputs - land and farm assets. The focuses of KPTP are on the input demand, and the own price effect of each crop, while cross price effect is ignored. Although KPTP's estimates, based on cross section data, are long run estimates, which should be greater than short run estimates from time series data, their results show that the own price elasticities of all crops are low. The own price elasticities of paddy supply in both areas are higher than those of the three upland crops. The own price elasticity of paddy supply in irrigated areas (0.6496) is higher than that in non-irrigated areas (0.5008). The own price elasticities of maize, cassava, and sugar-cane are 0.2030, 0.2201, and 0.2693, respectively.

For other crops, these estimates are lower than estimates of some studies based on single estimation. For paddy, these estimates do not significantly differ from estimates by other studies. Tumnong (1972) shows that the short run own price elasticity of maize is around 0.6. Sakchai (1982) reports estimates of the own price elasticity of paddy planted area by region. Based on 1967-1980 data, his short run estimates are 0.29 and 0.13, while his long-run estimates are 0.89 and 0.98 for the Northeast and the whole kingdom, respectively. Apichart's (1983) results are around 1 for maize, between 1-2 for cassava, between 0.5-1 for sugar-cane, and around 1 for kenaf. However, his estimates for the short run own price elasticities of paddy are between 0.4-0.5 which are very close to KPTP's estimates.

Apart from similar framework, more up to date data is another reason that this thesis chooses the lower estimates of KPTP and Phibul. For paddy, since more than 90% of ESAN (Northeast) land is non-irrigated, the own price elasticities of paddy supply in non-irrigated areas is used as a proxy for that of ESAN agricultural industry, while that of irrigated paddy is used for the non-ESAN agricultural industry. For other crops, except rubber, the elasticities are assumed to be the same across agricultural industries.

There is only one available study on rubber. Rungsan Hataiseree (1983) found that the own price supply response of rubber is low (0.219). He also found that paddy is a substitute product for rubber. The paddy price elasticity of rubber supply response is 0.108.

The estimates of the above mentioned studies are summarized in Table 4.6. A strong assumption adapted here is that the estimates from the above studies can represent the own price elasticities of output supplies from the system estimation. With these own price elasticities of supply and their 1988 shares in the total agricultural products by region, the values of product transformation parameters are imputed[2]. These parameters, as summarized in Table 4.7, show that, on average, farmers in the Northeast are less responsive to change in output price than farmers in other regions. An exception is other agricultural products, for which the supply response is much higher in the Northeast than in other regions.

TABLE 4.7: Own Price Elasticity of Supply, Share of Agricultural Product, and Imputed Transformation Parameter.

Producer Goods	Elasticity	Share	τ^0_{i1j}
ESAN Agriculture			
Paddy	0.50	0.5176	0.97
MCS	0.23	0.3846	0.60
Rubber	0.22	0.0	-
Others	0.30	0.0978	3.07
Non-ESAN Agriculture			
Paddy	0.65	0.2197	2.96
MCS	0.23	0.1114	2.06
Rubber	0.22	0.0833	2.64
Others	0.30	0.5856	0.51

Note: τ^0_{i1j} is the CRETH transformation parameter.

4.4.7. Other Relevant Parameters

Other set of parameters to be estimated are related to the production structure of each multi-output industry. The share of each multi-output industry in the total supply of each agricultural producer good is calculated from NESDB's 1988 gross regional product. As shown in Table 4.8, the share of the Northeast (ESAN) in total production of rubber is negligible. However, it is kept in the model because of its future potential to grow at a very

2) see Kohli (1978) for the relationship between the own price elasticity of supply and Allen-Uzawa elasticity of transformation.

substantial rate. The total returns to primary factors of the two multi-output industries are calculated by assuming that each output of the multi-output industries has the same cost share as shown in Table 4.9. This assumption is based on the ground that the cost share of each crop does not significantly differ across regions.

TABLE 4.8: Gross Regional Agricultural Product at 1972 Prices: 1988.

(Million Bahts)

Producer Goods	Region		
	Total	Northeast	Other Regions
Total Agriculture	73581	18968	54613
Paddy	17221	5223	11998
	(100)	(30.3)	(69.7)
MCS	9965	3880	6085
	(100)	(38.9)	(61.1)
Rubber	4547	-	4547
	(100)	(0.0)	(100.0)
Others	41848	9865	31983
	(100)	(23.6)	(76.4)

Note: Figures in parenthesis are in percent. Agricultural services and simple agricultural processed are not included.

TABLE 4.9: Cost Structure of Major Crops: 1988. **(%)**

Producer Goods	Labour	Capital	Land
Paddy	58.87	17.03	24.10
MCS	66.43	11.19	22.38
Rubber	66.83	9.49	23.68
Others	63.00	15.80	21.20

Sources: 1. Office of Agricultural Statistics.
2. Rubber Research Institute.

Another set of share parameters is the share of each industry in the total employment of each type of labour. The shares of agricultural, manufacturing, EWTC, and services labour in the total labour force are the average of data from the Report of the 1988 Labour Force Survey, rounds 1 and 3. Based on the Report of the 1987 Industrial Survey, the share of the manufacturing labour force is disaggregated into four manufacturing industries (Table 4.10).

TABLE 4.10: Labour Share, by Industry: 1988. **(%)**

Industry	Unskilled Labour	Skilled labour
1. ESAN	40.1007	-
2. Non-ESAN	30.0137	-
3. Agro-industry	0.7119	0.9997
4. Other Export Industries	2.4376	3.4232
5. Petroleum Industry	0.0059	0.0083
6. Other Import-competing Industries	6.0915	8.5544
7. EWTC	2.4396	5.9715
8. Services	18.1931	81.0429

Sources: 1. Report of the 1988 Labour Force Survey, Rounds 1 and 3.
2. Report of the 1987 Industrial Survey.

Appendix 4.1: Producer Goods, Classified by Trade Orientation

Producer Goods	Trade Orientation
1. Paddy	Non-traded
2. Maize, Cassava, and Sugar-cane, (MCS)	Non-traded
3. Rubber	Non-traded
4. Other Agricultural Products	Import competing (IC)
5. Agro-industry Products	Export oriented (EO)
6. Other Exportable Products	Export oriented (EO)
7. Petroleum Industry	Import competing (IC)
8. Other Import-competing Products	Import competing (IC)
9. Electricity, Water Supply, Transport, and Communication, (EWTC)	Non-traded
10. Services	Non-traded

Note: Traded goods are those for which export-production or import-production ratio are at least 2%. Export oriented goods are those for which the total export is greater than twice of the total import, otherwise they are classified as import competing goods.

Appendix 4.2: Equations in the Model

Equation		Number
(4.1) f_{1qj}	$= f_{1j} - \sigma^0_{1qj}.[r_{1qj} - \sum_q A^0_{1qj}.r_{1qj}].$	QJ
(4.2) f_{nj}	$= z_j - \sigma^0_{nj}.[r_{nj} - \sum_n A^0_{nj}.r_{nj}].$	NJ
(4.3) x^1_{isj}	$= z_j - \sigma^1_{ij}.[pr^1_{isj} - \sum_s H^1_{isj}.pr^1_{isj}].$	ISJ
(4.5) x^0_{j1}	$= z_j.$	J_s
(4.6) x^0_{i1j}	$= z_j + \tau^0_{i1j}.[p^0_{i1} - \sum_i H^*_{i1j}.p^0_{i1}].$	$(I\text{-}J_s)J_m$
(4.7) x^0_{i1}	$= \sum_j D^0_{i1j}.x^0_{i1j}.$	I-Js
(4.9) m^1_{isj}	$= x^1_{isj}.$	ISJ
(4.10) m^2_{is}	$= x^2_{is}.$	IS
(4.11) m^3_{isk}	$= x^3_{isk}.$	ISK
(4.12) m^4_{i1}	$= x^4_{i1}.$	I
(4.13) m^5_{is}	$= x^5_{is}.$	IS
(4.14) m	$= \sum_i\sum_s\sum_j A^1_{isj}.m^1_{isj} + \sum_i\sum_s A^2_{is}.m^2_{is}$	
	$+ \sum_i\sum_s\sum_k A^3_{isk}.m^3_{isk} + \sum_i A^4_{i1}.m^4_{i1}$	
	$+ \sum_i\sum_s A^5_{is}.m^5_{is}.$	1
(4.15) s	$= \sum_h H^s_h.s^h_h + H^s_g.s^g + \sum_j H^s_j.s^j_j + H^s_w.s^w.$	1
(4.16) s^j_j	$= v^j_j + pik.$	J
(4.17) s^w	$= v^w + pik.$	1
(4.18) x^2_{is}	$= v - \sigma^2_i.[p^2_{is} - \sum_s H^2_{is}.p^2_{is}].$	IS
(4.19) pik	$= \sum_i\sum_s G^2_{is}.p^2_{is}.$	1
(4.20) s	$= v + pik.$	1
(4.21) x^3_{isk}	$= c^3_k - \sigma^3_{ik}.[p^3_{is} - \sum_s H^3_{isk}.p^3_{is}].$	ISK
(4.22) x^3_{is}	$= \sum_k G^3_{isk}.x^3_{isk}.$	IS

Appendix 4.2: (continued)

Equation		Number
(4.23) y_h	$= \sum_q O_{1qh}.[f^s_{1q}+r_{1q}].H_{fh}$	
	$+\sum_j O_{2jh}.[f^s_{2j}+r_{2j}].H_{fh}$	
	$+\sum_j O_{3jh}.[f^s_{3j}+r_{3j}].H_{fh}+u.H_{uh}.$	H
(4.24) y_h	$= H^d_h.y^d_h+H^g_h.d^r_h+H^u_h.u_h.$	H
(4.25) d^r_h	$= y_h+t^d_h.$	H
(4.26) u_h	$= \theta^u_h.y_h.$	H
(4.27) s^h_h	$= v^h_h+pik.$	H
(4.28) y^d_h	$= B^s_h.s^h_h+B^c_h.c_h.$	H
(4.29) c^3_{kh}	$= \sum_q \eta_{hkq}.p^c_q+\eta_{hk}.c_h.$	HK
(4.30) u	$= \sum_h G^u_h.u_h+G^u_g.u^g.$	1
(4.31) p^w_{i1}	$= -\gamma_i.x^4_{i1}+f^4_{i1}.$	I
(4.32) t^w	$= \sum_i G^x_{i1}.(p^w_{i1}+g^4_{i1}+t^x_{i1}+x^4_{i1}+e^w)$	
	$+\sum_i G^m_{i2}.(p^w_{i2}+t^m_{i2}+x^0_{i2}+e^w).$	1
(4.33) t^i	$= \sum_i\sum_s G^i_{is}.(p^0_{is}+t^i_{is}+x^0_{is}).$	1
(4.34) t^d	$= \sum_h G^d_h.(y^d_h+t^d_h).$	1
(4.35) t^f	$= \sum_j O_{2jg}.(r_{2j}+f_{2j}).$	1
(4.36) y_g	$= H^w.t^w+H^i.t^i+H^d.t^d+H^f.t^f.$	1
(4.37) x^5_{is}	$= 0.$	IS
(4.38) s^g	$= v^g+pik.$	1
(4.39) u^g	$= \eta^5_g.y^g.$	1
(4.40) c^g	$= \sum_i\sum_s G^5_{is}.[x^5_{is}+p^5_{is}]+G^{5s}.s^g+G^{5u}.u^g.$	1
(4.41) 100dG	$= R^g.y^g-E^g.c^g-\sum_i E.S^e_{i1}(e^w+g^4_{i1}+x^4_{i1}).$	1
(4.42) t^i_{is}	$= tid_{is}+tbar^i_s+tbar^{is}.$	IS
(4.43) t^d_h	$= td_h+tbar^d.$	H

Appendix 4.2: (continued)

Equation	Number
(4.44) $r_{1qj} = r_{1q}+d_{1qj}.$	QJ
(4.45) $r_{1j} = \sum_{q} H^{1}_{1qj}.r_{1qj}.$	J
(4.46) $rw_{1q} = r_{1q}-cpi.$	Q
(4.48) $p^{0}_{j1}+z_{j} = \sum_{i}\sum_{s} G^{0}_{isj}.(x^{1}_{isj}+p^{1}_{isj})+G^{0}_{1j}.(f_{1j}+r_{1j})+G^{0}_{2j}.(f_{2j}+r_{2j})+G^{s}_{2j}.s^{j}_{j}$	
$-\sum_{i} H^{*}_{i2j}.(t^{w}_{i2}+p^{w}_{i2}+e^{w}+x^{1}_{i2j}+x^{4}_{j}-z_{j}).$	J_s
(4.49) $\sum_{i} B^{0}_{i1j}.(x^{0}_{i1j}+p^{0}_{i1}) = \sum_{i}\sum_{s} G^{0}_{isj}.(x^{1}_{isj}+p^{1}_{isj})+G^{0}_{1j}.(f_{1j}+r_{1j})$	
$+G^{0}_{2j}.(f_{2j}+r_{2j})+G^{s}_{2j}.s^{j}_{j}+G^{0}_{3j}.(f_{3j}+r_{3j}).$	J_m
(4.50) $p^{w}_{i1}+\varepsilon^{w}+g^{4}_{i1} = \beta_{i1}.p^{4}_{i1}+\alpha_{i1}.(p^{w}_{i1}+e^{w}+g^{4}_{i1}+t^{x}_{i1})$	I
(4.51) $p^{0}_{i2} = \beta_{i2}.(p^{w}_{i2}+\varepsilon^{w})+\alpha_{i2}.(p^{w}_{i2}+e^{w}+t^{m}_{i2})$	I
(4.52) $t^{x}_{j1}+p^{w}_{j1}+e^{w} = \sum_{i}.H^{m}_{i2j}(x^{1}_{i2j}+t^{m}_{i2}+p^{w}_{i2}+e^{w})-z_{j}$, j = 5 and 6	2
(4.53) $p^{1}_{isj} = H^{01}_{is}.p^{0}_{is}+H^{g1}_{is}.(p^{0}_{is}+t^{i}_{is})$	
$+H^{m1}_{isj}.(G^{m}_{71}.p^{0}_{71}+G^{m}_{81}.p^{0}_{81}).$	ISJ
(4.54) $pr^{1}_{isj} = G^{*}_{ij}.p^{1}_{isj}-K^{*}_{ij}.(p^{w}_{i2}+t^{m}_{i2}+e^{w}+x^{4}_{j}-z_{j})$	ISJ
(4.55) $p^{n}_{is} = H^{0n}_{is}.p^{0}_{is}+H^{gn}_{is}.(p^{0}_{is}+t^{i}_{is})$	
$+H^{mn}_{is}.(G^{m}_{71}.p^{0}_{71}+G^{m}_{81}.p^{0}_{81}).$	3IS
for n = 2, 3, and 5.	
(4.56) $p^{4}_{i1} = H^{04}_{i1}.p^{0}_{i1}+H^{g4}_{i1}.(p^{0}_{i1}+t^{i}_{i1})$	
$+H^{m4}_{i1}.(G^{m}_{71}.p^{0}_{71}+G^{m}_{81}.p^{0}_{81}).$	I
(4.57) $p^{c}_{k} = \sum_{i}\sum_{s} C^{3}_{isk}.p^{3}_{is}.$	K
(4.58) $f^{s}_{1q} = \sum_{j} N_{1qj}.f_{1qj}.$	Q
(4.59) $f^{s}_{2j} = f_{2j}.$	J
(4.60) $f^{s}_{3j} = f_{3j}.$	J_m
(4.61) $x^{0}_{i1} = \sum_{j} B^{1}_{i1j}.x^{1}_{i1j}+B^{2}_{i1}.x^{2}_{i1}+\sum_{k} B^{3}_{i1k}.x^{3}_{i1k}$	
$+B^{4}_{i1}.x^{4}_{i1}+B^{5}_{i1}.x^{5}_{i1}+B^{m}_{i1}.H^{m}_{i1}m.$	I

Appendix 4.2: (continued)

Equation		Number
(4.62) x^0_{i2}	$= \sum_j B^1_{i2j}.x^1_{i2j} + B^2_{i2}.x^2_{i2}$	
	$+ \sum_k B^3_{i2k}.x^3_{i2k} + B^5_{i2}.x^5_{i2}.$	I
(4.63) c^3_k	$= \sum_h G^3_{kh}.c^3_{kh}.$	K
(4.64) ε^3	$= \sum_k G^c_k.p^c_k.$	1
(4.65) ζ	$= (1/S_f).\sum_k H^f_k.p^c_k$, for k = 1,..., 5.	1
(4.66) e	$= \sum_i (x^4_{i1} + p^w_{i1}).S^e_{i1}.$	1
(4.67) m	$= \sum_i (x^0_{i2} + p^w_{i2}).S^m_{i2}.$	1
(4.68) 100dB	$= E.e - M.m.$	1
(4.69) 100dBOP	$= -100dG + F.s^w + E.e - M.m.$	1
(4.70) y	$= \sum_h S^0_h.y_h + S^0_g.t^f.$	1

Total number of equations is

$2QJ+NJ+4ISJ+(I-J_s)J_m+8I+9IS+2ISK+4J+Jm+7H+2K+HK+2Q+24$, where

$H = 10, I = 10, J = 8, J_s = 6, J_m = 2, K = 10, N = 3, Q = 2$, and $S = 2$.

The total number of equations is 1616.

Appendix 4.3: List of Variables

(Variables are in percentage change)

Variables and Definitions		Number
f^s_{1q}	Total supply of labour type q	Q
f^s_{2j}	Total supply of industry j's specific capital	J
f^s_{3j}	Total supply of industry j's specific land	J_m
f_{1qj}	Industry j's demand for labour type q	QJ
f_{nj}	Industry j's demand for factor n	NJ
r_{1qj}	The unit return to labour type q in industry j	QJ
d_{1qj}	Wage differential between the unit return to labour type q in industry j and the unit return to labour type q in general	QJ
r_{1q}	Unit return to labour type q in general	Q
rw_{1q}	Real unit return to labour type q in general	Q
r_{1j}	Unit return to industry j's effective labour	J
r_{2j}	Unit return to industry j's specific capital	J
r_{3j}	Unit return to land in multi-output industry	J_m
x^1_{isj}	Industry j's intermediate demand for the good i from source s	ISJ
z_j	Industry j's activity level	J
x^0_{i1}	Total domestic output of good i	I
x^0_{i2}	Total import of good i	I
x^0_{i1j}	Good i produced by multi-output industry j	$(I-J_s)J_m$
p^0_{i1}	Basic price of domestic producer good i	I
p^0_{i2}	Basic price of imported producer good i	I
x^2_{is}	Capital creation demand for good i from source s	IS
x^3_{isk}	Demand for good i from source s used in the production of consumer good k	ISK
x^3_{is}	Total demand for good i from source s used in the production of all consumer goods	IS
x^4_{i1}	Export demand for domestic good i	I
x^5_{is}	Government demand for good i from source s	IS

Appendix 4.3: (continued)

(Variables are in percentage change)

Variables and Definition		Number
m^1_{isj}	Margin used to facilitate the flow of x^1_{isj}	ISJ
m^2_{is}	Margin used to facilitate the flow of x^2_{is}	IS
m^3_{isk}	Margin used to facilitate the flow of x^3_{isk}	ISK
m^4_{i1}	Margin used to facilitate the flow of x^4_{i1}	I
m^5_{is}	Margin used to facilitate the flow of x^5_{is}	IS
m	Total demand for margin	1
p^1_{isj}	Purchase price of x^1_{isj}	ISJ
pr^1_{isj}	Purchase price of x^1_{isj}	ISJ
p^2_{is}	Purchase price of x^2_{is}	IS
p^3_{is}	Purchase price of x^3_{isk}	IS
p^4_{i1}	Purchase price of x^4_{i1}	I
p^5_{is}	Purchase price of x^5_{is}	IS
s	Total savings	1
pik	Capital price index	1
s^h_h	Savings of household h	H
s^j_j	Savings of industry j	J
s^g	Savings of government	1
s^w	Inflow of foreign direct investment in nominal terms	1
v^h_h	Real savings of household h	H
v^j_j	Real savings of industry j	J
v^g	Real savings of government	1
v^w	Inflow of foreign direct investment in real terms	1
v	Total real investment	1
p^c_k	Purchase price of consumer good k	K
ε^3	Consumer price index	1
c^3_k	Total supply of consumer good k	K
c^3_{kh}	Household h's demand for consumer good k	HK
y_h	Total income of household h	H
y^d_h	Disposable income of household h	H

Appendix 4.3: (continued)

(Variables are in percentage change)

Variables and Definition		Number
c_h	Consumption expenditure of household h	H
$d^r{}_h$	Direct tax burden on household h	H
$t^d{}_h$	Direct tax rate on household h	H
u_h	Household h's assistance payment to transfer pool	H
u^g	Government's transfer payment to transfer pool	1
u	Total payment to transfer pool	1
ε^w	Exchange rate in Baht per US$	1
$p^w{}_{i1}$	f.o.b. price of export of good i in US$	I
$p^w{}_{i2}$	c.i.f. price of import of good i in US$	I
$f^4{}_{i1}$	Exogenous change in world demand for export i	I
$g^4{}_{i1}$	Shift variable on export i	I
t^w	Government revenue from trade taxes	1
t^i	Government revenue from indirect taxes	1
t^d	Government revenue from direct taxes	1
t^f	Government revenue from property	1
y_g	Total government revenue	1
c_g	Total government expenditure	1
dG	Windfall effect of policy shocks on government budget deficit	1
$t^x{}_{i1}$	Export tax rate on the export of good i	I
$t^m{}_{i2}$	Import tax rate on the import of good i	I
$t^i{}_{is}$	Indirect tax rate on good i from source s	IS
tid_{is}	Exogenously determined indirect tax rate on good i from source s	IS
td_h	Exogenously determined direct tax rate on household h	H
$tbar^{is}$	Average indirect tax rate on all producer goods	1
$tbar^i{}_s$	Average indirect tax rate on producer goods from source s	S
$tbar^d$	Average direct tax rate	1

Appendix 4.3: (continued)

(Variables are in percentage change)

Variables and Definitions		Number
e	Total export revenue	1
m	Total import bill	1
ζ	Poverty line	1
dB	Trade balance	1
dBOP	Balance of payment	1
y	GDP	1

Total number of variables is

$3QJ+NJ+4ISJ+(I-J_s)J_m+13I+10IS+2ISK+6J+2J_m+9H+2K+HK+3Q+S+27$

= 1747.

By Walras Law, one equation can be excluded from the model.

Number of exogenous variables = 131+1 = 132.

Appendix 4.4: List of Parameters

Parameters and Definitions	
$\sigma^0{}_{1qj}$	Elasticity of substitution between two types of labour employed by industry j
$A^0{}_{1qj}$	Share of labour type q in the total wage bill of industry j
$\sigma^0{}_{nj}$	Elasticity of substitution between primary factors of production employed by industry j
$A^0{}_{nj}$	Share of primary factor n in industry j's total cost of primary factors
$\sigma^1{}_{ij}$	Elasticity of substitution between industry j's intermediate input i from different sources
$H^1{}_{isj}$	Share of intermediate input i from s in the total cost of intermediate input i in industry j
$\tau^0{}_{i1j}$	Elasticity of transformation in the multi-output industry j
$H^*{}_{i1j}$	Modified revenue share of good i produced by multi-output industry j
$H^0{}_{i1j}$	Revenue share of good i produced by multi-output industry j
$D^0{}_{i1j}$	Output share of good i produced by industry j in total output i
$A^1{}_{isj}$	Share of margin that facilitates the flow of good i from source s to industry j in total margin
$A^2{}_{is}$	Share of margin that facilitates the flow of good i from source s for the creation of capital in total margin
$A^3{}_{isk}$	Share of margin that facilitates the flow of good i from source s to the producer of consumer good k in total margin
$A^4{}_{i1}$	Share of margin that facilitates the flow of export i in total margin
$A^5{}_{is}$	Share of margin that facilitates the flow of good i from s for government consumption in total margin
$H^s{}_h$	Share of household h's savings in total savings
$H^s{}_g$	Share of government savings in total savings
$H^s{}_j$	Share of industry j's savings in total savings
$H^s{}_w$	Share of the inflow of foreign direct investment in total savings
$\sigma^2{}_i$	Armington elasticity of substitution between domestic and imported producer goods in the creation of capital
$G^2{}_{is}$	Cost share of producer good i from source s in capital creation

Appendix 4.4: (continued)

Parameters and Definitions

H^2_{is}	Cost share of producer good i from source s in the total cost of producer good i used in capital creation
σ^3_{ik}	Elasticity of substitution between input i from different source used in producing consumer good k
H^3_{isk}	Share of the total cost of input i used in the production of consumer good k accounted for by input i from sorce s
G^3_{isk}	Share of total input i from source s accounted for by the production of consumer good k
H_{fh}	Share of factor income in total income of household h
O^*_{1qh}	Share of total income from labour type q accounted for by household h
O_{1qh}	Share of total household h's income accounted for by the income from labour type q
O^*_{2jh}	Share of total income from industry j specific capital accounted for by household h
O_{2jh}	Share of total household h's income accounted for by the income from industry j's specific capital
O^*_{3jh}	Share of total income from industry j's specific land accounted for by household h
O_{3jh}	Share of total household h's income accounted for by the income from industry j's specific land
H_{uh}	Share of non-factor income in the total income of household h
H^d_h	Share of disposable income in total income of household h
H^g_h	Share of direct tax payment in total income of household h
H^u_h	Share of assistance payment in total income of household h
θ_h	Income elasticity of household h's expenditure
B^c_h	Share of consumption expenditure in household h's disposable income
B^s_h	Share of savings in total household h's disposable income

Appendix 4.4: (continued)

Parameters and Definitions	
η_{hkq}	Household h's own price and cross price elasticities of demand for consumer good k
η_{hk}	Household h's expenditure elasticity of demand for consumer good k
G^{u}_{h}	Share of household h's assistance payment in total transfer pool
G^{u}_{g}	Share of government transfer in total transfer pool
γ_i	Reciprocal of elasticity of world demand for Thai export of good i
G^{x}_{i1}	Share of revenue from the export tax of good i in total tariff revenue
G^{m}_{i2}	Share of revenue from the import tax of good i in total tariff revenue
G^{i}_{is}	Share of total indirect tax account for by producer good i from source s
G^{d}_{h}	Share of total direct tax accounted for by household h
O^{*}_{2jg}	Share of government in total return to industry j's specific capital
O_{2jg}	Share of revenue from industry j's specific capital in total government revenue from property
H^{w}	Share of tariff revenue in total government revenue
H^{i}	Share of indirect tax revenue in total government revenue
H^{d}	Share of direct tax revenue in total government revenue
H^{f}	Share of property income in total government revenue
R_g	Government revenue at the base year
η^{5}_{g}	Income elasticity of government transfer
G^{5}_{is}	Share of total government expenditure accounted for by expenditure on good i from source s
G^{5s}	Share of government savings in total government expenditure
G^{5u}	Share of total government expenditure accounted for by government transfer
C_g	Government expenditure at the base year
G^{0}_{isj}	Cost share of intermediate input i from source s in the total revenue of industry j
G^{0}_{1j}	Share of labour cost in the total cost of industry j
G^{0}_{2j}	Share of capital rent in the total cost of industry j

Appendix 4.4: (continued)

Parameters and Definitions	
G^s_{2j}	Share of industry savings in the total cost of industry j
G^0_{3j}	Share of land rent in the total cost of industry j
H^*_{i2j}	Share of import tax on intermediate input i in the total cost of industry j
B^0_{i1j}	Share of total revenue of multi-output industry j accounted for by good i
β_{i1}	Share of domestic export price in the world price of export i
α_{i1}	Share of export tax in the world price of export i
β_{i2}	Share of world price in the import price of producer good i
α_{i2}	Share of import tax in the import price of producer good i
H^m_{i2j}	Share of import tax on input i in the total tax on imported inputs paid by industry j
H^{0n}_{is}	Share of basic price in the purchase price of good i from source s for purpose n
H^{gn}_{is}	Share of indirect tax in the purchase price of good i from source s for purpose n
H^{mn}_{is}	Share of margin in the purchase price of good i from source s for purpose n
G^m_{71}	Value share of good 7 in the cost of supplying one unit of margin
G^m_{81}	Value share of good 8 in the cost of supplying one unit of margin
C^3_{isk}	Cost share of good i from source s in the total cost of producing one unit of consumer good k
B^1_{i1j}	Share of industry j's intermediate demand in the total demand for domestic good i
B^2_{i1}	Share of capital creation demand in the total demand for domestic good i
B^3_{i1k}	Share of consumer goods k demand for domestic good i in the total demand for domestic good i
B^4_{i1}	Share of export demand in the total demand for domestic good i

Appendix 4.4: (continued)

Parameters and Definitions	
B^5_{i1}	Share of government demand in the total demand for domestic good i
N_{1qj}	Share of industry j's demand in total demand for labour type q
B^m_{i1}	Share of domestic goods i used as margin in the total demand for domestic good i
H^m_{i1}	Share of domestic good i used as margin in the total demand for domestic goods used as margin
B^1_{i2j}	Share of industry j's intermediate demand in the total demand for imported good i
B^2_{i2}	Share of capital creation demand in the total demand for imported good i
B^3_{i2k}	Share of consumer goods k demand for imported good i in the total demand for imported good i
B^5_{i2}	Share of government demand in the total demand for imported good i
G^3_{kh}	Share of total household demand for consumer good k accounted for by household h's demand
G^c_k	Share of consumer good k in household consumption expenditure
G^*_{ij}	Value share of the general purchase price of imported intermediate input i to industry j in the purchase price of input i net of tax rebate
K^*_{ij}	Value share of tax rebate in the purchase price of imported intermediate input i for industry j net of tax rebate
S_f	Share of food expenditure in poverty line
H^f_k	Share of food consumer good k in total poverty line
S^e_{i1}	Share of producer good i's export in total export revenue
S^m_{i2}	Share of producer good i's import in total import bill
F	Inflow of foreign direct investment at the base year
E	Export value at the base year
M	Import value at the base year
S^0_h	Share of household h's income in GDP
S^0_g	Share of government property income in GDP

Appendix 4.5: Typical List of Exogenous Variables

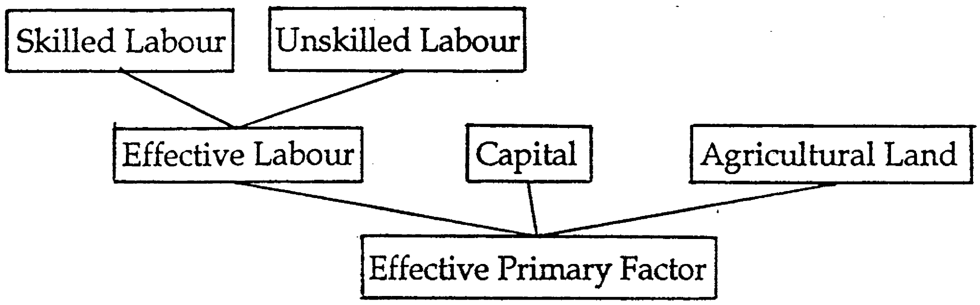
(Variables are in percentage change)

Variables and Definitions		Number
f^{s}_{1q}	Total supply of labour type q, q = 1	1
f^{s}_{2j}	Total supply of industry j's specific capital	J
f^{s}_{3j}	Total supply of industry j's specific land	J_m
d_{1qj}	Wage differential between the unit return to labour type q in industry j and the unit return to labour type q in general	QJ
rw_{1q}	Real unit return to labour type q in general, $q \neq 1$	Q-1
x^{4}_{i1}	Export demand for domestic good i	I-2
v^{h}_{h}	Real savings of household h	H
v^{j}_{j}	Real savings of industry j	J
v^{g}	Real savings of government	1
v^{w}	Inflow of foreign direct investment in real terms	1
ε^{w}	Exchange rate in Baht per US$	1
p^{w}_{i2}	c.i.f. price of import of good i in US$	I
f^{4}_{i1}	Exogenous change in world demand for export i	I
g^{4}_{i1}	Shift variable on export i	2
dG	Windfall effect of policy shocks on government budget deficit	1
t^{x}_{i1}	Export tax rate on the export of good i	I-2
t^{m}_{i2}	Import tax rate on the import of good i	I
tid_{is}	Exogenously determined indirect tax rate on good i from source s	IS
td_{h}	Exogenously determined direct tax rate on household h	H
$tbar^{is}$	Average indirect tax rate on all producer goods	1
$tbar^{i}_{s}$	Average indirect tax rate on producer goods from source s	S
dBOP	Balance of payment	1

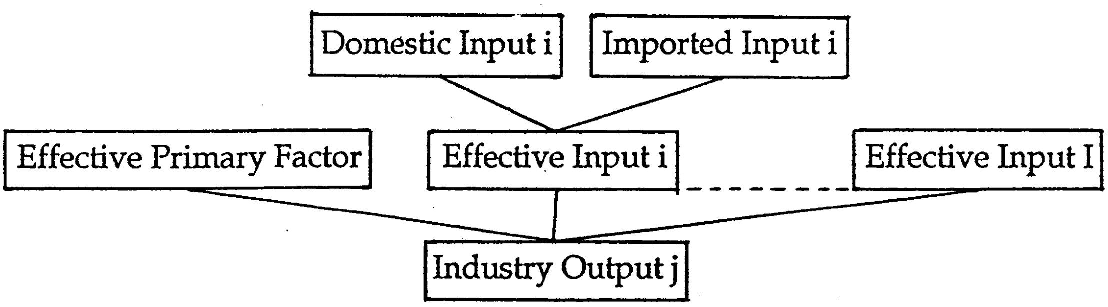
Total number of exogenous variables is $QJ+2J+J_m+IS+5I+2H+Q+S+4 = 132$.

Appendix 4.6: Diagrammatic Explanation of the Model

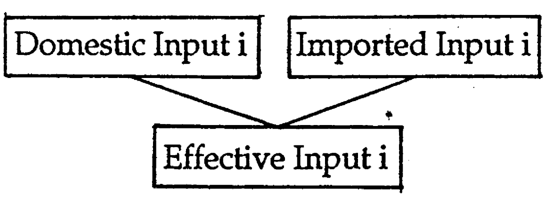
1. Primary Factor



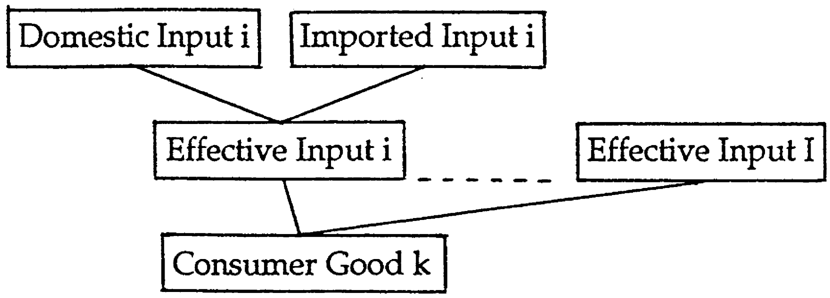
2. Industry Intermediate Input Demand



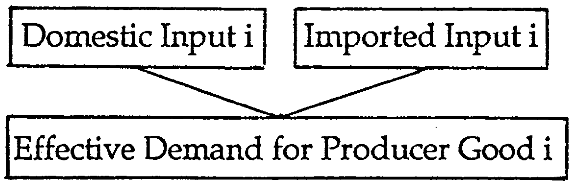
3. Capital Creation Demand



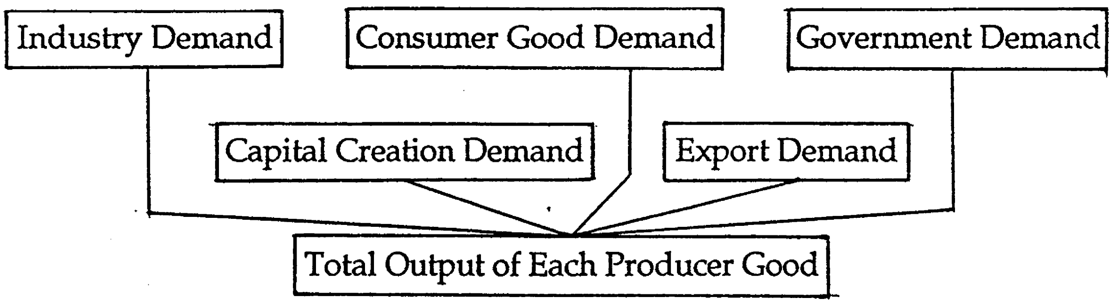
4. Intermediate Input Demand of Producer of Consumer Good



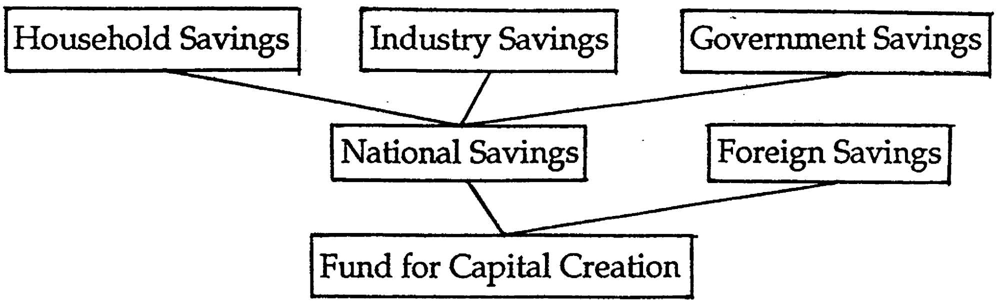
5. Government Demand



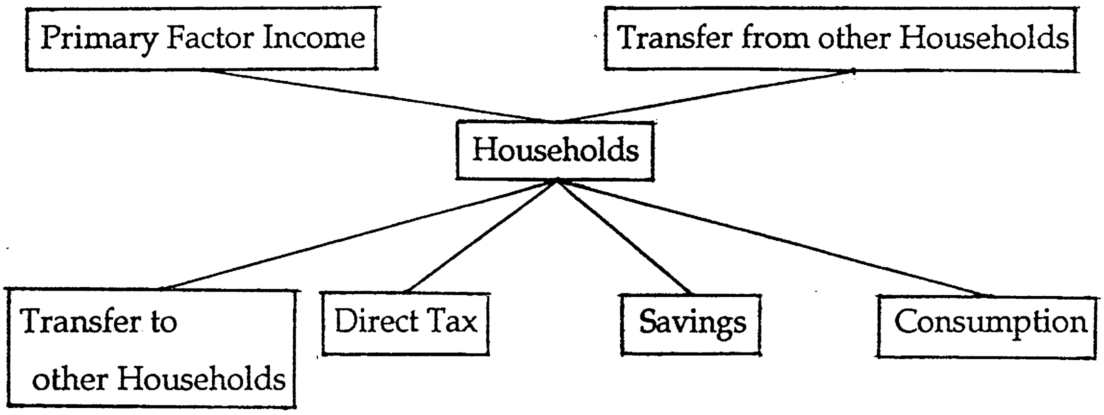
6. Domestic Output Demand



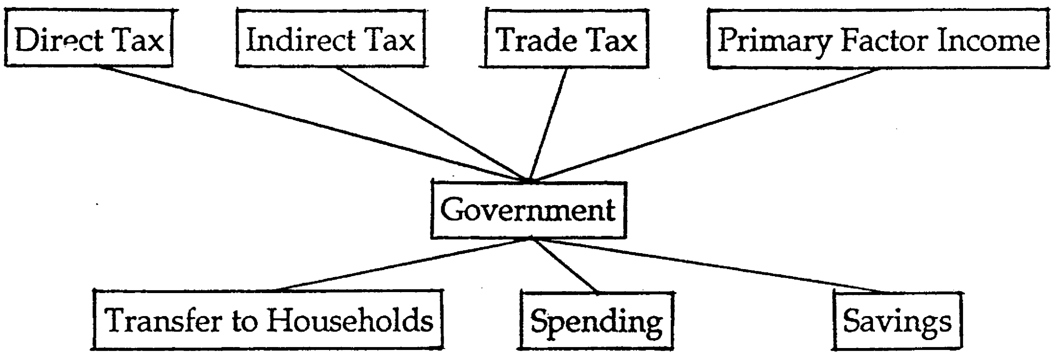
7. Savings and Investment



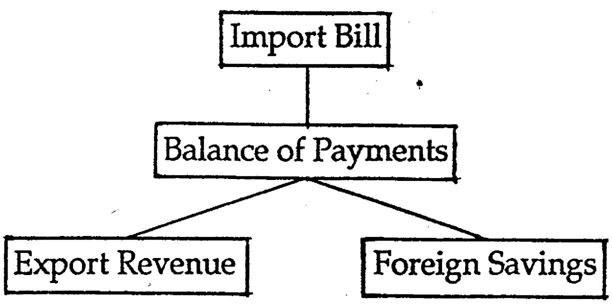
8. Household



9. Government



10. Balance of Payments



- CHAPTER 5 -

AN ESTIMATION OF CONSUMER DEMAND

5.1. Introduction

This thesis aims to use a general equilibrium framework to investigate the income distribution impact of industrial protection in Thailand. The general equilibrium model and the measurement of income distribution in general equilibrium, are developed in Chapters Four and Six. The methodology requires various parameters which explain the behaviour of economic agents, e.g. shares and elasticities. The important parameters are also discussed in these two chapters. The discussion includes the Social Accounting Matrix and various elasticities - except for elasticity of consumer demand. In this chapter, private or household consumption expenditure, which is an important part of national income, will be examined. This is essential for policy analysis. It provides information not only for the allocation of resources, but also for welfare improvement.

The need for study on private consumption behaviour in Thailand can be seen from the share of the consumption, which is about 80% of total consumption expenditure, and more than 60% of Gross Domestic Product. Past studies have been carried out both at macro- and at micro-level. Macro-level analyses, based on time series data from the national income of Thailand, provide short run estimates. The micro-level analyses, based on cross-section data, provide long run estimates. However, a micro-level analyses is more relevant for this study since it allows more disaggregation of households.

This chapter focuses on the analysis of consumption behaviour by using cross-section data. Following this introductory section, the chapter is organised into three parts: a data discussion; the theory and estimation of consumer demand; and a conclusion. The major objective is to estimate households' consumer demand, by using household expenditure data from the 1988 Household Socio-economic Survey (SES), and the 1988 regional price data from the Department of Business Economics. Households will be disaggregated by urban and rural settings, each with five expenditure classes, as classified by per capita household expenditure. The resulting dataset will be analysed by the well-known Linear Expenditure System (LES), developed by Stone (1954). The model produces estimates that satisfy two important economic properties, adding up and homogeneity, which is suitable for the analysis of household behaviour in the general equilibrium framework. The adding up property requires the share-weighted sum of expenditure elasticities equal to unity. The homogeneity property means homogeneity of degree zero in price and expenditure, i.e. there is no change in demand if all prices and consumption expenditure change by the same proportion.

5.2. Datasets

The 1988 Household Socio-economic Survey (SES) of the National Statistical Office, and the 1988 consumer price data of the Department of Business Economics are the two main sources of data used in this study. Detailed discussion of the two sources of data are as follows.

5.2.1. Household Expenditure

The SES provides detailed information of households' income, expenditure, savings, various demographic variables, and weight attached to each observation. It contains 11,045 observations from a stratified two-stage sampling[1]. The nature of this dataset is that observations represent stratum of unequal size and, thus, cannot be treated as random samples of equal probability. Past studies on consumption behaviour do not utilise weight information attached to each observation. Thus, the well-known heteroscedasticity problem in cross section data is more severe. Results can be inefficient estimators. The proof of a similar case (the case of grouped data in ordinary least square or OLS) is well-explained in Kmenta (1971), and Stewart and Wallis (1981). In this study, each observation is weighted by the weight information.

Household is defined as a person or group of persons who, together, make provision for food and other essentials of living. They are divided into ten classes, by per capita expenditure and urban/rural settings. Urban households mean households situated in municipal areas and sanitary districts. The remaining households are rural households. The characteristics, and the upper and lower limits of per capita expenditure of each quintile are presented in Tables 5.1 and 5.2. Uk and Rk mean urban and rural households in the k^{th} quintile. U1 is the poorest urban quintile, U5 is the richest urban quintile, and so on.

Household expenditure, as reported in the 1988 SES, is divided into ten commodities - five food commodities and five non-food commodities. For convenience, the term - commodity - is used, interchangeable with consumer good in other chapters. The ten commodities are 1) rice and cereals; 2) meat and fish; 3) fruit and vegetables; 4) other foods including meal eaten away from home; 5) non-alcoholic beverages; 6) clothing and footwear; 7) house and housing expenditure; 8) transport and communication; 9) medical expenses, education and entertainment; and 10) other non-foods including tobacco and alcoholic beverages. These household expenditures are reported

---

1) As explained in the report of the 1988 household socio-economic survey, group of provinces in each region, and the greater Bangkok area, constitute strata. Each strata was divided into three parts, according to municipal areas, sanitary districts and villages. The sample selection of blocks and villages were performed separately and independently in each part by using, probability proportional to the total number of households.

without any information about prices. Thus, price information from the Department of Business Economics will be augmented to the SES dataset.

TABLE 5.1: Urban and Rural Household Characteristics: 1988.

Characteristics	Urban Quintile				
	U1	U2	U3	U4	U5
Income	2750	4459	5969	7387	12141
Expenditure	2405	3797	5109	6369	11886
Per capita Expenditure					
Minimum	189	709	1101	1546	2371
Maximum	708	1100	1545	2370	42380
Number of Observations	1256	1259	1252	1254	1255
Weight					
Mean	570.04	622.81	681.74	736.41	774.52
S.D.	149.85	201.84	240.63	240.15	233.95

TABLE 5.1: (Continued).

Chracteristics	Rural Quintile				
	R1	R2	R3	R4	R5
Income	1732	2313	2735	3688	5557
Expenditure	1545	2123	2616	3308	6313
Per Capita Expenditure					
Minimum	97	385	533	728	1058
Maximum	384	532	727	1057	52218
Number of Observations	954	955	960	947	953
Weight					
Mean	2151.8	2039.3	1944.5	1882.8	1842.7
S.D.	311.59	320.98	311.06	281.40	258.17

Source: Calculated from the SES 1988.

TABLE 5.2: Weighted Average of Some Factors, by Household: 1988.

Household	A.P.C.	Size	Adult	Children
Urban 1	0.8745	4.6	3.4	1.2
Urban 2	0.8515	4.1	3.2	0.9
Urban 3	0.8559	3.8	3.1	0.7
Urban 4	0.8622	3.3	2.8	0.5
Urban 5	0.9790	2.7	2.5	0.2
Rural 1	0.8920	5.2	3.6	1.6
Rural 2	0.9179	4.6	3.5	1.1
Rural 3	0.9565	4.1	3.2	0.9
Rural 4	0.8970	3.7	3.0	0.7
Rural 5	1.1360	3.3	2.7	0.6

Note: A.P.C. Average propensity to consume.
Source: Calculated from the SES 1988.

5.2.2. Regional Price Indices

The price data consists of nine datasets, one for the major Bangkok area; four for urban areas in central, northern, northeastern and southern regions; and the other four for rural areas in each of the four regions. Thus, there are nine prices for each commodity. The resulting dataset allows different consumer prices across regions and communities (urban and rural). However, it still assumes a single commodity price in each regional urban or rural area. In absolute terms, these price datasets may not be the actual prices faced by the sampling households. In relative terms, they are expected to reflect the regional price differences which are, at least, preferable to assuming a single price faced by the households.

There are two studies on regional price differences (Oey, 1976 and Duangkamon, 1989), which attempt to investigate the significance of regional price differences in Thailand. But the level of commodity aggregation, year, and the focus of the studies are not compatible with this study. Here, a process is adapted, which is similar to the one used by the Department of Business Economics, and Oey (1976). The regional price dataset is constructed in four steps. First, Bangkok prices are chosen as base prices for all commodities. This is equivalent to choosing the unit of every commodity such that its Bangkok price is one[2]. Second, prices of other regions are then normalised by Bangkok prices. Third, commodity relative prices are aggregated by weights provided by the Department of Business Economics, so that the grouped relative prices are comparable with the SES commodity classification. Fourth, the expenditure share weighted sum of the grouped relative prices give the relative prices of the ten commodities as previously classified. The general formula is presented by Equation 5.1. The aggregated regional relative prices are reported in Table 5.3.

$$(5.1)\ PR_r = \sum_i (P_{ir}/P_{io})S_{ir},$$

TABLE 5.3: Regional Consumer Price Index: 1970 and 1988.

Community	Region				
	South	North -east	North	Central & East	Bangkok Area
1970					
Urban	110	107	101	96	100
Rural	116	104	101	99	-
1988	94.13	93.72	94.90	93.53	100

Sources: 1) 1970 indices from Table 2, Oey (1976).
2) 1988 indices calculated by this thesis.

2) In a seminar on an early draft of this chapter, participants raised a question as to whether the choice of using Bangkok prices as base prices for all commodities will affect the estimates. A sensitivity analysis was done by, first, excluding Bangkok from the estimation of consumer demand, and second, by estimating consumer demand for Bangkok separately. Comparing the estimates in both cases with the estimates reported in this chapter, differences in the estimates are insignificant.

when PR_r = the relative price of region r,

P_{ir} = the price of commodity i in region r,

P_{io} = the price of commodity i in Bangkok, and

S_{ir} = the weight given by the Department of Business Economics or a household's budget share of commodity i.

5.3. Theory and Estimation

There are at least four pertinent studies on consumption behaviour. The first two studies are Direk and Amnat (1988), and Suchart (1989). They have three features in common. They employ either the Linear Expenditure System (LES) or the Extended Linear Expenditure System (ELES), which are based on utility maximizing behaviour of consumers subjected to budget constraints. They also use data from the household socio-economic survey (SES) of the National Statistical Office, which contain no price information. Therefore, each commodity is assumed to have the same price across regions. Food is aggregated into only one commodity. There are also some differences between the two studies. Direk and Amnat analyse demand for twelve commodities (of which only one is food) by three households (municipal, sanitary district and rural). By using single equation estimation, they face an over-identification problem. A need to satisfy budget constraints is not considered, and the additivity and homogeneity properties of LES are not guaranteed. Consequently, various elasticities of demand cannot be drawn from the model. Suchart provides more detailed analysis of consumers by the disaggregation of households into eight classes, four classes for both urban and rural households. Household demand for food and seven non-food commodities is analysed. The savings decision is endogenised by the model (ELES). His result is weakened by the lack of price information. Suchart argues that his single price assumption is supported by Oey (1976), who states that regional price differences in Thailand are minor when compared with the experience of other developing countries (P. 48, Suchart, 1989). However, Oey also concludes that these price differences are significant (Table 5.3). Thus, the role of price information cannot be overlooked.

The other two studies are by Prasarn (1983) and Mason et al. (1987 quoted in Direk, 1989), who use a linear and/or log-linear model, both of which do not satisfy various economic properties. The attractiveness of these studies is their inclusion of demographic variables such as sex and age group, and, in the case of Prasarn, price information and quality. Prasarn's results have considerably lower explanatory power and, therefore, are questionable. Moreover, he only analyses demand for food commodities and ignores the cross price effect of non-food commodities. The results of these studies are presented in Table 5.4.

TABLE 5.4: Selected Elasticities from Other Studies.

Elasticity	Income	Own Price
1) Prasarn's estimates for low income group: 1975/76		
Rice	0.401	-0.736
Meat		
Beef	0.422	-7.181
Chicken	0.295	0.252
Pork	0.704	-2.215
2) Suchart's estimates for food and non-alcoholic beverages: 1981		
Urban	0.149	-0.079
Rural	0.313	-0.157
3) Mason's estimates: 1981		
Food	0.722	-
Beverages and Tobacco	0.979	-
Clothes	1.290	-
House	1.085	-
Health	1.299	-
Personal	0.884	-
Transport	1.708	-
Entertainment	1.655	-
Education	1.242	-
Others	1.762	-

Sources: 1) Table 14, Prasarn (1983).
2) Tables 4.10 and 4.11, Suchart (1989).
3) Mason et al. (1987, quoted in Table 7, Direk, 1989)

Given the objectives of this thesis, four important factors should be included in the estimation of consumer demand: 1) the disaggregation of household by income/expenditure class, and urban and rural setting, 2) price information, 3) higher degree of commodity disaggregation, especially food, and 4) demographic variables such as household size and composition. The implementation of the results from previous empirical studies is limited by the fact that none of them contain all four features. Thus, there is a need for an estimation of consumer demand that contains all these features.

5.3.1. Consumer Demand System

The model for the estimation of consumer demand can be divided into two broad categories, dual models and primal models. The most widely used model in the first category is the AIDS (Almost Ideal Demand System) developed by Deaton and Muellbauer (1980). This model is said to contain many desirable properties which are well discussed by its pioneers. The major conclusion is that this model has many properties which are not possessed simultaneously by any of its competitors, such as the Rotterdam and Translog models. It is also said to be un-restricted to any form of utility function, but to be restricted to the Piglog cost function. Moreover, homogeneity and symmetry restrictions can be rejected (Blanciforti and Green, 1983).

The well-known primal models are Stone's LES and Lluch's ELES, of which the quadratic expenditure system or QES developed by Howe, Pollak and Wales (1979) is a general form. The weakness of the QES is its high degree of non-linearity, which causes estimation difficulties and is time consuming. LES and ELES are more flexible, because of the lower degree of non-linearity. With single equation estimation, they can be linearly estimated by OLS.

The critique of LES is based on its restriction on Linear Geary-Stone utility function. It follows that the model assumes a linear Engel function and rules out inferior goods. Its strength lies in the utility maximizing behaviour of the consumer in the model. Thus, its estimates have the two desired properties of consumer demand, additivity and homogeneity, which is the major aim of this chapter. In order to satisfy the symmetry and semi-definiteness of substitution matrix, inferiority and complementarity are ruled out (Stone, 1954).

Savings is treated differently between LES and ELES. It is exogenously determined in LES, while it is endogenised in ELES. Thus, LES provides information on the expenditure elasticity of demand and ELES the income elasticity of demand. The choice of consumption/savings function is more flexible in LES than in ELES. Any functional form can be applied, provided that it is best fitted with data. The saving function in ELES is not supported by any consumption/savings theory in macro-economic theory. Though the Keynesian function comes close, ELES tends to produce a biased and inconsistent estimator of Keynesian marginal propensity to consume (MPC). The proof of a similar case (the case of nominal variables) is in Wallis (1979, p. 3).

As a guide-line, a pre-analysis of the Thai dataset was carried out by Ordinary Least Square (OLS). It shows that consumer demand is better explained by LES than ELES. As shown in Table 5.5, the number of significant t-statistic of household expenditure (LES) in the demand equation of each of the ten commodities is more than those of household income (ELES).

LES assumes that the consumer has utility maximizing behaviour and total expenditure is exogenously determined. The total expenditure is allocated in two steps, as described by LES. First, at a given set of prices, the consumer consumes each commodity to a level called committed level. Second, the consumer distributes the remaining expenditure in such a way that utility will be maximized. Thus, the consumer's behaviour can be explained by Equation 5.2. First order conditions lead to Equation 5.3 which is suitable for the estimation of consumer demand behaviour.

(5.2) Maximize $U = \sum_i \beta_i \ln(Q_i - \gamma_i)$,

subject to $E = \sum_i P_i Q_i$,

(5.3) $$E_i = P_i\gamma_i+\beta_i(E-\sum_i P_i\gamma_i)+u_i,$$

when E = consumer's total expenditure,

E_i = consumer's expenditure on commodity i,

P_i = the price of commodity i,

γ_i = the consumer's committed consumption level of commodity i, $\gamma_i \geq 0$,

Q_i = total consumption level on commodity i, $Q_i > \gamma_i$,

β_i = the marginal expenditure of commodity i out of total expenditure, $\beta_i \geq 0$ and $\sum_i \beta_i = 1$, and

u_i = the disturbance term, and $\sum_i u_i = 0$.

TABLE 5.5: Comparison between LES and ELES by Single Equation Estimation.

Household	Number of Significant t-statistic*	
	LES (Expenditure)	ELES (Income)
Urban 1	10	6
Urban 2	8	6
Urban 3	9	1
Urban 4	9	4
Urban 5	9	8
Rural 1	10	6
Rural 2	9	1
Rural 3	10	3
Rural 4	8	4
Rural 5	5	8

Note:* Number of equations, out of ten equations, of which t-statistic of household expenditure (LES) or household income (ELES) are more than 2. The models are

LES $E_i = P_i\gamma_i+\beta_i(E-\sum_i P_i\gamma_i)+u_i$.

ELES $E_i = P_i\gamma_i+\beta_i(Y-\sum_i P_i\gamma_i)+u_i$, and

In the case of n commodities, the system consists of n-1 non-linear equations. There are 2n-1 parameters to be estimated, n committed levels (γ_i) and n-1 marginal budget shares (β_i). The total committed expenditure ($\sum_i P_i\gamma_i$) should not be misinterpreted as a basic need or a poverty line. Since, by definition, γ_i is less than Q_i and, therefore, the use of the total committed expenditure will under-estimate poverty incidence.

The estimation of various elasticities depend on β_i and γ_i. A supernumerary ratio is defined as $-\Phi$ which is equal to $1-(1/E).\sum_i P_i\gamma_i$.

If $w_i = E_i/E$, the expenditure (ε_i),Marshallian price (ε_{ij}), and Hicksian price (η_{ij}) elasticities of demand can be calculated from the following equations.

(5.4) $\varepsilon_i = \beta_i/w_i.$

(5.5) $\varepsilon_{ii} = \varepsilon_i[\Phi-w_i(1+\Phi.\varepsilon_i)].$

(5.6) $\varepsilon_{ij} = -\varepsilon_i.w_j(1+\Phi.\varepsilon_j)].$

(5.7) $\eta_{ii} = \varepsilon_i(1-w_i)\Phi.$

(5.8) $\eta_{ij} = -\varepsilon_i.w_j.\Phi.$

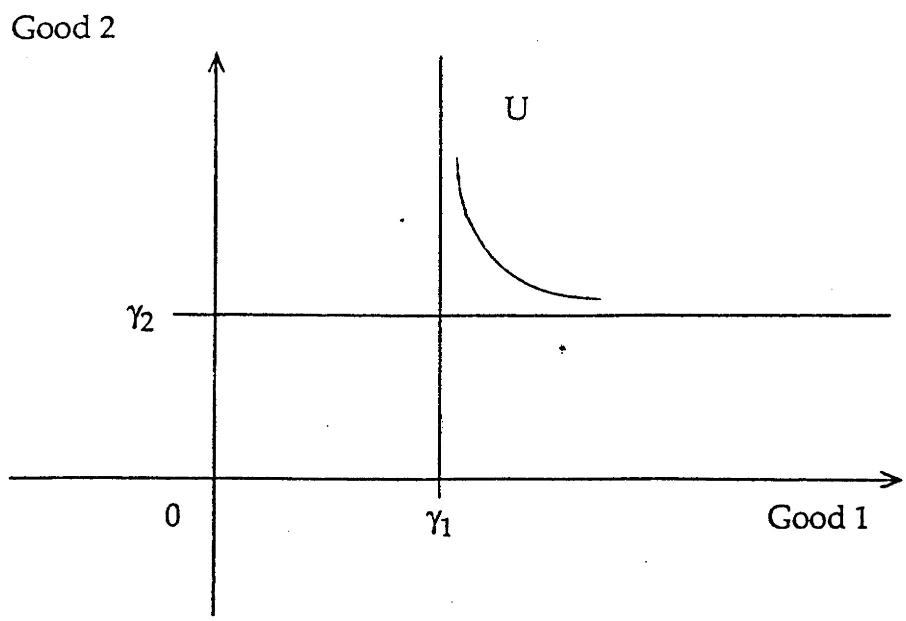


Figure 5.1: Linear Expenditure System (LES)

TABLE 5.6: Average Monthly Per Capita Expenditure (P_iQ_i or E_i), by Commodity and Household. (Baht)

Commodity	Urban Quintile				
	U1	U2	U3	U4	U5
TOTAL	2405.06	3797.39	5108.52	6369.20	11885.65
1.	368.83	340.66	291.06	254.73	208.47
2.	293.93	362.30	413.38	415.60	435.92
3.	156.12	200.30	261.19	294.42	353.26
4.	392.82	774.15	1172.70	1421.80	1930.10
5.	13.21	32.76	69.06	77.59	95.83
6.	99.77	173.87	249.31	355.31	789.32
7.	600.68	967.46	1278.80	1704.90	3547.00
8.	96.23	227.99	393.46	636.72	2401.10
9.	258.63	477.30	656.28	805.15	1473.90
10.	124.84	240.60	323.28	402.98	650.75

TABLE 5.6: (Continued)

Commodity	Rural Quintile				
	R1	R2	R3	R4	R5
TOTAL	1545.29	2123.20	2616.41	3307.50	6312.75
1.	405.73	439.40	433.82	401.13	377.32
2.	223.89	315.63	355.04	397.41	457.84
3.	115.38	153.80	180.84	199.73	248.33
4.	153.52	223.12	308.62	437.90	695.06
5.	1.99	5.31	10.55	20.14	39.95
6.	77.91	147.97	200.50	279.89	425.60
7.	326.87	450.40	565.54	729.57	1946.70
8.	41.06	82.88	132.04	266.84	957.99
9.	132.59	196.65	267.64	345.01	675.70
10.	66.35	108.04	161.82	229.88	488.26

Notes: 1. Rice and cereals. 2. Meat and fish.
3. Fruit and vegetables. 4. Other foods.
5. Non-alcoholic beverages. 6. Clothing and footwear.
7. House and housing expenditure. 8. Transport and communication.
9. Medical expenses, education, and entertainment. 10. Other non-foods.

Source: Calculated from the SES 1988.

In this thesis, a demand system will be estimated from Equation 5.3 by using a household as a unit of consumer. Although the choice of unit is still debatable, whether on a household or a per capita basis, the use of a household has many advantages over the per capita approach. It implicitly allows economies of scale. Decision making is always done at household level. However, it can be criticized on the ground that each household has a different composition and size. In particular, the size of rural and/or poor households, which are larger than those of urban and/or rich households. The inclusion of household composition and size will be proposed in Appendix 5.1. Despite higher degree of non-linearity than Equation 5.3, the model could be estimated if time is not a constraint.

5.3.2. Discussion of the Results

An estimation of a system of nine non-linear demand equations was performed separately for each of the ten households. The technique is a maximum likelihood nonlinear estimation. Each observation is weighted by the weight information from SES. There are three important sets of parameters for the estimation of various elasticities as shown by Equations 5.4-5.8. These are average commodity expenditure, commodity committed consumption levels, and marginal budget shares of which estimates are reported in Tables 5.6, 5.7, and 5.8.

By commodity, a zero committed expenditure for a commodity indicates that there is welfare gain from every baht spent on that particular commodity. A non zero committed expenditure indicates that, unless expenditure on the commodity exceeds committed level, there is no welfare gain from purchasing the commodity. Table 5.7 shows that committed expenditure for the first four commodities, i.e., foods, is significantly higher than zero in every quintile. This reflects the fact that foods are basic needs for every household. Committed expenditure for non-alcoholic beverages, and clothing and footwear is very low for urban households, and it is zero for poor urban households. Except for the top rural households, it is also zero for rural households. Except for the top rural households, committed expenditure for house and housing expenditure significantly differs from zero. Committed expenditure for transport and communication is zero for every quintile, including urban households for which transport and communication occupies much of their daily life. Total committed per capita expenditure (TCE) for households in every quintile in urban areas are higher than equivalent quintiles in rural areas, e.g. TCE of the lowest quintile in urban and rural areas is 664.17 Bahts and 553.06 Bahts, respectively.

TABLE 5.7: Monthly Committed Per Capita Expenditure ($P_i\gamma_i$), by Commodity and Household. (Baht)

Commodity	Urban Quintile				
	U1	U2	U3	U4	U5
TOTAL	664.17	1154.97	1370.44	1724.64	5105.39
1.	165.01 (27.60)	168.90 (24.56)	123.71 (21.69)	106.92 (20.14)	167.98 (39.31)
2.	109.22 (18.80)	119.10 (14.55)	108.86 (10.94)	63.34 (6.48)	275.02 (24.03)
3.	60.99 (19.59)	88.25 (20.73)	97.27 (17.89)	90.34 (15.49)	254.73 (35.83)
4.	63.64 (7.32)	201.96 (11.45)	400.29 (18.08)	651.69 (28.54)	1658.04 (66.53)
5.	0. (0.00)	4.94 (3.17)	0. (0.00)	29.45 (10.68)	77.45 (30.60)
6.	0. (0.00)	26.02 (3.50)	22.55 (2.41)	67.04 (5.92)	437.82 (19.01)
7.	260.90 (27.32)	456.43 (27.07)	490.89 (21.58)	590.35 (19.80)	990.62 (7.06)
8.	0. (0.00)	0. (0.00)	0. (0.00)	0. (0.00)	0. (0.00)
9.	0. (0.00)	0. (0.00)	0. (0.00)	0. (0.00)	752.71 (17.94)
10.	4.41 (0.88)	89.37 (10.02)	126.87 (11.31)	125.51 (9.12)	491.01 (24.68)

TABLE 5.7: (Continued)

Commodity	Rural Quintile				
	R1	R2	R3	R4	R5
TOTAL	553.06	613.37	596.65	761.68	2477.71
1.	176.19 (19.48)	153.26 (17.13)	98.11 (8.22)	124.97 (16.16)	341.59 (65.41)
2.	83.54 (14.94)	93.99 (11.52)	116.99 (13.41)	126.78 (13.89)	395.17 (54.89)
3.	52.55 (17.05)	79.58 (19.81)	81.06 (18.05)	94.84 (21.76)	214.13 (59.77)
4.	55.26 (14.31)	76.45 (12.08)	69.25 (8.55)	99.46 (8.47)	551.25 (47.56)
5.	0. (0.00)	0. (0.00)	0. (0.00)	0. (0.00)	31.45 (19.74)
6.	0. (0.00)	0. (0.00)	0. (0.00)	0. (0.00)	299.15 (26.18)
7.	173.77 (25.97)	210.09 (20.96)	231.24 (15.43)	315.63 (18.17)	0. (0.00)
8.	0. (0.00)	0. (0.00)	0. (0.00)	0. (0.00)	0. (0.00)
9.	11.75 (3.14)	0. (0.00)	0. (0.00)	0. (0.00)	299.75 (11.71)
10.	0. (0.00)	0. (0.00)	0. (0.00)	0. (0.00)	345.22 (16.26)

Note: Figures in parenthesis are t-statistic. These high t-statistics are results of the large number of observations used in the estimation.

The expenditure elasticity of demand (ε_i) can be used to determine whether the commodity is a necessity or a luxury good (Tables 5.10-5.19). In general, the results show that the first three food commodities are necessities ($\varepsilon_i<1$). The fourth food commodity, other foods, is a luxury for households in the two lowest urban quintiles, and a necessity for households in every rural quintile and the other three urban quintiles. An explanation is that, as income increases, low income urban residents tend to spend more on food eaten away from home (other foods). Clothing and footwear; transport and communication; and medical expenses, entertainment and education are also luxuries. The exception is households in the richest quintile in both areas, where clothing and footwear; and medical expenses, entertainment and education are necessities. More results are in Tables 5.10-5.19. On average, the estimates are close to those reported by Mason et al. (1987, quoted in Direk, 1989) (Table 5.4). For examples, Mason et al.'s ε_i are 0.722 for food, and 1.290 for clothes, while the simple average ε_i from this thesis are 0.7051 for rice and cereals, and 1.1185 for clothing and footwear.

TABLE 5.8: Marginal Budget Share (β_i), by Commodity and Household.

Commodity	Urban Quintile				
	U1	U2	U3	U4	U5
1.	0.1118 (23.33)	0.0587 (16.29)	0.0415 (18.86)	0.0301 (18.60)	0.0053 (9.13)
2.	0.1005 (21.97)	0.0854 (21.30)	0.0778 (22.24)	0.0742 (28.52)	0.0226 (16.32)
3.	0.0526 (20.07)	0.0403 (19.08)	0.0429 (21.27)	0.0437 (25.58)	0.0140 (15.14)
4.	0.1967 (28.25)	0.2334 (29.35)	0.2217 (30.50)	0.1757 (26.79)	0.0490 (15.22)
5.	0.0078 (14.16)	0.0104 (11.84)	0.0187 (20.32)	0.0106 (11.44)	0.0025 (6.72)
6.	0.0534 (21.46)	0.0462 (10.84)	0.0536 (14.00)	0.0567 (15.40)	0.0500 (16.74)
7.	0.2013 (29.60)	0.1984 (27.01)	0.2165 (31.83)	0.2462 (35.41)	0.3665 (31.86)
8.	0.0603 (23.83)	0.0831 (28.63)	0.0990 (30.93)	0.1345 (33.94)	0.3707 (32.27)
9.	0.1490 (38.74)	0.1891 (32.80)	0.1778 (40.25)	0.1724 (41.15)	0.0977 (19.89)
10.	0.0666	0.0550	0.0505	0.0559	0.0217

TABLE 5.8: (Continued).

Commodity	Rural Quintile				
	R1	R2	R3	R4	R5
1.	0.2341	0.1935	0.1698	0.1099	0.0076
	(27.02)	(25.74)	(22.29)	(25.49)	(5.91)
2.	0.1395	0.1457	0.1164	0.1032	0.0098
	(22.25)	(19.59)	(19.49)	(20.37)	(5.70)
3.	0.0611	0.0474	0.0472	0.0390	0.0049
	(15.35)	(11.54)	(14.27)	(15.29)	(5.54)
4.	0.0955	0.0933	0.1133	0.1265	0.0191
	(17.79)	(13.61)	(18.09)	(18.72)	(6.94)
5.	0.0018	0.0034	0.0049	0.0077	0.0009
	(6.71)	(8.04)	(11.16)	(12.45)	(2.32)
6.	0.0801	0.1010	0.1017	0.1125	0.0220
	(18.88)	(23.18)	(22.68)	(25.47)	(8.34)
7.	0.1551	0.1595	0.1679	0.1636	0.6572
	(19.09)	(16.84)	(16.74)	(17.73)	(49.74)
8.	0.0441	0.0561	0.0660	0.1135	0.1903
	(16.48)	(21.26)	(20.27)	(22.15)	(18.66)
9.	0.1180	0.1269	0.1326	0.1371	0.0613
	(27.99)	(28.77)	(28.00)	(31.60)	(10.14)
10.	0.0707	0.0732	0.0802	0.0870	0.0269

Notes: a) Figures in parentheses are t-statistics.
b) Marginal budget share of other non-foods is calculated from the identity, $\sum_i \beta_i = 1$.
Its t-statistic can be derived from those of the nine commodities.

A comparison shows that there is a contrast between the richest quintile in urban and rural areas, and the remaining poorer households. Except for the richest quintile in urban and rural areas, expenditure elasticities of every commodity are quite uniform across households. In the case of the first six commodities (rice and cereals, meat and fish, fruit and vegetables, other foods, non-alcoholic beverages, clothing and footwear), and the last two non-foods, the expenditure elasticities of the two richest quintiles are much lower than those of other quintiles. While in the case of house and housing expenditure, and transport and communication, their expenditure elasticities are generally higher. Thus, demand for these eight commodities will increase more if there is a 1% increase in income of households in the eight lower quintiles in urban and rural areas, rather than households in the two top quintiles. Vice versa, increases in demand for house and housing expenditure, and transport and communication is less if there is a 1% increase in income of households in the eight lower quintiles, rather than households in the two top quintiles.

The own price elasticities (ε_{ii}) displays some differences between food and non-food commodities, and between households in the top quintile and households in other quintiles (Tables 5.10-5.19). Generally, demand for non-food commodities is more sensitive to change in prices than demand for food commodities. Households in the top quintile of urban and rural areas behave differently from other households. Except for house and housing expenditure, their own price responsiveness is generally lower than those of the other quintiles. The main reason is that households in the two top quintiles can afford to buy, whatever the change in price. An example is the own price elasticity of demand for rice, which is between 0.5 and 0.8, while those of the top quintile in urban and rural areas are as low as 0.1775 and 0.0841, respectively.

A comparison between the results from this thesis with those from past studies shows some differences. As already mentioned, Suchart's (1989) estimates are restricted by the assumption of one price, and are considerably lower than the estimates of this thesis. Prasarn's (1983) own price elasticity[3] of rice and meat is -0.636 and -4.698, while this thesis's elasticities[4] are -0.616 and -0.613, respectively. Prasarn analyses beef, pork and chicken separately, while this thesis aggregates all types of meat, including fish and seafood. Therefore, the lower result for meat could be caused by the level of aggregation and substitution among different types of meat.

---

3) A simple average of Prasarn (1983)'s most significant results.
4) A simple average of the ten households.

In terms of cross price effects (ε_{ij}), almost every pair of commodities have complementarities (Tables 5.10-5.19). Since, these commodities, especially foods, are important in terms of consumption, a rise in price will reduce real income and, thus, reduce demand for other commodities. There are some exceptions, e.g. the effects of the cost of transport and communication; medical expenses, entertainment, and education; and other non-foods on the demand for other commodities, which are substitutes for many households. However, the degree of substitution is very low and should not be considered seriously in any interpretation.

The above estimation from Equation 5.3 assumes that committed expenditures of households in the same quintile are equal. But household size varies widely within each quintile, e.g. from 1 to 10 within the fourth urban quintile, and from 1 to 15 within the lowest rural quintile. The inclusion of household size and composition in the demand system would better clarify the household demand. A proposed model that incorporate household size and composition will be discussed in the following Appendix 5.1.

5.4. Conclusion

This chapter focuses on the estimation of a consumer demand system for policy simulations in a general equilibrium framework by using cross section data. The model applied in this thesis, Linear Expenditure System, is used to estimate various elasticities that satisfy desirable economic properties, such as homogeneity and additivity, and are therefore suitable for a general equilibrium analysis.

Three points make this estimation different from those of previous studies. First, the disaggregation of households into ten expenditure classes is caused by the need to investigate the income distribution impact of industrial protection. Second, price information is incorporated into the SES dataset. Third, food commodities are analysed in a less aggregated level and, thus, enhance the analysis of the impact of industrial protection on poverty incidence. Although household size and composition are not introduced into the model, a proposed model with size and composition is presented in the following appendix.

The estimates from the LES shows significant differences among households. There are four major conclusions. First, food commodities and housing expenditure are shown to be necessities, while non-alcoholic beverages and other non-foods are shown to be luxuries. Second, the own price effect of food is weaker than those of non-alcoholic beverages and non-foods. Third, the behaviour of the richest quintiles in urban and rural areas is different from the rest of the country. Fourth, the cross price effect illustrates weak complementarities between most pairs of commodities, especially foods.

Appendix 5.1: Demographic Variables in Consumer Demand

The role of demographic variables, especially household size and composition, in consumption behaviour is well-known. In addition to income, the economic welfare of households also depends on their size and composition. Many approaches have been used to incorporate these variables. The choice between the household and per capita approaches are two extreme cases. Pollak and Wales (1978) offer alternative techniques for incorporating demographic variables into the demand system. But Barnes and Gillingham (1984) prove that, in general, these techniques do not have greater explanatory power than a simple un-pooling estimation. There are many approaches based on economic theory, e.g. Prais and Houthakker (1955), and Muellbauer (1975). These approaches estimate a scale which is known as a consumer unit scale or an equivalent scale. This equivalent scale is useful not only for the analysis of consumer demand but also for the analysis of income distribution.

These scales are used widely and can be theoretically explained. They measure either the first adult or a standard household as one unit consumer. The additional household member can then be measured differently, e.g. male, female, adolescent, and baby. Many approaches have been used to estimate these scales. The well-known approach developed by Prais and Houthakker (1955) is based on an Engel curve. The approach by Barten (1974, quoted in Kakwani, 1977) is based on basic consumption theory. Both are widely used in the literature. Examples of these scales for Australia, Great Britain, and Thailand are shown in Table 5.9.

There are at least three estimations of such scales for Thailand. The first, as reported in the Journal of the Ministry of Agriculture and Co-operatives, is based only on food expenditure. The second, by Praphon (1988), is also based on food expenditure. Duangkamon (1989) produces a detailed analysis of the scales, by region, commodity, and expenditure class. But her results show inconsistency over time. Rule of thumb is also used, e.g., Atkinson (1989) values the first person in each family 1, +0.5 for all subsequent persons, and the maximum of 6 for any family of more than 10 persons; and Kakwani (1986 in Agrawal, 1987) values the first adult 1, the second adult 0.7, and each child 0.4. The reliability of results from such an arbitrary method must be questioned.

TABLE 5.9: International Comparison of Equivalent Scale.

Country	Equivalent Scale			
	Male	Female	Adolescent	Child
Australia[1)]	1.0000	0.9048	-	0.3762*
Great Britain[2)]	1.0000	0.8600	0.7350	0.5175
Thailand[3)]	1.0000	0.8900	0.8700	0.3767
Thailand[4)]	1.0000	0.9284	0.6866	0.3752

* Calculated from the first child.

Sources: 1) Simple average from Binh and Whiteford (1990).
2) Simple average from Table 30 of Prais and Houthakker (1955).
3) Simple averages from Table 7 in Prasarn (1983).
4) Simple averages from Duangkamol (1989).

The two main approaches are claimed to suffer from an identification problem (Singh and Nagar, 1973; Muellbauer, 1975; and Kakwani, 1977). However, Muellbauer (1975) points out that - 'there is another way in which an identification of equivalent scales can be achieved. This is by using information from price variation. But to do this one must know how prices enter into demand relationships which include household composition effects. The only models available that predict how prices enter are those based on utility functions...'. By applying Barten's approach in ELES, Kakwani (1977) shows that these scales can be estimated without an identification problem. Furthermore, van der Gaag and Smolensky (1982) show that Kakwani's approach is also applicable in the absence of price information.

It is well known that most of these scales are estimated by assuming one price and ignoring price variations. This thesis proposes to incorporate price, expenditure, and the equivalent scales in the LES. Following Prais and

Houthakker's approach, an Engel curve of a unit consumer can be written in the form of Equation 5.9. In the framework of LES, this Engel function is linear.

(5.9) $Q_i/(S^a_i A+S^k_i K) = f(E;\text{prices}),$

where A = the number of adults in a household,

K = the number of children in a household,

S^a_i = commodity i specific scale of each adult, generally $S^a_i = 1$, for all i, and

S^k_i = commodity i specific scale of each child.

If we assume: 1) that the utility maximizing consumer in Equation 5.2 is an adult equivalent unit and 2) that each adult equivalent unit in the household maximizes utility subject to household budget constraint; then Equation 5.2 can be transformed into the following Equation 5.10. One may argue that some members of the household, such as a baby, cannot be assumed as utility maximizers. But, one may also argue that other members will make decisions in a way that the baby's utility is also maximized.

(5.10) Maximize $U = \sum_i \beta_i \ln[Q_i/(A+S^k_i K)-\gamma_i].$

subjects to $\sum_i P_i Q_i = E.$

Where γ_i = the committed consumption level of commodity i for one adult equivalent unit.

Equation 5.11, which is equivalent to Equation 5.10, implies that the household is a utility maximizing consumer, and its commodity committed levels of consumption depend on size and composition. First order conditions of Equations 5.10 and 5.11 lead to Equation 5.12. In order to reduce collinearity between total expenditure and size of household (more specifically, the number of adults), Equation 5.12 is rewritten in share form (5.13).

$$\text{(5.11) Maximize } U = \sum_i \beta_i \ln[Q_i - \gamma_i(A+S^k{}_i K)],$$

$$\text{subjects to } \sum_i P_i Q_i = E.$$

$$\text{(5.12)} \quad E_i = P_i\gamma_i(A+S^k{}_i K)+\beta_i[E-\sum_j P_j\gamma_j(A+S^k{}_j K)].$$

$$\text{(5.13)} \quad S_i = E_i/E = [P_i\gamma_i(A+S^k{}_i K)/E]+\beta_i[1-\sum_j P_j\gamma_j(A+S^k{}_j K)/E].$$

The specification in Equation 5.13 is still weak in a marginal case. However, there are several ways in which the model can be improved. Given the definition of β_i, a household without a child will also buy a toy if the marginal budget share of the toy is greater than 0. A modification of β_i to $\beta_i(A + \sum_j W_i K)$ can capture this case without violating the general properties of LES. When W_i is a weight given to each child.

The model does not explicitly offer an equivalent scale. However, the scale can be calculated from commodity specific scales ($S^k{}_j$). By definition, the total committed level of expenditure for an adult is $\sum P_j\gamma_j$ while the total committed expenditure for each child is $\sum_j P_j\gamma_j S^k{}_j$.

Therefore, the expenditure (income) scale, at a given set of prices, for each child is $(\sum_j P_j\gamma_j S^k{}_j)/(\sum_j P_j\gamma_j)$.

TABLE 5.10: Expenditure (ε_1), Own Price ($\varepsilon_{1,1}$), and Cross Price ($\varepsilon_{1,j}$) Elasticities of Rice and Cereals, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_1	0.7290	0.6546	0.7289	0.7531	0.3034
$\varepsilon_{1,1}$	-0.5805	-0.4875	-0.5527	-0.5628	-0.1775
$\varepsilon_{1,2}$	-0.0360	-0.0236	-0.0175	-0.0084	-0.0072
$\varepsilon_{1,3}$	-0.0196	-0.0162	-0.0144	-0.0108	-0.0066
$\varepsilon_{1,4}$	-0.0153	-0.0271	-0.0491	-0.0716	-0.0408
$\varepsilon_{1,5}$	0.0001	-0.0009	-0.0001	-0.0034	-0.0020
$\varepsilon_{1,6}$	-0.0021	-0.0089	-0.0070	-0.0109	-0.0115
$\varepsilon_{1,7}$	-0.0758	-0.0764	-0.0670	-0.0664	-0.0271
$\varepsilon_{1,8}$	-0.0027	-0.0014	-0.0034	-0.0014	0.0029
$\varepsilon_{1,9}$	-0.0002	0.0039	0.0012	-0.0005	-0.0207
$\varepsilon_{1,10}$	-0.0027	-0.0165	-0.0192	-0.0169	-0.0129

TABLE 5.10: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_1	0.8916	0.9349	1.0238	0.9062	0.1269
$\varepsilon_{1,1}$	-0.6726	-0.7297	-0.8259	-0.7307	-0.0841
$\varepsilon_{1,2}$	-0.0493	-0.0421	-0.0469	-0.0369	-0.0084
$\varepsilon_{1,3}$	-0.0316	-0.0362	-0.0335	-0.0275	-0.0046
$\varepsilon_{1,4}$	-0.0339	-0.0362	-0.0312	-0.0317	-0.0125
$\varepsilon_{1,5}$	-0.0001	-0.0001	-0.0003	-0.0002	-0.0007
$\varepsilon_{1,6}$	0.0009	0.0020	0.0020	0.0018	-0.0069
$\varepsilon_{1,7}$	-0.0998	-0.0923	-0.0886	-0.0858	0.0115
$\varepsilon_{1,8}$	0.0015	0.0008	0.0005	0.0061	-0.0046
$\varepsilon_{1,9}$	-0.0090	-0.0022	0.0001	0.0011	-0.0089
$\varepsilon_{1,10}$	0.0023	0.0012	0.0001	-0.0023	-0.0078

Note: The above figures are calculated from Equations 5.4, 5.5, and 5.6. Their standard errors are based on those of the committed levels of consumption and marginal budget shares in Tables 5.7 and 5.8.

TABLE 5.11: Expenditure (ε_2), Own Price ($\varepsilon_{2,2}$), and Cross Price ($\varepsilon_{2,j}$) Elasticities of Meat and Fish, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_2	0.8227	0.8950	0.9616	1.1365	0.6152
$\varepsilon_{2,1}$	-0.0596	-0.0437	-0.0256	-0.0205	-0.0089
$\varepsilon_{2,2}$	-0.6361	-0.6550	-0.7267	-0.8415	-0.3656
$\varepsilon_{2,3}$	-0.0221	-0.0221	-0.0190	-0.0164	-0.0134
$\varepsilon_{2,4}$	-0.0173	-0.0371	-0.0648	-0.1081	-0.0827
$\varepsilon_{2,5}$	0.0001	-0.0012	0.0002	-0.0051	-0.0041
$\varepsilon_{2,6}$	-0.0023	-0.0122	-0.0092	-0.0164	-0.0233
$\varepsilon_{2,7}$	-0.0856	-0.1045	-0.0884	-0.1002	-0.0550
$\varepsilon_{2,8}$	-0.0030	-0.0020	-0.0044	-0.0022	0.0058
$\varepsilon_{2,9}$	0.0002	0.0053	0.0016	-0.0008	-0.0420
$\varepsilon_{2,10}$	-0.0030	-0.0225	-0.0253	-0.0254	-0.0261

TABLE 5.11: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_2	0.9629	0.9802	0.8579	0.8590	0.1357
$\varepsilon_{2,1}$	-0.1081	-0.0680	-0.0298	-0.0315	-0.0075
$\varepsilon_{2,2}$	-0.6715	-0.7412	-0.7016	-0.6961	-0.0914
$\varepsilon_{2,3}$	-0.0341	-0.0380	-0.0281	-0.0261	-0.0049
$\varepsilon_{2,4}$	-0.0366	-0.0380	-0.0261	-0.0301	-0.0134
$\varepsilon_{2,5}$	-0.0001	-0.0001	-0.0002	-0.0002	-0.0008
$\varepsilon_{2,6}$	0.0010	0.0021	0.0016	0.0017	-0.0073
$\varepsilon_{2,7}$	-0.1078	-0.0968	-0.0743	-0.0813	0.0123
$\varepsilon_{2,8}$	0.0017	0.0008	0.0004	0.0057	-0.0049
$\varepsilon_{2,9}$	-0.0097	-0.0023	0.0001	0.0010	-0.0095
$\varepsilon_{2,10}$	0.0024	0.0012	0.0001	-0.0021	-0.0083

Note: The same as Table 5.10.

TABLE 5.12: Expenditure (ε_3), Own Price ($\varepsilon_{3,3}$), and Cross Price ($\varepsilon_{3,j}$) Elasticities of Fruit and Vegetables, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_3	0.8100	0.7641	0.8394	0.9443	0.4726
$\varepsilon_{3,1}$	-0.0587	-0.0373	-0.0223	-0.0170	-0.0069
$\varepsilon_{3,2}$	-0.0400	-0.0275	-0.0201	-0.0106	-0.0112
$\varepsilon_{3,3}$	-0.6080	-0.5505	-0.6307	-0.7022	-0.2798
$\varepsilon_{3,4}$	-0.0170	-0.0317	-0.0565	-0.0898	-0.0635
$\varepsilon_{3,5}$	0.0001	-0.0010	0.0002	-0.0042	-0.0031
$\varepsilon_{3,6}$	-0.0023	-0.0104	-0.0080	-0.0137	-0.0179
$\varepsilon_{3,7}$	-0.0843	-0.0892	-0.0771	-0.0833	-0.0422
$\varepsilon_{3,8}$	0.0030	-0.0017	-0.0039	-0.0018	0.0045
$\varepsilon_{3,9}$	0.0002	0.0045	0.0014	-0.0006	-0.0323
$\varepsilon_{3,10}$	-0.0030	-0.0192	-0.0221	-0.0211	-0.0200

TABLE 5.12: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_3	0.8183	0.6544	0.6826	0.6456	0.1245
$\varepsilon_{3,1}$	-0.0919	-0.0454	-0.0237	-0.0237	-0.0069
$\varepsilon_{3,2}$	-0.0453	-0.0295	-0.0313	-0.0263	-0.0083
$\varepsilon_{3,3}$	-0.5544	-0.4907	-0.5493	-0.5166	-0.0802
$\varepsilon_{3,4}$	-0.0311	-0.0254	-0.0208	-0.0226	-0.0123
$\varepsilon_{3,5}$	-0.0001	-0.0001	-0.0002	-0.0001	-0.0007
$\varepsilon_{3,6}$	0.0008	0.0014	0.0013	0.0013	-0.0067
$\varepsilon_{3,7}$	-0.0916	-0.0646	-0.0591	-0.0611	0.0113
$\varepsilon_{3,8}$	0.0014	0.0006	0.0003	0.0043	-0.0045
$\varepsilon_{3,9}$	-0.0082	-0.0015	0.0001	0.0008	-0.0087
$\varepsilon_{3,10}$	0.0021	0.0008	0.0001	-0.0016	-0.0076

Note: The same as Table 5.10.

TABLE 5.13: Expenditure (ε_4), Own Price ($\varepsilon_{4,4}$), and Cross Price ($\varepsilon_{4,j}$) Elasticities of Other Foods, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_4	1.2041	1.1449	0.9656	0.7873	0.3020
$\varepsilon_{4,1}$	-0.0872	-0.0559	-0.0257	-0.0142	-0.0438
$\varepsilon_{4,2}$	-0.0595	-0.0412	-0.0232	-0.0088	-0.0072
$\varepsilon_{4,3}$	-0.0323	-0.0283	-0.0190	-0.0113	-0.0066
$\varepsilon_{4,4}$	-0.8968	-0.8442	-0.7716	-0.6489	-0.2129
$\varepsilon_{4,5}$	0.0002	-0.0016	0.0002	-0.0035	-0.0020
$\varepsilon_{4,6}$	-0.0034	-0.0156	-0.0092	-0.0114	-0.0114
$\varepsilon_{4,7}$	-0.1253	-0.1336	-0.0888	-0.0694	-0.0270
$\varepsilon_{4,8}$	0.0044	-0.0025	-0.0045	-0.0015	0.0029
$\varepsilon_{4,9}$	0.0004	0.0068	0.0016	-0.0005	-0.0206
$\varepsilon_{4,10}$	-0.0044	-0.0288	-0.0255	-0.0176	-0.0128

TABLE 5.13: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_4	0.9615	0.8874	0.9608	0.9558	0.1738
$\varepsilon_{4,1}$	-0.1079	-0.0616	-0.0334	-0.0351	-0.0096
$\varepsilon_{4,2}$	-0.0532	-0.0400	-0.0440	-0.0389	-0.0116
$\varepsilon_{4,3}$	-0.0341	-0.0344	-0.0314	-0.0290	-0.0063
$\varepsilon_{4,4}$	-0.6539	-0.6655	-0.7710	-0.7691	-0.1227
$\varepsilon_{4,5}$	-0.0001	-0.0001	-0.0003	-0.0002	-0.0010
$\varepsilon_{4,6}$	0.0010	0.0019	0.0018	0.0019	-0.0094
$\varepsilon_{4,7}$	-0.1076	-0.0876	-0.0832	-0.0905	0.0158
$\varepsilon_{4,8}$	0.0017	0.0008	0.0004	0.0064	-0.0063
$\varepsilon_{4,9}$	-0.0097	-0.0021	0.0001	0.0011	-0.0121
$\varepsilon_{4,10}$	0.0024	0.0011	0.0001	-0.0024	-0.0106

Note: The same as Table 5.10.

TABLE 5.14: Expenditure (ε_5), Own Price ($\varepsilon_{5,5}$), and Cross Price ($\varepsilon_{5,j}$) Elasticities of Non-alcoholic Beverages, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_5	1.4178	1.2103	1.3867	0.8679	0.3074
$\varepsilon_{5,1}$	-0.1027	-0.0591	-0.0369	-0.0156	-0.0045
$\varepsilon_{5,2}$	-0.0701	-0.0436	-0.0333	-0.0097	-0.0073
$\varepsilon_{5,3}$	-0.0381	-0.0299	-0.0274	-0.0125	-0.0067
$\varepsilon_{5,4}$	-0.0297	-0.0502	-0.0934	-0.0825	-0.0413
$\varepsilon_{5,5}$	-1.0261	-0.8439	-1.0144	-0.6368	-0.1774
$\varepsilon_{5,6}$	-0.0040	-0.0165	-0.0133	-0.0126	-0.0116
$\varepsilon_{5,7}$	-0.1475	-0.1413	-0.1275	-0.0765	-0.0275
$\varepsilon_{5,8}$	0.0052	-0.0027	-0.0064	-0.0017	0.0029
$\varepsilon_{5,9}$	0.0004	0.0071	0.0023	-0.0006	-0.0210
$\varepsilon_{5,10}$	-0.0052	-0.0305	-0.0365	-0.0194	-0.0130

TABLE 5.14: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_5	1.3838	1.3514	1.2086	1.2594	0.1471
$\varepsilon_{5,1}$	-0.1553	-0.0937	-0.0420	-0.0462	-0.0081
$\varepsilon_{5,2}$	-0.0765	-0.0609	-0.0554	-0.0513	-0.0098
$\varepsilon_{5,3}$	-0.0490	-0.0523	-0.0395	-0.0383	-0.0053
$\varepsilon_{5,4}$	-0.0526	-0.0524	-0.0368	-0.0441	-0.0145
$\varepsilon_{5,5}$	-0.8888	-0.9611	-0.9333	-0.9696	-0.0902
$\varepsilon_{5,6}$	0.0014	0.0028	0.0023	0.0025	-0.0079
$\varepsilon_{5,7}$	-0.1549	-0.1334	-0.1046	-0.1193	0.0134
$\varepsilon_{5,8}$	0.0024	0.0012	0.0006	0.0084	-0.0053
$\varepsilon_{5,9}$	-0.0139	-0.0032	0.0001	0.0015	-0.0103
$\varepsilon_{5,10}$	0.0035	0.0017	0.0001	-0.0031	-0.0090

Note: The same as Table 5.10.

TABLE 5.15: Expenditure (ε_6), Own Price ($\varepsilon_{6,6}$), and Cross Price ($\varepsilon_{6,j}$) Elasticities of Clothing and Footwear, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_6	1.2865	1.0094	1.0985	1.0156	0.7536
$\varepsilon_{6,1}$	-0.0932	-0.0493	-0.0292	-0.0183	-0.0109
$\varepsilon_{6,2}$	-0.0636	-0.0363	-0.0263	-0.0113	-0.0179
$\varepsilon_{6,3}$	-0.0345	-0.0249	-0.0217	-0.0146	-0.0164
$\varepsilon_{6,4}$	-0.0270	-0.0418	-0.0740	-0.0966	-0.1013
$\varepsilon_{6,5}$	0.0002	-0.0014	0.0002	-0.0045	-0.0050
$\varepsilon_{6,6}$	-0.9349	-0.7161	-0.8144	-0.7553	-0.4585
$\varepsilon_{6,7}$	-0.1338	-0.1178	-0.1010	-0.0895	-0.0674
$\varepsilon_{6,8}$	0.0047	-0.0022	-0.0051	-0.0019	0.0071
$\varepsilon_{6,9}$	0.0004	0.0060	0.0018	-0.0007	-0.0515
$\varepsilon_{6,10}$	-0.0047	-0.0254	-0.0290	-0.0227	-0.0319

TABLE 5.15: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_6	1.5883	1.4487	1.3276	1.3297	0.3266
$\varepsilon_{6,1}$	-0.1783	-0.1005	-0.0462	-0.0488	-0.0180
$\varepsilon_{6,2}$	-0.0878	-0.0652	-0.0608	-0.0541	-0.0217
$\varepsilon_{6,3}$	-0.0563	-0.0561	-0.0434	-0.0404	-0.0119
$\varepsilon_{6,4}$	-0.0604	-0.0562	-0.0405	-0.0465	-0.0322
$\varepsilon_{6,5}$	-0.0002	-0.0001	-0.0004	-0.0002	-0.0019
$\varepsilon_{6,6}$	-1.0183	-1.0271	-1.0224	-1.0208	-0.2161
$\varepsilon_{6,7}$	-0.1778	-0.1430	-0.1149	-0.1259	0.0297
$\varepsilon_{6,8}$	0.0028	0.0012	0.0006	0.0089	-0.0118
$\varepsilon_{6,9}$	-0.0160	-0.0034	0.0001	0.0016	-0.0228
$\varepsilon_{6,10}$	0.0040	0.0018	0.0001	-0.0033	-0.0199

Note: The same as Table 5.10.

TABLE 5.16: Expenditure (ε_7), Own Price ($\varepsilon_{7,7}$), and Cross Price ($\varepsilon_{7,j}$) Elasticities of House and Housing Expenditure, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_7	0.8061	0.7788	0.8648	0.9196	1.2279
$\varepsilon_{7,1}$	-0.0584	-0.0380	-0.0230	-0.0166	-0.0178
$\varepsilon_{7,2}$	-0.0399	-0.0280	-0.0207	-0.0103	-0.0292
$\varepsilon_{7,3}$	-0.0216	-0.0192	-0.0171	-0.0132	-0.0267
$\varepsilon_{7,4}$	-0.0169	-0.0323	-0.0583	-0.0874	-0.1651
$\varepsilon_{7,5}$	0.0001	-0.0011	0.0002	-0.0041	-0.0082
$\varepsilon_{7,6}$	-0.0023	-0.0106	-0.0083	-0.0133	-0.0465
$\varepsilon_{7,7}$	-0.6673	-0.6328	-0.7123	-0.7517	-0.8102
$\varepsilon_{7,8}$	0.0030	-0.0017	-0.0040	-0.0018	0.0116
$\varepsilon_{7,9}$	0.0002	0.0046	0.0014	-0.0006	-0.0839
$\varepsilon_{7,10}$	-0.0030	-0.0196	-0.0228	-0.0206	-0.0520

TABLE 5.16: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_7	0.7331	0.7518	0.7766	0.7415	2.1312
$\varepsilon_{7,1}$	-0.0823	-0.0521	-0.0270	-0.0272	-0.1176
$\varepsilon_{7,2}$	-0.0405	-0.0339	-0.0356	-0.0302	-0.1418
$\varepsilon_{7,3}$	-0.0260	-0.0291	-0.0254	-0.0225	-0.0775
$\varepsilon_{7,4}$	-0.0279	-0.0291	-0.0237	-0.0259	-0.2099
$\varepsilon_{7,5}$	-0.0001	-0.0001	-0.0002	-0.0001	-0.0123
$\varepsilon_{7,6}$	-0.0007	0.0016	0.0015	-0.0015	-0.1152
$\varepsilon_{7,7}$	-0.5528	-0.6088	-0.6668	-0.6409	-1.1010
$\varepsilon_{7,8}$	0.0013	0.0006	0.0004	0.0050	-0.0770
$\varepsilon_{7,9}$	-0.0074	-0.0018	0.0001	0.0009	-0.1488
$\varepsilon_{7,10}$	0.0019	0.0009	0.0001	-0.0019	-0.1301

Note: The same as Table 5.10.

TABLE 5.17: Expenditure (ε_8), Own Price ($\varepsilon_{8,8}$), and Cross Price ($\varepsilon_{8,j}$) Elasticities of Transport and Communication, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_8	1.5082	1.3842	1.2848	1.3450	1.8349
$\varepsilon_{8,1}$	-0.1092	-0.0676	-0.0342	-0.0242	-0.0266
$\varepsilon_{8,2}$	-0.0746	-0.0498	-0.0308	-0.0150	-0.0437
$\varepsilon_{8,3}$	-0.0405	-0.0342	-0.0253	-0.0194	-0.0398
$\varepsilon_{8,4}$	-0.0316	-0.0574	-0.0865	-0.1279	-0.2466
$\varepsilon_{8,5}$	0.0002	-0.0019	0.0003	-0.0060	-0.0122
$\varepsilon_{8,6}$	-0.0043	-0.0189	-0.0123	-0.0195	-0.0695
$\varepsilon_{8,7}$	-0.1569	-0.1615	-0.1181	-0.1186	-0.1640
$\varepsilon_{8,8}$	-1.0862	-0.9624	-0.9460	-0.9834	-1.0294
$\varepsilon_{8,9}$	0.0005	0.0082	0.0021	-0.0009	-0.1253
$\varepsilon_{8,10}$	-0.0056	-0.0348	-0.0339	-0.0301	-0.0778

TABLE 5.17: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_8	1.6591	1.4370	1.3074	1.4068	1.2543
$\varepsilon_{8,1}$	-0.1863	-0.0997	-0.0455	-0.0516	-0.0692
$\varepsilon_{8,2}$	-0.0918	-0.0647	-0.0599	-0.0573	-0.0835
$\varepsilon_{8,3}$	-0.0588	-0.0557	-0.0427	-0.0427	-0.0456
$\varepsilon_{8,4}$	-0.0631	-0.0557	-0.0398	-0.0492	-0.1235
$\varepsilon_{8,5}$	-0.0002	-0.0001	-0.0004	-0.0003	-0.0072
$\varepsilon_{8,6}$	0.0017	0.0030	0.0025	0.0028	-0.0678
$\varepsilon_{8,7}$	-0.1857	-0.1419	-0.1132	-0.1332	0.1140
$\varepsilon_{8,8}$	-1.0624	-1.0206	-1.0086	-1.0735	-0.8073
$\varepsilon_{8,9}$	-0.0167	-0.0034	0.0001	0.0017	-0.0876
$\varepsilon_{8,10}$	0.0042	0.0018	0.0001	-0.0035	-0.0766

Note: The same as Table 5.10.

TABLE 5.18: Expenditure (ε_9), Own Price ($\varepsilon_{9,9}$), and Cross Price ($\varepsilon_{9,j}$) Elasticities of Medical Expenses, Education and Entertainment, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_9	1.3854	1.5046	1.3841	1.3639	0.7876
$\varepsilon_{9,1}$	-0.1003	-0.0735	-0.0368	-0.0246	-0.0114
$\varepsilon_{9,2}$	-0.0685	-0.0541	-0.0332	-0.0152	-0.0187
$\varepsilon_{9,3}$	-0.0372	-0.0372	-0.0273	-0.0196	-0.0171
$\varepsilon_{9,4}$	-0.0291	-0.0624	-0.0932	-0.1297	-0.1059
$\varepsilon_{9,5}$	0.0002	-0.0020	0.0003	-0.0061	-0.0052
$\varepsilon_{9,6}$	-0.0040	-0.0205	-0.0133	-0.0197	-0.0298
$\varepsilon_{9,7}$	-0.1441	-0.1756	-0.1272	-0.1202	-0.0704
$\varepsilon_{9,8}$	0.0051	-0.0033	-0.0064	-0.0026	0.0074
$\varepsilon_{9,9}$	-1.0024	-1.0381	-1.0105	-0.9955	-0.5031
$\varepsilon_{9,10}$	-0.0051	-0.0379	-0.0365	-0.0305	-0.0334

TABLE 5.18: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_9	1.3747	1.3706	1.2966	1.3140	0.5723
$\varepsilon_{9,1}$	-0.1543	-0.0951	-0.0451	-0.0482	-0.0316
$\varepsilon_{9,2}$	-0.0760	-0.0617	-0.0594	-0.0535	-0.0381
$\varepsilon_{9,3}$	-0.0487	-0.0531	-0.0424	-0.0399	-0.0208
$\varepsilon_{9,4}$	-0.0523	-0.0531	-0.0395	-0.0460	-0.0564
$\varepsilon_{9,5}$	-0.0002	-0.0001	-0.0004	-0.0002	-0.0033
$\varepsilon_{9,6}$	0.0014	0.0029	0.0025	0.0026	-0.0309
$\varepsilon_{9,7}$	-0.1539	-0.1353	-0.1122	-0.1244	0.0520
$\varepsilon_{9,8}$	0.0024	0.0012	0.0006	0.0088	-0.0207
$\varepsilon_{9,9}$	-0.8965	-0.9778	-1.0008	-1.0099	-0.3876
$\varepsilon_{9,10}$	0.0035	0.0017	0.0001	-0.0033	-0.0349

Note: The same as Table 5.10.

TABLE 5.19: Expenditure (ε_{10}), Own Price ($\varepsilon_{10,10}$), and Cross Price ($\varepsilon_{10,j}$) Elasticities of Other Non-foods, by Household.

Elasticity	Urban Quintile				
	U1	U2	U3	U4	U5
ε_{10}	1.2833	0.8663	0.7974	0.8860	0.3962
$\varepsilon_{10,1}$	-0.0929	-0.0423	-0.0212	-0.0160	-0.0057
$\varepsilon_{10,2}$	-0.0634	-0.0312	-0.0191	-0.0099	-0.0094
$\varepsilon_{10,3}$	-0.0345	-0.0214	-0.0157	-0.0128	-0.0086
$\varepsilon_{10,4}$	-0.0269	-0.0359	-0.0537	-0.0842	-0.0533
$\varepsilon_{10,5}$	0.0002	-0.0012	0.0002	-0.0040	-0.0026
$\varepsilon_{10,6}$	-0.0037	-0.0012	-0.0076	-0.0128	-0.0150
$\varepsilon_{10,7}$	-0.1335	-0.1011	-0.0733	-0.0781	-0.0354
$\varepsilon_{10,8}$	0.0047	-0.0019	-0.0037	-0.0017	0.0037
$\varepsilon_{10,9}$	0.0004	0.0051	0.0013	-0.0006	-0.0271
$\varepsilon_{10,10}$	-0.9336	-0.6246	-0.6045	-0.6660	-0.2428

TABLE 5.19: (Continued).

Elasticity	Rural Quintile				
	R1	R2	R3	R4	R5
ε_{10}	1.6492	1.4405	1.2972	1.2525	0.3464
$\varepsilon_{10,1}$	-0.1841	-0.0999	-0.0451	-0.0460	-0.0191
$\varepsilon_{10,2}$	-0.0912	-0.0649	-0.0594	-0.0510	-0.0231
$\varepsilon_{10,3}$	-0.0584	-0.0558	-0.0424	-0.0380	-0.0126
$\varepsilon_{10,4}$	-0.0627	-0.0558	-0.0395	-0.0438	-0.0341
$\varepsilon_{10,5}$	-0.0002	-0.0001	-0.0004	-0.0002	-0.0020
$\varepsilon_{10,6}$	0.0016	0.0030	0.0025	0.0025	-0.0187
$\varepsilon_{10,7}$	-0.1846	-0.1422	-0.1123	-0.1186	0.0315
$\varepsilon_{10,8}$	0.0029	0.0012	0.0006	0.0084	-0.0125
$\varepsilon_{10,9}$	-0.0166	-0.0034	0.0001	0.0015	-0.0242
$\varepsilon_{10,10}$	-1.0548	-1.0226	-1.0012	-0.9672	-0.2316

Note: The same as Table 5.10.

- CHAPTER 6 -

POVERTY AND INCOME INEQUALITY IN THE GENERAL EQUILIBRIUM MODEL

6.1. Introduction

In Chapter Two, industrial protection policies in Thailand during the 1960s, 1970s, and 1980s were reviewed. The theoretical impact of these policies on the functional distribution of income was also discussed. However, their implementation is limited by the rigidity of frameworks employed by those theories. Thus, they cannot fully explain the impact of the policies on poverty incidence and income inequality in Thailand during the periods.

As is well-known, the degree of impact is influenced by many parts of the economy, such as household ownership of factors of production, producer demand for those factors, intermediate input demand, regional allocation of sectors of production, and household demand for consumer goods. Given the roles of and the linkages amongst these parts, a general equilibrium analysis is selected. As discussed in Chapter Four, the structure of the model is designed to capture two main features, which are central to this thesis - industrial protection policies and income distribution in Thailand.

Three types of income distribution are important in terms of investigating the income distribution impact of policy in a general equilibrium framework, i.e. the functional distribution, the socio-economic distribution, and the size distribution of income. As is well-known, most economic theories only explain the impact of a policy on the functional distribution of income, which explains how total factor income is divided among factors of production such as labour, capital, and land. Chapter Four describes how the socio-economic distribution can be derived from a factor ownership matrix. Information from the Social Accounting Matrix can be used to construct this matrix. Each element in a particular column of the matrix explains the proportion of each factor owned by a particular socio-economic class. As an owner of factors, each socio-economic class derives income from the returns to factors of production. Although, as pointed out by de Melo and Robinson (1980), this socio-economic distribution can reflect social and political division, which are relevant for policy analysis; it does not place enough emphasis on the size distribution of income, which explains the unequal distribution of income amongst members of each class.

This chapter deals with the size distribution of income. It explains the methodology used to transform policy impacts on the functional distribution and the socio-economic distribution into policy impacts on the size distribution of income and, therefore, on poverty incidence and income inequality. The focus is on the problem of income distribution in Thailand during 1988, the base year of this thesis. The methodology consists of three steps. First, the size distribution of income among members of each socio-economic class is estimated by using information from the 1988 Household Socio-economic Survey. As in Chapters Four and Five, households are divided into ten classes, based on their per capita expenditure and urban/rural settings. Second, the distribution among members of each class can be used to measure poverty incidence and income inequality in that class. These two steps can be done with any desirable number of classes and a particular poverty line faced by each member of that class. However, the present resources and time constraints limit the number of classes to ten (five urban quintiles and five rural quintiles), and an average national poverty line is used. Third, based on the population and expenditure shares of these classes in each region and community, the additive decomposable property of various poverty and inequality measures can be used to investigate the national and regional distribution impact of changes in protection policies.

The remainder of this chapter is organised into five sections. The first provides various issues in income distribution and data discussion. The second focuses on the estimation of a density function, or a size distribution of income within each expenditure class. The third section discusses the concept of a poverty line and the standard properties of measurement of poverty incidence. This is important for the uses of the measurements themselves, and for the interpretation of results from the model. The decomposition property of these measures enhances the analysis of the model in many dimensions, i.e. community and region. Since the methodology used in this thesis is the Johansen type CGE model, these measures are also derived in percentage change forms. The number of poor and the intensity of poverty in Thailand in 1988 are also presented. The fourth section discusses income inequality measures, their properties, and income inequality in Thailand. The final section summarizes the framework.

6.2. Source of Data and Choice of Unit

The 1988 Household Socio-economic Survey (SES) of the National Statistical Office is the data source. The detail of this data source are discussed in the previous chapter.

Tables 6.1-6.2 summarise basic household statistics from this survey. About 72% of the Thai population live in rural areas, while the remaining 28% live in urban areas, i.e. municipal areas and sanitary districts. More than half of this 28% live in Bangkok. However, the income and expenditure share of rural areas does not match their population share. Only about half of total income and expenditure are shared by rural Thais. This unequal distribution of income and expenditure is mainly dominated by the Northeast and Bangkok. The population, income, and expenditure share of the Northeast is 34.27%, 20.95%, and 21.89%, respectively. While the share of Bangkok is 14.50%, 31.91%, and 30.83%. Bangkok's per capita income and expenditure is more than twice the national figures, while the Northeast's figures are slightly over 60% of the national figures.

The classification of households into ten classes, five urban quintiles and five rural quintiles, is based on per capita household expenditure and urban/rural settings. This is described in Chapters Four and Five. The analysis of income distribution in this thesis is also based on per capita household expenditure. The record of income data is naturally more accurate than that of expenditure data, but expenditure is sometimes preferred to income because of its better explanation of economic welfare, coverage, and reliability. However, high levels of expenditure could also be the result of income transfer or consumption from past savings. As a result, poverty incidence and inequality, based on per capita household expenditure, could be lower than those based on per capita household income.

TABLE 6.1: Household Characteristics, by Community and Region: 1988.

Community and Region	Number of Population (thousand)	Per Capita Monthly Household	
		Income (Baht)	Expenditure (Baht)
WHOLE KINGDOM	55153	1064.00	999.81
Urban	15457	1888.00	1680.80
Rural	39696	743.11	734.67
North	10878	929.95	852.10
Northeast	18899	650.41	638.54
Central	10210	1061.70	981.75
South	7169	935.72	945.05
Bangkok	7997	2083.30	2172.60

Note: Bangkok includes Nonthaburi, Pathum Thani, and Samut Prakarn.
Source: Calculated from the SES 1988.

The use of 'household' expenditure implicitly includes the role of the household in decision making. Although the 'per capita' cannot capture the role of household composition, it captures the role of household size. It also assumes constant return to scale, or the homogeneity hypothesis, i.e. household consumption is homogeneous of degree one in household size.

The use of a better choice, a consumer unit scale which is discussed in Chapter Five, is limited by the well-known identification problem; and non-uniformity across region, community, and income position.

6.3. Income Distribution: a Nonparametric Estimation

Two approaches have been used to explain the within class distribution of income. The first approach assumes a parametric form of probability density function (Robinson and Derwis, 1977; Adelman and Robinson, 1978; de Melo and Robinson, 1980; and Narayana et al., 1987). The two most commonly used functions are Lognormal and Pareto distribution functions which belong to the family of non-intersecting Lorenz curves (Kakwani, 1980b). The fit of the Lognormal distribution to the upper income levels, and the fit of the Pareto distribution to the lower income levels are far from satisfactory (Singh and Maddala, 1976). The fit of any particular distribution used by this approach is questionable, and should be checked by a test such as Chi-square or Kolmogorov-Smirnoff. With a large number of observations, as in the case of SES 1988, it is more likely that the fitness of the data to the distribution will be rejected by the test, even when it is true. The smoothness of a parametric distribution also ignores the actual differences amongst income positions. However, the attractiveness of this approach is its ability to capture the impact of policy on poverty incidence through a change in income in relation to a change in the poverty line. The second approach divides consumers or households into a number of income/expenditure classes (e.g., Coxhead and Warr, 1991b) and assumes that the within class distribution of income is uniform. This approach ignores the actual distribution of income within each class. However, it conforms with the assumption that the within group distribution is unaffected by policy shock. This implicitly assumes that all members of each class own the same proportion of factors of production. The greater the number of classes, the smaller the error that arises from this assumption.

TABLE 6.2: Population, Income, and Expenditure Shares, by Community and Region: 1988.

Community and Region	Share (%)		
	Population	Income	Expenditure
WHOLE KINGDOM	100.00	100.00	100.00
Urban	28.02	49.73	47.12
Rural	71.98	50.27	52.88
North	19.72	17.24	16.81
Northeast	34.27	20.95	21.89
Central	18.51	18.47	18.18
South	13.00	11.43	12.29
Bangkok	14.50	31.91	30.83

Note: Bangkok includes Nonthaburi, Pathum Thani, and Samut Prakarn.
Source: Calculated from the SES 1988.

This thesis employs a non-parametric density estimation of income distribution within each expenditure class. It incorporates the strengths of the two approaches described above in that 1) it does not ignore the actual difference amongst income positions and 2) it does not ignore the actual distribution of income within each class. Moreover, it can be used to study policy impacts on income inequality as well as poverty incidence. This kind of density estimation was first proposed by Fix and Hodges (1951, quoted in Silverman, 1986) and has been widely used in the area of statistics. In his introduction, Galton put forward his view that, in some cases, the geometric mean is to be preferred to the arithmetic mean as a measure of location (Galton, 1879 quoted in Aitchison and Brown, 1957). Thus, in terms of the position of each individual in the distribution of income, log per capita expenditure seems to be a better alternative than per capita expenditure. This is true in the case of the SES data set used in this thesis. Because of time and resource constraints, the number of classes is limited to ten. The per capita household expenditure was first transformed into a natural logarithmic form. The density function of each of the ten classes was then estimated by using the Kernel function. The Kernel function is Gaussian, and page width is calculated from variance of data[1]. The property of the density function is such that for every per capita household expenditure Y there is f(X) = f[ln(Y)] and F(X) = F[ln(Y)]. When X = ln(Y), f(X) is the density of X, and F(X) is the cumulative density of X.

The combined density estimates of per capita household expenditure for the ten classes are presented in Figures 6.1-6.2 (urban and rural density functions). Even in logarithmic form, the shapes of the distributions are skewed to the right and tend to be normally distributed. These characteristics are treated as exogenous factors to the CGE model and are not within the scope of this thesis. They are assumed to be unaffected by protection policy. Figures 6.3-6.4 present the cumulative density functions of urban and rural per capita household expenditure.

FIGURE 6.1: Density of Log of Per Capita Urban Household Expenditure.

1) The theoretical background of the technique is well-discussed in Silverman (1986).

FIGURE 6.2: Density of Log of Per Capita Rural Household Expenditure.

FIGURE 6.3: Cumulative Density of Log of Per Capita Urban Household Expenditure.

FIGURE 6.4: Cumulative Density of Log of Per Capita Rural Household Expenditure.

As in Equation 6.1, the slope of a cumulative density, at a particular level of log per capita expenditure, indicates a change in the proportion of people whose expenditure is below (or above) that level. This important information can be used to measure the effects of population and income (expenditure) changes on poverty incidence. It can also be used to evaluate the effect of price change on poverty incidence.

$$(6.1) \quad F'(X).dX \doteq F'[\ln (Y)].y,$$

when X = log of Y,

y = percentage change in per capita household expenditure Y,

$F(X)$ = cumulative density function of X, and

$F'(X)$ = the slope of $F(X)$.

The income distribution impact of a policy can be analysed by various measurements of income inequality and poverty incidence. Conventionally, income inequality is a relative measure and poverty incidence is an absolute measure. Their weaknesses and strengths are well-discussed in the literature, e.g., Seers (1972), Sen (1973), Meier (1976), and Sharif (1986). Additionally, among absolute measures and relative measures, there is both support and criticism. None contains all the desirable properties. This thesis opts for two measurements of poverty incidence - the head-count ratio (HCR) and the Foster, Greer, and Thorbecke (FGT) Index; and one measurement of income inequality - the Square of Coefficient of Variation (SCV). The following two sections discuss these indices and their application to the case of Thailand poverty incidence and income inequality in 1988.

6.4. Poverty Line and Poverty Incidence

This section is in four parts. The first presents the basic definition of a poverty line. The second presents the basic properties of poverty measures. The third discusses some measurements of poverty incidence. Two measures are used in this thesis - the HCR, which indicates the proportion of people whose income falls below a poverty line, and the FGT index, which measures the intensity of poverty and allows for different degrees of emphasis on poverty alleviation. The two measures contain many desirable properties of poverty measures, including the additive decomposable property. The final part of this section presents the contribution of poverty incidence at community and regional levels to national poverty incidence.

6.4.1. Poverty Line

A poverty line or subsistence expenditure can be defined in various ways (see Sharif, 1986 for a survey of the literature on the concept of subsistence). At least three approaches have been used widely. The first observes a standard of living directly from the social prescription. The second determines a standard of living from the declaration of members or representatives of a society. These are both criticised as being relative criteria. The third approach is based on a scientific estimation of physiological and mental requirements. This approach is supported by a World Bank study on Brazil, which indicates that the elimination of malnutrition through the provision of subsistence can lead to substantial gains in labour productivity and overall economic growth (World Bank, 1979, quoted in Sharif, 1986). In this context, both the concept of growth and distribution are justified. The poverty line for Thailand in this thesis is based on this approach.

The nutrition approach has some weaknesses (see Sharif, 1986). Nutritional requirements vary across age, sex, health, environment, activity, etc. The most serious criticisms against the nutritional approach are those of inter-personal and inter-regional variability of nutritional requirements, and the existence of adaptive mechanisms operating over time for the same person (Sukhatme, 1977; Sukhatme, 1978; Srinivasan, 1979; and Rein, 1970; quoted in Sharif, 1986). Therefore, there would be differences in estimated nutritional requirements amongst researchers which will affect the measurement of poverty incidence. There is also the question of conversion from nutritional requirements into a low cost basket of goods. In general, cost minimisation technique is used under nutritional requirement constraints. This method is criticized for excluding from the calculation taste and cultural traits, which are very difficult to determine. An additional problem arises from specifying subsistence in terms of income or expenditure. Finally, there is the lack of treatment of other factors, such as physical rest or leisure. Although some studies (e.g. Durnin and Passmore, 1967, quoted in Sharif, 1986) show that leisure is needed for both physical and mental efficiency, there has been little attempt to incorporate this need into a subsistence basket (Sharif, 1984, quoted in Sharif, 1986). The World Bank has a living standard measurement study program, which suggests the estimation of subsistence directly in terms of physical, mental, and social attainments, but little progress has been made (Chander et al., 1980; Sullivan et al., 1982; Grootaert, 1982; and Acharya, 1982; quoted in Sharif 1986). Another effort which attempts to include life expectancy, infant mortality rate, and literacy, has been developed (Morris, 1979, quoted in Sharif, 1986). Moreover, there are different treatments of non-food items in the nutritional approach. Some economists use a constant proportion of non-food items, and some include them in the minimisation process. An international comparison of poverty incidence must take into account these differences.

Thailand's national subsistence bundle or poverty line, as presented in Table 6.3, is based on Medhi, Pranee, and Suphat (1991). It is based on the energy required to maintain the functioning of all organs in the body, at work as well as at rest. This poverty line is based on expenditure information from the SES 1988, and is also calculated at regional and community levels. It includes the minimum income that an average household in the lowest quintile needs to buy basic food and non-food necessities, in order to maintain a minimal livelihood in society. The proportion of non-food items in the poverty line, based on the actual proportion of non-food consumption by households in the lowest quintile, is assumed constant. Other factors such as leisure, school enrolment rate, and mortality rate are not included.

TABLE 6.3: Composition of Thailand Poverty Line: 1988.

Consumer Goods	Value	Percent
TOTAL	8210.76	100.00
Food	4671.92	56.90
Rice and Cereals	1395.83	17.00
Meat and Fish	1771.88	21.58
Fruit and Vegetables	777.56	9.47
Other Foods	690.52	8.41
Beverages	36.13	0.44
Non-food	3538.84	43.10
Ratio (Non-Food/Food)	0.75747	-

Source: Medhi, Pranee, and Suphat (1991).

6.4.2. Axioms

Once a poverty line is identified, the next step is the choice of poverty measures which possess various properties. Sen (1976) asserts an axiomatic approach to evaluate poverty indices. Sen's first two axioms, monotonic and transfer axioms, are regarded as important criteria for a poverty index. In addition to these two axioms, another Sen's axiom and a Kakwani's axiom are also accepted as important properties of a poverty index. The following paragraphs summarise these axioms.

Axiom M (Monotonicity): Given other things, a reduction in income of a person below the poverty line must increase the poverty index.

Axiom T (Transfer): Given other things, a pure transfer of income from a person below the poverty line to anyone who is richer must increase the poverty index.

Sen's third axiom: A change in non-poor income leaves the poverty index unchanged (Sen, 1976 quoted in Foster, 1984), i.e. the poverty measure should capture only the change in income of the poor. This axiom overlooks the effect of a change in income of the marginal non-poor. This thesis asserts that 'a poverty index should increase if a decrease in the marginal non-poor income is large enough to bring them into poverty.'

In general, poverty indices implicitly assign zero weight to the welfare of the non-poor. According to Sen's axioms, weights attached to the welfare of the poor are equal. Kakwani (1980a) adds another three axioms which emphasize the importance of transfer among the poor and, thus, their welfare. These three axioms are monotonic-sensitivity axiom, transfer sensitivity I axiom, and transfer-sensitivity II axiom. The basic idea of the monotonic-sensitivity axiom is that the increase in overall deprivation should be higher if the same amount of money is taken from a poorer person. The transfer-sensitivity I axiom states that 'when the number of positions between the transferor and the transferee is fixed, the sensitivity of a poverty index should depend on the position of the transferor in the ranking of poor people.' The following transfer-sensitivity II axiom, implicitly summarises the first two axioms, and gives a higher weight to the transfer of income at the lower end than at the upper end of income distribution, i.e. higher weight to the welfare of the poorest poor.

Axiom TSII (Transfer-Sensitivity II): If a transfer of income take place from the i^{th} poor, with income Y_i, to the poor with income Y_{i+h}, then for a given h > 0, the magnitude of increase in the poverty index decreases as i increases.

Apart from these four axioms, there are many other axioms, including 1) Sen's other three axioms which link the level of welfare to the level of income and weight the poverty of each poor by their rank orders; and 2) Kakwani (1980b)'s axioms, an alternative for 1), which weight a poverty gap by a proportion between the income of the poor and the poverty line. Interested readers are referred to the original papers. The following paragraphs evaluate two poverty indices by the above four axioms.

6.4.3. Measurement of Poverty

In terms of the above four axioms, there are pros and cons for every index. However, given the methodology of this thesis, an important property is the additive decomposability which allows quantitative, as well as qualitative, assessment of the effect of changes in sub-group poverty on overall poverty. This section discusses the properties of two indices used in this thesis, the head-count ratio (HCR) and the FGT index. They show two important sides of poverty incidence. The HCR presents the number of poor as a proportion of the total population, and the FGT reflects the intensity of poverty.

Head Count Ratio (HCR): HCR is a crude measure which simply counts the number of poor as a percentage of the total population. Every poor is equally measured by this index, no matter how poor they are, having nothing or only one Baht less than the poverty line. Between the poor and the non-poor, the index is not sensitive to a sharp fall of income of the poor or a pure transfer of income from the poor to the non-poor. Thus, it violates axioms M, T, and TSII. Despite its weaknesses, HCR is a very simple index and easy to understand. In terms of mobility analysis, any in-migration or out-migration of poor and non-poor can be detected by this index. Moreover, it is additive decomposable.

The definition of HCR is as follows. Let $P(Y_i<Z)$ be a probability that the income of the i^{th} poor is less than Z, and F(Z) be the cumulative density function that individual incomes will be less than Z. If Z is defined as a poverty line then the HCR and its decomposed form can be defined as follows.

$$(6.2) \quad H = Q/N \text{ or } P[\ln(Y_i)<\ln(Z)] \text{ or } = F[\ln(Z)].$$

$$(6.3) \quad H = \sum_g (N_g/N).H_g, \text{ or } = \sum_g (N_g/N).P_g[\ln(Y_i)<\ln(Z)], \text{ or } = \sum_g (N_g/N).F_g[\ln(Z)],$$

when

H = the head-count ratio of the total population,

H_g = sub-group g's head-count ratio,

Q = the total number of poors,

Q_g = the number of poors in sub-group g,

N = the total number of population, and

N_g = the number of population in sub-group g.

When lower cases represent the percentage change form of the upper cases, the percentage change form of (6.3) can be written as

$$(6.4) \quad h = \sum_g (N_g H_g/NH)(n_g-n+h_g).$$

Provided that the within sub-group income distribution is fixed, two changes can cause an equivalent change in sub-group HCR (H_g), i.e. an equal

h_g. These are a change in the poverty line (z) and an opposite change in the subgroup's mean income or expenditure (m_g). The movement of the poverty line is the effect of changes in prices. Therefore, if

F_g = the probability that an individual in sub-group g will be in poverty, as defined by Equation 6.1, and

F'_g = the first derivative of F_g at $\ln(Y_i) = \ln(Z)$, then

dH_g = $F'_g(z-m_g)$, and

$$(6.5)\ h_g = (z-m_g)F'_g/H_g.$$

The FGT Class: Another index which is used widely is the FGT class of poverty index, developed by Foster, Greer, and Thorbecke (1984). This index satisfies Sen's first two axioms and Kakwani's axiom TS2. It has three advantages. First, it can capture the intensity of poverty. Second, in terms of an analysis on the distribution impact of a policy, it allows different degrees of emphasis on poverty alleviation (by varying a parameter α). Third, it is well-suited for sub-group poverty analysis. Similar to the HCR, the overall FGT index is equal to the population share weighted sum of sub-group indices. The FGT class of index, its decomposition, and its percentage change forms are defined by the following Equations 6.6, 6.7, and 6.8.

$$(6.6)\ P^{\alpha}(y,z) = (1/N)\sum_i [G_i/Z]^{\alpha},$$

$$(6.7)\ P^{\alpha}(y,z) = \sum_g (N_g/N).P^{\alpha}_g(y,z),$$

$$(6.8)\ p^{\alpha}(y,z) = \sum_g [(N_g P^{\alpha}_g/NP^{\alpha}).(n_g - n + p^{\alpha}_g)],$$

where

$P^{\alpha}(y,z)$ = FGT index of order α,

G_i = $Z-Y_i$,

Y_i = income of the i^{th} household, and, in the context of this thesis, y_i is the percentage change in sub-group i's mean income or expenditure, for all i,

α = the coefficient of poverty aversion, a larger α gives a greater emphasis to the poorest poor,

$P^{\alpha}_{g}(y,z)$ = sub-group g's FGT index of order α, and

$$(6.9)\ P^{\alpha}_{g}(y,z) = (1/N_g)\Sigma_{i\varepsilon g}[G_i/Z]^{\alpha}.$$

Equation 6.10 shows that the percentage change in sub-group FGT index of order α (p^{α}_{g}) can be written in terms of sub-group FGT index of order α and α-1 (P^{α}_{g} and $P^{\alpha-1}_{g}$), and percentage changes in sub-group mean income or expenditure (m_g), poverty line (z), sub-group HCR (h_g), and the number of poor in the sub-group (n_{pg}). In the absence of mobility, n_{pg} is zero. The derivation of (6.10) from (6.9) is detailed in Appendix 6.1.

$$(6.10)\ p^{\alpha}_{g} = \alpha[(P^{\alpha-1}_{g}/P^{\alpha}_{g})-1].(z-m_g)+h_g-n_{pg}.$$

Foster, Greer, and Thorbecke (1984) claim that:

if $\alpha > 0$, the monotonic axiom holds;

if $\alpha > 1$, the transfer axiom also holds;

if $\alpha > 2$, the transfer-sensitive II axiom also holds. Much of the literature uses the second order of FGT index (α=2).

Despite many strengths, the FGT class possesses a property which can be misinterpreted. It does not properly measure the effect of mobility of poor and non-poor between sub-groups. This is proven in Appendix 6.2. Poverty in a sub-group, measured by the FGT index, can be easily reduced by adding one less poor person into that sub-group.

6.4.4. Poverty Incidence in 1988

The characteristics of poverty incidence in Thailand can be discussed in many aspects. The decompositions of poverty incidence by community and region are presented in the following paragraphs. These decompositions are based on Equations 6.3 and 6.7, and statistics in Tables 6.2 and 6.4.

The poverty line used in this chapter is based on the new concept of the poverty line (8210.76 Bahts/person/year) which is higher than the old concept. Therefore, poverty incidence is also higher. A different choice of poverty line creates different results. Based on the old concept, poverty lines move in line with the change in consumer price indices. While the new poverty line moves in line with the changes in food prices and, assumes constant ratio between non-food and food expenditures. The major advantage of using this new poverty line is the availability of its composition, which allows tracing back the effects of various price changes on poverty incidence.

The composition of the national poverty line in Table 6.3 states that 56.90% of the poverty line (8210.76 Baht per year) will be spent on food. Non-food expenditure is only about 76% of food expenditure. Among food, meat and fish has the highest share (21.58%); followed by rice and cereals (17.00%), fruit and vegetables (9.47%), other foods (8.41%), and beverages (0.44%). Different changes in prices of these foods have different impacts on poverty incidence. The bigger share means more impact on poverty.

Table 6.4 shows that the number of poor is higher in rural areas (65%) than urban areas (20%). Bangkok has the lowest number of poor. On average, only 6 of every 100 people in Bangkok are in poverty, while 76 out of every 100 people in the Northeast are in poverty. Table 6.5 shows that rural areas contribute nearly 90%, and the Northeast contributes nearly half of the national HCR. Any policy impact on these two areas could have significant consequences for national poverty incidence.

In terms of poverty intensity, the FGT^2 index shows similar rankings. The intensity is very low in Bangkok, and urban areas, and very high in regional and rural areas. The intensity in the Northeast, 0.1603, is exceptionally high, when compared with 0.0032 for Bangkok. The Central region, which is the closest to Bangkok, has the second lowest intensity of 0.0477, followed by the South (0.0621), and the North (0.0914). The decomposition of the FGT^2 index shows the same ranking, but to a stronger degree. Poverty intensities in rural areas, and the Northeast contribute more than 90% and 60% of the country's poverty intensity, respectively.

TABLE 6.4: Poverty Incidence, by Community and Region: 1988.

Community and Region	Head Count Ratio		FGT^2	
	Index	Rank	Index	Rank
WHOLE KINGDOM	0.5258	-	0.0903	-
Urban	0.2014	2	0.0211	2
Rural	0.6521	1	0.1173	1
North	0.5788	2	0.0914	2
Northeast	0.7610	1	0.1603	1
Central	0.4224	4	0.0477	4
South	0.4891	3	0.0621	3
Bangkok	0.0623	5	0.0032	5

Note: Based on national poverty line in Table 6.3.
Source: Calculated from the SES 1988.

TABLE 6.5: Decomposition of Poverty Incidence, by Community and Region: 1988.

Community and Region	Head Count Ratio		FGT^2	
	%	Rank	%	Rank
WHOLE KINGDOM	100.00	-	100.00	-
Urban	10.77	2	6.57	2
Rural	89.23	1	93.43	1
North	21.71	2	19.95	2
Northeast	49.61	1	60.82	1
Central	14.87	3	9.78	3
South	12.09	4	8.94	4
Bangkok	1.72	5	0.51	5

Note: Based on poverty incidence in Table 6.4.
Source: Calculated from the SES 1988.

As discussed in Chapter Three, poverty in Thailand is a rural phenomenon. The diference in poverty incidence across region is the consequence of the size of the rural sector within each region. For example, nearly 90% of the Bangkok population live in urban areas, while nearly 90% of the Northeast population live in rural areas. The disaggregation of urban and rural households into ten quintiles allows more emphasize on poverty incidence in the areas. The aggregate decomposition of the HCR and the FGT class (Equations 6.5, 6.8, and 6.10) can be used to analyse the income distribution impacts of trade liberalization through changes in income and prices. Moreover, data in Tables 6.7, 6.11, and 6.12 can be used to impute the distribution impacts of trade liberalization at regional levels, as well as at community and national levels. An assumption is that income distribution within each quintile is the same across regions.

6.5. Income Inequality

The previous section discusses the measurement of poverty by which weights of the non-poor are zero. This section discusses the measurement of inequality, which takes into account both poor and non-poor. In terms of distribution impact of policy shock, two important types of transfer could affect income inequality: 1) a transfer at the end of an income distribution, and 2) a transfer at the mode of the distribution. For example, a more equal distribution of income could be the effect of either a transfer from the rich at the upper end, or a transfer from people at the mode to people at the lower end. The index used in this thesis, the square of coefficient of variation (SCV), is more sensitive to a transfer at a lower income level, i.e. higher weight to the welfare of the poorer people.

There are three parts in this section. The first presents various axioms which are accepted as standard properties of inequality measures. The second discusses the properties of the SCV, and the third discusses income inequality in Thailand, and its decomposition by region, community, and class.

6.5.1. Axioms

The standard properties of income inequality measures are clearly influenced by the work of earlier writers in the field of income distribution, such as Pigou and Dalton (1912 and 1920, quoted in Sen, 1973 and Atkinson, 1983). In order to provide a framework for inequality comparison, a set of properties which should be satisfied by an inequality measure is proposed in the form of axioms by Kakwani (1980b). Some of these axioms are similar to conditions suggested by others (Dalton, 1920 quoted in Sen, 1973; and Shorrocks and Foster, 1987). The following paragraphs summarise these axioms.

Let $Y = (Y_1, Y_2, Y_3, \ldots, Y_n)$ be a set of an ordered income distribution among n individuals. An inequality measure (I) should satisfy the following axioms

Axiom S (Scale Independence): If $Y = \alpha X$ ($\alpha > 0$), then $I(X) = I(Y)$[2].

This axiom makes the measure scale independent. Without this property, the elimination of inequality can be done by simply changing the unit of measurement. An example of measures that violate this property is variance which depends on mean income level and is scale dependent.

This axiom is debatable when sources of income are considered. Inequality can be separated into two parts, the within source inequalities, and the between source inequalities (see for example, Shorrocks, 1980). An equal increase in the total income of two individuals may lead to differences in inequalities. Kolm (1976) points out the effects of the change in individual incomes from various sources, which may lead to a change in income inequality dissatisfying this axiom. In practice, most empirical studies of income inequality still assume this property (Aitkinson 1989).

---

2) This axiom contradicts Dalton's suggestion that an equal proportionate addition (subtraction) to all income should diminish (increase) inequality (quoted in Kakwani, 1980b). However, he also adds that the unit of measurements used by any measure satisfying his condition should have the same purchasing power. Therefore, international comparison is possible.

Axiom A (Addition): If a new distribution Y is obtained from X by adding to incomes of all individuals a constant amount d, it follows that

a) if $d > 0$, $I(Y) < I(X)$;

b) if $d < 0$, $I(Y) > I(X)$[3].

Axiom P (Proportionate Growth): Inequality remains unaffected if a proportionate number of persons are added at all income levels.

Axiom T (Transfer): If a transfer of income $d < h/2$ takes place from a person with income X to a person with lower income (X-h), the inequality measure is strictly diminished. The restriction, $d < h/2$, ensures that the amount of transfer is not big enough to reverse the relative position of any two individuals in the distribution[4].

Some of the literature implicitly focuses on the welfare of the poor by giving higher weight to the transfer of income at lower levels of income. An example is Shorrocks and Foster (1987), who define two levels of transfer sensitivity, weak and strong. The weak transfer sensitivity gives a higher weight to a transfer at a lower income level than at any higher income level. The strong transfer sensitivity adds that the variance of the distribution should not be changed and the rank order should not be reversed[5].

For convenience, Kakwani adds that the value of any inequality measure should lie between zero and one (axiom 5.6, Kakwani, 1986b). Perfect inequality (measure = 1) is the situation in which one person gets all

---

3) This axiom is equivalent to Dalton's principle of addition (Kakwani, 1980b).

4) This axiom is similar to the first of two minimum requirements for the inequality measure suggested by Sen (1973). The first requirement is the Pigou-Dalton condition, or Dalton's principle of transfer (Dalton, 1920, quoted in Sen, 1973 and Kakwani, 1980b) in which Dalton asserts that any income inequality measure must satisfy this minimal property. This condition states that 'any transfer from a poorer person to anyone who is richer, other things remaining the same, always increases the measure (index).' Another condition is the relative sensitivity, which is the property of being sensitive to income transfer at all levels of income.

5) Shorrocks and Foster (1987) also state that the two conditions are equivalent.

income, and perfect equality (measure = 0) is the situation in which everybody has equal income.

6.5.2. Measurement of Inequality

Sen (1973) divides income inequality measures into two classes. Measures in the first class, normative measures, are based on the explicit formation of social welfare and the loss incurred from an unequal distribution of income. Three well-known measures in this class are Dalton's measure, Atkinson's measure and Sen's measure. The concept of using welfare function in these measures is economically interesting but, as Sen (1973) argues, the idea of inequality depends on the form of utility function[6]. The use of utility function leads to an unattractive property, being scale dependent. Although, this dependency can be avoided by the normalization of every individual's income by mean, other properties, such as axiom A, are not clearly satisfied by these measures. As a result, this class of measures will not be used.

Positive measures in the second class make no explicit use of the concept of social welfare. Most of them are statistical measurements by nature. Examples are range, relative mean deviation, variance, coefficient of variation, standard deviation of logarithm, relative mean difference, Gini index, Kakwani's measure, and Theil's entropy measure. Although these measures do not explicitly incorporate social welfare function, their implicit incorporation of welfare function is acceptable. Detailed discussion on the properties of these measures can be found in Sen (1973). Two of these measures, the Gini index and the square of coefficient of variation, are widely used. However, the use of the Gini index is limited to the case of intersecting Lorenz curves, and its non-additive decomposability. The square of coefficient of variation, of which properties are more attractive, is addressed in the following discussion.

---

6) Sen develops his own measure, which does not rely on the form of utility function and carries an egalitarian view. However, he does not show how his measure can be used without assuming a form of welfare function or utility function.

The Square of Coefficient of Variation (SCV): Three measures - variance, the coefficient of variation, and the square of coefficient of variation- are developed from statistical variance. The square of coefficient of variation satisfies all axioms - scale independence, addition, proportionate growth, and transfer sensitivity. It is more sensitive to transfer at lower levels of income. As it is also additive decomposable, it allows for the analysis of the effects of subgroup inequalities on overall inequality.

Consider variance as the origin of a class of measures. Variance, although simple, is scale dependent. Dividing standard deviation by mean, gives CV which satisfies the transfer axiom, and equally captures the sensitivity of transfers at every income level. But, it is not additive decomposable. The square of CV (SCV), which can be considered as the variance of income normalized by mean, possesses all of the desired properties.

Let $Y = (Y_1, Y_2, Y_3, \ldots, Y_n)$ be a set of an ordered income distribution among n individuals whose mean is M. A set of income normalized by M can be defined as

$$Y^* = (Y_1/M, Y_2/M, Y_3/M, \ldots, Y_n/M),$$

whose mean is equal to one.

The variance of this normalized income (V^*), which is the total percentage variation of income, can be calculated from the following equation.

$$(6.11) \quad V^* = (1/N) \sum_i [(Y_i/M)-1]^2 = (CV)^2$$

This is exactly the same as the square of CV (SCV) and twice of order two of an entropy index I_2 (Shorrocks, 1980). It can be shown that the value of V^* lies between 0 and (N-1). In order that V^* will have a convenient property of lying between 0 and 1, it is divided by (N-1). This adjustment does not affect any other properties and the adjusted V^* becomes

(6.12) $V^{**} \quad = \quad [1/N(N-1)]\sum_i[(Y_i/M)-1]^2$, or

(6.13) $V^{**} \quad = \quad [1/(N-1)] \int [(Y_i/M)-1]^2 f(y)dy.$

The satisfaction of V^* and V^{**} to every property is implied by the properties of I_2 and their proofs are shown in Appendix 6.3. These properties are 1) scale independence, 2) variant to equal addition (subtraction), 3) invariant to proportionate growth, and 4) transfer sensitivity. In the case of single intersecting Lorenz curve, V^* can represent all inequality measures, satisfying property 1, 3, and 4 (corollary 1, Shorrocks and Foster, 1987).

V^* can also be used to analyse the effects of sub-group inequalities on an overall inequality. Let

N_g = the number of population in sub-group g,
N = the number of total population,
V_g^* = inequality of sub-group g,
W_g = $(S_gM_g)/M$,
S_g = income or expenditure share of sub-group g which is equal to $(N_gM_g)/(NM)$,
M_g = mean income (expenditure) of sub-group g,
M = mean income (expenditure) of total population.

The overall V^* is equal to

$$V^* = \sum_g W_gV_g^* + \sum_g W_g - 1,$$

$$= \sum_g W_gV_g^* + \sum_g S_gM_g/M - \sum_g S_g, \text{ and}$$

$$(6.14) \quad V^* = \sum_g W_gV_g^* + \sum_g S_g(M_g/M-1).$$

The first term in Equation 6.14 represents the effect of sub-group inequalities on the overall inequality. The second term represents the inter-group effect due to the average position of each sub-group in the overall distribution of income. The term $(M_g/M)-1$ shows the difference between the position of sub-group mean income (expenditure) and the position of the overall mean income (expenditure). In percentage change form, Equation 6.14 can be rewritten as

$$(6.15)\ (1+v^*) = \sum_g [\{W_g(1+V_g^*)/(1+V^*)\}.\{w_g-(1+v_g^*)\}].$$

Where $(1+v^*) = d(1+V^*)/(1+V^*)$

$= v^*V^*/(1+V^*)$, and

$(1+v_g^*) = d(1+V_g^*)/(1+V_g^*)$

$= v_g^*V_g^*/(1+V_g^*)$.

Given the assumption that the within sub-group distribution is unaffected by policy being analysed, the changes in sub-group SCV (v_g^*) and $(1+v_g^*)$ are zero. The term w_g can be expanded as n_g-n+2m_g-2m. Thus, Equation 6.15 is reduced to Equation 6.16, which shows that the change in an overall SCV depends on the change in sub-group population and expenditure share.

$$(6.16)\ v^*V^*/(1+V^*)= \sum_g [\{W_g(1+V_g^*)/(1+V^*)\}.(n_g-n+2m_g-2m)]$$

6.5.3. Inequality in 1988

Based on per capita household expenditure, inequality was highest in rural areas and the Northeast. The unequal distribution of income in Thailand is indicated by the decomposition of SCV by community and region. The decompositions show that the main source of national inequality is the within group inequality (Table 6.6). The contribution of inequality within urban areas, and inequality within rural areas, are more than 46% and 45%, respectively. While the inequality between urban and rural areas contributes only about 8% to national inequality. Similarly, the total contribution of inequalities within each region to national inequality is nearly 90%.

TABLE 6.6: Inequality and Decomposition of Inequality, by Community and Region: 1988.

Community and Region	SCV	Rank (i,j)	Decomposition (%) b	c	Total
WHOLE KINGDOM	2.1562	-	91.72	8.28	100.00
Urban	1.2616	2,1	46.32	14.81	61.13
Rural	2.5129	1,2	45.40	-6.53	38.87
WHOLE KINGDOM	2.1562	-	89.18	10.82	100.00
North	1.4743	2,3	9.80	-1.15	8.65
Northeast	5.1085	1,2	33.12	-3.67	29.45
Central	0.9234	5,4	7.65	-0.15	7.50
South	1.2785	3,5	6.89	-0.31	6.58
Bangkok	1.0435	4,1	31.72	16.10	47.82

Notes: a. Rank i for sub-group inequality and rank j for sub-group's contribution to national inequality.

b. From Equation 6.14, the effect of sub-group inequalities on national inequality.

c. From Equation 6.14, the inter-group effects due to the position of sub-group mean incomes on national inequality.

Source: Calculated from the SES 1988.

Based on the assumption that the within group income distribution is exogenous to the model, in terms of inequality, the power of the model in explaining national inequality depends on the contribution of inequalities between groups which contribute only 8.28% to national inequality. Table 6.9 shows that, when urban and rural households are disaggregated into ten quintiles, the contribution of between group inequalities increases to nearly 40%. Thus, the power of the model increases as well. The greater the disaggregation of households in urban and rural areas, the greater the power of the model in explaining national inequality. Because of time and resource constraints, this thesis cannot go beyond this. In addition, based on population and expenditure shares in Tables 6.11 and 6.12, the same methodology can be used to impute the impact of policy shock at the regional level, as well as at community and national levels. Similarly to the case of poverty incidence, an assumption is made that income distribution within each class is the same across regions.

TABLE 6.7: Poverty Incidence and Inequality, by Household: 1988.

Household	HCR	FGT^1	FGT^2	SCV
Urban Quintile				
1.	0.9427	0.2563	0.0986	0.0605
2.	0.0	0.0	0.0	0.0160
3.	0.0	0.0	0.0	0.0092
4.	0.0	0.0	0.0	0.0157
5.	0.0	0.0	0.0	0.6009
Rural Quintile				
1.	1.0000	0.5686	0.3316	0.0451
2.	1.0000	0.3329	0.1146	0.0086
3.	0.8167	0.0969	0.0146	0.0079
4.	0.0	0.0	0.0	0.0118
5.	0.0	0.0	0.0	1.8670

Source: Calculated from the SES 1988.

6.6. Conclusion

This chapter presents the methodology to transform the functional and class distributions of income into the size distribution of income in two main steps. The first estimates the density and cumulative density of the log of household per capita expenditure within each of the ten classes. The estimate is less restrictive than any other estimates used in the area of income distribution and CGE modelling. The second decomposes the overall poverty incidence, HCR and FGT^2, and SCV into sub-group measures. These decompositions are also derived in percentage change form, which can be easily added to the Johansen type CGE developed in Chapter Four.

The incidence of poverty and inequality, in the base year 1988, are discussed by using the decomposition. The finding is an exceptionally high contribution of poverty incidence in the Northeast and rural areas to national poverty. The main causes of national inequality are the within-group inequalities, and not the inter-group inequalities. The major contribution is the inequality amongst the rural population and the Northeast population. The expenditure gap between urban and rural areas, and between Bangkok and regional areas, is a minor contribution.

TABLE 6.8: Population and Expenditure Shares, by Household: 1988.

Household	Share (%)	
	Population	Expenditure
Urban Quintile		
1.	5.99	3.05
2.	5.87	5.23
3.	5.85	7.66
4.	5.48	10.40
5.	4.84	20.78
Rural Quintile		
1.	19.23	5.68
2.	16.23	7.41
3.	14.03	8.72
4.	12.11	10.53
5.	10.37	20.54

Source: Calculated from the SES 1988.

The disaggregation of households into ten classes increases the power of the model in explaining the distribution impact of policy shocks in the general equilibrium framework. The poorer classes are understood to have less capital income and more labour income than the richer classes. It is implicitly assumed that all members of each class own the same proportion of factors of production. Any error that arises from this assumption can be reduced by increasing the degree of disaggregation. However, because of time and resource constraints, the number of classes is limited to ten. Further, by assuming that the within class income distributions are homogeneous across regions, the additive decomposability of poverty measures and inequality measure can be used to analyse income distribution at regional, as well as at national and community levels.

The frameworks developed in Chapter Four, and in this chapter, are used to simulate the distribution impacts of a move from the 1987 system of industrial protection toward free trade. Generally, a reduction in protection affects income of various households through the returns to factors of production and household ownership of these factors. Changes in prices and household income affect poverty incidence and inequality (Appendix 6.4). The following chapter discusses results of the simulations.

TABLE 6.9: Decomposition of Inequality, by Household: 1988.

Household	SCV	Decomposition (%)		
		a	b	Total
WHOLE KINGDOM	2.1562	60.39	39.61	100.00
Urban Quintile	1.2616	25.09	36.16	61.25
1.	0.0605	0.04	-0.69	-0.65
2.	0.0160	0.04	-0.26	-0.22
3.	0.0092	0.04	1.10	1.14
4.	0.0157	0.14	4.32	4.46
5.	0.6009	24.83	31.69	56.52
Rural Quintile	2.5129	35.30	3.45	38.75
1.	0.0451	0.04	-1.85	-1.81
2.	0.0086	0.01	-1.86	-1.85
3.	0.0079	0.02	-1.53	-1.51
4.	0.0118	0.05	-0.64	-0.59
5.	1.8670	35.18	9.33	44.51

Notes: a. From Equation 6.14, the effect of sub-group inequalities on national inequality.
b. From Equation 6.14, the inter-group effects due to the position of sub-group mean expenditure on national inequality.
Source: Calculated from the SES 1988.

TABLE 6.10: Decomposition of Poverty Incidence, by Household: 1988.

Household	Decomposition (%)	
	HCR	FGT^2
WHOLE KINGDOM	100.00	100.00
Urban Quintile		
1.	10.74	6.54
2.	0.00	0.00
3.	0.00	0.00
4.	0.00	0.00
5.	0.00	0.00
Rural Quintile		
1.	36.58	70.60
2.	30.88	20.59
3.	21.80	2.27
4.	0.00	0.00
5.	0.00	0.00

Source: Calculated from the SES 1988.

TABLE 6.11: Population Share, by Household and Region: 1988.

Household	Row % (Column %)				
	North	Northeast	Central	South	Bangkok
Urban Quintile					
1.	25.37 (7.70)	29.78 (5.20)	23.08 (7.46)	10.30 (4.74)	11.47 (4.74)
2.	15.63 (4.65)	17.23 (2.95)	24.10 (7.64)	10.74 (4.85)	32.30 (13.07)
3.	9.17 (2.72)	9.97 (1.70)	16.85 (5.32)	10.43 (4.70)	53.58 (21.62)
4.	9.71 (2.70)	8.13 (1.30)	11.31 (3.35)	8.99 (3.79)	61.86 (23.38)
5.	7.45 (1.83)	5.86 (0.83)	6.70 (1.75)	6.05 (2.26)	73.93 (24.69)
Rural Quintile					
1.	18.38 (17.93)	65.54 (36.80)	7.53 (7.83)	8.55 (12.66)	0.00 (0.00)
2.	23.93 (19.69)	47.53 (22.51)	15.14 (13.27)	12.84 (16.04)	0.57 (0.64)
3.	21.69 (15.43)	34.53 (14.13)	24.32 (18.43)	17.69 (19.10)	1.76 (1.70)
4.	24.55 (15.07)	24.97 (8.82)	26.94 (17.62)	19.06 (17.76)	4.48 (3.74)
5.	23.36 (12.28)	19.03 (5.76)	30.93 (17.32)	17.69 (14.11)	8.99 (6.43)

Note: Bangkok includes Nonthaburi, Pathum Thani, and Samut Prakarn.
Source: Calculated from the SES 1988.

TABLE 6.12: Expenditure Share, by Household and Region: 1988.

Household	Row % (Column %)				
	North	Northeast	Central	South	Bangkok
Urban Quintile					
1.	24.33 (4.42)	28.19 (3.93)	23.96 (4.02)	10.68 (2.65)	12.84 (1.27)
2.	15.21 (4.74)	17.09 (4.09)	23.98 (6.91)	10.52 (4.48)	33.19 (5.63)
3.	9.10 (4.15)	9.79 (3.43)	16.58 (6.99)	10.34 (6.45)	54.18 (13.45)
4.	9.51 (5.88)	8.04 (3.82)	11.27 (6.45)	8.97 (7.59)	62.20 (20.97)
5.	7.22 (8.92)	5.35 (5.08)	6.51 (7.44)	5.93 (10.03)	74.98 (50.49)
Rural Quintile					
1.	18.83 (6.37)	64.41 (16.73)	7.71 (2.41)	9.05 (4.19)	0.00 (0.00)
2.	23.86 (10.52)	47.15 (15.96)	15.38 (6.27)	13.03 (7.86)	0.58 (0.14)
3.	21.64 (11.23)	34.34 (13.68)	24.49 (11.75)	17.70 (12.56)	1.83 (0.52)
4.	24.32 (15.24)	24.78 (11.93)	27.38 (15.86)	18.90 (16.20)	4.62 (1.58)
5.	23.35 (28.53)	22.76 (21.36)	28.23 (31.91)	16.73 (27.98)	8.93 (5.95)

Note: Bangkok includes Nonthaburi, Pathum Thani, and Samut Prakarn.
Source: Calculated from the SES 1988.

Appendix 6.1: Percentage Change Form of FGT Class of Index

Given the density function of sub-group g, the FGT can be written in terms of the density function (F_g) or sub-group HCR (H_g), the total poverty intensity $\sum_i (G_i/Z)^\alpha$, and the number of poors in this sub-group (N_{pg}).

$$P^\alpha{}_g \quad = \quad (H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^\alpha$$

Using a partial differentiation, therefore

$$\begin{aligned}
dP^\alpha{}_g &= (H_g/N_{pg})d\sum_{i\varepsilon g}(G_i/Z)^\alpha + \sum_{i\varepsilon g}(G_i/Z)^\alpha d(H_g/N_{pg}) \\
&= (H_g/N_{pg})\sum_{i\varepsilon g}d(G_i/Z)^\alpha + (H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^\alpha d\ln(H_g/N_{pg}) \\
&= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^{\alpha-1}d(G_i/Z) \\
&\quad +(H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^\alpha d(\ln H_g - \ln N_{pg}) \\
&= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^{\alpha-1}d[1-(Y_i/Z)] \\
&\quad +(H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^\alpha.(h_g-n_{pg}) \\
&= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^{\alpha-1}d(-Y_i/Z) \\
&\quad +P^\alpha{}_g(h_g-n_{pg}) \\
&= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^{\alpha-1}.(-Y_i/Z)d\ln(Y_i/Z) \\
&\quad +P^\alpha{}_g(h_g-n_{pg}) \\
&= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^{\alpha-1}.(-Y_i/Z).d[\ln(Y_i)-\ln(Z)] \\
&\quad +P^\alpha{}_g(h_g-n_{pg}) \\
&= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^{\alpha-1}.(-Y_i/Z)(y_i-z) \\
&\quad +P^\alpha{}_g(h_g-n_{pg}) \\
&= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^{\alpha-1}.[-1+1-(Y_i/Z)](y_i-z) \\
&\quad +P^\alpha{}_g(h_g-n_{pg})
\end{aligned}$$

$$= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}(G_i/Z)^{\alpha-1}.[-1+(G_i/Z)](y_i\text{-}z)$$

$$+P^{\alpha}{}_g(h_g\text{-}n_{pg})$$

$$= (\alpha H_g/N_{pg})\sum_{i\varepsilon g}[(G_i/Z)^{\alpha}\text{-}(G_i/Z)^{\alpha-1}](y_i\text{-}z)$$

$$+P^{\alpha}{}_g(h_g\text{-}n_{pg})$$

$$= \alpha[P^{\alpha}{}_g\text{-}P^{\alpha-1}{}_g](y_i\text{-}z)+P^{\alpha}{}_g(h_g\text{-}n_{pg})$$

$$= \alpha[P^{\alpha-1}{}_g\text{-}P^{\alpha}{}_g](z\text{-}y_i)+P^{\alpha}{}_g(h_g\text{-}n_{pg})$$

By assuming that the within-group income distribution (the within-group density function) is exogenously fixed, the percentages change in income (expenditure) of all members of the group are equal. Thus, the percentage change in the sub-group FGT index can be written as

(6.10) $p^{\alpha}{}_g \quad = \alpha[(P^{\alpha-1}{}_g/P^{\alpha}{}_g)\text{-}1].(z\text{-}m_g)+h_g\text{-}n_{pg}.$

Appendix 6.2: Population Mobility and FGT Class of Index

In terms of dynamic analysis which is characterized by population growth and mobility, the following property, poverty and non-poverty growth, is suggested by Kundu and Smith (1983).

Axiom G (Poverty and non-poverty growth): Other things being equal, if a new person below (above) the poverty line is added to a society, the degree of poverty in the society should thereby increase (decrease).

This axiom is not satisfied by the FGT class. Poverty in a society, measured by the FGT index, can be easily reduced or increased, by an in-migration of a less poor person or an out-migration of a more poor person, respectively. This property limits the use of FGT index when the population is mobile.

The proof is as follows: Suppose that a group of m persons migrate into a group which previously has

$$P\alpha = (1/N) \sum_i (G_i/Z)^\alpha \qquad i = 1,..,Q,$$

$$= A/N,$$

$$\text{when } A = \sum_i (G_i/Z)^\alpha \qquad i = 1,..,Q.$$

The FGT index of the in-migrating group is equal to

$$Pm\alpha = (1/M)\sum_j (G_j/Z)^\alpha \qquad j = 1,..,Q_m,$$

$$= B/M,$$

$$\text{when } B = \sum_j (G_j/Z)^\alpha \qquad j = 1,..,Q_m.$$

After this in-migration, the new FGT index is

$$P^*\alpha = [1/(N+M)]\sum_k (G_i/Z)^\alpha \qquad k = 1,...,(Q+Q_m),$$

$$= [1/(N+M)][\sum_i (G_i/Z)^\alpha + \sum_j (G_j/Z)^\alpha],$$

$$= (A+B)/(N+M).$$

The expectation is that P'^{α} would be greater than P^{α}, i.e.,

$$(A+B)/(N+M) > A/N$$

or

$$B/M > A/N$$

The above inequality means a higher FGT index for the in-migrating group than the FGT index for the existing population. The same condition is also applied to the case of out-migrating poors from a group, where we expect a decrease in poverty incidence. Thus, a government can simply reduce poverty incidence, as measured by the FGT index, by allowing emigration of groups whose poverty intensity is lower than the national figure.

Appendix 6.3 : Proof of the Properties of SCV

We define the square of coefficient of variation (SCV) or variance of normalized income as

$$V^* = (1/N)\sum_i[(Y_i/M)-1]^2$$

$$= (CV)^2$$

Various properties of this measure can be tested as follows:

1. Axiom S (Scale Independence): For a set of income Y

$$V(Y)^* = (1/N)\sum_i[(Y_i/M_y)-1]^2$$

If $X = aY$ $(a > 0)$, then $M_x = aM_y$ and

$$V(X)^* = (1/N)\sum_i[(X_i/M_x)-1]^2$$

$$= (1/N)\sum_i[(aY_i/aM_y)-1]^2$$

$$= V(Y)^*$$

2. Axiom A (Addition): For a set of income Y

$$V(Y)^* = (1/N)\sum_i[(Y_i/M_y)-1]^2$$

$$= (1/N)\sum_i[(Y_i-M_y)/M_y]^2$$

If $X = Y+d$, then $M_x = M_y+d$ and

$$V(X)^* = (1/N)\sum_i[(X_i/M_x)-1]^2$$

$$= (1/N)\sum_i[(Y_i+d)/(M_y+d)-1]^2$$

$$= (1/N)\sum_i[(Y_i+d-M_y-d)/(M_y+d)]^2$$

$$= (1/N)\sum_i[(Y_i-M_y)/(M_y+d)]^2$$

which is $< V(Y)^*$ if $d > 0$,

$= V(Y)^*$ if $d = 0$,

and $> V(Y)^*$ if $d < 0$.

3. Axiom P (Proportionate Growth): The proof of this axiom is implied by the definition of SCV in Equations 6.12 and 6.13.

4. The satisfaction of axiom T (Transfer), Pigou-Dalton condition and the relative sensitivity can be proven at the same time:

For a set of income Y

$$V(Y)^* = (1/N)\sum_i[(Y_i/M_y)-1]^2,$$

$$\partial V(Y)^*/\partial Y_i = (2/NM_y).[(Y_i/M_y)-1],$$

$$\partial V(Y)^*/\partial Y_j = (2/NM_y).[(Y_j/M_y)-1],$$

$\partial V(Y)^*/\partial Y_i - \partial V(Y)^*/\partial Y_j$, the effect of an income transfer on $V(Y)^*$,

$$= (2/NM_y)\,[(Y_i/M_y)-(Y_j/M_y)]$$

$$= (2/NM_y)\,[(Y_i-Y_j)/M_y]$$

$$= (2/NM^2{}_y)(Y_i-Y_j)$$

Thus, it satisfies axiom T and is sensitive to transfer at every income level. The effect of transferring one unit of income on $V(Y)^*$ depends on income differential between the transferer and the transferee, i.e. the same income gap means the same change on the measure. Thus, this measure is more sensitive to transfer from the upper end of income distribution to the lower end than from the middle to the lower end.

5. Additive Decomposability: If V^* is the overall inequality of a population size N with mean income M then

$$V^* = (1/N)\sum_i[(Y_i/M)-1]^2,$$

$$= (1/N)\sum_i[(Y_i/M)^2-2(Y_i/M)+1],$$

$$= (1/N)\sum_i(Y_i/M)^2 - (1/N)\sum_i[2(Y_i/M)-1],$$

$$= (1/N)\sum_i(Y_i/M)^2-(1/N)[2NM/M-N],$$

$$= (1/N)\sum_i (Y_i/M)^2 - 1,$$

$$= (1/N)[\sum_{i\varepsilon g=1}(Y_i/M)^2 + \sum_{i\varepsilon g=2}(Y_i/M)^2 + \ldots] - 1,$$

$$= (1/N)[\sum_g\sum_i (Y_{gi}/M)^2] - 1,$$

where Y_{gi} = income of individual i in any subgroup g. Thus

$$V^* = (1/N)[\sum_g (M_g/M)^2 \sum_{i\varepsilon g}(Y_{gi}/M_g)^2] - 1,$$

$$= [\sum_g (1/N)(M_g/M)^2 \sum_{i\varepsilon g}(Y_{gi}/M_g)^2] - 1,$$

$$= [\sum_g (M_g/M)(M_g/NM)\sum_{i\varepsilon g}(Y_{gi}/M_g)^2] - 1,$$

$$= [\sum_g (M_g/M)(N_g M_g/NM)(1/N_g)\sum_{i\varepsilon g}(Y_{gi}/M_g)^2] - 1,$$

$$= [\sum_g (M_g/M)(S_g)(1/N_g)\sum_{i\varepsilon g}(Y_{gi}/M_g)^2] - 1,$$

$$= \sum_g (S_g M_g/M)(1/N_g)[\sum_{i\varepsilon g}(Y_{gi}/M_g)^2] - 1,$$

$$= \sum_g (S_g M_g/M)\{(1/N_g)\sum_{i\varepsilon g}(Y_{gi}/M_g)^2 - 1 + 1\} - 1,$$

$$= \sum_g (S_g M_g/M)\{[(1/N_g)\sum_{i\varepsilon g}(Y_{gi}/M_g)^2 - 1] + 1\} - 1,$$

$$= \sum_g (S_g M_g/M)\{V_g^* + 1\} - 1,$$

$$= [\sum_g (S_g M_g/M)].V_g^* + \sum_g (S_g M_g/M) - 1,$$

,i.e., $$V^* = \sum_g W_g V_g^* + \sum_g W_g - 1,$$

$$= \sum_g W_g V_g^* + \sum_g S_g[(M_g/M) - 1],$$

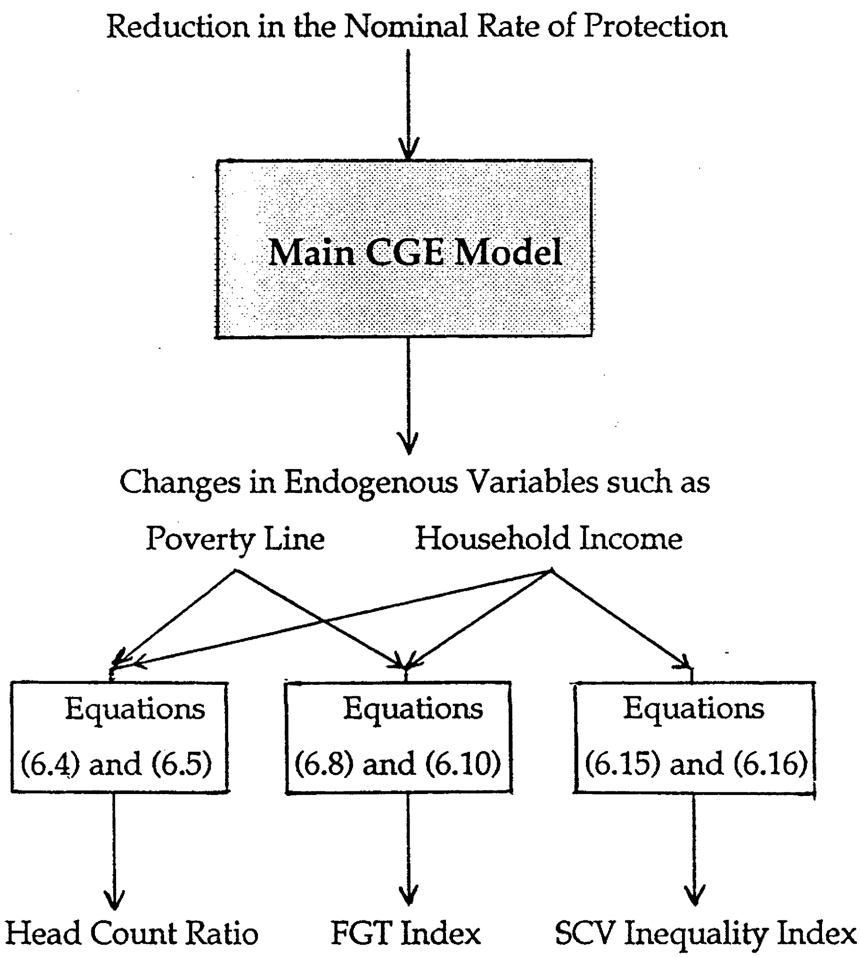
where S_g = expenditure share of subgroup g, and

W_g = $S_g M_g/M$.

Dividing by N-1, then their value lie between 0 and 1, i.e.,

$$V^*/(N-1) = [\sum_g W_g V_g^* + \sum_g W_g - 1)]/(N-1).$$

Appendix 6.4: Link between the Model and the Measurement of Income Distribution



- CHAPTER 7 -

IMPACT OF A MOVE TOWARDS FREE TRADE

7.1. Introduction

The patterns of industrialisation, industrial protection, and income distribution are clearly related. All three reflect the regional bias of economic policies in Thailand. Basically, industrial protection affects income distribution through the returns to factors of production. Because of the regional bias of industrial location, especially those of the highly protected industries, it seems possible that the problem of income distribution is accentuated by the system of protection.

This chapter analyses the income distribution impact of the move from the 1987 system of protection towards free trade. The 1987 nominal rates of protection are summarised in Table 7.1 by producer good. The system favoured manufacturing while disadvantaging agriculture. On average, import competing manufacturing industries received higher rates of protection than export oriented manufacturing industries. Protection for import competing industries generally includes import duties and import surcharge. Protection for export oriented industries is the sum of tax rebates (less export tax and royalty) - an exemption of import duty for exporters who import intermediate inputs used in the production of their exports. This is equivalent to an export subsidy.

Based on the general equilibrium framework developed in the previous chapters, the income distribution impact of a move towards free trade is examined by reducing all nominal rates of protection by 10%. The 10% reduction means that all nominal rates of protection are lowered by 10% of their base values. Thus, protection for other export products is reduced from 1.49% to 1.34%. Protection for import competing products is reduced from 18.93% to 17.04%, and so on.

Table 7.1: Nominal Rate of Protection (NRP), by Producer Good: 1987

Producer Good	NRP (%)
1. Paddy	0.00
2. Maize, Cassava, and Sugar-cane (MCS)	0.19
3. Rubber	0.00
4. Other Agricultural Products	7.74
5. Agro-industry Products	0.13[a]
6. Other Export Oriented Products	1.49[a]
7. Petroleum Products	1.40
8. Other Import Competing Products	18.93
9. Electricity, Water Supply, Transport, and Communication (EWTC)	0.00
10. Services	0.22

Note: a. Adjusted rates (see Section 4.4.1).
Source: Weighted average from figures given in Table 3.13, Paitoon et al. (1989).

The reduction alters directly the demand for, and domestic prices of, all imports and exports, and indirectly those of all other parts through quantity and price adjustment in factor and goods markets. The adjustment in the supply and returns to factors of production affects household income. These are captured by the CGE model developed in Chapter Four.

The move towards free trade also has some impact on the government budget. When protection for an import competing good is reduced, the government revenue from trade taxes will decrease if import volume remains the same. However, because of cheaper domestic prices, imports will generally increase and raise more revenue from trade taxes. Thus, the move towards free trade will lead to a change in the government budget, deficit or surplus. If the first effect outweighs the second, the government budget moves into deficit, and vice versa if the second effect outweighs the first.

Generally, trade theory argues that tariff reduction will lead to efficient allocation of resources and higher economic welfare. One of the basic assumptions behind this argument is that a change in government revenue from trade taxes is equally redistributed back to the public. However, the means of redistribution, taxation, has a distortionary effect and requires proper care. This is discussed in the literature (e.g. Hatta, 1986). Indirect taxation has a distortionary effect because it causes households to adjust their consumption patterns and leads to a consumption loss. Direct taxation distorts the choice between work and leisure, and because of the differences amongst the base year direct tax rates on households, it also distorts household demand for consumer goods. Lump-sum taxes such as a poll tax, which has no distortionary effect, are not being implemented in Thailand.

The methodologies developed in Chapter Six are used to analyse the impact of the move on poverty incidence and income inequality. Following the changes in household income and purchase prices, poverty incidence is measured by the number of poor (HCR) and the intensity of poverty (FGT^2). HCR indicates how many people are brought into or out of poverty, as a result of the move towards free trade, while FGT^2 measures the change in poverty intensity rather than the number of poor. An income inequality index (SCV) measures the impact of the move in income inequality. These are examined at the national, regional, and community level.

The remainder of this chapter is organised as follows. Section 7.2 summarises the economic environment of the simulations carried out in this thesis - the macro-economic closure of the model, factor market, trade orientation of each producer good, and policy variables. Emphasis is on the income distribution aspects of each choice of closure and exogenous variables. Section 7.3 discusses the impact of the move, from the 1987 system of protection towards free trade. The decrease in all nominal rates of protection brings about a government deficit, which is financed by an across the board increase in all direct tax rates. Both the pre-tax and post-tax income distribution impact is investigated. The deficit can also be financed by some other means, e.g. borrowing or an increase in indirect taxes. Section 7.4 explores the impact of different government instruments to redistribute the adverse effect of the move towards free trade on the government budget deficit. The instruments are external financing, and an across the board increase in all indirect tax rates. Section 7.5 discusses a sensitivity analysis, and compares the results of an alternative assumption with the one used in the previous sections. Section 7.6 summarises this chapter.

7.2. Closure of the Model

As shown in Chapter Four, the total number of equations in the model is 1616, and the total number of variables is 1747. By Walras law, one equation can be excluded from the model. The model is closed by having a set of 132 exogenous variables. The following paragraphs discuss the choice of macro-economic closure and the set of exogenous variables. They provide an economic environment in which simulations have been carried out.

7.2.1. Macro-economic Closure

The importance of macro-economic closure is debated among CGE modellers. Kehoe and Sierra-Puche (1983) found that the treatment of government deficits was crucial for their results, while Adelman and Robinson (1987), cited in Adelman and Robinson (1989), found that the impact of shock on the size distribution is virtually identical and small under all closures. However, Robinson (1989) asserts that three macro-economic closures are involved in the SAM-based model. These are savings-investment balance, trade balance, and government budget deficit. In the context of income distribution, the same study adds that the savings-investment balance is crucial. Most CGE modellers achieve equilibrium either by having investment adjust to savings, or by having savings adjust to the exogenous levels of investment. Both mechanisms rely on a shift between household demand and investment demand, which may have apriori distribution impact. In a full intertemporal or a long run model, changes in savings and investment induce changes in the ownership of factors of production and, thus, income distribution.

In the short run, the presence of real savings and investment underestimates the distribution impact of the move towards free trade, since a short run model cannot capture the future benefit of real savings and investment allocation. The inclusion of the net inflow of real foreign savings distorts the distribution impact, since it incurs future debt payment which is not captured by the model.

This thesis focuses on the short run income distribution impact of a change in industrial protection policy. The impact of the move is converted to present consumption. By assuming that the change has no impact on savings-investment decisions of economic agents, there is no real change in aggregate savings and investment (v is zero), or in any components of domestic savings and net inflow of foreign savings (v^j, v^h, v^g, and v^w are zero). Consequently, since the balance of payments is assumed to remain constant, the current account deficit is equal to the net inflow of nominal foreign savings, i.e. direct foreign investment plus external financing of a government budget deficit. This assumption is discussed in Sub-section 4.2.3.

7.2.2. Factor Markets

The period of time, about 2-3 years, is assumed to be sufficiently long for relative prices, consumption, and demand and supply of factors and goods to reach a new equilibrium, but sufficiently short for ignoring the impact of shocks on investment allocation, and each industry specific capital stock. Thus, the supplies of industry specific capital are assumed constant.

Land is also specific to each multi-output industry, because it is geographically defined. Although, it is well known that the past increase in agricultural outputs was based on the expansion of agricultural land; it is also recognised that the expansion has reached its frontier (Ammar, 1987, and Jeerakiat and Chucheep, 1987). This is the basis for the assumption that land are in fixed supplies.

Theoretically, the supply of labour is based on workers' trade off between leisure and wage rates in order to maximise their utilities. Labour supply depends on how leisure is valued and, therefore, on the degree of workers' responses to a change in the return to labour. By assuming an unlimited supply of labour, the income distribution impact of a policy shock could be more favourable. However, it could also be over-estimated due to the value of forgone leisure, which is not taken into account. The issue becomes more complicated when income tax is included.

Labour supplies can be set exogenously in the model, while real wage rates are endogenous. Alternatively, if labour supplies are endogenised in the model, real wages are exogenously set. The total returns to other factors are influenced by the way labour responds to the move towards free trade. In the limited supply case, skilled labour absorbs the benefit of the move through higher real wages, instead of through an increase in employment as in the unlimited supply case. Returns to other factors are affected accordingly.

This thesis assumes that supply of skilled labour is fixed, while that of unskilled labour is perfectly elastic. Income tax will have no impact on the supply of both types of labour, since skilled labour supply is fixed and unskilled labour income is lower than the income tax-free threshold. The assumption of the unlimited supply of unskilled labour is based on evidence of variable participation rates by youngsters, and female members of rural households, who can be drawn into the labour force in response to peak season demand (Bertrand, 1980). The shortage of skilled labour, and the inadequacy of labour skill upgrading, are widely accepted in the literature (for example Sirilaksana, 1992). This implicitly points to the scarcity and limited supply of skilled labour, which is one of the main concerns of the seventh development plan (1992-1996).

Another set of exogenous variables is wage differential variables, which is outside the scope of this thesis. They are set at zero, i.e. the move has no impact on wage differential, for the same skill category, across industries.

7.2.3. Foreign Trade

By small country assumption, Thailand is a price taker in world markets. The volume of Thai imports has no impact on world prices. The world prices of imports are exogenously determined and are assumed constant (p^{w}_{i2} are zero). The exchange rate (numeraire price) is also fixed.

In the case of exports, the relationship between Thai exports and world prices is governed by the price elasticity of world demand for Thai exports, which indicates the market power of Thai exports. This is discussed in Chapter Four. The sensitivity of simulation results to the market power of Thai exports will be reviewed in Section 7.5. The export of exportable producer goods (i = 5 and 6) is endogenously determined by the model, while those of import-competing and non-traded producer goods are exogenously fixed. The shift variable (g^{4}_{i1}) is set at zero for export producer goods. For non-export producer goods, it is allowed to adjust in such a way that the domestic prices of these goods are not directly related to world prices, i.e. they are determined by domestic conditions. The shock of world demand for Thai exports (f^{4}_{i}) is assumed zero, i.e. no exogenous change in world demand for Thai exports.

7.2.4. Policy Variables

Trade taxes, direct taxes, and indirect taxes are policy variables. They can be exogenously determined in this model. This thesis simulates the income distribution impact of a 10% across the board reduction in all nominal rates of protection, i.e. all tariff variables are exogenously set at -10. An exception is the rate of subsidy for export of agro-industry and other export oriented producer goods, which is endogenously determined by Equation 4.52. All other tax variables (tid_{is}, $tbar^{i}_{s}$, and td_{h}) are exogenously set at zero, i.e. other tax rates are fixed. As will be discussed in subsequent sections, the uniformity change in all rates of direct or indirect tax ($tbar^{is}$ or $tbar^{d}$) can be policy instruments to redistribute the effect of the move towards free trade on the government budget deficit (100dG = 0). Alternatively, the government budget deficit can be endogenised in the model, i.e. the deficit is financed by some external source, and debt repayment is not included in this model.

7.3. Trade Liberalization and Direct Taxation

This section focuses on the simulation results of the move from the 1987 system of industrial protection towards free trade, by the reduction of all rates of protection by 10%. Following the move towards free trade, which leads to a government budget deficit, the government decides to redistribute the deficit by an across the board increase in direct tax rates. The simulation assumes market power for agro-industry exports, and small country assumption for all other exports. It also assumes the supply of unskilled labour is perfectly elastic, while that of skilled labour is perfectly inelastic.

Tables 7.2-7.5 present some important data drawn mainly from the 1988 Social Accounting Matrix which was discussed in Section 4.3.

Table 7.2: Primary Factor and Intermediate Input Shares, by Producer Good **(%)**

Producer Good	Primary Factor	Intermediate Input	
		Domestic	Import
Paddy	79.06	15.65	5.29
MCS	65.93	29.10	4.97
Rubber	85.95	7.28	6.77
Other Agriculture	62.61	32.12	5.27
Agro-industry	19.94	79.58	0.48
Other Export Oriented	37.64	53.40	8.96
Petroleum	9.22	22.13	68.65
Other Import Competing	34.88	40.56	24.56
EWTC	42.73	41.49	15.78
Services	66.03	29.92	4.05

Table 7.3: Primary Factor Cost Share, by Producer Good (%)

Producer Good	Labour		Capital	Land
	Skilled	Unskilled		
Paddy	-	58.87	17.03	24.10
MCS	-	66.43	11.19	22.38
Rubber	-	66.83	9.49	23.68
Other Agriculture	-	63.00	15.80	21.20
Agro-industry	8.21	11.07	80.72	-
Other Export Oriented	25.91	11.73	62.36	-
Petroleum	28.83	2.16	69.01	-
Other Import Competing	12.10	17.01	70.89	-
EWTC	10.85	34.42	54.73	-
Services	17.10	30.78	52.12	-

Table 7.4: Cost Shares of Domestic and Imported Inputs, by Consumer Good (%)

Consumer Good	Intermediate	
	Domestic	Import
Rice and Cereals	99.15	0.85
Meat and Fish	96.67	3.33
Fruit and Vegetables	96.90	3.10
Other Foods	95.32	4.68
Non-alcoholic Beverages	99.90	0.10
Clothing and Footwear	97.81	2.19
House and Housing Expenditure	88.88	11.12
Transport and Communication	88.68	11.32
Medical Expense, Education, and Entertainment	82.24	17.76
Other Non-foods	94.08	5.92

TABLE 7.5: Base Year Direct Tax Rate, by Household (%)

Household	Direct Tax Rate
Urban 1	0.7728
Urban 2	1.0392
Urban 3	1.8434
Urban 4	3.1336
Urban 5	6.9700
Rural 1	0.0966
Rural 2	1.0297
Rural 3	0.0971
Rural 4	0.5594
Rural 5	1.6444

Source: Socio-economic Survey 1988, NSO.

Tables 7.6-7.14 summarise the simulation results of the move towards free trade when a government budget deficit is financed by an increase in all rates of direct taxes by 8.37%. The nature of direct taxes in Thailand is progressive and targets urban households. This is well-discussed in the literature (e.g. Chongrak, 1981, Chalongphob, Pranee, and Tienchai, 1988). Table 7.5 summarises the direct tax rates on each type of household[1]. By increasing all direct tax rates by the same proportion, the new direct tax structure, particularly on urban households, becomes more progressive.

The move towards free trade lowers import prices in relation to domestic prices of all import competing products. Buyers will find it cheaper to substitute imported goods for domestic goods. Thus, the move generally leads to an increase in imports, and a contraction in demand for outputs and employment of all import competing industries. All export oriented industries can attract more resources and, thus, expand. The effect on non-traded industries, which mainly service the domestic market, is dependent

1) It should be noted that the information from the SES 1988 is apparent anomaly since the rate on Rural 2 is higher than those on the richer rural households (Rural 3 and Rural 4).

on how the industries are related with the export oriented and import competing industries.

Since the move leads to cheaper imports, it also permits domestic firms to produce at a lower cost, through purchasing imported inputs at lower domestic prices. Thus, the first round effect is offset, to some extent, by the reduction in production cost which benefits all domestic industries.

The increase in all direct tax rates directly diverts resources from households to government, and also indirectly influences how resources are reallocated among industries. The economic rationale for the adjustment is that an increase in the direct tax burden on households leads to a decrease in household consumption expenditure, which, in turn, induces a change in demand for each consumer good. Since the consumer demand system in this model does not allow inferior goods, the change is simply a decrease in demand. Based on their expenditure elasticity of demand, household expenditure for various consumer goods is reduced accordingly until their budget balances. The induced decrease in demand for consumer goods, in turn, stimulates changes in demand for, and prices of, producer goods used as inputs in the production of consumer goods.

From this point, the resource allocation impact plays its role through changes in output, employment, wage rates, and returns to industry specific factors. These changes induce second round changes in household income, through their ownership of factors of production. The process will continue until all markets are in equilibrium.

7.3.1. Macro Impact

The simulation results project that, following the move towards free trade, nominal GDP decreases by 0.21%. This reduction is accompanied by a decrease in almost all components of GDP, except exports and imports. Overall household consumption (C) decreases by 0.43%, while investment (I) and government expenditure (G) decrease by 0.65% and 0.47%, respectively. Net exports increase, since exports (X) expand by 0.24% while imports (M) increase by 0.14%.

Table 7.6: Macro Impact of the Move Towards Free Trade and Direct Taxation

Industry	Change (%)
GDP (Nominal)	-0.2149
Consumption	-0.4312
Investment	-0.6461
Government	-0.4706
Export[a]	0.2403
Import[a]	0.1405
Price Indices	
Consumer	-0.4670
Capital	-0.6461
Government Revenue	
Trade Taxes	-9.7693
Indirect Taxes	-0.6557
Direct Taxes	8.1418
Property	-0.2388
Tax Rate	
Direct Taxes	8.3669
Indirect Taxes	-
Unskilled Labour Employment	0.2916
Nominal Wage	
Skill	-0.3036
Un-skilled	-0.4670

Note: a Valued at world prices.

Despite the decrease in nominal GDP, the move towards free trade leads to an increase in real GDP. The simulation results project that real GDP, as indexed by the CPI, increases by about 0.25%. The increase in total exports of about 0.24% appears to be the major force behind this growth. This leads to a 0.29% increase in employment of unskilled labour. A 0.04% increase in real consumption points to an overall welfare gain after the move towards free trade. Since investment and government expenditure are assumed constant in real terms, their nominal falls are explained by the fall in prices, e.g. the capital price index falls by 0.65%.

The decrease in government revenue is mainly caused by a dramatic fall in revenue from trade taxes of about 9.77%, followed by a fall in revenue from indirect taxes and property income by 0.66% and 0.24%, respectively. In order to finance its budget, the government has to raise more revenue from direct taxes by an across the board increase in all direct tax rates by 8.37%, which results in an increase in revenue from direct taxes of about 8.14%.

7.3.2. Production Impact

Table 7.7 shows that other import competing industries, protected at 18.93%, are most adversely affected by the move towards free trade. With less protection, these industries become less competitive and cannot compete with similar products from world markets. The contraction of output by about 0.05% is mainly explained by an increase in the import of imported counterparts by more than 0.23% (Table 7.8). As a result, employment of skilled and unskilled labour in these industries decreases by 0.27% and 0.11%, respectively. The expansion of another import competing industry, petroleum, is mainly because the industry has been relatively efficient and competitive. Nominal protection for the industry was very low (1.40%) while effective protection was -6.8% (Table 3.14, Paitoon et al., 1989). Thus, the adverse impact of the move towards free trade is very small, and is offset by benefits from the reduction of imported inputs which account for nearly 70% of the industry's total cost (Table 7.3). The industry is able to attract more labour out of the highly protected industries. Skilled and unskilled labour employment in the industry increases by 0.79% and 0.95%, respectively. The results project that, following the move towards free trade, the industry will expand by 0.25%. The expansion is induced by an increase in total demand for domestic petroleum products and a 0.45% decrease in demand for imported petroleum products (Table 7.8).

Other beneficiaries are other export oriented industries, agro-industry, and agriculture. By attracting more skilled and unskilled labour, a rise of about 0.50% and 0.66%, other export oriented industries expand at the rate of 0.21%. The expansion of the industries is dominated by a more than 0.67%

increase in world demand for their exports (Table 7.8). Similarly, another export oriented industry, agro-industry, also expands by 0.21%, world demand for agro-industry exports increases by 0.36%, and labour employment in the industry increases by more than 1% (Tables 7.8 and 7.9).

TABLE 7.7: Impact of the Move Towards Free Trade and Direct Taxation on Output Supply and Employment, by Industry (%)

Industry	Output	Labour Employment		
		Total	Skilled	Unskilled
ESAN (Northeast)	0.3066	0.4937	-	0.4937
Non-ESAN	0.0911	0.1458	-	0.1458
Agro-industry	0.2147	1.1140	1.0201	1.1836
Other Export Oriented	0.2060	0.5475	0.4965	0.6600
Petroleum	0.2476	0.7990	0.7856	0.9511
Other Import Competing	-0.0520	-0.1786	-0.2741	-0.1106
EWTC	0.0201	0.0445	-0.0798	0.0837
Services	0.0509	0.1063	0.0012	0.1647

The impact on non-traded industries is dependent on the relationship between these industries with expanding and contracting industries. EWTC and services are also encouraged by the move towards free trade. The expansion of the two agricultural industries, ESAN and non-ESAN, is driven by the relationship between these industries and agro-industry. Since agriculture supplies much of the intermediate inputs of agro-industry, the expansion of agro-industry induces demand for the outputs of agriculture, especially paddy, MCS, and rubber.

The expansion of ESAN industry (0.31%) is more than that of non-ESAN industry (0.09%). The explanation lies mainly in the fact that, between the two agricultural industries, the share of paddy, MCS, and rubber in total output of ESAN industry is higher than that of non-ESAN industry. On the other hand, the share of highly protected other agricultural products is lower in ESAN industry than in non-ESAN industry. Based on their output combination, ESAN industry is less protected than non-ESAN industry. Therefore, ESAN industry is less adversely affected by the move towards free trade.

TABLE 7.8: Impact of the Move Towards Free Trade and Direct Taxation on Trade, by Producer Good **(%)**

Producer Good	Export		Import	
	Quantity	Price[a]	Quantity	Price[a]
Paddy	-	-0.4053	0.1560	0.0000
MCS	-	-0.3890	-	-
Rubber	-	-0.3711	-	-
Other Agriculture	-	-0.4677	0.0349	-0.6674
Agro-industry	0.3588	-0.1911	0.3331	-0.6600
Other Export Oriented	0.6701	-0.1488	0.2614	-0.5720
Petroleum	-	-0.9259	-0.4484	-0.1156
Other Import Competing	-	-0.6955	0.2307	-1.2892
EWTC	-	-0.5196	0.0073	-
Services	-	-0.4457	0.0234	-0.0214

Note: a Domestic price, i.e. p^4 for export and p^0 for import.

Since the prices of other agricultural products decrease in relation to those of paddy, MCS, and rubber, agricultural industries find it more profitable to produce paddy, MCS, and rubber, and are expected to reallocate their resources towards the production of these crops (Table 7.9). The output of other agricultural products would increase to a lesser degree. Thus, the total outputs of paddy, MCS, and rubber, increase by 0.22%, 0.21%, and 0.16%, while that of other agricultural products increases by 0.10%. However, the decision of ESAN and non-ESAN industries also depend on their production transformation possibilities, which are governed by irrigated area and land quality. The benefit to ESAN industry is less than that to non-ESAN industry, for which land quality and irrigation are better. The expansion of ESAN industry is relatively less efficient, since it is constrained to allocate too many resources to increase the output of the less profitable other agricultural products by 0.25%. Non-ESAN industry increases the output of other agricultural products by only 0.05%.

TABLE 7.9: Impact of the Move Towards Free Trade and Direct Taxation on Domestic Supply and Basic Price, by Industry and Producer Good (%)

Industry and Producer Good	Output	Basic Price
Total Agriculture		
Paddy	0.2170	-0.3787
MCS	0.2111	-0.3819
Rubber	0.1615	-0.3711
Other Agriculture	0.1016	-0.4689
ESAN (Northeast)		
Paddy	0.3771	-0.3787
MCS	0.3483	-0.3819
Rubber	-	-0.3711
Other Agriculture	0.2530	-0.4689
Non-ESAN		
Paddy	0.1474	-0.3787
MCS	0.1237	-0.3819
Rubber	0.1615	-0.3711
Other Agriculture	0.0548	-0.4689
Agro-industry	0.2147	-0.1383
Other Export Industry	0.2060	-0.1233
Petroleum Industry	0.2476	-0.9769
Import-competing Industry	-0.0520	-0.7304
EWTC	0.0201	-0.5196
Services	0.0509	-0.4457

Note: Following ORANI's definition, the basic price is equal to the average cost of all inputs used in the production of one unit output, i.e. the price received by industry.

7.3.3. Factor Market Impact

Changes in the returns to industry specific factors (hereafter referred to as rent) are related to changes in employment and other domestic conditions, such as output and price. The reallocation of labour is induced by the assumption that change in the real wage of each type of labour, as indexed by CPI, is equal across industries. With the immobility of specific factors, the expansion of industries is obtained by hiring more labour, and the contraction of industries by reducing labour. With an increase (decrease) in employment, specific factors become relatively scarce (abundant) and rents are bid up (depressed). Therefore, as shown in Table 7.10, the average unit return to labour in expanding industries decreases in relation to the rent. In the other import competing industries, the rent decreases in relation to the unit return to labour in general. An exception is the expanding petroleum industry where rent decreases in relation to wage. This can be explained by the fact that the industry is relatively intensive in skilled labour in relation to unskilled labour. In order to attract skilled labour, which is in limited supply, the industry has to offer high wages and, thus, press down rent. These changes in returns to primary factors - the functional distribution of income - eventually affect the size distribution of income, and poverty incidence and inequality.

Table 7.10 also shows that, except in the ESAN industry, the rent in non-export oriented industries decreases while those of export oriented industries increase. The change in agricultural and non-agricultural rents are, on average, very significant. The 0.03% increase in the rent of ESAN industry is very impressive in relation to the 0.32% decrease in the rent of non-ESAN industry. Nominal wage rates for skilled and unskilled labour decreases by 0.30% and 0.47%, respectively while unskilled labour employment increases by 0.29% (Table 7.6). The decrease in the nominal wage rate for unskilled labour is the result of the assumption that the real wage for unskilled labour, as indexed by the CPI, is fixed.

Table 7.10: Impact of the Move Towards Free Trade and Direct Taxation on Return to Primary Factor, by Industry (%)

Industry	Return to		
	Labour[a]	Capital	Land
ESAN	-0.4670	0.0267	0.0267
Non-ESAN	-0.4670	-0.3213	-0.3213
Agro-industry	-0.3974	1.0878	-
Other Export Industries	-0.3545	0.3754	-
Petroleum Industry	-0.3149	-0.7503	-
Other Import-competing Industries	-0.3991	-0.6372	-
EWTC	-0.4278	-0.3834	-
Services	-0.4086	-0.3024	-

Note: a For ESAN and non-ESAN industries, this is unskilled labour. For the remaining industries, this includes skilled and unskilled labour.

7.3.4. Income Distribution Impact

There are many features of the factor ownership matrix that explain different changes in household income and thus income distribution (Table 7.11). Income from skilled labour is a relatively more important part of the income of urban households, especially in the middle quintiles, than that for rural households. Income from unskilled labour is an important source of income for most types of households, especially poor and rural households. The higher the quintile, the lower the share of income from unskilled labour in total household income. The share of income from non-agricultural capital in total household income varies with the household's position in the distribution of income. Rich households earn more from non-agricultural capital than poor households. The share of non-agricultural capital in urban household income is greater than in rural household income. Although agricultural capital is not a very important source of income, it is relatively more important for rural households than for urban households. Income from land is mostly owned by rural households. However, poor quality land in the Northeast is a relatively more important source of income for poor rural households than for rich rural households, while income from land in other regions is a more important source for households at the mode of the rural income distribution than for other households.

Table 7.11: Factor Ownership Matrix **Row % (Column %)**

Household	Labour		Capital		Land	
	S	US	A	NA	NE	NON
Urban 1	14.2 (3.0)	47.6 (4.5)	1.0 (1.4)	35.2 (2.2)	0.4 (1.5)	1.6 (1.9)
Urban 2	16.5 (5.8)	38.1 (6.0)	0.4 (0.8)	44.3 (4.6)	0.0 (0.3)	0.7 (1.3)
Urban 3	17.2 (8.5)	34.7 (7.6)	0.2 (0.7)	47.6 (7.0)	0.0 (0.1)	0.3 (0.7)
Urban 4	17.0 (10.8)	30.7 (8.6)	0.2 (0.6)	51.7 (9.7)	0.0 (0.3)	0.4 (1.4)
Urban 5	15.3 (21.2)	14.0 (8.6)	0.2 (1.9)	69.7 (28.5)	0.1 (1.3)	0.7 (5.2)
Rural 1	15.6 (5.2)	62.9 (9.3)	3.3 (6.7)	7.4 (0.7)	6.0 (32.5)	4.8 (9.0)
Rural 2	10.3 (4.9)	59.8 (12.7)	4.7 (13.9)	13.7 (1.9)	4.2 (32.4)	7.3 (19.7)
Rural 3	11.4 (7.0)	49.9 (13.6)	5.1 (19.3)	25.3 (4.6)	1.9 (18.5)	6.4 (22.1)
Rural 4	13.9 (11.4)	38.1 (13.8)	4.0 (20.2)	39.2 (9.5)	0.5 (7.2)	4.3 (19.7)
Rural 5	13.7 (22.2)	21.2 (15.3)	3.4 (34.5)	59.4 (28.5)	0.2 (5.9)	2.1 (19.0)
Govt.	- (-)	- (-)	- (-)	100.0 (2.8)	- (-)	- (-)

Note: S Skilled Labour. US Unskilled Labour.
A Agricultural Capital. NA Non-agricultural Capital.
NE ESAN (Northeast) Land. NON Non-ESAN Land.

As a result, the move towards free trade tends to relatively favour rural households, especially those in the lower quintiles. The move towards free trade leads to a general reduction in prices and nominal income. However, Table 7.13 shows that the income of households in the lower (poorer) quintile decrease less than those of households in the upper (richer) quintiles. Income of rural households decreases less than those of urban households in the equivalent quintile. Most importantly, the reduction in income for households in all quintiles are lower than that of the poverty line (0.35%). These features point to the favourable distributional impact of the move towards free trade. Similar features can be found for household consumption expenditure. However, since the government has to raise revenue by direct taxation, the progressive nature of direct taxes tends to bring more urban people into poverty.

The income distribution impact is summarised in Table 7.12. HCR shows a change in the number of poor, FGT^2 a change in the intensity of poverty, and SCV a change in inequality. As already discussed in Chapter Six, these measurements are based on household per capita expenditure. However, in order to separate the progressive effect of direct taxation, Table 7.12 also compares the change in poverty and inequality in two dimensions, pre-tax and post-tax analyses. The pre-tax results are based on household income, and the post-tax results are based on household consumption expenditure. A common characteristic of the pre-tax and post-tax cases is that reductions in poverty intensity (FGT^2) are more than reductions in the number of poor (HCR). This indicates that the move towards free trade not only brings some people out of poverty, but also reduces the hardship of people who are still in poverty.

Table 7.12 shows that, before tax, the income distribution impact of the move towards free trade is very favourable. The number of poor, poverty intensity, and inequality decreases at national level, in every region, and community. The decrease in poverty is substantial, although not dramatic. The striking characteristics of the results are that the reduction in the number of poor and poverty intensity is more in the urban areas and Bangkok, and is smallest in the poorest region, the Northeast. The decrease in inequality is not substantial. The reduction in national inequality is a result of decreased inequality within urban areas and rural areas, and a decrease in inequality between urban and rural areas.

Table 7.12: Income Distribution Impact of the Move Towards Free Trade and Direct Taxation, by Community and Region (%)

Income Distribution	Pre-tax	Post-tax
Overall HCR	-0.1520	-0.1674
Urban	-0.2331	-0.1480
Rural	-0.1423	-0.1697
North	-0.1561	-0.1699
Northeast	-0.1034	-0.1150
Central	-0.2464	-0.2724
South	-0.2071	-0.2352
Bangkok	-0.2970	-0.2611
Overall FGT^2	-0.4077	-0.3567
Urban	-0.7250	-0.4605
Rural	-0.3853	-0.3493
North	-0.4370	-0.3717
Northeast	-0.3458	-0.3109
Central	-0.5816	-0.4930
South	-0.5159	-0.4500
Bangkok	-1.3862	-0.9778
Overall SCV	-0.0307	-0.5203
Urban	-0.0215	-0.7244
Rural	-0.0369	-0.1714
North	-0.0496	-0.5264
Northeast	-0.0224	-0.1593
Central	-0.0525	-0.6041
South	-0.0453	-0.5759
Bangkok	-0.0172	-0.6044

Note: HCR is the number of poor over the total population, FGT^2 is the measurement of poverty intensity, and SCV is the measurement of income inequality.

Direct taxation diverts household income to government. In the post tax situation, the distribution of income has become somewhat more equal. National inequality decreases by about 0.52% which is more than the 0.03%

decrease of the pre-tax case. As a result of progressive tax rates, decreases in inequality in both urban and rural areas are also much more than those in the pre-tax case. As expected, the expenditure gap between urban and rural households has also narrowed. Again, the Northeast records the lowest improvement in inequality. The decreases in the overall poverty, especially FGT^2, are smaller, since both the non-poor and the poor are subjected to the 8.37% increase in all direct tax rates. Bangkok is most adversely affected by the direct taxation since poverty intensity decreases by 0.98%, which is much less than the 1.39% of the pre-tax case.

7.3.5. Consumption Impact

Household income is affected by the move towards free trade, through a change in unskilled labour employment, changes in wage rates, and changes in the returns to industry specific factors. Based on the changes in their income constraints, and relative prices, households adjust their consumption patterns. Accordingly, a change in overall domestic consumption alters domestic demand, output, and employment.

The 8.37% increase in all the rates of direct taxes diverts resources from households to government. It allows the government to maintain its existing level of spending and investment, in real terms. At the same time, it squeezes overall household consumption expenditure. The benefit of imported price reduction is offset by the burden of the increase in direct taxes to finance the government budget.

Table 7.13 points out that the system of industrial protection is equivalent to a subsidy for the well off households, especially in the urban areas. Despite the overall welfare gain, indicated by the 0.04% increase in real national consumption, the same table shows that the favourable impact of income distribution is not costless. Changes in real consumption of households in various quintiles are different. Although, real consumption of urban households in the three lower quintiles, and all rural households, increases, that of households in the other quintiles decreases. The move towards free trade allows most households to buy imported and domestic varieties at lower prices and most households get back some of their deadweight loss.

Table 7.13: Impact of the Move Towards Free Trade and Direct Taxation on on Income and Consumption, by Household (%)

Household	Income	Consumption	Real Consumption[a]
Urban 1	-0.2007	-0.2569	0.1923
Urban 2	-0.2130	-0.2929	0.1767
Urban 3	-0.2172	-0.3690	0.1103
Urban 4	-0.2191	-0.4895	-0.0042
Urban 5	-0.2311	-0.9384	-0.4366
Rural 1	-0.1795	-0.1727	0.2455
Rural 2	-0.1887	-0.2533	0.1707
Rural 3	-0.1998	-0.1698	0.2651
Rural 4	-0.2111	-0.2089	0.2383
Rural 5	-0.2245	-0.3336	0.1489

Note: a Consumption expenditure deflated by household consumption price index, the price of consumer goods weighted by the share of each good in household consumption basket.

Based on their response to change in consumption expenditure and prices, households unequally adjust their demand for various consumer goods. With general decreases in prices, and increases in real consumption expenditure of most households, their demand for consumer goods is expected to increase. However, this increase is partly offset by a decrease in demand from richer households in higher urban quintiles who experience a fall in real consumption expenditure. Since these richer households share much of the national private consumption expenditure, total household demand for all consumer goods increases very slightly (Table 7.14). This slight increase in real national consumption indicates that the economy allocates resources towards production for export which leads to economic growth.

Table 7.14: Impact of the Move Towards Free Trade and Direct Taxation on Consumer Goods **(%)**

Consumer Goods	Quantity	Price
Rice and Cereals	0.0844	-0.3200
Meat and Fish	0.0227	-0.2877
Fruit and Vegetables	0.0759	-0.4576
Other Foods	0.0736	-0.4660
Non-alcoholic Beverages	0.1840	-0.6580
Clothing and Footwear	-0.0856	-0.1902
House and Housing Expenditure	0.0588	-0.5064
Transport and Communication	-0.0418	-0.5801
Medical Expenses, Education, and Entertainment	0.2087	-0.6384
Other Non-foods	0.1704	-0.5653

7.4. Trade Liberalisation and Redistribution Impact

Having examined the impact of the move towards free trade when the government raises more revenue through direct taxation, the focus now moves to external financing and redistribution of the government deficit through indirect taxation. The government may choose to cut its expenditure on goods and services, or on public investment spending. But the cut in expenditure on goods and services can have a dramatic impact on the prosperity of all producing industries, while the cut in investment spending can severely impair the long-term benefit of investment projects which are not presented in the model. In the following discussion, the government may decide to raise more revenue through an across the board increase in all indirect tax rates. Indirect taxation will create another distortionary effect, since each producer good is subject to different indirect tax rates. The government may also choose to borrow from some external source to finance the deficit. Because such external financing may lead to long term damage to the fiscal system and create a burden for future generations, not well-captured in the model, any favourable impact should be viewed with caution.

7.4.1. Indirect Taxation and Distortionary Effect

This simulation allows the Government to finance its budget deficit by a 2.59% increase in all the base year rates of indirect taxes as shown in Table 7.15. The indirect taxes exclude trade taxes and subsidies. The increase is across the board, on all producer goods, and on both domestic and imported goods. As shown in Table 7.15, industries subjected to the two highest rates are the petroleum industry (18.30%), and other import competing industries (8.97%). A 2.59% increase means a rise in the indirect tax rate on petroleum goods from 18.30% to 18.77%, on other import competing goods from 8.97% to 9.20%, and so on.

TABLE 7.15: Indirect Tax Rate, by Producer Good **(%)**

Producer Goods	Indirect Tax Rate
Paddy	0.42
MCS	0.36
Rubber	7.71
Other Agricultural Products	0.49
Agro-industry Products	1.20
Other Export Oriented Products	2.80
Petroleum Products	18.30
Other Import Competing Products	8.97
EWTC	1.60
Services	2.16

Source: Input-Output Table of Thailand 1985, NESDB.

The increase is neither progressive nor regressive in the sense that it raises all indirect tax rates by the same proportion. However, through the different rates at the base year, the share of intermediate inputs in total cost, and the cascading effect of indirect taxes, it alters the price of all producer goods differently. While the move towards free trade leads to a more efficient allocation of resources, the increase in the indirect tax rates leads to a more inefficient reallocation of resources, and redirects resources out of highly taxed industries. The higher the base year indirect tax rate, the greater the adverse effect on demand and supply of producer goods. This is the direct dead-weight loss to producers and consumers due to the increase in indirect tax rates.

The increase in indirect tax rates also alters the purchase prices of consumer goods differently, since each good uses different proportions of various producer goods. Accordingly, the upward shift in the supply of each consumer good, induced by higher input cost, reduces the consumer and producer surplus of these goods. The burden of indirect taxes on households depends on the share of each consumer good in their consumption budget.

Under the same economic environment, Table 7.16 compares the effect of financing the government budget deficit through an across the board increase in all indirect tax rates with those of direct tax rates. The first and second column are the simulation results of the cases of direct and indirect taxation. The third column shows that the distortionary effect of indirect taxation is dramatic. It obstructs all the favourable impact of the move towards free trade, especially the improvement in income distribution.

Indirect taxation leads to a rise in prices which offsets the fall in prices caused by the move towards free trade. The inefficiency caused by indirect taxation leads to a contraction in the economy, with a decrease in nominal GDP of about 0.44% and, as indexed by the CPI, a decrease in real GDP of about 0.07%. Aggregate welfare loss is indicated by a fall in real consumption of about 0.08% and a decrease in unskilled labour employment of more than 0.27%. Based on the change in the CPI, changes in household consumption show that the loss is mainly a burden on rural households and urban households in the three lower quintiles.

Table 7.16: Comparison between Direct and Indirect Taxations (%)

Industry	Direct	Indirect	Distortion[a]
GDP (Nominal)	-0.2149	-0.4418	-0.2269
Consumption	-0.4312	-0.4590	-0.0278
Investment	-0.6461	-0.5348	0.1113
Government	-0.4706	-0.3895	0.0811
Export[b]	0.2403	0.1354	-0.1049
Import[b]	0.1405	0.0599	-0.0806
Price Indices			
Consumer	-0.4670	-0.3752	0.0918
Capital	-0.6461	-0.5348	0.1113
Poverty Line	-0.3548	-0.3157	0.0391
Government Revenue			
Trade Taxes	-9.7693	-9.8477	-0.0784
Indirect Taxes	-0.6557	1.8644	-
Direct Taxes	8.1418	-0.4747	-
Property	-0.2388	-0.5516	-0.3128
Tax Rate			
Direct Taxes	8.3669	-	-
Tax Rates	-	2.5919	-
Un-skilled Labour Employment	0.2916	0.0188	-0.2728
Nominal Wage			
Skilled	-0.3036	-0.4953	-0.1917
Un-skilled[c]	-0.4670	-0.3752	0.0918
Overall Income Distribution			
HCR	-0.1674	0.0831	0.2505
FGT2	-0.3567	0.1459	0.5026
SCV	-0.5203	-0.0999	0.4204
Household Consumption Expenditure			
Urban 1	-0.2569	-0.4348	-0.1779
Urban 2	-0.2929	-0.4710	-0.1781
Urban 3	-0.3690	-0.4805	-0.1115
Urban 4	-0.4895	-0.4821	0.0074
Urban 5	-0.9384	-0.5135	0.4249
Rural 1	-0.1727	-0.3569	-0.1842
Rural 2	-0.2533	-0.3681	-0.1148
Rural 3	-0.1698	-0.3936	-0.2238
Rural 4	-0.2089	-0.4301	-0.2212
Rural 5	-0.3336	-0.4881	-0.1545

Table 7.16: (Continued) **(%)**

Industry	Direct	Indirect	Distortion[a]
Industry Output			
ESAN	0.3066	0.0977	-0.2089
non-ESAN	0.0911	0.0104	-0.0807
Agro-industry	0.2147	0.1254	-0.0893
of which Export	0.3588	0.3214	-0.0374
Other Export Oriented	0.2060	0.0250	-0.1810
of which Export	0.6701	0.3151	-0.3510
Petroleum	0.2476	0.1180	-0.1296
Other Import Competing	-0.0520	-0.1479	-0.0959
EWTC	0.0201	-0.0564	-0.0765
Services	0.0509	-0.0200	-0.0709

Notes: a. Column two (indirect tax) less column one (direct tax).
b. Valued at world prices.
c. By assumption, this is equal to the percentage change in the consumer price index.

The performance of all industries is poorer than those in the direct tax case, especially for EWTC and services industries. These industries expand by about 0.02% and 0.05% in the direct tax case, while they contract by 0.06% and 0.02% in this case. The contraction of other import competing industries increases from 0.05% in the direct tax case to 0.15% in this case. Export performance of agro-industry and other export oriented industries is also squeezed by the distortionary effect of indirect taxation, from 0.36% and 0.67% to 0.32% and 0.32%, respectively. The expansion of agro-industry, other export industries, and agriculture are also depressed by indirect taxation. The adverse effect on agriculture, especially ESAN industry, has a dramatic impact on income distribution.

The employment of unskilled labour, an important source of income for poor households, slightly increases by 0.02% while skilled labour wage rates decrease by 0.50%. As indexed by a decrease in the CPI of about 0.38%, real wages for skilled labour falls. Thus, the contraction of the economy leads to a fall in labour's real income. The increase in all indirect tax rates impedes the impact of the move towards free trade on domestic price reduction. Consequently, poverty increases, both in the number of poor and poverty intensity. Inequality also decreases in this case, however, in a smaller degree than for the direct taxation case. This indicates that the burden of indirect taxation is greater on the poor than on the non-poor.

7.4.2. External Financing and Dutch Disease

Empirical studies on the effect of trade liberalization show that many developing countries experience average annual positive growth rates in the post-liberalization era (Michaely et al., 1991). However, liberalization in many countries also came with a net capital inflow, especially external financing of the government budget deficit, that aimed to permit import liberalization (e.g., Garcia, 1991, and Cuadra and Hachette, 1991). One question on the findings of these studies asks what would have been the impact if there had been no extra income flow to these countries.

This sub-section discusses the impact of the move towards free trade, when the government budget deficit is financed by some external source. This is similar to a gift from foreigners, in the sense that its repayment is not covered by this model. Any present benefit of such government external financing, if it exists, should take into account the future burden in terms of debt repayment.

Under the same economic environment, Table 7.17 compares the effect of external financing with those of direct taxation. The first and second column are the simulation results of the cases of direct taxation and external financing. The third column shows the difference between the two alternatives of financing government budget deficit. This is referred to as another form of Dutch Disease, because external financing leads to an increase in the availability of foreign exchange and real exchange rate appreciation. A comparison between this case - external financing - and the direct taxation case, points to the benefit and adverse effect of external financing (third column, Table 7.17). The benefit is mainly in terms of income and consumption, while the adverse effect is mainly in terms of losses in employment and outputs of agriculture and export oriented industries.

Table 7.17: Comparison between Direct Taxation and External Financing.

(%)

Industry	Direct Tax	Financing	Dutch Disease[a]
GDP (Nominal)	-0.2149	-0.0114	0.2035
Consumption	-0.4312	0.0595	0.4907
Investment	-0.6461	-0.4560	0.1701
Government	-0.4706	-0.2415	0.2291
Export[b]	0.2403	-0.2729	-0.5132
Import[b]	0.1405	0.2748	0.1343
Price Indices			
Consumer	-0.4670	-0.2941	0.1729
Capital	-0.6461	-0.4560	0.1901
Poverty Line	-0.3548	-0.2198	0.1350
Government Revenue			
Trade Taxes	-9.7693	-9.5969	0.1724
Indirect Taxes	-0.6557	-0.4736	0.1821
Direct Taxes	8.1418	-0.0016	-8.1434
Property	-0.2388	0.0025	0.2413
Direct Tax Rates	8.3669	-	-8.3669
External Financing (million Bahts)	-	3794	3794
Un-skilled Labour Employment	0.2916	0.2583	-0.0333
Nominal Wage			
Skilled	-0.3036	0.0600	0.3636
Un-skilled[c]	-0.4670	-0.2941	0.1729
Overall Income Distribution			
HCR	-0.1674	-0.2286	-0.0612
FGT^2	-0.3567	-0.5397	-0.1830
SCV	-0.5203	0.0990	0.6193
Household Consumption Expenditure			
Urban 1	-0.2569	0.0162	0.2731
Urban 2	-0.2929	0.0330	0.3259
Urban 3	-0.3690	0.0456	0.4146
Urban 4	-0.4895	0.0633	0.5528
Urban 5	-0.9384	0.1362	1.0746
Rural 1	-0.1727	-0.0024	0.1703
Rural 2	-0.2533	-0.0054	0.2479
Rural 3	-0.1698	0.0125	0.1823
Rural 4	-0.2089	0.0468	0.2557
Rural 5	-0.3336	0.0654	0.3990

Table 7.17: (Continued)

Industry	Direct Tax	Financing	Dutch Disease[a]
Industry Output			
ESAN	0.3066	0.2555	-0.0511
non-ESAN	0.0911	0.0084	-0.0827
Agro-industry	0.2147	0.1336	-0.0811
of which Export	0.3588	0.1525	-0.2063
Other Export Oriented	0.2060	-0.1450	-0.3510
of which Export	0.6701	-1.0353	-1.7054
Petroleum	0.2476	0.3638	-0.1162
Other Import Competing	-0.0520	-0.0286	0.0234
EWTC	0.0201	0.2077	0.2597
Services	0.0509	0.1248	0.0739

Notes: a. Column two (external financing) less column one (direct tax).
b. Valued at world prices.
c. By assumption, this is equal to the percentage change in the consumer price index.

The simulation results project that, because of the extra income from external financing, the economy will grow at a faster rate than in the direct tax case. As indexed by the CPI, real GDP increases by about 0.28%. An increase in household welfare is indicated by an increase in nominal and real consumption of 0.06% and 0.35%, respectively. Other components of GDP decrease, including a 0.24% decrease in government expenditure, a 0.46% decrease in investment, and a 0.27% decrease in total exports. Total imports increase by 0.27%. These changes point out that economic growth is led by the tremendous increase in household consumption, implicitly financed by the extra income injected into the economy.

Unskilled labour employment increases only by about 0.26%, compared with the 0.29% in the direct tax case. A comparison between the the direct tax case and this case shows that, while agriculture, the petroleum industry, and all export oriented industries are squeezed by external financing, all other industries are supported. This points to the reallocation of resources towards import competing industries and non-traded industries at the expense of agriculture, the petroleum industry, and the export oriented industries.

Following the move towards free trade, the decrease in total exports is paradoxical. However, it can be explained by the fact that agro-industry, and and other export oriented industries, are squeezed by the deterioration of international competitiveness. The major consequence is the exports of other export oriented industries, which decrease tremendously (1.04%). Despite an overall increase in domestic demand, the 1.04% fall in export demand outweighs the increase in domestic demand, and results in a 0.15% contraction of the industries. Agro-industry are also adversely affected by the external financing. In comparison to the direct tax case, the increases in output and export of the industry fall from 0.21% to 0.13% and from 0.36% to 0.15%, respectively. Consequently, the preformance of both agricultural industries are pressed down.

The major cause of the deterioration is the 3,794 million Bahts of government external financing. The tremendous capital inflow, in terms of an increase in extra government revenue, creates demand for domestic and imported goods. Since the balance of payments is assumed to be zero, external financing also puts pressure on Thai exports. Although the actual exchange rate is fixed, the external financing results in a real exchange rate appreciation and, therefore, a deterioration in international competitiveness. These are indicated by an increase in real wages in general, and the expansion of non-traded industries, especially EWTC and services. This results in a contraction in Thai exports and the outputs of all export oriented industries (Table 7.17). Therefore, resources are diverted from export oriented industries towards non-traded industries. At the same time, demand for imports also increases, since imports become cheaper. Taking into account the fact that the income effect increases domestic demand for the outputs of import competing industries, the improvement of the industries by external financing indicates that the income effect outweights the price effect. Thus, in comparison to the direct tax case, import competing industries are encouraged by external financing.

Table 7.17 shows that the income distribution impact is favourable. Poverty incidence significantly decreases, both in terms of the number of poor and poverty intensity. The reduction in poverty is nation wide.

However, the increase in inequality points out that the benefits of government external financing is mostly absorbed by the better-off households. Therefore, inequality increases nation wide, in every region and community.

7.5. Sensitivity Analysis

Having examined the impact of a 10% reduction in all rates of protection, this section focuses on the reliability of the model and the sensitivity of the impact on the choices of parameters and assumptions. The simulation results of the model are based on the model's structure, as well as its parameter settings, which are subjected to estimation errors.

The reliability of the model is tested by the homogeneity property, i.e. a 10% increase in the exchange rate will increase all the nominal variables by 10%, while all the real variables remain the same. The income distribution model is also tested, by the axioms discussed in Chapter Six.

Sensitivity of the results on the imputed value of each parameter can be tested and, in most cases, are found to be negligible. A sensitivity analysis of the results on all parameters is complicated by the fact that changes in the value of different parameters may produce a different impact which may cover up each other. Thus, the analysis requires a much more comprehensive technique. This is discussed in the literature (e.g., Pagan and Shannon, 1989). Generally, it involves a large number of simulations and incurs limited time and resources.

One of the arguments in support of protection is the optimum tariff argument. If a country is large enough in world markets, its tariff can improve its terms of trade. Although, tariff reduces trade volume and generates production and consumption losses, a moderate tariff could benefit a large country, because the favourable terms of trade effect offsets the unfavourable production and consumption cost. Therefore, a move towards free trade could bring about an unfavourable impact to the economy.

The market power assumption for Thai exports plays its role through this argument. Two agro-industry products - rice and processed rubber -

have substantial shares in the world markets. As discussed in Chapter Four, this is the ground for an assertion that the export volume of these products could have some impact on world prices. Thus, the reciprocal of price elasticity of world demand for Thai exports of agro-industry products is not zero, and is set at 0.5. For other manufacturing exports, the reciprocal is set at 0.0001.

Moreover, the intermediate inputs of agro-industry products, such as paddy (rice) and rubber, are important sources of farm income and employment, which can affect income distribution, this sub-section examines the differences in the simulation results when Thailand is assumed to be a small country in international trade. A change in its export or import volume has no impact on the world prices and free trade is theoretically optimum, i.e. the reciprocal of price elasticities of world demand for all Thai exports are zero.

Table 7.18 summarises and compares the simulation results of a move towards free trade based on the market power and small country assumptions. The effect of the move on a government budget deficit is re-distributed by an across the board increase in all rates of direct taxes. Fixed supply of skilled labour and infinite supply of unskilled labour are assumed. The only difference is the reciprocal of elasticities of world demand for Thai exports. Results in the first column are based on the market power assumption. Results in the second column of the table are based on the small country assumption for all Thai exports, i.e. all the reciprocal of elasticities is set at 0.

In brief, the most striking feature of the results, based on the two different assumptions, is their similarities. But the absence of market power for the export of agro-industry products magnifies the favourable impact of the move towards free trade. In comparison to the market power assumption, the growth of real GDP (0.29%) is higher in this case and an increase in real national consumption by 0.07% is also higher. Due to the perfect elasticity of world demand for Thai exports, a 0.25% increase in exports, valued at world prices, is also slightly higher., while imports increase slightly, about 0.16%.

Table 7.18: Comparison between Market Power and Small Country Assumptions (%)

Industry	Market Power	Small Country
GDP (Nominal)	-0.2149	-0.1361
Consumption	-0.4312	-0.3605
Investment	-0.6461	-0.6060
Government	-0.4706	-0.4247
Export[b]	0.2403	0.2524
Import[b]	0.1405	0.1557
Price Indices		
Consumer	-0.4670	-0.4257
Capital	-0.6461	-0.6060
Poverty Line	-0.3548	-0.3038
Government Revenue		
Trade Taxes	-9.7693	-9.7446
Indirect Taxes	-0.6557	-0.6246
Direct Taxes	8.1418	8.8129
Property	-0.2388	-0.1681
Direct Tax Rates	8.3669	8.9629
Un-skilled Labour Employment	0.2916	0.3548
Nominal Wage		
Skilled	-0.3036	-0.2313
Un-skilled[c]	-0.4670	-0.4257
Overall Income Distribution		
HCR	-0.1674	-0.2077
FGT^2	-0.3567	-0.4588
SCV	-0.5203	-0.5668
Industry Output		
ESAN	0.3066	0.3781
non-ESAN	0.0911	0.1112
Agro-industry	0.2147	0.3157
of which Export	0.3588	0.5721
Other Export Oriented	0.2060	0.1352
of which Export	0.6701	0.3278
Petroleum	0.2476	0.2566
Other Import Competing	-0.0520	-0.0547
EWTC	0.0201	0.0338
Services	0.0509	0.0625

Notes: The same as in Table 7.17.

Since an increase in the export of agro-industry products does not drive down its world price and, thus, encourages agro-industry to expand faster. More resources are attracted into agro-industry, at the expense of other export oriented and other import competing industries. In comparison to the market power assumption, the impact on other industries is also favourable, but the degree of impact depends on their linkages with agro-industry. Typical is ESAN and non-ESAN agricultural industries - the major suppliers of inputs to the agro-industry. The performance of agricultural industries, the biggest pool of unskilled labour employment, is also enhanced by the small country assumption.

The expansion of industries leads to an increase in demand for both types of labour. In order to attract more skilled labour, which is nationally scarce, industries bid up their wage. Thus, real wages for skilled labour, as indexed by the CPI, increase more in this case (0.19%) than in the market power case (0.16%). At the same time, the employment of unskilled labour also expands more in this case, 0.35% compared to 0.29%. Rent is affected accordingly. Since the absence of market power for Thai exports of agro-industry products leads to a more favourable effect on both types of labour income, much of which is owned by poor households, this leads to a more favourable income distribution impact than the market power assumption does. The decrease in the number of poor, poverty intensity, and inequality, is more substantial. Thus, the increases in real GDP and real consumption, as indexed by the CPI, and the improvement in income distribution confirm the argument in support of free trade on the ground of more efficiency and higher welfare.

7.6. Conclusion

This chapter discusses the distribution impact of the move towards free trade. Based on the assumption that the government prepares to raise revenue by direct taxation, the simulation results indicate that, without industrial protection, Thailand could have achieved more efficient allocation of resources through the benefits of import price reduction, and higher real

GDP as indexed by the CPI. Since the benefits of economic growth can be trickled down to people at the lower end of income distribution, especially those in rural areas, the simulation results project that poverty incidence could have been reduced faster. However, the increase in all rates of direct tax, which diverts resources from households to government, reduces the benefits of the move towards free trade. This leads to a lesser decrease in poverty, especially in urban areas and Bangkok.

The income distribution impact is not dramatic. The impact is affected by the way the government finances its budget deficit. In sum, direct taxation is preferred to indirect taxation and external financing. However, there would be a welfare effect of direct taxation through work-leisure substitution which is not taken into account in this thesis. The choice of indirect taxation is not desirable, since it has a second round effect which leads to further inefficient allocation of resources. External financing has a very desirable impact, and would receive support from the public in the short run. However, the long term consequences of external financing of the deficit, means the repayment of the debt would be a burden for future generations. The overall favourable impact of direct taxation is hampered by the decrease in real consumption of households in the higher income quintiles, and may be opposed by the public, especially the lower income households in Bangkok and urban areas.

When the model departs from one critical assumption, the market power for Thai export of agro-industry products, the results indicate that there will be no different conclusion. Moreover, it strengthens the argument in support of free trade, since the simulation results become more favourable, e.g. higher real GDP, as indexed by the CPI, and more equal income distribution, when a small country assumption is employed.

- CHAPTER 8 -

SUMMARY, CONCLUSIONS, AND SUGGESTIONS

8.1. Summary

Chapters Two and Three of the thesis examine the historical background of industrialization, protection, and income distribution during the past three decades. The analyses of the chapters indicate that the degree of industrial protection has been increasing. It also indicates that there is some relationship between industrial protection and factor intensity, resource allocation, and changes in productivity.

The analyses point to striking similarities between the protection systems and income distribution. Chapter Two points out that the systems of industrial protection have a regional bias, especially towards Bangkok and the Central region. The reason for this is the bias of the system towards import competing industries and the manufacturing sector, which are mainly located in Bangkok and the Central region. Empirical studies show that the degree of bias has been increasing during the past three decades. Chapter Three shows that poverty incidence and income inequality also have regional and sectoral dimensions. Moreover, they are directly related to the performance of the agricultural sector and market conditions for agricultural products.

Based on a general equilibrium framework, this thesis has attempted to answer the question: ***What would be the income distribution impact of a move from the 1987 system of industrial protection towards free trade?*** To answer this question, a general equilibrium analysis is required, because it allows multi-market analyses, and takes into account the way in which the prices of all factors and goods in an economy adjust simultaneously. It can also incorporate certain factors affecting income distribution.

The structure of the computable general equilibrium model developed in Chapter Four contains many important features in terms of industrial protection and income distribution - the classification of industries, factors of production, and the disaggregation of households. Most importantly, the disaggregation of agriculture and land into ESAN (Northeast) and non-ESAN implicitly takes into account the difference in land quality and irrigated areas between the Northeast, the poorest region, and other regions. The exclusion of agro-industry from other export industries, is based on the fact that it has very strong linkages with agriculture, especially through main crops such as paddy, maize, cassava, sugar-cane, and rubber. Similarly, the petroleum industry is separated from other import competing industries, because it provides important inputs for other industries and is relatively less protected, and highly import dependent.

In Chapter Four, a Social Accounting Matrix (SAM) is constructed. The matrix gives an integrated and consistent picture of the Thai economy. It provides share parameters for the base year 1988, including input-output production technology for producer and consumer goods, functional distribution matrix, and factor ownership matrix.

Except for SAM, consumer demand, and income distribution parameters, most other parameters are imputed from past studies. Where estimates from Thai data are not available, estimates from relevant studies, based on other country data, are employed. This practice is inevitable for a general equilibrium analysis which demands a considerably large number of parameters.

The consumer demand system, estimated in Chapter Five, allows different changes in demand of various households in response to changes in relative prices and total household consumption expenditure. The estimates are based on the well known Linear Expenditure System (LES). Data used in the estimation contain ten households and ten consumer goods, enriched by price information, instead of assuming one price, as in most past studies. In addition, the chapter proposes a modified version of the LES, in order to capture the role of household size and composition in the consumer demand system.

Many features of the estimates indicate how the move towards free trade indirectly affects demand for various households. The clear distinction between the behaviour of households in the top urban and rural quintiles, and other households, indicates that they will differently perceive the consequences of a move towards free trade. The estimates generally exhibit a clear distinction between demand for food commodities, house and housing expenditure, and other commodities. As expected, food commodities, and house and housing expenditure are shown to be necessities, and changes in household income will not significantly alter demand for these goods. Non-alcoholic beverages and other non-foods are shown to be luxuries, for which a 1% increase in income will generate a larger than 1% increase in demand. Own price elasticities of demand are negative as predicted by economic theory. However, the elasticity of foods is generally weaker than those of non-alcoholic beverages and non-foods. Weak complimentarity is shown between most pairs of commodities, especially foods.

Chapter Six discusses the concept of poverty and income inequality. The discussion focuses on the concept of the subsistence bundle, and various important properties of poverty and inequality indices. Based on these properties, this thesis selects three indices - HCR, FGT^2, and SCV. The indices are incorporated into the general equilibrium framework and are used to measure the impact of the move towards free trade on the number of poor, poverty intensity, and income inequality, at national, regional, and community levels. It can be disaggregated further into other dimensions such as socio-economic class. In the presence of population mobility, the model proposed in this chapter can also be used to measure the effect of mobility on poverty incidence and inequality.

By using a Kernel function, the chapter also estimates non-parametric density functions of household per capita expenditure in both urban and rural areas. The density functions provide parameters for the measurement of poverty - HCR and FGT^2 - in the general equilibrium model. This is the first time that this technique has been used to estimate the size distribution of income, and is incorporated into a general equilibrium framework. It allows the model to capture an increase or decrease in poverty caused by a change in consumer or household income, and prices. Both are driven by the mobility and household ownership of factors of production.

Chapter Seven presents the simulation results of a move towards free trade by a 10% reduction in nominal rates of protection. This has been designed to demonstrate the difference in the pattern of change that arises when the government raises more tax revenue or borrows from overseas to finance its budget deficit, caused by the move.

With the government budget deficit financed by direct taxation, the results point to a benefit of a move towards free trade. The results project that, within a period of 2-3 years, the move will lead to higher economic growth, and also indicate that there is no trade-off between economic growth and income distribution, since overall poverty incidence and income inequality improve. Especially for urban areas and Bangkok, poverty decreases in all regions and communities. Inequality decreases nation-wide, in every region and community.

Alternatively, in financing the budget deficit, the government may choose to borrow or to increase indirect tax rates. The distortionary effect of indirect taxation offsets the efficient resource allocation impact of the move towards free trade. It pushes resources out of highly taxed industries. In comparison to direct taxation, it decreases employment, squeezes all industries, and leads to a decrease in real GDP as indexed by the CPI. Since more people are brought into poverty, inequality decreases. The choice of external financing, although leading to a more favourable impact, benefits the present generation at the expense of future generations. The extra income injected into the economy leads to a deterioration of competitiveness and squeezes all export oriented industries. The income distribution impact, although favourable in terms of poverty, mostly benefits those who are better-off, and leads to a nation-wide increase in inequality.

8.2. Conclusions

The simulation results call into question the role of industrial protection, which has been part of modern industrialisation in Thailand for more than three decades. The results suggest that a move towards free trade leads to a more efficient allocation of resources and a more equal distribution of income. However, there are several points that can be made from the results.

The conventional wisdom on the impact of industrialisation on income distribution is that the movement of labour out of agriculture into non-agriculture is too sluggish in relation to GDP. But, following a move towards free trade, the decrease in employment in the highly protected other import-competing industries indicates that, even if it has been sluggish, the structural change in employment has been towards inappropriate sectors, at the cost of efficiency and employment elsewhere in the economy.

The simulation results depend on how the government budget deficit is financed. This thesis analyses three alternative methods of financing the deficit. The 8.37% increase in all rates of direct taxes leads to a more efficient resource allocation and, therefore, higher economic growth. The results project that the majority of the population will experience higher real consumption. However, because richer households are heavily taxed to finance the government budget deficit, their real consumption decreases substantially. Since these richer households share much of national consumption, national consumption increases slightly. The income distribution impact is very favourable.

The 2.59% increase in all rates of indirect taxes produces a second round resource allocation. While a move towards free trade leads to more efficient allocation, the indirect taxation leads to inefficient allocation. This alternative presses down the performance of all industries and results in negative growth and less inequality at the cost of more people in poverty.

In comparison to direct taxation, the choice of external financing is preferable. It leads to higher economic growth, higher nominal and real consumption of all households, and favourable income distribution. However, since all debt has to be repaid in the future, unless the external financing is a gift, this is not the first best alternative.

Direct taxation tends to be a preferred alternative, since it leads to more efficient resource allocation, less income inequality, and less poverty, especially in rural and regional areas. This is not to say that direct taxation is better than indirect taxation. This thesis simply states that, between an increase in all direct tax rates and all indirect tax rates, the former is more favourable. Certainly, these results are based on certain assumptions employed by the thesis. A strong assumption is that there is no collection cost. With a high collection cost, direct taxation may not be a feasible choice. There are also many other alternatives which could produce totally different results. This issue requires further analysis.

The impact of the move towards free trade is notable. With the government budget deficit financed by direct taxation, the efficient reallocation of resources leads to an increase in employment and higher real GDP, as indexed by the CPI. Highly protected import competing industries shrink, while other export oriented industries expand. The increase in exports is the major source of the growth in GDP. The increase in employment and the expansion of agriculture leads to higher household income, especially those of poor and rural households, and a favourable income distribution impact.

Assumptions underlying the model also affect the way value added is redistributed and, thus, the distribution of income.

Because of the immobility of capital, capital owners receive whatever is left after industries pay their wages bill. The immobility constrains labour to work with the available capital, and also obstructs an increase in labour productivity by the reallocation of capital. It also allows the owners of scarce capital to earn more than average and squeezes the rent of capital that becomes excess.

Return to land shares much of the income of the poor in the Northeast. But, because of the poor quality of paddy land, farmers in ESAN industry do not fully benefit from the move towards free trade. Although the industry can attract more resources, farmers cannot efficiently allocate these resources towards the production of the most beneficial crops such as paddy, maize, cassava, and sugar-cane, and continue to inefficiently increase production of other agricultural products, which become less profitable after the move towards free trade. If the quality of land in the Northeast was not so poor, the improvement in both poverty incidence and inequality in the region would be more substantial.

The results indicate that agro-industry products tend to be another source of foreign exchange and a means towards more equal distribution of income. Because of the linkages between agro-industry and agriculture, the results also indicate that agriculture would not shrink as fast as it actually has, but expand and employ more labour. The distribution of income would have been better.

The methodological contribution of this thesis is the incorporation of poverty incidence and income inequality into a general equilibrium model. Despite the overall improvement in poverty and inequality, the methodology has shown that, at disaggregated levels, improvement is less impressive. A detailed analysis, based on the proposed methodology, confirms the argument in Chapters Two and Three that protection and income distribution are related through regional bias. In comparison to other regions, the impact on poverty in the Northeast, the poorest region, is least, and the impact on inequality is very low. The results indicate that there are still some other factors, affecting poverty and inequality in the region, which require further attention. On the other side, in urban areas and Bangkok, poverty has been found to be very responsive to a move towards free trade, while inequality is less responsive. However, direct taxation adversely affects households in the area. It brings less number of people in Bangkok and urban areas out of poverty and, at the same time, reduces inequality substantially.

Although the income distribution impact has been examined at national level, by region, and in both urban and rural areas, there are still many other dimensions, such as socio-economic class and sector of production, which have been found to be important in terms of income distribution. The methodology proposed in Chapter Six can be used to examine the impact in those dimensions.

The favourable impact of the move towards free trade on income distribution is not reversible by any change in the major assumption - from market power to small country. The analysis unambiguously supports the conclusion that a move towards free trade leads to higher economic growth and a more favourable distribution of income.

Considering that the absence of market power for Thai exports leads to a more favourable impact on income distribution, the findings of the thesis are rather impressive. Because of differences amongst countries with regard to industrial structure, production technology, regional imbalances, various government policies, and household ownership of factors of production, the results of this theses are only specific to Thailand.

8.3. Suggestions

8.3.1. Policy Implementation

There are several ways in which trade can be liberalized. This thesis suggests that, in easing the adjustment process, trade should be liberalized gradually rather than suddenly. The contraction of other import competing industries will lead to a movement of labour. Thus, schemes to inform workers, and to facilitate the movement of labour to available jobs, are required. An improvement of productivity can also be achieved through skill upgrading. At the same time, the expansion of agriculture will need some support in terms of infrastructure.

Unless the government budget deficit can be financed by financial support from overseas, and there is no future repayment, the simulation results project that direct taxation has more favourable results. Due to the nature of direct taxes, the imposition of higher direct tax rates to finance the budget deficit should also be gradual, since they could be effectively administered, and easily accepted by the public.

Farmers in the Northeast, the poorest region, have the highest land ownership. However, the quality of land is very poor and irrigation insufficient. An extensive technological development program in the region may benefit these poor farmers and, to some degree, remedy the poverty problem. In addition, a more efficient alternative is to promote the development of labour intensive industries in the region.

Politics also has a role to play. Where the government uses direct taxes to raise revenue to finance its budget deficit, it is likely that the move towards free trade would be supported, provided that people are well informed about the benefits of the policy. The main reason is that those who gain from the move towards free trade in real terms are the poorest 60% of urban households, and all households in rural areas. Since the rural population shares more than 70% of the total population, this group forms the majority of Thais.

However, even in a democracy, the will of the majority does not always form the basis for government decisions. It may be that the potential gainers and losers do not fully comprehend the benefits of trade liberalization and the cost of protection. In addition, those who would feel the effect of the move towards free trade much more directly, could engage intensively in the political debate, thereby, placing some pressure on the policy makers, and possibly influencing the final decision of government.

It is hoped that this thesis can provide an additional and useful basis for policy decisions. However lessons from the past suggest that there is a glaring gap between theory and reality. Narongchai and Juanjai (1986) point out that, after two decades of protection, the economic inefficiency generated by protected industries, and the effort from some economists, has prompted the Thai government to shift the policy to a more liberal regime. However, Chapter Two has shown that the move is still far from a reality. Many industries have been highly protected for almost the entire three decades of industrialisation. On average, the degree of protection has been increasing during the 1980s.

8.3.2. Future Research

This thesis has attempted to capture the impact of the move from the 1987 system of protection towards free trade - the 10% reduction in all nominal rates of protection - by a general equilibrium model. Various important features of the Thai economy are reflected by the structure of the model. Special emphasis is placed on the impact of the move towards free trade on poverty and income inequality. However, there are still many ways in which improvements can be made.

Empirical evidence shows that, in the past, changes in tariff in Thailand was in the order of around 50%. However, the linearization of the model constrains this thesis to focus on a small reduction (10%). A greater reduction of 50% can be simulated, but incurs computational error caused by the linearization of nonlinear relationships. Although this error can be solved, it requires time and resources.

The power of the income distribution model depends on the number of classes, i.e. types of households. Although this thesis limits the number to ten, within the same framework, more accurate results could be obtained by increasing the number of classes in the model and in the factor ownership matrix. As shown in Chapter Six, the greater the number of classes, the smaller is the error that arises from the methodology proposed in this thesis.

A focus on the impact of the move towards free trade in a shorter period of time, about one year, would provide another insight into the question. This period is long enough for prices, demand, and supply of factors and goods to reach new equilibrium after a policy shock. However, it is too short for some types of labour - e.g. skilled labour - to move. This type of labour is tied to certain industries due to reasons such as industrial location and specific skill. This specific labour will have common interest and collude with the owners of specific capital in any move, either in support of or against the move towards free trade.

Alternately, a medium to long run model will allow the reallocation of the newly created capital. This will directly affect the return to capital and other factors of production. The reallocation of household expenditure between consumption and savings also affects investment and household ownership of factors of production and has important consequences in terms of income distribution.

The relationship between protection and foreign capital inflow is one of many challenging questions. During the late 1980s, there was a tremendous influx of direct foreign investment from Japan and the 'Gang of Four'. Direct foreign investment in 1988 and 1989 was more than the total direct foreign investment for the preceding ten years. Corden (1974) asserts that there are two important effects of protection on foreign capital inflow. The direct effect, due to an increase in potential profit in the protected industries, where protection attracts domestic capital out of un-protected industries and induces the inflow of foreign capital into the protected industries. The most important indirect effect is where, under full employment, the return to other factors is bid up and investment in the un-protected industries becomes less profitable because of higher costs. Both effects also have interesting income distribution consequences.

The analysis in this thesis also points to the importance of technology and quality of agricultural land, which exhibits its role in the adjustment of supply in response to the move towards free trade. Typical is ESAN industry which has been constrained by the quality of land.

Although there are two agricultural industries, the model developed in this thesis still needs further development in terms of spatial dimension. The model implicitly assumes that a tradable good is tied to the same transport margin. However, some agricultural products, e.g. paddy, can be produced both in the North, the Northeast and the Central plain. A difference in distance from the three regions to Thai ports could lead to a difference in transport margin. Higher transport margin presses down farm gate prices, return to agricultural specific factors, and, thus, adversely affects income distribution.

REFERENCES

Adelman, I. and Robinson, S. (1978): *Income Distribution Policy in Developing Countries: A Case Study of Korea,* New York: Oxford University Press.

Adelman, I. and Robinson, S. (1989): 'Income Distribution and Development,' in Chenery, H. and Srinivasan, T.N. (eds): *Handbook of Development Economics* II, New York: Elsevier Science Publishers B.V., 949-1003.

Agrawal, N. (1987): 'Analyzing Distributional Issues Using Equivalent-Adult Disposable Incomes,' IMPACT Project, Preliminary Working Paper No. IP-32, University of Melbourne, Melbourne.

Ahluwalia, M.S., Carter, N.G. and Chenery, H.B. (1979): 'Growth and Poverty in Developing Countries,' *Journal of Development Economics* 6, 299-341.

Aitchison, J. and Brown, J.A.C. (1957): *Lognormal Distribution: with Special Reference to Its Uses in Economics,* Cambridge: Cambridge University Press.

Alaouze, C.M., Marsden, J.S., and Zeitsch, J. (1977): 'Estimates of the Elasticity of Substitution between Imported and Domestically Produced Commodities at the Four Digit ASIC Level,' IMPACT Project, Working Papers No. O-11, University of Melbourne, Melbourne.

Ammar Siamwalla (1987): 'The Future of Agriculture in Thailand,' in Kraiyoot Theeratayakheenan (ed.), *The Knowledge of Thai Economists,* The Economics Association of Thailand, 1-44.

Ammar Siamwalla et al. (1989): 'A Dynamic Analysis of Thai Agricultural Growth: Some Lessons from the Past,' paper presented to the Workshop on TDRI Research Activities Supported by the EPD II Project, October 7-8.

Apichart Phongsi-Adulchai (1983): 'An Analysis of Supply of Major Crops of Thailand,' *Thammasat Economics Journal* 1(3), 137-159, (in Thai).

Armington, P.S. (1969): 'A Theory of Demand for Products Distinguished by Place of Production,' Staff Working Papers XVI, IMF, Washington D.C.

Atkinson, A.B. (1983): *Social Justice and Public Policy*, Sussex: Wheatsheaf Books Ltd.

Atkinson, A.B. (1989): 'Measuring Inequality and Differing Social Judgements,' Discussion Papers No. TIDI/129 (May), London School of Economics.

Balisacan, A.M. (1991): 'Agricultural Growth, Landlessness Off-farm Employment and Rural Poverty in the Philippines,' paper presented at the 35th Annual Conference of the Australian Agricultural Economic Society, Armidale, 12-14 February.

Bandit Nitjathaworn (1985): 'Macroeconomic Model of Thailand: a Survey,' *Thammasat Economics Journal* 3(3), 5-41, (in Thai).

Bank of Thailand (1970-90): *Quarterly Bulletin*, Bank of Thailand, Bangkok.

Barnes, R. and Gillingham, R. (1984): 'Demographic Effects in Demand Analysis: Estimation of the Quadratic Expenditure System Using Microdata,' *Review of Economics and Statistics* 66, 591-601.

Behrman, J.R. (1968): *Supply Response in Underdeveloped Agriculture: A Case Study of Four Major Annual Crops in Thailand, 1937-63,'* Amsterdam: North-Holland.

Bergemeier, D. and Hoffman, R. (1988): *Economic Survey of Thailand*, Asian Development Bank.

Bertrand, T. (1980): 'Thailand - Case Study of Agricultural Input and Output Pricing,' Staff Working Papers No. 385, World Bank.

Binh, T.N. and Whiteford, P. (1990): 'Household Equivalent Scales: New Australian Estimated from the 1984 Household Expenditure Survey,' *The Economic Record* 66(194), 221-234.

Biro Pusat Statistik, *Social Account Matrix Indonesia 1975*, Volume 1.

Blanciforti, L. and Green, R. (1983): 'An Almost Ideal Demand System Incorporating Habits: An Analysis of Expenditures on Food and

Aggregate Commodity Groups,' *Review of Economics and Statistics* 65, 511-515.

Branson, W.H. and Litvack, J.A. (1976): *Macroeconomics*, New York: Harper and Row.

Buhmann, B., Rainwater, L., Schmaus, G. and Smeeding, T. (1988): 'Equivalent Scales, Well-Being, Inequality and Poverty: Sensitivity Estimates Across Ten Countries Using the Luxemberg Income Study (LIS) Database,' *Review of Income and Wealth* 34, 115-142.

Buppha Tantrakul (1979): 'The Structure of Industrial Protection in Thailand,' Unpublished Masters Thesis, Chulalongkorn University, Bangkok, (in Thai).

Caddy, V. (1976): 'Empirical Estimation of the Elasticity of Substitution: A Review,' IMPACT Project, Preliminary Working Papers No. OP-09, University of Melbourne, Melbourne.

Cassing, J.H. and Warr, P.G. (1985): 'The Distributional Impact of a Resource Boom,' *Journal of International Economics* 18(1985), 301-319.

Caves, R. and Jones, R.W. (1985): *World Trade and Payments: An Introduction*, (4th ed.), Boston: Little Brown and Company.

Chaipruek Tangsirichaiphong (1980): 'The Structure of Industrial Promotion in Thailand: A Study on Industrial Promotion Policy During 1964-74,' unpublished Masters Thesis, Thammasat University, Bangkok, (in Thai).

Chaiyut Pilun-Owat (1978): 'The Impact of Thailand's Economic Development Plans on Foreign Trade Performance (1958-71): A Case Study,' unpublished PhD Thesis, New York University, New York.

Chalongphob Sussangkarn (1987): 'The Thai Labour Market: A Study of Seasonality and Segmentation,' paper presented to the Macroeconomic Research Conference, TDRI.

Chalongphob Sussangkarn et al. (1988): 'The Long Term View on Growth and Income Distribution,' paper presented to the 1988 TDRI Year-End Conference on Income Distribution and Long-term Development, Thailand Development Institute and Foundation, December.

Chalongphob Sussangkarn, Pranee Tinakorn, and Tienchai Chongpeerapien (1989): 'The Tax Structure in Thailand and Its Distributional Implications,' paper presented to the 1988 TDRI Year-End Conference on Income Distribution and Long-term Development, Thailand Development Institute and Foundation, December.

Chongrak Rarueysong (1981): 'The Impact of Taxation upon Economic Growth in Thailand, 1960-78,' unpublished PhD Thesis, University of Illinois, Illinois.

Corden, W.M. (1967): 'The Exchange Rate System and the Taxation of Trade,' in Silcock, T. H. (ed.): *Thailand Social and Economic Studies in Development*, Canberra: Australian National University Press, 151-169.

Corden, W.M. (1974): *Trade Policy and Economic Welfare*, Oxford: Clarendon Press

Coxhead, I.A. (1990): 'The Identification and Measurement of Poverty,' Department of Economics and National Centre for Development Studies, Working Paper No. 90/5, Australian National University.

Coxhead, I.A. and Warr, P.G. (1991a): 'Structure of the APEX Computable General Equilibrium Model of the Philippine Economy,' paper presented to the Workshop on General Equilibrium Modelling for Agricultural Policy Analysis, Pattaya, Thailand, 21-25 May.

Coxhead, I.A. and Warr, P.G. (1991b): 'Poverty and Welfare Effects of Technical Change: A General Equilibrium Analysis for Philippines Agriculture,' paper presented to the 35th Annual Conference of the Australian Agricultural Economics Society, Armidale, 12-14 February.

Cuadra, D. and Hachette, D. (1991): 'The Experience of Chile,' in Michaely, M., Papageorgiou, D., and Choksi, A.M. (eds): *Liberalizing Foreign Trade: Lessons of Experience in the Developing World*, Oxford: Basil Blackwell, Volume 1, 169-320.

Dapice, D. and Flatters, F. (1989): 'Thailand: Prospects and Perils in the Global Economy,' paper presented to the 1989 TDRI Year-End Conference, Thailand Development and Research Institute, Chon Buri, December 16-17.

de Melo, J. and Robinson, S. (1980): 'The Impact of Trade Policies on Income Distribution in a Planning Model for Columbia,' *Journal of Policy Modelling* 2, 81-100.

Deaton, A. and Muellbauer, J. (1980): 'An Almost Ideal Demand System,' *American Economic Review* 7(3), 312-326.

Department of Business Economics (1986-88): 'Price of Consumer Goods, by Community and Region,' unpublished Data, Department of Business Economics, Bangkok, (in Thai).

Department of Business Economics (1990): *The Adjustment of the Calculation of Consumer Price Index,* Department of Business Economics, Bangkok, (in Thai).

Department of Business Economics (1991): *The Adjustment of the Calculation of Rural Consumer Price Index,* Department of Business Economics, Bangkok, (in Thai).

Direk Patamasiriwat (1990): 'Rate of Return to Capital: A Comparison Among Agriculture, Industry, and Services,' *Chulalongkorn Economic Journal* 2(2), 225-236, (in Thai).

Direk Patamasiriwat and Vilai Sathitsirikul (1991): 'Demand for and Supply of Thai Rice Export,' *Thammasat Economics Journal* 9(1), 31-65, (in Thai).

Direk Patmasiriwat (1989): 'A Study on Pattern of Consumption Expenditure from National Income Account,' *Chulalongkorn Economics Journal* 1(2), 244-264.

Direk Patmasiriwat and Amnat Wetmanat (1988): 'The Analysis of the Consumption Pattern of Thai Households in 1986,' in Kraiyoot Theeratayakheenant (ed.): *The Knowledge of Thai Economists,* the Economics Association of Thailand, 117-145.

Dixon, P.B., Parmenter, B.R., Sutton, J., and Vincent, D.P. (1982): *ORANI: A Multisectoral Model of the Australian Economy,* Amsterdam: Nort-Holland.

Duangkamon Chotikapanich (1989): 'Measurement of Poverty and Inequality in Thailand, 1975/76-1981: Some Analytical and Empirical Results,' unpublished PhD Thesis, The University of New England, Armidale.

Foster, J., Greer J. and Thorbecke E. (1984): 'A Class of Decomposable Poverty Measures,' *Econometrica* 52(3), 761-766.

Foster, J.E. (1984): 'On Economic Poverty: A Survey of Aggregate Measures,' *Advances in Econometrics* 3, 215-251.

Fuchs, V.R. (1963): 'Capital-Labour Substitution: A Note,' *The Review of Economics and Statistics* 45, 436-39.

Garcia, J.G. (1991): 'The Experience of Columbia,' in Michaely, M., Papageorgiou, D., and Choksi, A.M. (eds): *Liberalizing Foreign Trade: Lessons of Experience in the Developing World*, Oxford: Basil Blackwell, Volume 4, 143-270.

Hatta, T. (1980): 'Welfare Effects of Changing Commodity Tax Rates Towards Uniformity,' *Journal of Public Economics* 29(1), 99-112.

Hock, L.K. (1985): 'Malaysia: The Structure and Causes of Manufacturing Sector Protection,' in Findley, C. and Garnaut, R. (eds): *The Political Economy of Manufacturing Protection: Experiences of ASEAN and Australia*, Sydney: Allen and Unwin, 99-134.

Howe, H., Pollak, A.P. and Wales, T.J. (1979): 'Theory and Time Series Estimation of the Quardratic Expenditure System,' *Econometrica* 47(5), 1231-1247.

Industry Commission (1991): 'SALTER: A General Equilibrium Model of the World Economy,' Canberra.

Ingram, J.C. (1971): *Economic Change in Thailand 1850-1970*, (2nd ed.), Standford: Standford University Press.

Jansen, K. (1990): 'Thailand: the Next Newly Industrialized Country?,' *Chulalongkorn Economics Journal* 2(1), 30-57, (in Thai).

Jeerakiat Aphibunyophat and Chucheep Phiphatsithi (1987): 'Agriculture and Rural Development in Thailand,' in Kraiyoot Theeratayakheenan (ed.), *The Knowledge of Thai Economists*, The Economics Association of Thailand, 45-106.

Jones, R.W. (1975): 'Income Distribution and Effective Protection in a Multicommodity Trade Model,' *Journal of Economic Theory* 11, 1-15.

Kakwani, N.C. (1977): 'On the Estimation of Consumer Unit Scales,' *The Review of Economics and Statistics 59*, 507-510.

Kakwani, N.C. (1980a): 'On a Class of Poverty Measures,' *Econometrica* 48, 437-446.

Kakwani, N.C. (1980b): *Income Inequality and Poverty: Methods of Estimation and Policy Application*, New York: Oxford University Press.

Kanbur, S.M.R. (1987): 'Measurement and Alleviation of Poverty,' Staff Papers 34, IMF, 60-85.

Kehoe, T.J. and Sierra-Puche, J. (1983): 'A Computable General Equilibrium Model with Endogenous Unemployment and Analysis of the 1980 Fiscal Reform in Mexico,' *Journal of Public Economics* 22, 1-26.

Keuning, S. and de Ruijter, W.A. (1988): 'Guidelines for the Construction of a Social Account Matrix,' *The Review of Income and Wealth* 34(1), 71-100

Kim, K.S. and Vorasopontaviporn, P. (1989): 'International Trade, Employment, and Income: the Case of Thailand,' *The Developing Economies* XXVII-1(March), 60-74.

King, B.B. (1981): 'What is SAM? A Layman's Guide to Social Account Matrices,' Staff Working Papers No. 463, World Bank.

Kmenta, J. (1971): *Elements of Econometrics*, New York: Macmillan.

Kohli, U.R. (1978): 'A Gross National Product Function and the Derived Demand for Imports and Supply of Exports,' Canadian Journal of Economics XI(2), 167-182.

Kolm, S.C. (1976): 'Unequal Inequalities. II,' *Journal of Economic Theory* 13, 82-111.

Kruaphant Nitwattanakul (1974): 'Prediction on Demand for Some Thai Manufacturing Exports,' unpublished Masters Thesis, Chulalongkorn University, Bangkok, (in Thai)

Kumpol Puapanichya and Panayotou, T. (1985): 'Output Supply and Input Demand in Rice and Upland Crop Production: the Quest for Higher Yield in Thailand,' in Panayotou, T. (ed.): *Food Policy Analysis in Thailand*, Agricultural Development Council, Bangkok, 23-99.

Kundu, A. and Smith T.E. (1983): 'An Impossibility Theorem on Poverty Indices,' *International Economic Review* 24(2), 423-434.

Lam, N.V. (1977): 'Incidence of the Rice Export Premium in Thailand,' *The Journal of Development Economics* 14(1), 3-13.

Lim Chong Yah and Associates (1988): *Policy Options for the Singapore Economy*, Singapore: McGraw-Hill.

LLuch, C. and Williams, R. (1975): 'Consumer Demand Systems and Aggregate Consumption in the U.S.A.: an Application of the Extended Linear System,' *Canadian Journal of Economics* VIII(1), 49-66.

Magee, S.P. (1978): 'Three Simple Tests of the Stolper Samuelson Theorem,' in Oppenheimer, P. (ed.): *Issues in International Economics,* Stocksfield: Oriel Press, 138-153.

Malinee Tengamnuai (1981): 'Household Saving Behaviour in Thailand,' unpublished Masters Thesis, Thammasat University, Bangkok.

Mansur, A. and Whalley, J. (1984): 'Numerical Specification of Applied General equilibrium Models: Estimation, Calibration, and Data,' in Scarf, H.E. and Shoven, J.B. (eds), *Applied General Equilibrium Analysis,* Cambridge: Cambridge University Press, 69-126.

Martin, W. and Warr, P.G. (1990): 'The Declining Share of Agricultural Sector in Thailand', *Chulalongkorn Economics Journal* 2(2), 178-224, (in Thai).

Medhi Krongkaew (1977): 'Income Distribution Among Thai Households in 1972,' *Thammasat Economics Journal* 10(1), 61-99, (in Thai).

Medhi Krongkaew, Pranee Tinakorn, and Suphat Suphachalasai (1991): 'Priority Issues and Policy Measures to Alleviate Rural Poverty: The Case of Thailand,' Research Report Submitted to the Economic Development Centre, Asian Development Bank.

Meier, G.M. (1976): *Leading Issues in Economic Development* (3rd ed.), New York, Oxford University Press.

Michaely, M., Papageorgiou, D., and Choksi, A.M. (1991): 'Lessons of Experience in the Developing World,' in Michaely, M., Papageorgiou, D., and Choksi, A.M. (eds): *Liberalizing Foreign Trade: Lessons of Experience in the Developing World,* Oxford: Basil Blackwell, Volume 7.

Mikesell, R. and Zinser, J.E. (1973): 'The Nature of the Savings Function in Developing Countries: a Survey of the Theoretical and Empirical Literature,' *Journal of Economic Literature,* 1-26.

Ministry of Agriculture and Cooperatives, Division of Agricultural Economics (1979): *Demand Elasticities for Food of Farmers, 1977-78,* September (in Thai).

Muellbauer, J. (1975): 'Identification and Comsumer Unit Scales,' *Econometrica* 43(4), 807-809.

Narayana, N.S.S., Parikh, K.S., and Srinivasan, T.N. (1987): 'Indian Agricultural Policy: An Applied General Equilibrium Model,' *Journal of Policy Modelling* 9, 527-558.

Narong Chuprakorb (1989): *Farmers' Poverty and Agricultural Development in the Northeast*, Defence Academy, Bangkok.

Narongchai Akrasanee (1973): 'The Manufacturing Sector in Thailand: A Study of Growth, Import Substitution, and Effective Protection, 1960-69,' unpublished PhD Thesis, Johns Hopkins University, Baltimore.

Narongchai Akrasanee (1975): 'The Structure of Effective Protection in Thailand: A Study of Industrial and Trade Policies in the Early of 1970s,' Report prepared for the Ministry of Finance, the National Economic and Social Development Board, and World Bank.

Narongchai Akrasanee (1977): 'Industrialization and Trade Policies, and Employment Effects in Thailand,' in Narongchai Akrasanee, Naya, S., and Vinyu Vichit-Vadakan (eds): *Trade and Employment in Asia and Pacific*, The 8th Pacific Trade and Development Conference, Pattaya, Thailand, 215-277.

Narongchai Akrasanee and Juanjai Ajanant (1986): 'Thailand: Manufacturing Protection Issues and Empirical Studies,' in Findley, C. and Garnaut, R. (eds): *The Political Economy of Manufacturing Protection: Experiences of ASEAN and Australia*, Sydney: Allen and Unwin, 77-98.

National Statistical Office (1960): *Report of the 1960 Population and Housing Census*, NSO, Bangkok.

National Statistical Office (1970): *Report of the 1970 Population and Housing Census*, NSO, Bangkok.

National Statistical Office (1980): *Report of the 1980 Population and Housing Census*, NSO, Bangkok.

National Statistical Office (1987): *Report of the 1987 Industrial Survey*, NSO, Bangkok.

National Statistical Office (1988): *Report of the 1988 Household Socio-economic Survey*, NSO, Bangkok.

National Statistical Office (1988): *Report of the 1988 Intercensal Survey of Agriculture*, NSO, Bangkok.

National Statistical Office (1988): *Report of the 1988 Labour Force Survey*, NSO, Bangkok.

National Statistical Office (1988): *Report of the Survey of Agricultural Household Income: Crop Year 1987/88*, NSO, Bangkok, (in Thai).

National Statistical Office (1988): *Village Surveys,* Unpublished Data, NSO, Bangkok.

National Statistical Office (1990): *Report of the 1990 Population and Housing Census,* NSO, Bangkok.

Nga, T.B. (1985): 'Singapore: The Structure and Causes of Manufacturing Sector Protection,' in Findley, C. and Garnaut, R. (eds): *The Political Economy of Manufacturing Protection: Experiences of ASEAN and Australia,* Sydney: Allen and Unwin, 135-158.

Nishimizu, M. and Page, Jr. J.M. (1986): 'Productivity Change and Dynamic Comparative Advantage,' *The Review of Economics and Statistics* LXVIII (2), 241-247.

O'Mara, G. and Le-Si, V. (1985): 'The Supply and Welfare Effect of Rice-Pricing Policy in Thailand,' Staff Working Papers No. 714, World Bank.

Oey Astra Meesook (1976): 'Regional Consumer Price Indices for Thailand,' Discussion Papers, Series 49, Thammasat University, Mimeographed (in Thai).

Oey Astra Meesook (1979): 'Income, Consumption, and Poverty in Thailand,' 1962/63 to 1975/76, Staff Working Papers No. 364, World Bank.

Office of Agricultural Economics (1987/88): 'Cost Structure,' Unpublished Data, OAE, Bangkok.

Office of Agricultural Economics (1990): *Agricultural Statistics of Thailand, Crop Year 1989/90,* OAE, Bangkok.

Office of the National Economic and Social Development Board (1960): *The First National Economic Development Plan,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1966): *The Second National Economic Development Plan,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1969): *National Income of Thailand, 1968/69,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1971): *The Third National Economic Development Plan,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1976): *The Fourth National Economic Development Plan,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1976): *National Income of Thailand, 1976,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1981): *The Fifth National Economic Development Plan,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1985): *Input-output Table of Thailand 1985,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1986): *The Sixth National Economic Development Plan,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1989): *National Income of Thailand, 1989,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1990): *National Income of Thailand, 1990,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1990): 'Total Net Capital Stock at 1972 Prices, Classified by Input-output Sector,' unpublished Data, NESDB, Bangkok.

Office of the National Economic and Social Development Board (1990): *Summary of the Direction of the Seventh Development Plan (1992-96),* NESDB, Bangkok, 6 August, (in Thai).

Office of the National Economic and Social Development Board (1991): *The Seventh National Economic Development Plan,* NESDB, Bangkok.

Office of the National Economic and Social Development Board (1991): *Summary of the Direction of Income Distributional Plan in the Seventh Development Plan (1992-96),* paper presented to the Seminar on the National Plan and Income Distributional Plan in the Seventh Development Plan, NESDB, Pattaya, 26-27 April.

Office of the National Economic and Social Development Board: 'Gross Regional Product (1986-88),' Unpublished Data, NESDB, Bangkok.

Office of the National Economic and Social Development Board: *National Income of Thailand, Gross Regional Product (1963),* NESDB, Bangkok, (in Thai).

Office of the National Economic and Social Development Board: *National Income of Thailand, Gross Regional Product (1977)*, NESDB, Bangkok, (in Thai).

Overbusch et al. (1988): 'Income Distribution and Government Interventions: Thailand Agricultural Model-2,' paper presented to the Workshop on Modelling the Thai Agriculture, Hua Hin, Thailand, October 29-30.

Pagan, A. and Shannon, J. (1989): 'Sensitivity Analysis for Linearized Computable General Equilibrium Models,' in Piggott, J. and Whalley, J. (eds): *New Developments in Applied General Equilibrium Analysis*, Cambridge: Cambridge University Press, 104-118.

Pairote Wongwuttiwat (1975): 'The Structure of Differential Incentives in the Manufacturing Sector: A Study of Thailand Experience During 1945-74,' unpublished Masters Thesis, Thammasat University, Bangkok.

Paitoon Wiboonchutikul (1975): 'Protection and Resource Allocation : A Study on Employment Effects of Differential Incentives in Thailand,' unpublished Masters Thesis, Thammasat University, Bangkok.

Paitoon Wiboonchutikul, Rachain Chintayarangsan, and Nattapong Thongpakde (1989): 'Trade in Manufactured Goods and Mineral Products,' paper presented to the 1989 TDRI Year-End Conference on Thailand in the International Economic Community, 16-17 December.

Pangestu, M. and Boediono (1985): 'The Indonesia: The Structure and Causes of Manufacturing Sector Protection,' in Findley, C. and Garnaut, R. (eds): *The Political Economy of Manufacturing Protection: Experiences of ASEAN and Australia*, Sydney: Allen and Unwin, 1-47.

Phibul Jiam-Anukulkit (1988): 'An Analysis of Output Supply and Input Demand in the Production of Upland Crops,' unpublished Masters Thesis, Thammasat University, Bangkok, (in Thai).

Phornphen Vorasitha (1987): 'Simulation Model for the Impact of Trade Protection on the Thai Economy,' paper presented to the 1987 Annual Meeting of the Economics Association of Thailand.

Pollak, A.P. and Wales T.J. (1978): 'Comparison of the Quadratic Expenditure System and Translog Demand Systems with Alternative Specifications of Demographic Effects,' *Econometrica* 48(3), 595-612.

Prais, S.J. and Houthakker, H.S. (1955): *The Analysis of Family Budget*. Cambridge: Cambridge University Press.

Pranee Tinakorn (1992): 'Industrialization and Welfare: How Poverty and Income Distribution Are Affected,' Paper Presented to the Conference on The Making of a Fifth Tiger?, Canberra, December 7-9.

Praphon Patamakitsakul (1988): 'The Analysis of the Household's Food Share Consumption,' in Kraiyoot Theeratayakheenan (ed.), *The Knowledge of Thai Economists,* the Economics Association of Thailand, 146-168, (in Thai).

Prasarn Trairatvorakul (1983): 'Income and Price Changes, and Food Consumption of the Poor in Thailand,' *Thammasat Economics Journal* 1(4), pp.139-187, (in Thai).

Ray, R. (1980): 'Analysis of a Time Series of Household Expenditure Surveys for India,' *The Review of Economics and Statistics* 62, 595-602.

Reinert, K.A. (1992): 'Armington Elasticities for United States Manufacturing Sectors,' *Journal of Policy Modelling* 19(5), 631-39.

Robinson, S. (1989): 'Multisectoral Models,' in Chenery, H. and Srinivasan, T.N. (eds): *Handbook of Development Economics* II, New York: Elsevier Science Publishers B.V., 885-947.

Robinson, S. and Derwis, K. (1977): 'Income Distribution and Socioeconomic Mobility: A Framework for Analysis and Planning,' *Journal of Development Studies* 3(4), 347-364.

Rogers, B.L. (1989): 'Indicators of Household Income for the Use in the Evaluation of Agricultural Development Projects,' Evaluation Occasional Paper No. 33, A.I.D..

Rungsan Hataiseree (1983): 'An Economic Analysis of the Thai Natural Rubber Industry,' unpublished Masters Thesis, Thammasat University, Bangkok.

Sakchai Suwanphaithoon (1982): 'Price Responsiveness of Rice Supply in Thailand,' Unpublished Masters Thesis, Chulalongkorn University, Bangkok, (in Thai).

Seers, D. (1972): 'What Are We Trying to Measure?,' *Journal of Development Economics* 8(3), 21-36.

Sen, A.K. (1973): *On Economic Inequality,* Oxford: Clarendon Press.

Sen, A.K. (1976): 'Poverty: An Ordinal Approach to Measurement,' *Econometrica* 44(2), 219-231.

Sharif, M. (1986): 'The Concept and Measurement of Subsistence: A Survey of the Literature,' *World Development* 14(5), 555-577.

Shorrocks, A.F. (1980): 'The Class of Additively Decomposable Inequality Measures,' *Econometrica* 48(3), 613-625.

Shorrocks, A.F. (1984): 'Inequality Decomposition by Population Subgroups,' *Econometrica* 52(6), 1369-1385.

Shorrocks, A.F. (1988): 'Aggregation Issues in Inequality Measurement,' in Eichhorn, W. (ed.): *Measurement in Economics: Theory and Applications of Economic Indices*, Heidelberg: Physica-Herlag, 429-451.

Shorrocks, A.F. and Foster, J.E. (1987): 'Transfer Sensitivity Inequality Measures,' *Review of Economics Studies* LIV, 485-497.

Sierra-Puche, J. (1984): 'A General Equilibrium Model for the Mexican Economy,' in Scarf, H.E. and Shoven, J.B. (eds): *Applied General Equilibrium Analysis*, Cambridge: Cambridge University Press, 447-482.

Singh, B. and Nagar, A.L. (1973): 'Determination of Consumer Unit Scales,' *Econometrica* 41(2), 347-355.

Singh, S.K. and Maddala, G.S. (1976): 'A Function for Size Distribution of Incomes,' *Econometrica* 44(5), 963-970.

Sirilaksana Khoman (1992): 'Thailand's Industrialization: Implications on Health, Education, and Science and Technology,' paper presented to the Conference on The Making of the Fifth Tiger: Thailand's Industrialisation and Its Consequences, The Australian National University, Canberra, 7-9 December.

Siverman, B.W. (1986): *Density Estimation for Statistics and Data Analysis*. London and New York: Chapman and Hall.

Somphorn Kritsanasap and Somkhit Jakrachai (1986): 'Cost of Rubber Production in Thailand: 1985,' Report of the Rubber Research Institute, Bangkok, (in Thai).

Somsak Tambunlertchai (1985): 'Thai Import Demand Analysis,' in Lim, D. (ed.) *ASEAN-Australia Trade in Manufactures*, Melbourne: Longman Cheshire, 191-199.

Somsak Tambunlertchai (1991): 'A Summary on Regional Industrialisation,' Papers on Research Summary and Public Policy, No. 118, Social Science Association of Thailand.

Sophon Rotthamrong (1983): 'Households Saving Behaviour in the Northeastern Region,' *Thammasat Economics Journal* 1(2), 171-192, (in Thai).

Stern, R.M., Francis, J., and Schumacher, B. (1976): *Price Elasticities in International Trade, An Annotated Bibliography*, Trade Policy Centre, London: MacMillan.

Stewart, M.B. and Wallis, K.F. (1981): *Introductory Statistics*, (2nd ed.), Oxford: Basil Blackwell.

Stone, R. (1954): 'Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand,' *The Economic Journal* 64, 511-527.

Suchart Techaposai (1989): 'Household Consumption and Saving Pattern in Thailand: 1981,' unpublished Masters Thesis, Thammasat University, Bangkok.

Suganya Hutaseranee and Somchai Jitsuchon (1988): 'Thailand Income Distribution and Poverty Profile and Their Current Situations,' paper presented to the 1988 TDRI Year-End Conference on Income Distribution and Long Term Development, Thailand Development and Research Institute, December.

Sujitra Buabai (1984): 'The Analysis of Saving Household Behaviour in the Urban and Rural Areas of Thailand,' unpublished Masters Thesis, Chulalongkorn University, Bangkok, (in Thai).

Sundrum, R.M. (1990): *Income Distribution in Less Developed Countries*, London and New York: Routledge.

Suphawadi Kodamrong (1980): 'An Analysis of the Trend of Poverty in Urban and Rural Areas in 1967/68 and 1975/76,' unpublished Masters Thesis, Chulalongkorn University, Bangkok, (in Thai).

Suree Siricharoensaeng (1987): 'Thai household Saving Behaviour Under An Alternative Saving Concept: An Analysis of Cross Section Data 1981,' unpublished Masters Thesis, Thammasat University, Bangkok.

Suwat Duangpan (1986): 'Demand for Import and Impact of Change in Tariff Rates on Government Revenue from Major Products,' unpublished Masters Thesis, Thammasat University, (in Thai).

Tan, N.A. (1985): 'The Philippines: The Structure and Causes of Manufacturing Sector Protection,' in Findley, C. and Garnaut, R. (eds): *The Political Economy of Manufacturing Protection: Experiences of ASEAN and Australia,* Sydney: Allen and Unwin, 48-76.

Teerana Bhongmakapat (1990): 'Income Distribution in a Rapidly Growing Economy: Thailand,' paper presented to the 15th FAEA Conference on Income Distribution in ASEAN, Singapore, November 15-17.

Tumnong Dasri (1972): 'An Economic Analysis of Maize Supply Response in Thailand: 1950-70,' unpublished Masters Thesis, Thammasat University, Bangkok.

United Nations (1968): *A System of National Accounts,* Studies in Methods, Series F No. 2 Rev. 3, United Nations, New York.

United Nations Industrial Development Organization (UNIDO) (1985): *Thailand: Industrial Development Review,* Rome.

van der Gaag, J. and Smolensky, E. (1982): 'True Household Equivalent Scales and Characteristics of the Poor in the United States,' *Review of Income and Wealth* 28, 17-28.

Vousden, N. (1990): *The Economics of Trade Protection,* Cambridge: Cambridge University Press.

Wallis, K.F. (1979): *Topics in Applied Econometrics,* (2nd ed.), Oxford: Basil Blackwell.

Whalley, J. (1985): *Trade Liberalization among Major World Trading Areas,* Cambridge: The MIT Press.