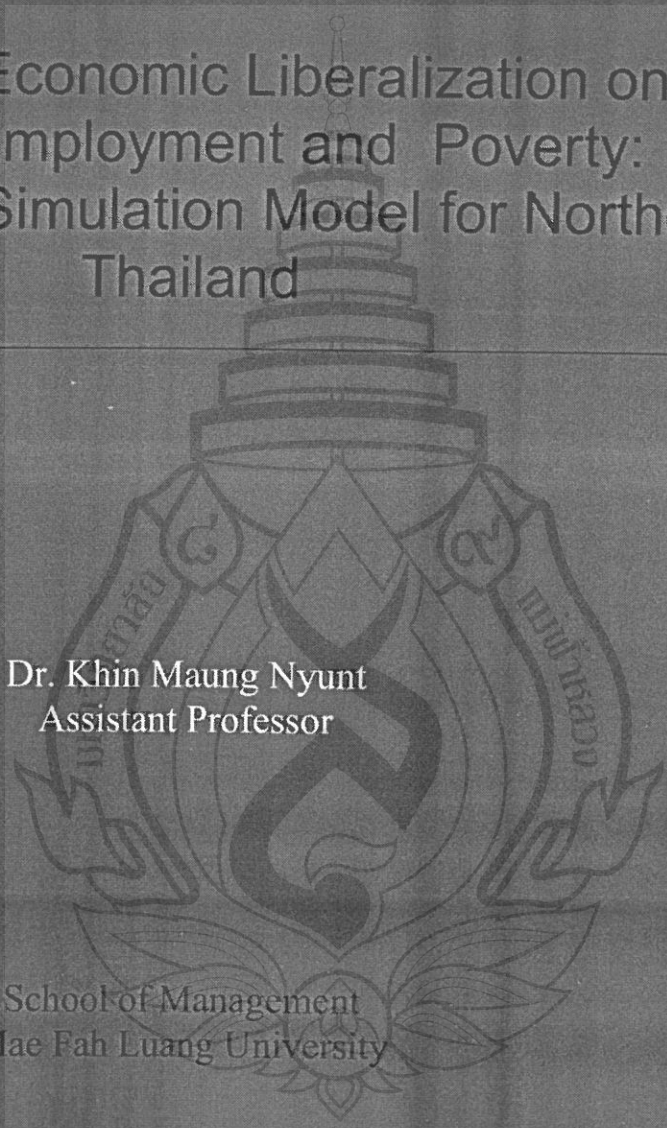


Research Report

Impact of Economic Liberalization on
Growth, Employment and Poverty:
Micro-Macro Simulation Model for Northern
Thailand

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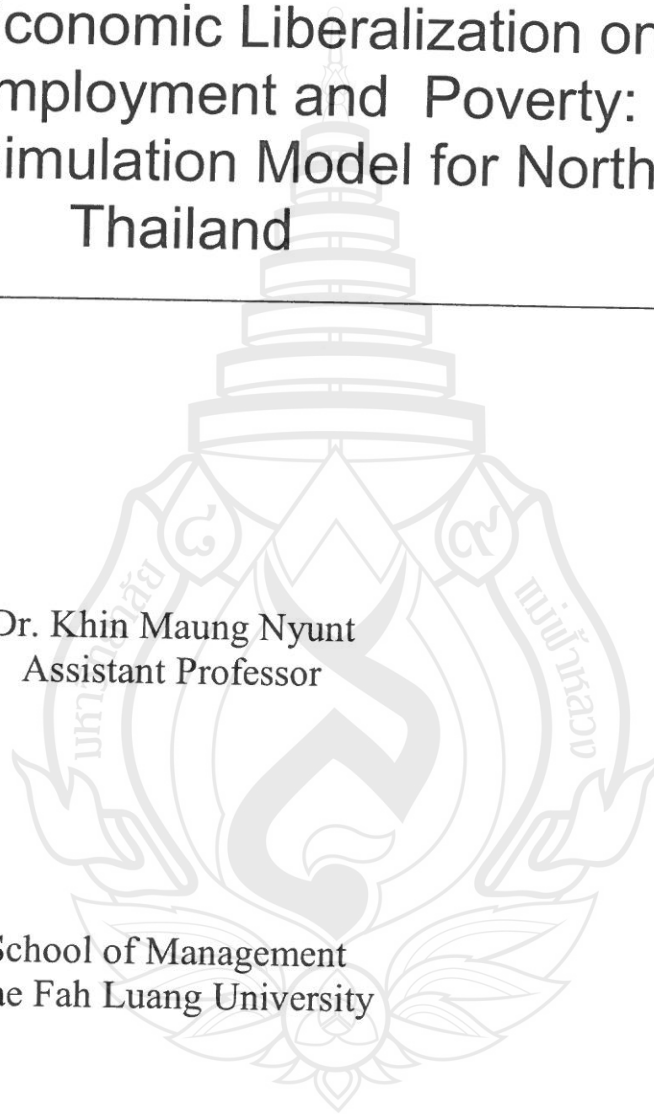
School of Management
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Abstract

This study investigates the factors determining household income based on household characteristics and housing characteristics such as household size, gender of household head, occupation, assets, skilled, educational achievement, village characteristics, health and social services. It also examines the effect of economic liberalization on household income distribution and inequality in Northern Thailand.

A micro-macro simulation model is applied in this study using household data with explicit treatment of heterogeneity of skills, labor and consumption preferences at household level. The consumption patterns and income structures of 8235 households in Northern Thailand are investigated econometrically modeling wage and consumption functions. The model's parameters are estimated using data from 'The 2004 Household Socio-Economic Survey (SES): Northern Region'. Various scenarios of economic liberalization policy simulation are carried out to examine the comparative static of the model and the impact of different growth strategies on poverty and inequality.

Average monthly income of households in Northern Thailand was 10,885 Baht, compared with a national average of 16355 Baht, in 2004. In 2007, average monthly income of households in Northern Thailand indicated 13568 Baht while a national average was 18660 Baht. In addition, average monthly wages and salaries of individuals in Northern Thailand increased from 3974 Baht in 2004 to 4068 Baht in 2007 which reached far above the national poverty line of 1386 Baht per month in 2007. The results also indicate that the number of people in poverty declined drastically from 11 million in 1998 to 6.1 million in 2006. This study also investigates the principal determinants of wage income of households under study.

To construct a wage function of households, 8235 wage-earners from the '2004 SES survey' were employed in the model under study. The major factors influencing wages of individuals are

¹ The author gratefully acknowledges the financial support from Mae Fah Luang University to complete this research report. All errors are the author's responsibility.

gender, age, education, urban or rural habitation and the size of farm. The model primarily focuses on labor allocation at the household level, but consumption behavior is also modeled. Finally the impact of trade liberalization policies on poverty and inequality are examined applying computable general equilibrium (CGE) model. The results suggest that the effects of such liberalization on household' income vary across policy options depending on micro and macro economic factors outlined in this study. Simulation results show the potential usefulness of economic policy options on the inequality interventions in explaining intra-group income distribution.



Key words: income distribution, poverty eradication, poverty measures, micro-macro simulations and determinants of household income , CGE model and Northern Thailand

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Chapter 1

Introduction

This research centers on the quantitative assessment of the factors determining household income such as type of occupation, ownership of assets, skill labor, educational achievement and household characteristics. Moreover, it also examines the impacts of trade liberalization poverty in Northern Thailand. Finally, reconciling the micro and macro interactions in the economy, the research suggests effective policy measures to promote trade, and investment in Northern Thailand.

1.1 Objectives

The study aims to explore the extent of the inequality of income, changes in inequality, the effect of trade liberalization on household income, the impact of changes in income and expenditure on total welfare and the determinants of income inequality in Northern Thailand

The major objective of this study is to conduct an empirical study of the impacts of globalization on trade, business culture, employment, and poverty in Northern Thailand on the basis of sequential linking of a model based on micro-level data with a model based on macro-level: the micro-macro simulation model. It also aims to assist in enhancing the national capacity of Thailand to respond effectively the challenging opportunities emerging from globalization and its impact on business development, growth and poverty eradication based on the evidence from Northern Thailand.

1.2 Research Questions

This research provides an empirical investigation of the impact of economic liberalization to address the following research problems:

- (i) To examine the differential impact of trade liberalization on different household stratum and income level in Northern Thailand for the period: 1998-2007,
- (ii) To estimate the poverty change by selected provinces, household stratum earning and impact and,
- (iii) To formulate effective policies in relation to trade, investment and enterprise in response to economic liberalization in Thailand.

The research primarily aims to focus four main areas as follows: (i) a profile of poverty, poverty status and change of poverty status; (ii) income inequality and household characteristics such as occupation, assets, skilled and unskilled labor, employment by type and village characteristics; (iii) income inequality and housing characteristics such as: household size, household sex, number of wage earners, disability, education attainment, housing condition, healthcare and social welfare received; (iii) the determinants of household income and consumption based on wage and income functions; and (iv) impact of economic liberalization on household income and macroeconomic fundamentals.

1.3 Literature Review

Previous research on the effect of trade liberalization on trade and employment of Thailand can be found in the studies of Narong (1998), Srawooth (1999), Poapongsakorn, N. and al (2000), ILO/UNDP (2000), Bidani, B. and Kaspar Richter (2001), Kitisak Isra (2001) and Warr (2001) from various paradigms. However, recent developments in methodology in this area point out further research needs to be undertaken. In particular, a growing number of studies on trade, growth and poverty by Robillard, Bourguignon and Robinson (2001), Ianchovichina E, A. Nicita and I. Soloaga (2001), Hertel, T., Maros Ivanic, Paul Prekel B and John Cranfield (2003) and Congneau and Robillard (1999) employ micro-macro simulation modeling, with national household survey data, incorporating macro economic shocks and capturing feedback impacts of poverty.

In terms of methodology, existing literature on trade, growth and poverty with special reference to developing countries can be classified into four broad categories, as follows²: (a) cross-countries regression analysis, (b) partial-equilibrium and/or cost-of-living approaches, (c) general equilibrium models based on a disaggregated Social Accounting Matrix (SAM), and (d) micro-macro synthesis. A number of cross-country studies on globalization and poverty, e.g. Warr (2002) have shown a positive relation between trade openness and economic growth. However, the nature of their model is static and it does not capture dynamic effects.

The second approach employed by McCulloch and Calandrino (2001) examines poverty based mainly on household expenditure. Thus it ignored other factors determining income

² Jeffrey Reimer, (2002). "Estimating the Poverty Impacts of Trade Liberalization", GTAP working paper No. 20. Purdue University, Indiana, USA.

distribution. Jitsuchon, S. and K. Richter (2007) explore one aspect of issue on the importance of small area estimation poverty maps as an essential tool for poverty eradication in Thailand. Deolalikar, A.B, (2002) examines the impacts of economic growth and changes in income inequality on poverty for the period: 1992-1999. It suggests that income inequality can play a critical role in affecting the rate of poverty reduction.

Robilliard A-S, Bourguignon and Robinson (2001) explore the effects of the 1997 Indonesian crisis on poor households in the context of micro-macro synthesis. The general equilibrium is based on a single-region SAM that captures macroeconomic constraints along with intersectoral flows for 38 sectors and 15 factors of production. The general equilibrium model is linked to the micro-simulation model through (i) wage levels; (ii) income levels in the informal sector; (iii) numbers of wage workers; and (iv) consumption price. Moreover, Hertel and Reimer (2005) examine how global trade liberalization affects poverty in each of seven different developing countries using Global Trade Analysis Project (GTAP) model of trade. Their study centers on factor market effects, but also allows for commodity market and terms of trade effects. They suggested that multi-lateral trade liberalization will reduce overall poverty in Indonesia, the Philippines, Uganda and Zambia, but increase overall poverty in Brazil, Chile, and Thailand.

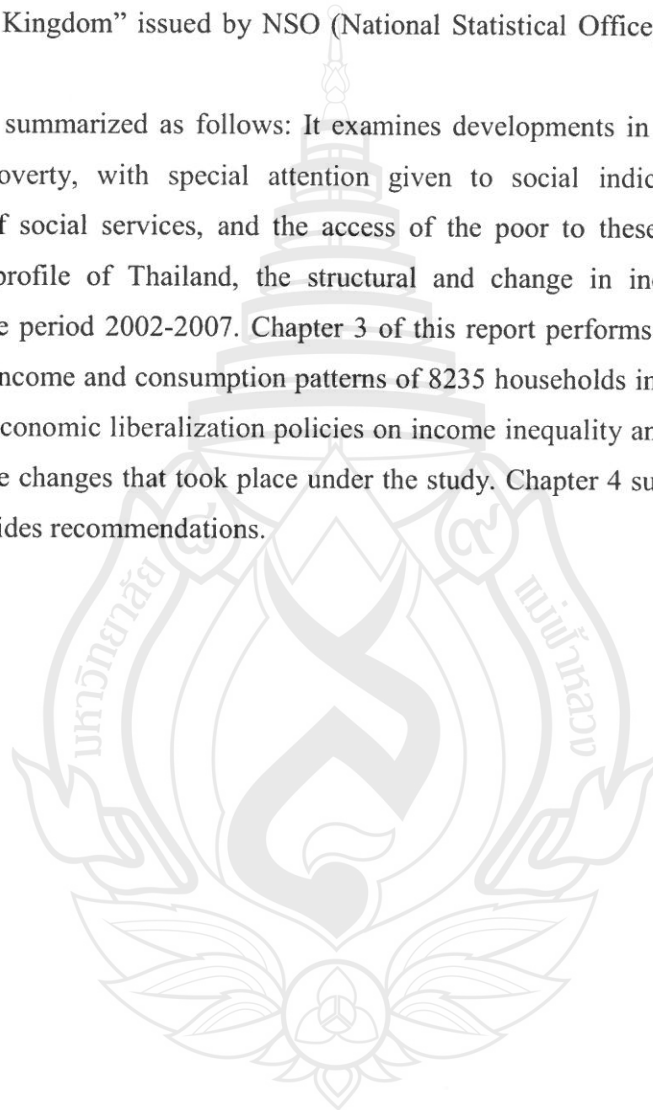
The micro simulation model was pioneered in the work of Orcutt (1957). It has often been used for evaluating the impact of fiscal reforms, health care financing, or for studying issues related to demographic dynamics (Harding, 1993). Bourguignon et. al, 1998; Alatas and Bourguignon (1999) constructed models based on household surveys carried out on various dates built to identify and analyze determinants of the evolution of inequality. Most micro-simulation models are conducted within a framework of partial equilibrium. General equilibrium effects have been incorporated simply by coupling an aggregate CGE model with a micro-simulation model in a sequential way by Meagher (1993). Tongeren (1994) and Cogneau (1999) carried out full integration of a micro-simulation model within a general equilibrium framework, the former to analyze the behavior of Dutch companies within a national framework, the latter to study the labor market in the town of Antananarivo.

In brief, the recent research in this area link sequentially the top-down and bottom-up approaches in a two-step procedure in such a way that general equilibrium mechanisms are incorporated along with household survey information. Another methodology incorporates large numbers of actual households into a general equilibrium simulation model. It allows for the

possibility of substantial heterogeneity across households within a region, while maintaining feedback effects between those households and the rest of the economy.

The present research attempts to bridge the gap between the existing research by applying micro-macro simulation modeling on trade, growth and poverty with special reference to Northern Thailand. Data contains “basic information on households’ data on CD: “The 2002 Household Socio-Economic Survey: Whole Kingdom” issued by NSO (National Statistical Office) and own survey data.

Structure of the report is summarized as follows: It examines developments in the social sectors and their impact on poverty, with special attention given to social indicators, the organization and management of social services, and the access of the poor to these services. Chapter 2 analyses a poverty profile of Thailand, the structural and change in income and expenditure of households for the period 2002-2007. Chapter 3 of this report performs modeling the determinants of households’ income and consumption patterns of 8235 households in Northern Thailand. Finally, the impact of economic liberalization policies on income inequality and poverty giving special consideration to the changes that took place under the study. Chapter 4 summarizes the findings of the study and provides recommendations.



Chapter 2

Socioeconomic Characteristics of Household and Change of Profile of Poverty in Northern Thailand

In this chapter, a profile of poverty, source of income and changing patterns of income and consumption are analyzed in line with household characteristics in assessing socio economic condition and social welfare for the period: 1998-2007.

2.1 A Profile of Poverty

The poverty profile reflects the status of poverty for different deciles of the population, urban and rural areas, household characteristics, change in poverty and change in household income and expenditure. The poverty profile is analyzed in the context of income inequality and poverty and consumption poverty in this section.

The patterns of poverty line exhibited firm that Thailand experienced a decline of poverty during the period: 1999-2006. As shown in Table 2.1, the average monthly income indicated 22.6 increases compared to that of 1998. It showed that nationwide household earned on average 1386 Baht per month in 2006. The average income per household increased 11.5 percent during the period under study. The Gini coefficient of household declined from 0.428 percent in 2002 to 0.418 percent in 2007. The highest 10 percent of households earned almost 49 percent of income, while the lowest 10 percent of households earned a constant share of 5.7 percent in 2007. The total number of people in poverty declined from 11 million in 1998 to 6.1 million in 2006. There were significantly different trends in the rural and urban areas. The number of poor in fell sharply as mentioned above, while those in the poverty gap declined from 5.1million to 1.8 million.

Mean per capita household expenditure grew by 41.6 percent and the average income of household increased by 46.6 percent during the periods: 1988 and 2006. People living at this level and below are classified as "poor." These lines reflect a close approximation of poverty and extreme poverty.

Income distribution in Thailand improved in better shape since severity poverty declined nationally from 2 percent in 1998 to 2.5 percent in 2006 with a two folds declined. The headcount index fell 18.8 percent in 2002 to 9.6 percent in 2006. However, it needs to examine both the

composition of growth share by the poor and the distribution of income so that poverty can be targeted in the processes.

With respect to household income by region, households in Bangkok Metropolis and three provinces: Nonthaburi, Pathu Thani, and Samut Prakan, earned on average 35,007 Baht, which was higher than those of other regions. The average monthly income of households in the South, Central and the North indicated 19,716 Baht, 18,932 Baht, and 13,568 Baht respectively. Whereas households in the Northeast earned the lowest of about 12,995 Baht. However, it showed that an increasing rate of household income in the Northern (10.0%) was higher than those in Northeast and South.

TABLE 2.1 AVERAGE MONTHLY INCOME AND EXPENDITURE PER HOUSEHOLD AND AVERAGE DEBT PER HOUSEHOLD : 1999 - 2007

Year	Income		Average Expenditure		Average Debt	
	Per Household Baht/ month	Change (%)	Per Household Baht / Month	Change (%)	Per Household Baht / Year	Change (%)
1999	12,729	1.9	10,238	-1.5	71,713	2.9
2000	12,150	-4.5	9,848	-3.8	68,405	-4.6
2001	12,185	0.3	10,025	1.8	68,279	-0.2
2002	13,736	12.7	10,889	8.6	82,485	20.8
2004	14,963	4.4	12,297	6.3	104,571	12.6
2006	17,787	9	14,311	7.9	116,585	5.6
2007	18,660	4.9	14,500	1.3	116,681	0.1

Source: National Statistical Office and Office of the National Economic and Social Development Board, Office of the Prime Minister, Bangkok 2007.

TABLE 2.2 POVERTY LINE, NUMBER OF POOR, HEADCOUNT INDEX, POVERTY GAP INDEX AND SEVERITY OF POVERTY: 1994 -2006

Year	Poverty Line Baht/Person/Month	No. of Poor Mil of Persons	Headcount Index (%)	Poverty Gap	Severity of Poverty (%)
1998	1,130	11	18.8	5.1	2
2000	1,135	12.8	21.3	6.1	2.5
2002	1,190	9.5	15.5	4.1	1.6
2004	1,242	7.1	11.3	2.6	1
2006	1,386	6.1	9.6	1.8	0.5

Source: National Statistical Office and Office of the National Economic and Social Development Board, Thailand, Bangkok, 2007.

TABLE 2.3 SHARE OF HOUSEHOLD CURRENT INCOME BY FIVE QUINTILE GROUPS AND GINI COEFFICIENT OF HOUSEHOLD AND PERSON IN WHOLE KINGDOM : 2002 – 2007

	2002	2004	2006	2007
Group1 (Lowest Income)	5.7	6.1	5.1	5.7
Group 2	9.3	9.8	9.1	9.6
Group 3	13.7	14.2	13.9	14.2
Group 4	21.2	21.2	21.0	21.3
Group5 (Highest Income)	50.1	48.8	50.9	49.2
Gini Coefficient				
(i) Household	0.428	0.411	0.439	0.418
(ii) Person	.418	0.425	0.418	-

Source: National Statistical Office and Office of the National Economic and Social Development Board, Thailand, Bangkok, 2007.

Figure 2.1 The Patterns of Average Monthly Income, Expenditure and Debt

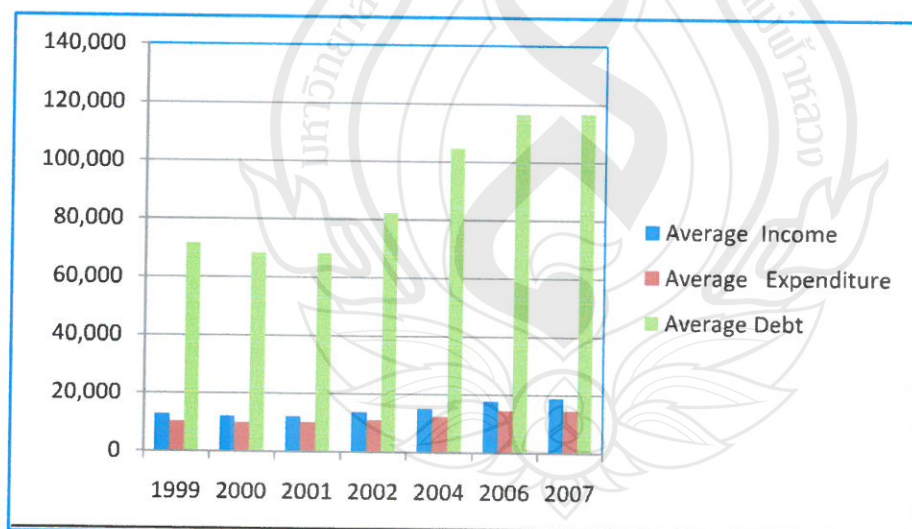


TABLE 2.4 AVERAGE MONTHLY INCOME AND EXPENDITURE
PER HOUSEHOLD AND PER CAPITA BY REGION : 2007

Year	Average Monthly Income (Baht)		Average Monthly Expenditure (Baht)	
	Per Household	Per Capita	Per Household	Per Capita
Bangkok and Vicinity	35,007	11,284	23,996	7,735
Central	18,932	5,833	15,168	4,673
North	13,568	4,321	10,990	3,500
Northeast	12,995	3,657	10,920	3,073
South	19,716	5,683	15,875	4,576

Source: National Statistical Office and Office of the National Economic and Social Development Board, Thailand, Bangkok, 2007.

The depth of poverty exhibits the extent to which the incomes of the poor fall below the poverty line. In contrast the poverty gap index measures the shortfall between the incomes or consumption expenditures of poor household and the poverty line. The sum of all individual poverty gaps in a survey sample can be interpreted as the minimum amount of income transfers needed to bring all of the poor just up to the poverty line in the presence of perfect poverty targeting. As shown in Table 2.2, for perfect poverty targeting purpose, a poverty gap of 1.8 percent for Thailand in 2006 suggests an income transfer of Baht 25(0.018 x national poverty line of Baht 1386) per person per month would be required to alleviate poverty.

Figure 2.2 Income Inequality and Gini Coefficient

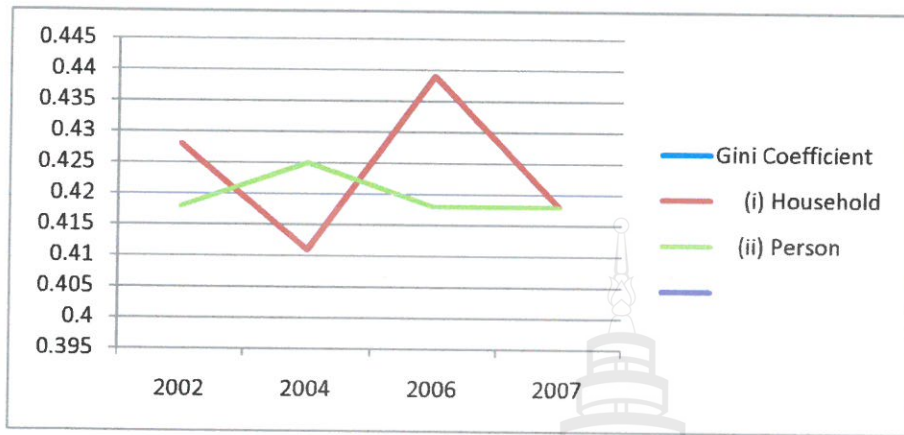


Figure 2.3 Poverty Line of Thailand

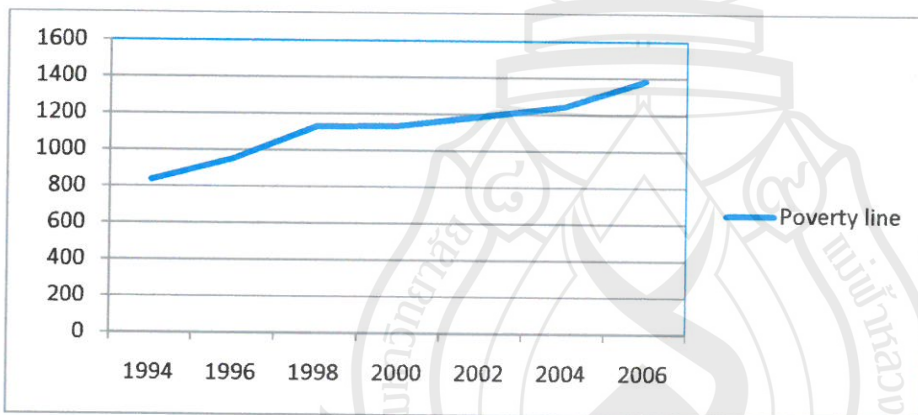


Figure 2.4 Headcount Index

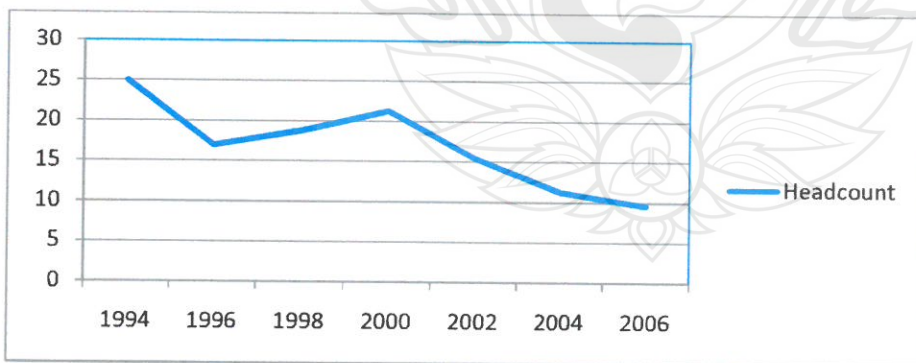


TABLE 2.5 PERCENTAGE OF HOUSEHOLDS BY AVERAGE MONTHLY INCOME AND REGION, 2007

Income (Baht)	Total	Greater Bangkok ^{1/}	Central	North	Northeast	South
Monthly Income Per Household	100.0	100.0	100.0	100.0	100.0	100.0
≤ 1,500	0.8	0.2	0.5	1.1	0.9	1.0
1501 - 3000	4.3	0.3	2.4	6.7	6.4	2.9
3001 - 5000	10.1	1.2	6.6	14.6	15.3	6.6
5001 - 10000	27.8	11.5	24.0	34.0	36.3	23.6
10,001 - 15,000	18.5	16.3	21.4	17.6	17.7	20.1
15,001 - 30,000	23.5	35.5	30.3	17.5	15.2	27.7
30,001 - 50,000	9.2	17.9	10.1	5.7	5.1	12.1
50,001 - 100,000	4.7	12.6	3.8	2.3	2.7	5.0
≥ 100,000	1.2	4.5	0.8	0.4	0.4	0.9
Monthly Income Per Capita	100.0	100.0	100.0	100.0	100.0	100.0
≤ 500	0.6	0.1	0.3	1.0	0.9	0.7
501 - 1501	11.2	0.5	5.0	13.3	20.2	8.2
1501 - 3000	26.5	4.3	20.9	34.7	37.2	24.0
3001 - 5000	21.8	14.3	27.4	23.9	20.3	23.1
5001 - 10000	24.1	43.8	30.3	17.5	13.4	26.7
10,001 - 15,000	8.0	17.7	8.9	5.0	4.2	8.6
15,001 - 30,000	5.8	13.7	5.9	3.5	2.7	6.8
30,001 - 50,000	1.4	3.7	0.9	0.9	0.8	1.4
50,001 - 100,000	0.4	1.3	0.3	0.2	0.2	0.3
≥ 100,000	0.2	0.6	0.1	0.1	0.0	0.1

1/ Nonthaburi, Pathum Thani and Samut Prakan.

Source: *Ibid*, 2007.

Households in the Northeast have the lowest level of income, expenditure, and debt. The ratio of income to expenditure in 2007 was 80.9 percent in the Northern region. As a result, households in this region's debt repayment rate were low comparing to other region. The income distribution in terms of income-basket shown in Table 2.5, benefits of growth was also not shared equally among regions. For the top 10 percent of the population, the increase was higher than the national average. For the bottom 20 percent there was a decline, and the decline was especially large. The slower growth in the Northern region and longstanding lags in provision of health, education and other social services have resulted in proportionately more poor being in Northern region in 2007. Extreme poverty is more pronounced in the rural areas of during the period 1998-2006, there were large declines in severity poverty in urban areas of Thailand as shown in Table 2.2.

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TABLE 2.6 PERCENTAGE OF HOUSEHOLDS BY AVERAGE MONTHLY
EXPENDITURE AND REGION, 2007

Baht	Whole Kingdom	Greater Bangkok/1	North	Northeast	South
Monthly Expenditure Per Household	100.0	100.0	100.0	100.0	100.0
≤ 1,500	0.2	-	0.2	0.5	0.2
1501 – 3000	2.9	0.1	1.9	6.0	3.3
3001 – 5000	9.9	1.0	6.4	16.3	13.9
3001 - 10000	34.4	15.5	28.9	39.1	46.8
10,001 - 15, 000	21.3	22.8	26.5	18.6	18.0
15,001 - 30, 000	22.2	36.7	28.1	15.0	13.2
30,001 - 50, 000	6.5	15.4	6.0	3.2	3.7
50,001 - 1000, 000	2.6	8.6	2.1	1.2	0.8
≥ 100,000					2.4
Per Capita	100.0	100.0	100.0	100.0	100.0
≤ 1,500	0.0	-	-	0.2	-
1501 – 3000	9.3	0.2	3.5	13.3	16.0
3001 – 5000	33.0	5.6	26.9	41.5	47.0
3001 - 10000	25.2	22.8	31.8	24.5	21.5
10,001 - 15, 000	22.5	46.8	27.6	14.9	10.5
15,001 - 30, 000	5.8	13.7	6.3	3.0	3.0
30,001 - 50, 000	3.6	9.1	3.4	2.4	1.7
50,001 - 1000, 000	0.5	1.5	0.3	0.3	0.3
≥ 100,000	0.1	0.4	0.1	0.0	-
					0.1

Source: *Ibid.*

2.2 Major Sources of Household Income

The major source of income in five regions is presented in Table 2.7. Wages and salaries form a main source of income; 4067 Baht followed by net profit from non-farm business 2645 Baht and net profit from farming 2332 Baht in the Northern region . Income from economically inactive was mainly from assistance from other persons outside the household or from government 1282 Baht, followed by income from property 222 Baht. The other source of earning was from assistance from government and organization in the form of welfare/goods and services 83 Baht.

As shown in Table 2.7, agriculture is generally the largest source of income, although livestock is also very important in most areas. Most of the off-farm income derives from small businesses, usually food processing, petty trading of agricultural products, or income from selling locally collected firewood and homemade charcoal.

The data reported in Table 2.9 suggests that a majority of households in the study communities were net buyers of basic food staples. Portion of the poor in the Northern region is higher than in the Southern or Middle regions. Such communities mostly in rural areas are characteristically lack of schools, hospitals, welfare facilities and access roads. The existence of the regional, sectoral and location specific dimensions of poverty, the targeted interventions and policies oriented toward equity are critical for reaching specific groups of the poor.

The national level average income grew and poverty declined during the period under study. However the average income of Northern Thailand groups faced substantially lower growth.

TABLE 2.7 AVERAGE MONTHLY INCOME PER HOUSEHOLD BY SOURCES OF INCOME, REGION AND AREA, 2007 (Baht)

Source of Income	Whole Kingdom	Region				
		Greater Bangkok1/	Central	North	Northeast	South
Total Monthly Income	18660	35007	18932	13568	12995	19716
Total Current income	18296	34514	18647	13219	12622	19394
Money Income	15584	30473	16032	11017	10086	16971
From Work	13366	26919	14315	9045	7796	15445
Wages and Salaries	7445	18326	8301	4067	3872	6635
Net Profits from Business	3894	8279	3685	2645	2349	4485
Net Profits from Farming	2028	313	2329	2332	1574	4324
From Current Transfer	1852	2361	1468	1751	2144	1244
Pension / Annuities and other Assistance	380	657	439	385	244	278
Work Compensation and Terminated Payment	11	30	17	1	4	6
Assistance from Persons Outside HH.	1398	1655	951	1282	1812	914
Assistance from Govt. & Organization	64	19	61	83	84	46
From Property Income	366	1193	249	222	146	282
Income from Renting	173	540	139	113	63	137
Interest and Dividends from Deposit, Bonds and Stocks	173	644	98	101	71	65
Interest from "Shares" and Loans	19	8	11	7	12	79

Source: *Ibid*, 2007.

TABLE 2.8 AVERAGE MONTHLY INCOME PER HOUSEHOLD BY SOURCE OF INCOME, IN NORTHERN THAILAND 2004

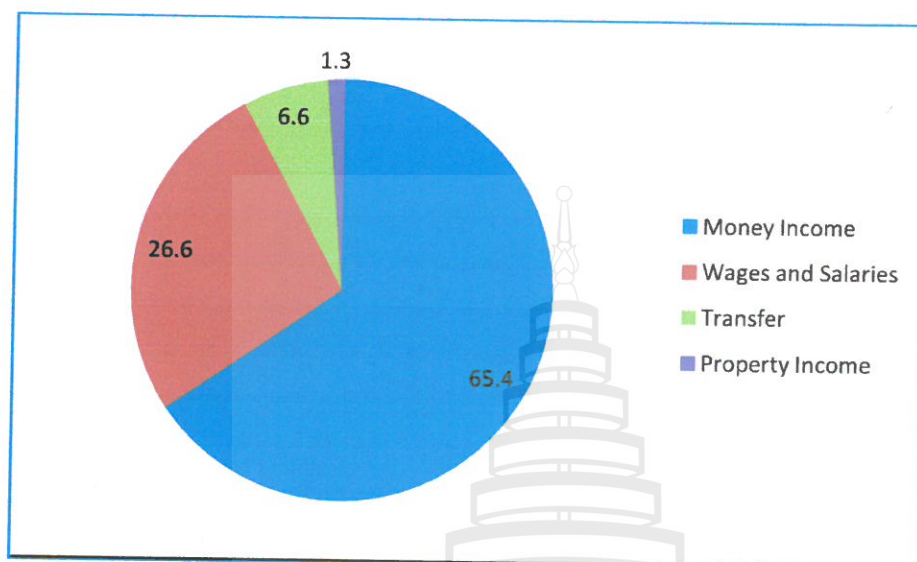
Province	Total Income	Wages & Salaries	Profits, Non- Farm	Profits, from Farming	Current Transfers 1/	Property Income	Other Money Receipts	Non- Money Income 2/
Northern Region	10,885	3,974	1,920	1,558	1,212	153	194	1,873
Kamphaeng Phet	12,776	2,841	2,009	2,986	1,435	320	684	2,502
Chiang Rai	8,920	3,598	1,582	786	1,002	71	51	1,831
Chiang Mai	12,586	4,840	3,217	1,161	943	190	147	2,087
Tak	9,549	4,080	1,466	899	1,083	130	118	1,773
Nakhon Sawan	10,200	3,453	1,657	2,256	920	145	323	1,446
Nan	10,751	4,138	1,729	861	1,527	127	297	2,070
Phayao	9,643	3,397	1,464	1,200	1,423	48	56	2,055
Phichit	10,951	3,815	1,329	2,957	1,134	128	73	1,515
Phitsanulok	12,751	5,750	2,017	1,352	1,133	300	138	2,060
Phetchabun	9,572	2,740	1,947	2,098	1,087	99	208	1,392
Phrae	11,333	5,004	1,486	679	1,929	169	351	1,715
Mae Hong Son	8,676	2,655	1,135	1,321	1,277	88	112	2,088
Lampang	10,576	4,777	1,611	677	1,512	141	37	1,822
Lamphun	11,843	4,996	2,124	1,283	780	95	292	2,273
Sukhothai	11,427	2,198	2,760	2,537	1,691	151	160	1,931
Uttaradit	10,940	4,734	1,090	1,213	1,707	127	95	1,975
Uthai Thani	9,817	3,080	1,104	2,808	873	169	185	1,598

1/ Includes assistance payments, pensions and annuities, terminal pay.

2/ Includes Imputed rental value owned dwelling

source: The 2004 Household Socio-economic survey, National Statistical office.

Figure 2.5 Share of Source of Income of Household (Percent), 2007



As shown in Figure 2.5, income from economic activities constituted the major source of income of household of the Northern region, which stood at 64.4 percent of total income in 2007, of which wages and salaries showed 26.6 percent. Net profit from non-farm business accounted for 20.8 percent, while net profit from farming indicated 10.9 percent.

Thus households in the Central region experienced a decreasing rate of household income (1.8%). The households of employed professional, technical, executive workers earned the highest average annual income of about 42,863 Baht, while the households of operators in non-farm business, households of clerical/sales/service workers, and households of production workers earned 19,311 Baht, and 14,095 Baht, respectively). Agricultural operators on fishery/forestry/hunting earned the lowest annual income (9,185 Baht).

About 63.3 percent of households in the whole country (63.3%) were indebted. The top two categories were for household consumption (33.3%) and for buying house/land (31.3%). Using credit for agricultural was 15.2 percent, followed by the debt on non-farm business (14.4%), where the loan for education was only 2.7 percent. It was found that households of high income also had a considerable amount of debt as well as high expenditure. In addition, the percentage of changes of

debt, the survey result found that households in the South experienced an increasing rate of 3.8 percent, followed by households in the Northeast of about 3.1 percent.

2.3 Regional Dimensions of Income Inequality

There were significant regional differences reflecting the differing economic structures and poverty. Northern region accounted for 46 percent of the lowest income group while country average of lowest income group show 31 percent in 2006. In addition the lowest income group in municipal area accounted for 20.3 percent while that of lowest income group in non-municipal area indicated 79.7 percent in the same year (Table 2.9)

Table 2.9 Number of Household by Average Household Income per Month, Region and Area:
2006

Average Household Income	Average Household Income per Month (Baht)					
	Total	Whole Kingdom		Northern region		
		Municipal area	Non-municipal area	Northern	Municipal area	Non-municipal area
Total	18061145	5710856	12350289	3531578	716987	2814591
< 5,000	5645803	715054	4930749	1473381	194643	1278738
5,000-9,999	5479558	1416807	4062751	1196627	226150	970477
10,000-14,999	2753611	1122356	1631255	403029	109263	293766
15,000-19,999	1355421	681250	674171	163467	52593	110874
20,000-24,999	946523	504381	442142	106006	42692	63314
25,000-29,999	392488	238077	154411	48231	20531	27700
30,000-34,999	390330	247102	143228	41700	19404	22296
35,000-39,999	158797	106026	52771	19500	8472	11028
≥ 40,000	938614	679805	258809	79638	43240	36398

Source: *The 2006 Household Socio-Economic Survey Whole Kingdom*, National Statistical Office, Ministry of Information and Communication Technology.

TABLE 2.10 PERCENTAGE OF HOUSEHOLDS BY AVERAGE

MONTHLY INCOME IN NORTHERN THAILAND 2006

Income	Baht	Whole country Total (%)	North Region(%)
<	1,500	1.2	1.7
1,500 -	3,000	5.6	7.9
3,001 -	5,000	11.6	16.8
5,001 -	10,000	28.0	32.7
10,001 -	15,000	17.6	15.8
15,001 -	30,000	22.3	16.8
30,001 -	50,000	8.1	5.2
50,001 -	100,000	4.4	2.7
≥ 100,000		1.1	0.4
<	500	1.1	1.1
500 -	1,500	14.4	17.5
1,501 -	3,000	26.3	33.0
3,001 -	5,000	21.1	22.0
5,001 -	10,000	22.6	16.6
10,001 -	15,000	7.3	4.9
15,001 -	30,000	5.6	3.8
30,001 -	50,000	1.2	0.9
50,001 -	100,000	0.4	0.2
≥ 100,000		0.1	0.1

Source: The 2006 Household Socio-Economic Survey Whole Kingdom, National Statistical Office, Ministry of Information and Communication Technology.

TABLE 2.11 AVERAGE MONTHLY INCOME PER HOUEHOLD BY SOURCE OF INCOME AND REGION, 2004

	Whole Kingdom	Greater	Central	North	Northeast	South
Total Monthly Income	14,963	28,135	16,355	10,885	10,139	14,469
Total Current Income	14,778	28,011	16,190	10,690	9,933	14,237
Money Income	12,423	24,387	13,833	8,817	7,868	12,039
Earnings	10,818	21,973	12,501	7,452	6,200	10,828
Wages and Salaries	6,558	16,944	7,400	3,974	3,165	4,583
Profits, Non-Farm	2,668	4,899	3,169	1,920	1,557	3,004
Profits from Farming	1,591	130	1,932	1,558	1,477	3,241
Property Income	194	451	165	153	113	176
Land Rent for Farming	20	1	30	40	10	24
Other Rent from Properties	65	220	63	23	18	52
Interest and Dividends	109	229	72	91	85	100
License and Copyright	-	-	-	-	-	-
Current Transfers	1,412	1,963	1,167	1,212	1,555	1,034
Assistance Payments	1,028	1,098	782	901	1,379	631
Pensions and Annuities	351	818	362	259	165	348
Terminal Pay	33	48	23	52	11	55
Non-Money Income	2,354	3,624	2,357	1,873	2,066	2,199
Received as Part of Wages/Salaries	225	560	299	140	83	174
Home-Produced ^{1/}	432	210	276	422	671	368
Received Free Dwelling	412	515	453	330	325	561
	1,285	2,339	1,329	981	987	1,095
Other Money Receipts	186	124	165	194	206	231
Insurance Proceeds	23	5	11	35	38	11
Lottery Winnings	41	47	38	45	37	44
Other Receipts	121	72	116	114	132	176

^{1/} Includes crops received as rent

Source: Report of The 2004 Household Socio-Economic Survey Whole Kingdom, National Statistical Office, Ministry of Information and Communication Technology

TABLE 2.12 AVERAGE MONTHLY HOUSEHOLD INCOME BY SOURCE OF INCOME AND AREA

Source of Income	Region		Municipal Areas		Non- Municipal Areas	
	Baht	%	Baht	%	Baht	%
Percent of Households	100		21.9		78.1	
Average Household Size	3.2		3.0		3.3	
Total Income	9,530	100	13,952	100	8,374	100
Total Current Income	9,287	97.5	13,687	98.1	8,137	97.2
Money Income	7,682	80.6	11,841	84.9	6,595	78.8
Wages and Salaries	3,301	34.6	5,648	40.5	2,688	32.1
Profits, Non-Farm	1,718	18	3,846	27.6	1,162	13.9
Profits from Farming	1,457	15.3	556	4	1,692	20.2
Property Income	140	1.5	276	2	104	1.3
Current Transfers ^{1/}	1,066	11.2	1,514	10.8	949	11.3
Income-in-kind ^{2/}	1,605	16.9	1,846	13.2	1,542	18.4
Other Money Receipts	243	2.5	265	1.9	237	2.8

^{1/} Includes assistance payments, pensions and annuities, terminal pay.

^{2/} Includes imputed rental value of owned dwelling.

Source: The 2002 Household Socio- economic Survey, National Statistical Office.

2.4 Household Expenditure Patterns

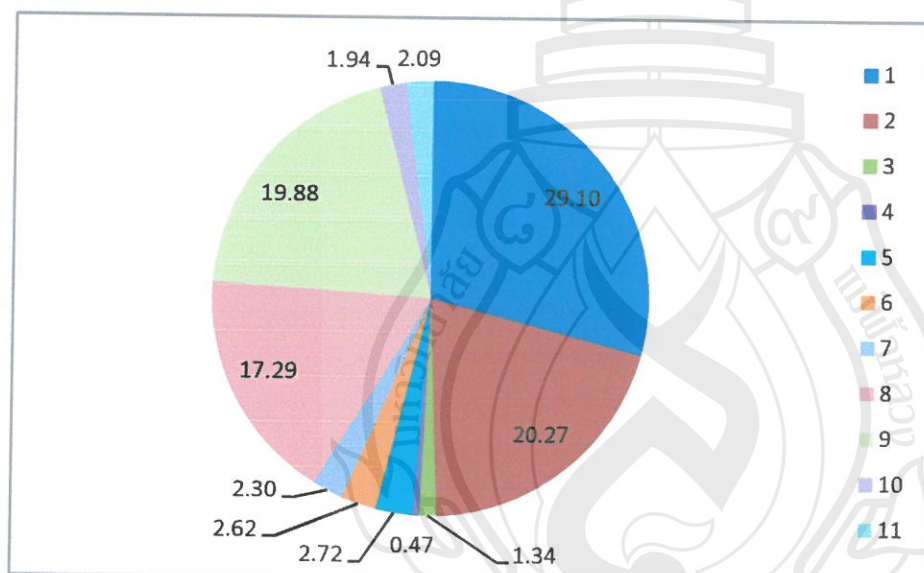
An alternative approach to assess household well-being is by assessing changes in household expenditure patterns, including changes in the proportion of total expenditure that a household use for food. Typically, a drop in the food share in total household consumption is associated with an improvement in the level of household well-being.

The survey result exhibited that nationwide household expenditure was average 14,500 Baht per month. About 33.0 percent was mainly spent on food and beverages (of which 1.3 percent was paid for alcoholic drinking), followed by expense on housing and household appliances (20.1%), vehicles and transportation (18.2%), personal supplies/clothing/footwear (5.6%), communication (3.4%), recreation and entertainment (2.5%), education (2.1%), and activities related to religious

(1.0%). In addition, household had non-consumption expenditure such as expenses on taxes, gifts, insurance lottery, and interest payment, which was about 12.2 percent.

. The share of food in total per capita expenditure was 66 percent in 2007 and the food share was remained stable, but the poorest households show a decrease in expenditure on food decreased during the period. Data from the SES indicate that the food share in total consumption decline from 62% to 59% from 2002 to 2007. Further analysis shows that, between 2002 to 2007, there were a decline in the share of food in total consumption at all levels of income.

Figure 2.6 Average Monthly Expenditure Per Household By Expenditure Group (Percent)



1. Food and Beverages, 2. Food Prepared at Home, 3. Alcoholic Beverages
 4. Tobacco Product, 5. Apparel and Foot wear, 6. Personal Care, 7. Medical and Health
 Care, 8. Household Operation, 9. Transport & Communication, 10. Education, 11. Recreation

2.5 Household Characteristics

The households' income inequality associated with characteristics is analyzed on the basis of household size, number of wage earners, disability, healthcare and social welfare received. Tables 2-15 and 2.17 summarize the age distribution and social services. It is striking that the female headed households which make up 10 percent of all households contribute only 5 percent to rural poverty and 8 percent to urban. In households headed by the young 16-25 years - only 20 percent were poor in 2004. Such households seem to be poor in 1992. But the incidence of poverty was lower in 2007 than in 2004 for most other households.

This section examines four key aspects of poverty: location, education status, welfare and occupation by household type. The results highlight the income inequality of households, of single male headed households in the Northern region areas, and the constraints on women's educational and employment opportunities as reflected in the type of household. In the Northern and middle zones, one-third of all households are female headed but only one-sixth male headed households predominating with 55-62 percent of all households in all three regions. Female headed households constituted 31.4 percent of total households of Northern region, while male headed households showed 68.6 percent as shown in Table 2.15.

While the poor spend proportionately more of their expenditures on food, the non-poor spend 3.6 to 4.5 times as much for food. The incidence of poverty is higher in larger households. How the different characteristics of heads of households and the regional location of the population affected the incidence of poverty in 2004 and 2007 is shown in Table 2.7. Rural populations are significantly poorer than urban. Households are headed by a man with no formal education, and only 6 percent have completed primary education.

In 2007 number of household which earned average income less than 5000 Baht indicated 1.27 million. Average income varied from Baht 630 in the Northern region to Baht 937 in the Southern region (Table 2.9). In the same year, income distribution between municipal and non-municipal area total population and there were considerable regional variations in urbanization and in average expenditure per capita in urban areas (Table 2.13). There were also significant differences in average expenditures in these regions.

TABLE 2.13 AVERAGE MONTHLY EXPENDITURE PER HOUSEHOLD BY GROUP AND PROVINCE, 2004

Province	Total Expenditures	Food Beverages & Tobacco	Apparel & Footwear	Housing ^{1/}	Transport & Commu- nication	Medical & Personal Care	Consumption Expenditure	Non-Consumption Expenditure ^{2/}
Northern Region	9,361	3,074	331	1,825	2,001	457	545	1,129
Kamphaeng - Phet	11,554	3,215	455	2,442	2,490	738	809	1,405
Chiang Rai	8,428	3,117	271	1,849	1,433	376	515	868
Chiang Mai	11,121	3,377	346	2,151	2,826	505	830	1,086
Tak	8,799	2,477	299	1,706	2,532	417	389	979
Nakhon Sawan	8,307	2,760	263	1,631	1,459	395	519	1,280
Nan	10,479	3,034	495	1,995	2,672	384	565	1,333
Phayao	7,905	2,876	344	1,548	1,310	570	303	954
Phichit	9,454	3,557	280	1,608	1,789	488	424	1,307
Phitsanulok	11,208	3,825	477	2,086	2,271	638	571	1,341
Phetchabun	7,829	2,682	285	1,451	1,652	380	456	923
Phrae	9,480	2,968	319	1,719	2,095	281	485	1,613
Mae Hong - Son	7,682	2,781	247	1,771	1,240	400	372	872
Lampang	8,660	3,021	269	1,458	2,132	310	405	1,066
Lamphun	10,247	3,257	277	1,927	2,175	458	730	1,425
Sukhothai	8,347	2,547	344	1,943	1,739	486	436	851
Uttaradit	8,754	3,105	437	1,827	1,655	503	327	900
Uthai Thani	8,125	2,956	203	1,347	1,631	366	549	1,073

1/ Includes Imputed rental value owned dwellin

2/ Includes taxes, gifts, contributions, insurance premium, lottery ticket, etc.

source: The 2004 Household Socio-economic survey , National Statistical office.

TABLE 2.14 AVERAGE MONTHLY EXPENDITURE PERHOUSEHOLD BY
EXPENDITURE GROUP, REGION AND AREA , 2007

Expenditure Group	Region				
	Greater Bangkok ^{1/}	Central	North	Northeast	South
Total Monthly Expenditures	23,996	15,168	10,990	10,920	15,875
Consumption Expenditures	21,009	13,273	9,623	9,702	13,868
Food and Beverages (excludes alcoholic)	6,457	4,683	3,427	3,882	4,877
Food Prepared at Home	2,491	2,611	2,387	2,744	3,110
Prepared Food	3,623	1,808	918	1,018	1,540
Food Taken Home	1,446	750	380	508	641
Food Eaten Away from Home	2,177	1,058	538	510	898
Non-alcoholic Beverage	343	264	122	120	228
Alcoholic Beverages	281	263	158	133	211
Drunk At Home	168	177	85	75	116
Drunk Away from Home	114	86	72	58	95
Tobacco Products	151	115	55	65	139
Cigarettes, Tobacco etc.	151	111	50	56	133
Betelnut, Snuff etc.	1	4	4	9	6
Apparel and Footwear	537	410	320	287	520
Cloth and	439	342	260	234	438
Footwear	97	68	60	53	82
Personal Care	756	450	308	299	409
Personal Supplies	592	367	252	258	309
Personal Services	164	83	55	41	100
Medical and Health Care	484	256	271	186	340
Medicine and supplies	64	56	39	23	55
Medical Services (outpatients)	306	137	112	85	190
Medical Services (inpatients)	114	63	120	78	95

Source. *Ibid* 2007

Table 2.14

(Contd.)

Expenditure Group	Region				
	Greater Bangkok ^{1/}	Central	North	Northeast	South
Household Operation, Furniture and Equipment	5,626	3,039	2,036	2,059	2,838
Shelter	804	240	55	40	187
Estimated Rental Value of Dwelling (Include owned dwelling)	2,900	1,603	1,105	1,112	1,369
Repair / Maintenance Dwelling	217	201	104	182	326
Furniture and Major Equipment					
Household Textiles Small Appliances	127	140	150	119	199
Fuel, Lighting and Water Supply	1,155	648	451	451	577
Cleaning Supplies	232	180	142	139	163
Service Workers in Household	190	27	28	16	18
Transport and Communication	5,321	3,233	2,342	2,172	3,823
Vehicles Purchase	1,202	1,007	906	836	1,597
Vehicle Repairing & Maintenance	356	243	194	154	256
Local Transportation	2,191	1,294	785	752	1,245
Special Occasion Travelling and Tour	563	172	118	102	244
Communication	1,008	517	340	328	480
Education	750	266	228	165	254
Recreation Reading and Religious Activity	583	356	246	173	265
Recreation Equipment and Sports	80	56	62	32	59
Toys, Pets, Shurbs and Recreation	183	104	52	32	82
Admission, Sports fee	61	16	9	2	12
Reading/ Religious Activities	259	180	123	107	111
Special Ceremony Expenses	63	204	233	282	193

Table 2.14

(Contd.)

Expenditure Group	Region				
	Greater Bangkok ^{1/}	Central	North	Northeast	South
Non-Consumption Expenditures	2,987	1,895	1,367	1,218	2,006
Taxes/Charge/Fees and Fine	226	47	47	29	44
Career Membership Expense	1	4	6	1	3
Money/Material Give to Other Person					
Outside this Household	1,176	692	482	382	864
Contribute Money/Material to NGO					
Institute	26	27	12	7	20
Other Contributions	170	281	148	178	302
Insurances Premiums, Cremation fee	978	496	337	302	367
Lottery Tickets and Other Kind of Gambling	163	118	106	82	103
Interest Payment	223	217	221	216	282
Other Expenses	23	13	8	23	21

Source: *Ibid*, 2007

TABLE 2.15 PERCENTAGE OF HOUSEHOLDS BY MAJOR HOUSING CHARACTERISTICS IN NORTHERN REGION

	Whole Kingdom	North
1. Head of Household	100.0	100.0
Male	68.3	68.6
Female	31.7	31.4
	100.0	100.0
Under 20 Years	0.7	0.5
20 - 29 Years	6.4	3.6
30 - 39 Years	16.9	12.6
40 - 49 Years	24.7	25.6
50 - 59 Years	23	24.8
60 Years or More	28.3	32.8
Level of Completed Education Level	100.0	100.0
Never Attended School	6.2	12.6
Pre - Primary and Primary Education	66	68.6
Lower Secondary / Upper Secondary Education	15.3	11
Vocational or Technical and Post – Secondary Education	5.5	3.3
University / Bachelor Degree Level	6.1	4
Postgraduate / Master / Doctoral Degree Level	0.8	0.5
Other Education	0.1	0.1

Source: Ibid.

2.6 Household Housing Characteristics

The age distribution of population demonstrated that it has the highest proportion of ages was between the age of 60 year or more (32.8%) in 2007 (Table 2.15). The 40–49 and 50–59 age groups had the highest rates of uninsurance (32.8 and 24.8%, respectively; 50.4% combined). Northern Thailand ranked second highest in the universal health cover (82.8%). However, the Medicaid holder and private insurance policy holders indicated only 4.7 percent and 2.1 percent respectively.

In education, Table 2.15 presents the percentage of the primary, secondary and high schools completion rates. The data are disaggregated by age, region, area, household status and household wealth. The primary school attainment rate was 68.6 percent in the Northern region while the secondary school attainment rate showed 11 percent. The vocational education attainment rate was 3.3 percent in contrast, the completion rate of university degree indicated 4 percent in the Northern Thailand. The poverty profile and the evolution of poverty between 2004 and 2007 showed clearly that growth is fundamental to the reduction of poverty, but the composition of growth is also important.

Access to social services is a critical factor in overcoming poverty, particularly primary education. It is suggested that geographical and sectoral concentrations of poverty needs to focus on the pattern of growth is in which the poor in urban and rural areas can share in the growth process both to induce growth and to provide social services and infrastructure. Almost all rural areas show better social indicators than the Northern region, which includes both urban and rural areas. This underscores the severe lag in the development of the Northern region compared to the central one. It also reflects the fact that rural areas in the Northern region were relatively poor.

Similar regional patterns are evident in indicators of education services. Primary and secondary enrollment ratios are much higher in the southern than in the northern regions. Household surveys show a much larger proportion of the population in Northern areas have never attended formal schools 12.6 percent of total population in the Northern region compared with 6.2 percent in the whole kingdom.

These indicators are generally presented by age and sex to illustrate how patterns of school attainment and completion have changed over time as shown in Table 2.15. It suggests that poor households differ from non-poor ones in several ways.

Characteristic of the poor households tend to be in communities in which most of the other households are also poor, whereas the non-poor households tend to be in communities in which the population is largely non-poor. The overall income inequality in the Northern region is due largely to income inequality between urban and rural, and much less to income inequality between households within rural area.



TABLE 2.16 PERCENTAGE OF HOUSEHOLDS BY AVERAGE MONTHLY EXPENDITURE AND REGION: 2006

Expenditure Baht		Whole Kingdom	North
Monthly Expenditure Per Household		100.0	100.0
<	1,500	0.3	0.6
1,500	- 3,000	3.9	6.5
3,001	- 5,000	11.4	16.8
5,001	- 10,000	34.2	39.3
10,001	- 15,000	20.9	17.6
15,001	- 30,000	20.6	13.7
30,001	- 50,000	6.2	3.9
≥	50,000	2.7	1.7
Monthly Expenditure Per Capita		100.0	100.0
<	500	0.1	0.2
500	- 1,500	12.3	15.2
1,501	- 3,000	32.4	40.4
3,001	- 5,000	24.0	23.2
5,001	- 10,000	21.1	14.3
10,001	- 15,000	5.6	3.7
15,001	- 30,000	3.7	2.4
30,001	- 50,000	0.6	0.5
≥	50,000	0.2	0.1

Source: The 2006 Household Socio-Economic Survey Whole Kingdom, National Statistical Office, Ministry of Information and Communication Technology.

TABLE 2.17 PERCENTAGE OF HOUSEHOLDS BY MAJOR HOUSING CHARACTERISTICS AND REGION: 2006

Characteristics	Whole	North
2. Member of Household		
Household Size (include servants)	100.0	100.0
1 - 2 Persons	33.8	36.4
3 - 4 Persons	45.3	48.2
5 - 7 Persons	19.5	14.7
8 Persons or More	1.4	0.7
Household Size (exclude servants / employee)	100.0	100.0
1 - 2 Persons	33.8	36.4
3 - 4 Persons	45.4	48.2
5 - 7 Persons	19.4	14.7
8 Persons or More	1.3	0.7
Number of Earners	100.0	100.0
None	8.2	9.5
1 Person	24.8	25.0
2 - 3 Persons	60.0	59.9
4 Persons or More	6.9	5.6
Number Disability	100.0	100.0
None	97.6	97.0
1 Person	0.7	0.8
2 - 3 Persons	0.3	0.4
4 Persons or More	1.4	1.8

Source: *Ibid.*

TABLE 2.17 PERCENTAGE OF HOUSEHOLDS BY MAJOR HOUSING CHARACTERISTICS AND REGION: 2006

(Contd.)

Major Housing Characteristics	Whole Kingdom	North
Received Government/		
State Enterprise's Welfare	100.0	100.0
None	90.2	90.2
Have	9.8	9.8
Received Universal Health		
Coverage Card	100.0	100.0
None	23.3	17.2
Have	76.7	82.8
Received Medical Card		
(social security)	100.0	100.0
None	90.1	95.3
Have	9.9	4.7
Received Private Health Insurance	100.0	100.0
None	97.9	97.9
Have	2.1	2.1
Received Welfare by Employer	100.0	100.0
None	99.7	99.8
Have	0.3	0.2
Received Social Pension for the Poor Elderly	100.0	100.0
None	97.7	97.1
Have	2.3	3.0
Received Social Assistant for Disability	100.0	100.0
None	99.7	99.5
Have	0.3	0.6

Source: *Ibid.*

TABLE 2.17 PERCENTAGE OF HOUSEHOLDS BY MAJOR HOUSING CHARACTERISTICS AND REGION: 2006

(Contd.)

Major Housing Characteristics	Whole Kingdom	North
Received Government's Scholarship	100.0	100
None	99.2	98.6
Have	0.8	1.4
None	99.5	99.2
Have	0.5	0.8
Borrowed People Bank	100.0	100.0
None	99.6	99.5
Have	0.4	0.5
Borrowed Village Fund Scheme	100.0	100.0
None	89.7	86.3
Have	10.3	13.7
Other Government Loan	100.0	100.0
None	99.0	98.7
Have	1.0	1.3
Members who Accessed to the Internet	100.0	100.0
None	75.9	76.9
Have	24.1	23.1
Type of Dwelling	100.0	100.0
Detached House	80.0	93.8
Row House	10.5	3.9
Townhouse or Twin house	4.7	1.2
Apartment or Flat	2.9	0.8
Room or Rooms	1.2	0.1
Improvised Quarter and Others	0.6	0.3

Source: *Ibid.*

Chapter 3

Micro-Macro Simulation Model of Northern Thailand

The modeling of income distribution of household in Northern Thailand is performed in this chapter applying Computational General Equilibrium (CGE) micro-simulation model as discussed in Section 3.1. In contrast, a standard specification CGE model is presented in Section 3.2. The special attention is made on investigating determinants of household income using the wage function, while consumption function is modeled using SES survey data 2004. The model results are discussed in Section 3.3 and the policy implications are discussed finally, the results of the CGE micro-simulation model which centers on the effects of economic liberalization policies on microeconomics: rural and urban household incomes and macroeconomics: private consumption, government consumption, investment, export, import, tariff and gross domestic product (GDP) are analyzed in Sections 3.4.

3.1 Description of Micro-Macro Simulation Model

To explain the link between economic growth and income inequality, an applied general equilibrium models are often used, which initially built on the Social Accounting Matrices (SAM) in the presence of one representative household. In comparison, a micro-simulation approach enables relaxation of the representative agent assumption. The links can be performed in two ways. The first is by using information at the microeconomic level - at the individual level based on the variable being considered. The second is by estimating behavioral equations starting from the same microeconomic data. The estimated model allows indigenizing some of the behavior. The unexplained portion error term reflects fixed effect or elements of unexplained heterogeneity. The construction of a basic CGE micro-simulation model in the present study is technically based on Cogneau and Robilliard (1999) and Cockburn (2001) that integrate survey household that obtained from a nationally representative household survey directly into a standard CGE model. The aggregated SAM is constructed in this study replacing a single household with multiple household obtained under SES survey 2004: Northern Thailand". The construction of Thai SAM is based on the works of Li (2002) and Thaiprasert (2006).

In linking households under survey with standard SAM survey, first the household hold category in the standard CGE model was aggregated into three categories: agricultural households,

non-agricultural households and government-employed households) in the standard CGE model to facilitate reconciliation with the survey data. Second, the household income and expenditure vectors in the aggregate SAM were then recalculated using the survey data. Next, aggregate values for the three household categories were calculated by multiplying individual household values by the respective survey sampling weights and summing over all households in each region.

The introduction of the individual data from survey in the SAM, the SAM inevitably becomes unbalanced. To reestablish equilibrium, the survey-based household income and expenditure vectors were fixed while all other values in the SAM are adjusted until row and column sums were all equal. For this purpose, a DAD software of Duclos, Araar et Fortin, 2001 is applied to seek to establish equilibrium while minimizing the variations in all SAM cells.

The optimization problem of this approach is summarized on the basis of Cockburn (2001), which includes minimizing the sum of the square of the rates of variation between the original (AO_{ij}) and new (A_{ij}) SAM values as follows:

$$\text{Min. } \sum_i \sum_j (A_{ij} - AO_{ij}/AO_{ij})^2$$

$$\text{subject to } \sum_i A_{ij} = \sum_j A_{ij} \text{ and } A_{hj} = A_{jh}$$

where AO_{ij} denote original cells in SAM, A_{ij} depicts new SAM values and h represents the household account in the SAM.

After the aggregate SAM was balanced and coherent with the household survey data, we increased the number of household categories in the CGE to 3373 in our study based on survey data of Northern Thailand and introduced individual household income, consumption and savings data. A standard CGE is applied in modeling wage function and impact analysis under various policy scenarios. Poverty and income distribution analysis is performed using DAD software.

3.2 Specification of the CGE Model

The standard CGE model explains all of the payments contained in the SAM using a set of systems of equations (models). The model therefore follows the SAM disaggregation of factors such as land, labor, and capital; activities: economic activities by sectors; commodities based on sectors, and institutions: household, enterprises, government and other institutions. The equations

define the behavior of the different actors such as: producers and consumers. The production and consumption behaviors are model applying nonlinear, first-order optimality conditions. Therefore production and consumption models are estimated using the maximization of profits and utility, respectively. The equations also include a required set of constraints. All transfers between the rest of the world and domestic institutions, households and factors are fixed in foreign currency. The households use their income to pay direct taxes, save, consume, and make transfers to other institutions. Producer maximizes sales subject to imperfect transformability between exports and domestic sales, expressed by a constant elasticity of transformation (CET) function. The model includes three macroeconomic balances: the government balance, the external balance (the current account of the balance of payments, which includes the trade balance), and the Savings. The standard CGE model can be summarized comprising four equation blocks viz. (i) price block, (ii) absorption block, (iii) production and trade block, and (iv) institution block and system constraint block in the following section. The notations of variables of these equations are provided in Appendix 1.

I. Price Block

Import Price

$$1. PM_c = (1 + t_c) \cdot pwn_c \cdot EXR$$

Export - price

$$2. PE_c = (1 + t_c) \times EXR$$

Demand Price of Domestic Nontraded Goods

$$3. PDD_c = PDS_c$$

Absorption

$$4. PQ_c(1 - tq_c) = PDD_c QD_c + PM_c \cdot QM_c$$

Marketed Output

$$5. PX_c QX_c = PDS_c QD_c + PE_c \cdot QE_c$$

Activity Price a_c .

$$6. PA = \sum PXA_c \cdot \theta_{ac}$$

Aggregate Intermediate Input Price

$$7. PINTA_a = \sum_{c \in C} PQ_c \cdot i_{ca} \cdot ca_c$$

Activity Revenue and Costs

$$8. PA_{1\alpha} \cdot (1 - t_{\alpha}) Q_{A_{ac}} = PV_{A_{ac}} \cdot QV_{A_{ac}} + PINT_{A_{ac}} \cdot QINT_{A_{ac}}$$

Consumer Price Index

$$9. \overline{CPI} = \sum_{c \in C} PQ_c \cdot cwt_s_c$$

Producer Price Index for Nontraded Market Output

$$10. DPI = \sum_{c \in C} PDS_c \cdot dcwt_s_c$$

II. Production and Trade Block

CES Technology Activity Production Function

$$11. QA_{\alpha} = \alpha_{\varepsilon}^{\alpha} \cdot (\delta_{\varepsilon}^{\alpha} QV_{A_{\alpha}}^{-\rho} + (1 - \delta_{\varepsilon}^{\alpha}) QINT_{A_{\alpha}}^{-\rho})^{-1/\alpha}$$

CES Technology Value – Added – Intermediate Ratio

$$12. \frac{QV_{A_{\alpha}}}{QV_{T_{A_{\alpha}}}} = \left[\begin{array}{cc} PINT_{A_{\alpha}} & \delta_{\alpha}^{\alpha} \\ INT_{A_{\alpha}} & 1 - \delta_{\alpha}^{\alpha} \end{array} \right]^{1+\rho}$$

Leontief Technology : Demand for Aggregate Value Added

$$13. QVA_a = iv_a \cdot QA_a$$

Leontief Technology : Demand for Aggregate Intermediate input

$$14. QINTA_a = int_a \cdot QA_a$$

Value – Added and Factor Demand

$$15. QVA_a = \alpha_{\alpha}^{vI} \left(\sum_{j \in F} \delta_{f\alpha}^{vI} QF_{f\alpha}^{-\rho} \right)^{-1/\alpha}$$

Factor Demand

$$16. WF_f = WFDIS_{f\alpha} = PVA_a (1 - tv_a) \cdot QV \left(\sum_{f \in F} \delta_{f\alpha}^{vI} QF_{f\alpha}^{-\rho} \right)^{-1/\alpha}$$

Disaggregated Intermediate Input Demand

$$17. QINT_{\alpha} = ica_{c,\alpha} \cdot QINTA_a$$

$$18. QX_{ac} + \sum_{h \in H} QHA_{ach} \cdot \theta_{ac} \cdot QA_a$$

Output Aggregation Function

$$19. QX_c = \alpha \left[\sum_{a \in A} \delta_a^{vac} \cdot QXAC_{ac}^{-\rho_c ac} \right]^{1/\rho_c} \rho_c^{\alpha-1}$$

First – Order Condition for Output Aggregation Function

III Institution Block

$$20. PXA_{C\alpha} = PX_c QX_c \left[\sum_{a \in A} \delta_a^{vac} \cdot QXAC_{ac}^{-\rho_c ac} \right]_c^{-1/\rho_c} \delta_a^{vac} \cdot QXAC_{\alpha c}^{-\rho_c ac}$$

Output Transformation (CET) Function

$$21. QX_{ac} = \alpha_c^f \left(\delta_a^{vac} \cdot QE_{\alpha c}^{-\rho_c ac} + (1 - \delta_c^f) QD_{\alpha c}^{-\rho_c ac} \right)$$

Export – Domestic Supply Ratio

$$22. \frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1 - \delta_c^t}{\delta_c^t} \right)^{1/\rho_c^t}$$

Output Transformation for Domestically Sold Outputs Without Exports and for Exports without Domestic Sales

$$23. QE_c = QD_c + QE_c$$

Composite Supply (Armington) Function

$$24. QQ_c = \alpha_c^t \left(\delta_c^t QM_c^{-\rho} + QE_c \right)^{-\rho}$$

Infra – Institutional Transfers

$$25. TRII_{ii} = shii_{ii} \cdot (1 - MPS_i) \cdot (1 - TINS_i) \cdot YI_i$$

Household Consumption Expenditures

$$26. EH_h = \left[1 - \sum_{i \in NSDNG} shii_{ih} \right] \cdot (1 - MPS_h) \cdot (1 - TINS_h) \cdot YI_h$$

Factor Income

$$27. YF_{if} = \sum_{a \in A} WF_f \cdot WFDIST_{fa} \cdot QF_{fa}$$

institutional Factor Incomes

$$28. YIF_{if} = shif_{if} \left[(1 - tf_f) \cdot YF_f - trnsfr_{rowf} \cdot EXR \right]$$

Household Consumption Spending on Marketed Commodities

$$29. PQ_c \cdot QH_{ch} = PQ_c \cdot Y_{ch}^m + \beta_{ch}^m \left[EH_h - \sum_{c \in C} PQ_c \cdot Y_{ch}^m - \sum_{a \in A} \sum_{c \in C} PXAC_{ac} \cdot y_{ach}^h \right]$$

Investment Demand

$$30. QINV_c = IADJ \cdot qinv_c$$

Government Consumption Demand

$$31. QG_c = GADJ \cdot qg_c$$

Government Revenue

$$32. YG = \sum_{i \in I} TINS_i \cdot YI_i + \sum_{j \in F} tf_j \cdot YF_j + \sum_{a \in A} tva_a \cdot PVA_a \cdot QVA_a \\ + \sum_{a \in A} ta_a \cdot PA_a \cdot QA_a + \sum_{c \in CM} tm_c \cdot pwm_c \cdot QM_c \cdot EXR + \sum_{c \in CE} te_c \cdot pwe_c \cdot QE_c \cdot EXR \\ + \sum_{c \in C} tq_c \cdot PQ_c \cdot QQ_c + \sum_{j \in F} YIF_{govf} + trnsfr_{govrow} \cdot EXR$$

Government Expenditure

$$33. EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{i \in I} trnsfr_{igov} \cdot \overline{CPI}$$

IV System Constraint Block

Factor Markets

$$34. \sum_{a \in A} QF_{fa} = QFS_f$$

Composite Commodity Markets

$$35. QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c + QINV_c + qdst_c + QT_c$$

Current – Account Balance for the Rest of the World, in Foreign Currency

$$36. \sum_{c \in VCM} pwm_c \cdot QM_c + \sum_{j \in F} trnsfr_{rowf} = \sum_{c \in CE} pwe_c \cdot QE_c + \sum_{i \in I} trnsfr_{irow} + \overline{FSAV}$$

Government Balance

$$37. YG = EG + GSAV$$

3.3 The Characteristics of Household in Northern Region

The classification of households in Northern region into poor and non-poor are performed in this study on using 8136 individuals under 'The 2004 SES Survey: Northern Thailand' and the poverty line (Baht 1163). The results suggest that there were no urban poverty in this region, however, average wage of combined male and female in urban was lower than that of rural area. The average wage of female (Baht 793.5) was lower than that of male (Baht 857.8) in rural area. Table 3.1 shows that the income structure differs greatly between rural households, whose incomes are dominated by agricultural production, and urban households, whose incomes are dominated by formal production factors. The consumption patterns also differ since the agricultural budget share was 17.9% in the urban sector and 27.9% in the rural sector. The income inequality among income groups in Northern Thailand is estimated and reported in Table 3.2

	Non-poor	Poor
Urban		
Average wage male	10619.13	-
Average wage female	9730.62	-
Total Wage	10357.12	-
Schooling year	8.07	-
Rural		
Average wage male	13989.01	793.59
Average wage female	11761.66	857.81
Wage	13252.33	817.71
Schooling year	9.23	5.65
Farm size	39.55	43.46
Combine		
Average wage male	12304.07	793.59
Average wage female	10746.14	857.81
Wage	11804.72	817.71
Schooling year	8.65	5.65
Farm size	38.73	43.46

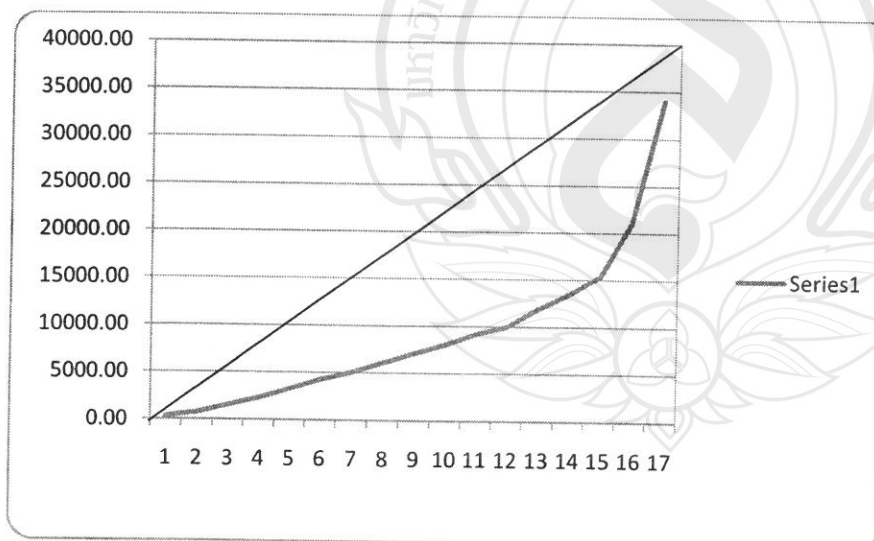
Source: Calculations based on 8136 individuals under the 2004 SES survey.

Table 3.2 Income Inequality in Northern Thailand

Consumption Baht	Frequency	% Frequency	Cumulative Frequency	Cumulative % Frequency	Average	Average %
<=1163	1418	0.1743	1418	0.1743	630	0.0022
1164-1500	215	0.0264	1633	0.2007	1659	0.0057
1501-2000	806	0.0991	2439	0.2998	1762	0.0061
2001-2500	443	0.0545	2882	0.3543	2623	0.0090
2501-3000	281	0.0345	3163	0.3888	2096	0.0072
3001-5000	910	0.1119	4073	0.5007	3544	0.0122
5001-7000	1119	0.1376	5192	0.6382	5277	0.0182
7001-9000	623	0.0766	5815	0.7148	7731	0.0266
9001-11000	936	0.1151	6751	0.8299	9941	0.0343
11001-13000	121	0.0149	6872	0.8447	11917	0.0411
13001-15000	56	0.0069	6928	0.8516	13486	0.0465
15001-17000	411	0.0505	7339	0.9022	15043	0.0518
17001-19000	38	0.0047	7377	0.9068	17613	0.0607
19001-21000	376	0.0462	7753	0.9530	19981	0.0688
21001-23000	6	0.0007	7759	0.9538	21586	0.0744
23001-25000	7	0.0009	7766	0.9546	23460	0.0808
25001-27000	77	0.0095	7843	0.9641	25022	0.0862
27001-29000	6	0.0007	7849	0.9648	27403	0.0944
29001-31000	181	0.0222	8030	0.9871	29997	0.1034
>31000	105	0.0129	8135	1.0000	56131	0.1934
	8135	0.6457			290229	1

Source: Calculations of Author based on 8136 individuals under the 2004 SES Survey.

Figure 3.1 Lorenz Curve of Income Distribution of Northern Thailand



The Lorenz curve (LC) is depicted in Figure 3.1 which is a representation of the cumulative distribution function of the empirical probability distribution of household income of Northern region. The shape of the LC is a good visual indicator for how much inequality for how much inequality there is in an income distribution. As can be seen in Figure 3.1 income distributions among income group are less dispersed i.e. there is little variability among income groups, and thus the LC tends toward the equal distribution line.

3.4. An Aggregated SAM for Thailand

The model is based on information at the household level, an aggregate SAM can be derived from Table 3.3. In this aggregated SAM, the labor factor is disaggregated into three types of work: agricultural family work, informal wage work and formal wage work. This matrix summarizes the model accounts, which include 8235 households³. Thus, there are thousands of household, factor, and activity accounts in the full model SAM.

Household incomes come from various sources: agriculture, informal activities, formal wages, dividends of formal capital, income from sharecropping, and transfers from other households and from the government. Apart from income from the formal sector and transfers, all income is endogenous in the model. Part of total income is saved, and savings rates are endogenous. The implicit assumptions are that government savings and total investment are flexible, that the exchange rate is fixed, and foreign savings are flexible.

The model is static and thus no change in investment with three sectors: agricultural, manufacturing, and transport, communication. The agricultural sector produces two types of good services. A tradable good that is exported and a non-tradable good. The two other sectors each produce one type of good. The agricultural (informal sector) good is a non-tradable good, while the formal good is tradable. The production factors are labor, land and formal capital. Total labor supply is endogenous and determined at the household level. The levels of agricultural and informal production are also determined at the household level, as is the agricultural labor demand. Informal labor demand is determined at the aggregate level by the demand for informal goods and for agricultural wage labor. The supply of informal labor is determined at the individual level

³ To estimate the required parameters of the CGE model, the field surveys on the Household Socio-Economic Survey were also conducted in Phayao and Sukhothai Provinces before a CD-ROM of 'The 2004 SES Survey: Northern Thailand' was released. The results are not reported due to inefficiency of the regression results.

through the labor allocation model and formal labor demand is exogenous. Capital stocks are specific and fixed for agricultural and formal activities, while the capital used in the informal sector is integrated into activities. Capital and labor are substitutable in agricultural technology when represented through a Cobb-Douglas function. The formal labor market operates with exogenous demand at fixed prices. The allocation of work between agricultural and informal production is determined at microeconomic level according to the labor allocation model.

3.5 Household Income and Consumption Functions

To model labor allocation of households among various activities, three sectors are considered: formal, informal, and agricultural. Individuals can be wage workers or self-employed. Thus, three types of activities include: i) agricultural activity, ii) informal activity, iii) wage-earning in the formal sector. The model is explicitly explores agricultural households as producers. Traditionally, CGE models represent the behavior of sectors that hire workers and contribute value-added through the production factors. However this specification does not take into account the heterogeneity of producers, nor does it represent interactions between production and consumption decisions.

In modeling the consumption function, the demand for leisure, and consequently labor supply, is determined by the maximization of utility. The separability of demand and labor supply behavior depends on the existence and operation of the labor market: if it and functions perfectly, then the household independently maximizes profits and utility. Non-agricultural households supply informal and/or formal wage work. Their demand for labor and supply of labor depend on their wage rate and income apart from labor income.

Table 3.2 shows some structural characteristics of the households in Northern Thailand. These characteristics partly determine the labor productivity of the households in the agricultural and informal activities and hence income of household. Other characteristics, not observed, also contribute to heterogeneity among the households.

Table 3.3 SOCIAL Accounting Matrix of Thailand: 1988

SECTORS	PRIMAA	AINDUS	MANUA	UTICONA	TRADEA	SER-A	PRIMAC	AINDUSC	MANUC	UTICONC	TRADEC	SER-C	LAB	CAP
PRIMA-A							1148980							
AINDUS-A								1362878						
MANU-A									4326345					
UTICON-A										719513				
TRADE-A											1677846			
SER-A												2132057		
PRIMA-C	92547	362524	235059	49682	345	129329								
AINDUS-C	46025	376244	23525	0	769	107806								
MANU-C	190389	111879	2182141	207441	237283	169137								
UTICON-C	21025	30164	130647	36930	33616	123720								
TRADE-C	105951	110589	508591	88207	162183	126278								
SER-C	66878	52249	275907	42413	241219	203525								
LAB	95787	95787	362888	136124	135758	536704								
CAP	421771	132049	500270	142260	835148	670803								
A-HHD													202476	297923
G-HHD													425463	64894
N-HHD													830051	1237662
ENT-G														124496
ENT-P														897921
GOV														79405
YTAX														
ITAX	13665	91393	107317	16456	31525	64755	9235	6355	68802	93		4003		
TAR							1963	6117	50099	6		3852		
S-I							161597	83843	1432424	3784	71078	249579		
ROW														
TOTAL	1148980	1362878	4326345	719513	1677846	2132057	1321775	1459193	5877670	723396	1748924	2389491	1457990	2702301

Source: Calculations based on Li, Jennifer Chung-I, "A 1998 Social Accounting Matrix (SAM) for Thailand", TMD Discussion Paper No.95, Washington DC: International Food Policy Research Institute.

Table 3.3 SOCIAL Accounting Matrix of Thailand: 1988

Contd.

SECTORS	A-HHD	G-HHD	N-HHD	ENT-G	ENT-P	GOV	YTAX	ITAX	TAR	S-I	ROW	TOTAL
PRIMA-A												1148980
AINDUS-A												1362878
MANU-A												4326345
UTICON-A												719513
TRADE-A												1677846
SER-A												2132057
PRIMA-C	70608	27668	113860			831				15633	223689	1321775
AINDUS-C	189171	92511	356467			55				-24282	290902	1459193
MANU-C	177269	86691	334041			22112				493031	1666256	5877670
UTICON-C	9787	4787	18445			7364				295545	11366	723396
TRADE-C	34720	42795	165657			13136				100926	289891	1748924
SER-C	114914	141634	548255			457207				3675	241615	2389491
LAB												1457990
CAP												2702301
A-HHD						11443					19820	531662
G-HHD						2945					3826	497128
N-HHD						36068					35199	2138980
ENT-G												124496
ENT-P	1011	13903	28848			18976					78981	1039640
GOV							276736	413599	62037		20677	852454
YTAX	2576	41166	94444	3419	34199	104351						276736
ITAX												413599
TAR												62037
S-I	-68394	45973	478963	90297	632621	281451					390300	1851211
ROW					302668	866				966683		2882222
TOTAL	531662	497128	2138980	124496	1039640	852454	276736	413599	62037	1851211	2882222	

Source: Calculations based on Li, Jennifer Chung-I, "A 1998 Social Accounting Matrix (SAM) for Thailand", TMD Discussion Paper No.95, Washington DC: International Food Policy Research Institute.

Notations:Sector Activity

AAGR1	agricultural activity 1
AAGR2	agricultural activity 2
AAGR3-EX	agricultural activity 3 (only exports)
AIND	industrial activity
ATTRA	trade and transportation services activity
AOSER	other services activity

Commodities

CAGR1	agricultural commodity 1
CAGR2	agricultural commodity 2
CAGR3-EX	agricultural commodity 3 (only exports)
CIND	industrial commodity
CTTRA	trade and transportation services commodity
COSER	other services commodity
CIMP	imported commodity (no domestic production)

Trade transactions

TRNSC-E	transactions costs for exports
TRNSC-M	transactions costs for imports
TRNSC-D	transactions costs for domestic sales of output

Factors

LAB	labor
CAP	capital

Domestic non-government institutions

ENT	enterprises
HURB	urban households
HRUR	rural households

Taxes

YTAX	direct income tax collection
ATAX	activity tax collection
VATTAX	value-added tax collection
STAX	sales tax collection
TAR	tariff collection (import tariff)
ETAX	export tax collection

Other accounts

GOV	government
ROW	rest of the world
S-I	savings-investment
DSTK	stock changes

Wage Function

This section models household consumption behavior by using household-level data for 2004. Three specification of wage function are estimated to learn more about consumption behavior of household in Northern Thailand. This objective is to analyze major determinants of wage income applying econometric estimations of the wage functions. The empirical model applied in this study is based on the Working-Leser model. The original form of the Working-Leser model was discussed by Working (1943) and Leser (1963). The other studies contributed in this area can be found in the studies Bodkin and Hsiao (1996) and Deaton and Muellbauer (1980).

Model specification in log-linear of the wage function can be expressed as follows:

$$1. \quad y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5$$

where

y = log wage income of household head;

x_1 = log age of household member

x_2 = log of household size;

x_3 = number of year attended under education attainment;

x_4 = dummy variable for male; and

x_5 = dummy variable for urban.

This research investigates the factors determining household income based on household characteristics such as occupation, assets, skilled and unskilled labor and village characteristics. It also examines the development of the government's micro and macro-economic policy changes under economic liberalization and their impact on household income distribution and poverty eradication in Northern Thailand. The model shown in Equation 1 can be estimated by the ordinary least squares (OLS). The CGE micro-simulation model is applied using household data with explicit treatment of heterogeneity of skills, labor and consumption preferences at household level, allowing for an endogenous determination of relative prices. The model's parameters are estimated using data from 'The 2004 Household Socio-Economic Survey (SES): Northern Region'. The consumption patterns and income structures of 1,8136 household members in Northern Thailand were investigated econometrically using behavioral equations in the model. Various scenarios of

simulation are carried out to examine the comparative static of the model and the impact of different growth strategies on poverty and inequality are explored. Some microeconomic functions are estimated on cross-sectional data: the agricultural production function, the income wage and consumption function at individual level.

Model and Estimation Results

The logarithm wage equations are at the individual level based on number of observation of 8127 from sample size of 18136 individuals under survey. Three specifications of wage functions are estimated in this study based on its major determinants; age, education, gender (male and female), location: (urban and rural) and firm size.

$$1. y = -24.97 + 83.9316x_2 + 401.90x_3 + 1913.765x_4$$

$$(-0.033) \quad (6.692) \quad (35.396) \quad (5.366)$$

$$R^2 = 0.1439, \text{ DW} = 1.82074, \text{ Number of observations} = 8127$$

$$2. y = 5.862 + 0.307 \log x_2 + 0.732x_3$$

$$(33.112) \quad (7.595) \quad (44.097)$$

$$R^2 = 0.2205 \text{ DW} = 1.7457, \text{ Number of observations} = 7299$$

$$3. y = 1.59x_1 + 0.084x_2 + 0.068x_3 + 0.884x_4 + 0.012x_5$$

$$(39.25) \quad (78.76) \quad (52.53) \quad (20.45) \quad (13.31)$$

$$R^2 = .07925, \text{ DW} = 1.7415, \text{ Number of observations} = 8122$$

where y = Wage income of household members

x_1 = Dummy (male)

x_2 = Age of individuals

x_3 = Education of household members

x_4 = Dummy (urban)

x_5 = Farm size (land acre, Rai)

The results show that the coefficients of education have the expected signs in the two equations and these coefficients are also significant. The impacts of urban dummy are positive in

the two regressions but significant only in the second. In addition, the coefficients of education appear 2 times higher than that of age. The coefficient of the gender variable of the head of household is significant and positive, indicating that men have a significantly higher average wage rate than that of the women. Figures in parenthesis are t-values.

This study sought to present a household consumption model of Northern Thailand, with an aim of generating a better understanding of the factors that determine household consumption in the long run and the purpose of forecasting consumption expenditure growth. The specific objectives of the study were to determine the relationship that exists between income and consumption, in particular, the extent to which the household characteristics influence the households' consumption.

The results also point out that impact of firm size on household income is also positive and significant. The consumption functions of household of Northern region are also modeled using the econometric estimations. From these estimations it is found that type of employment, location, household size and consumption on capital goods constitute major explanatory variables of the regression.

Consumption Function

This study sought to present a household consumption model of Northern Thailand, with an aim of generating a better understanding of the factors that determine household consumption in the long run and the purpose of forecasting consumption expenditure growth. The specific objectives of the study were to determine the relationship that exists between income and consumption, in particular, the extent to which the household characteristics influence the households' consumption.

The results also point out that impact of firm size on household income is also positive and significant. The consumption functions of household of Northern region are also modeled using the econometric estimations. From these estimations it is found that type of employment, location, household size and consumption on capital goods constitute major explanatory variables of the regression.

The findings reveal the existence of a long run relationship between consumption, income and wealth. This suggests that consumption is significantly determined by income in this region. Income seems to impact consumption more in Northern region as it is evident from the elasticity of consumption functions.

$$4. \quad c_1 = 1.518x_1 + 0.856x_2 + 1.346x_3$$

(28.77) (61.08) (82.235)

$$R^2 = -2.8828, \quad DW = 1.521, \quad \text{Number of observations} = 8135$$

where, y_1 = Consumption

x_1 = Dummy (urban)

x_2 = Household size

x_3 = Dummy (employment type)

Consumption elasticity obtained for household size is 0.856 percent and that obtained for employment type is 1.346 percent. This implies that 85 percent of the consumers are sensitive to changes in household size while 134 percent of the consumers are sensitive to changes in employment type in the long run. Urban dummy is also highly significant in determining consumption as expected.

3.6 The Impact of Economic Liberalization on Poverty and Inequality: Micro-Macro Simulation Model Results

The impact of economic liberalization on poverty and inequality of Northern Thailand is analyzed focusing on trade and investment openness scenarios. The comparative statics of the model is examined through the analysis of the results at the aggregate level that makes it possible to emphasize the importance of the general equilibrium effects.

The microeconomic data are obtained from a CD Rom of “The 2004 Household Socio-Economic Survey (SES): Northern Thailand”; a national survey which covered 8808 households. After individual households were aggregated into SAM, the aggregated SAM was used as the base for a CGE model applied to Northern Thailand. Economic liberalization scenarios and their impacts on poverty are investigated using CGE Modeling. The trade liberalization policy simulation scenarios conducted in this study are summarized as follows:

1. TARCUT 20% cut in import tariff
2. INVSTINC 20% increase in capital in industrial commodity
3. INVSTINA 20% increase in capital in industrial (agro-industrial)commodity
4. PWEAGR 20% increase in agriculture export price
5. PWMICR 25% increase in import price
6. EXCHR 10% depreciation in Thai Baht

The effects of each trade liberalization policy options are reported in Tables 3.4A and 3.4B in the context of percent change in individual variables under study.

The first four simulations relate to an increase in real sector value added because these encourage industrial imports and investment into agriculture sector and agro-based industries. Given model structure, formal value added comes from two production factors labor and capital. In the first simulation, a 20% reduction in import tariff is conducted. Trade sector growth corresponds to the creation of new importing activities and thus to an increase in the capital stock and employment. It is simulated through an increase in income coming from dividends for shareholders, and from formal labor demand.

In the second simulation (INVESTINC), an increase in capital stock in agro-based industry was performed and it had no effect on GDP. The value added of formal capital increases as in the preceding simulation. The direct effect of this policy is an increase in the incomes of households receiving formal wages. Compared to the preceding simulation, this policy option is more favorable because the effect of impacts on household income is larger than the one under tariff reduction.

The third simulation a 25% increase in investment in primary agriculture (INVESTINA) can be considered as an increase in total factor productivity under primary agriculture sector. This leads to an increase in agricultural income and agricultural production. However, the effect on household income under this policy option is lower compared to simulation-3.

The following simulations relate to the foreign trade agricultural sector. The fifth simulation (PWEAGR) considers a 25% increase in agriculture exports. This leads to an increase in agricultural income and agricultural production. In the next simulation, a 25% increase in import price: (PWMINCR) leads to a decline in GDP. The notations mentioned in Tables 3.4A and 3.4B are expressed below.

GDPMP1	GDP at market prices (from spending side)
PRVCON	private consumption
GOVCON	government consumption
INVEST	investment
NITAX	net indirect taxes
GDPFC	GDP at factor prices
GDPMP2	GDP at market prices (from income side)
HURB	urban households
HRUR	rural households
CTTRA	trade and transportation services sector



Table 3.4A Trade Liberalization Policy Simulation Results:
Impact on Household Income and Macroeconomic Fundamentals
TARCUT, INVESTINC and INVESTINA

	BASE	TARCUT	$\Delta\%$		
GDPMP1	46341.4	46286.5	-0.119		
PRVCON	25259.5	25227.0	-0.129		
GOVCON	5001.0	4994.9	-0.122		
INVEST	8828.1	8811.8	-0.185		
EXPORT	27239.4	27239.2	-0.001		
IMPORT	-19986.6	-19986.4	-0.001		
NITAX	512.9	294.6	42.550		
GDPFC	40652.3	40651.9	-0.001		
GDPMP2	41165.2	40946.6	-0.531		
YHREPP: Impact on household income ($\Delta\%$)					
HURB			0.0009		
HRUR			0.0009		
	BASE	INVEST INC	$\Delta\%$	INVEST INA	$\Delta\%$
GDPMP1	46341.9	46286.9	-0.119	46214.0	-0.157
PRVCON	25259.7	25227.1	-0.129	25184.0	-0.171
GOVCON	5000.9	4994.9	-0.122	4986.7	-0.162
INVEST	8828.6	8812.2	-0.185	8790.6	-0.246
EXPORT	27239.0	27238.9	0.000	27238.7	-0.001
IMPORT	-59958.5	-19986.2	66.667	-19986.0	-0.001
NITAX	890.4	890.7	0.031	891.1	0.040
GDPFC	40652.3	40652.0	-0.001	40651.7	-0.001
GDPMP2	41542.7	41542.7	0.000	41542.7	0.000
YHREPP: Impact on household income ($\Delta\%$)					
HURB			0.0017		-0.001
HRUR			0.0018		-0.001

Table 3.4B Trade Liberalization Policy Simulation Results:
Impact on Household Income and Macroeconomic Fundamentals
(PWEINCR, PWMINCR, and EXCHR)

	BASE	PWEINCR	$\Delta\%$	PWMINCR	$\Delta\%$
GDPMP1	46341.9	47027.6	1.480	41254.0	-10.979
PRVCON	25259.7	25237.5	-0.088	25205.8	-0.213
GOVCON	5000.9	4996.8	-0.083	4990.8	-0.203
INVEST	8828.6	8816.0	-0.143	8801.4	-0.308
EXPORT	27239.0	27962.8	2.657	27238.5	-0.002
IMPORT	19986.3	-19985.5	-0.004	-24982.4	24.998
NITAX	890.4	890.6	0.018	1046.0	17.467
GDPFC	41542.7	40651.8	-2.145	40652.3	0.000
GDPMP2	41542.7	41542.5	-0.001	41698.3	0.374
YHREPP: Impact on household income ($\Delta\%$)					
HURB			-0.001		-0.001
HRUR			-0.001		-0.001
	BASE	EXCHR	$\Delta\%$		
GDPMP1	46341.586	47011.731	1.446		
PRVCON	25259.674	25227.175	-0.129		
GOVCON	5000.947	4994.855	-0.122		
INVEST	8828.575	8812.271	-0.185		
EXPORT	27237.89	29960.712	9.996		
IMPORT	-19985.5	21983.282	9.996		
NITAX	890.424	952.714	6.996		
GDPFC	40652.286	40651.965	-0.001		
GDPMP2	41542.71	41604.679	0.149		
YHREPP: demand for factor from activity CTTRA ($\Delta\%$)					
HURB			0.0007		
HRUR			0.0008		

Figure 3.2 The Effect of TARCUT on Household Income and Macroeconomic Fundamentals

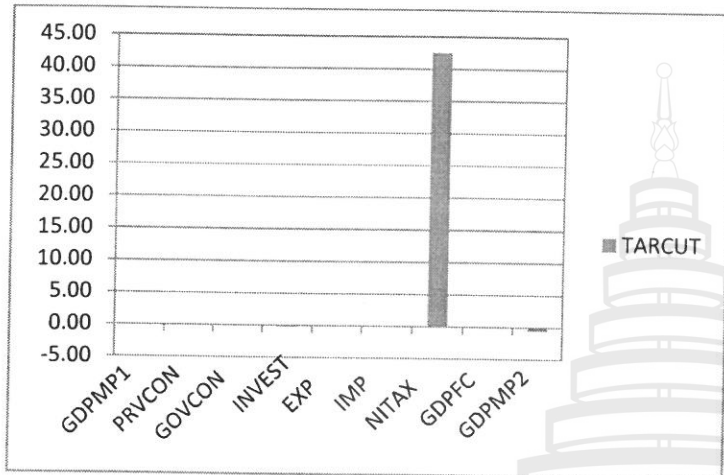


Figure 3.3 The Effect of INVESTINC on Household Income and Macroeconomic Fundamentals

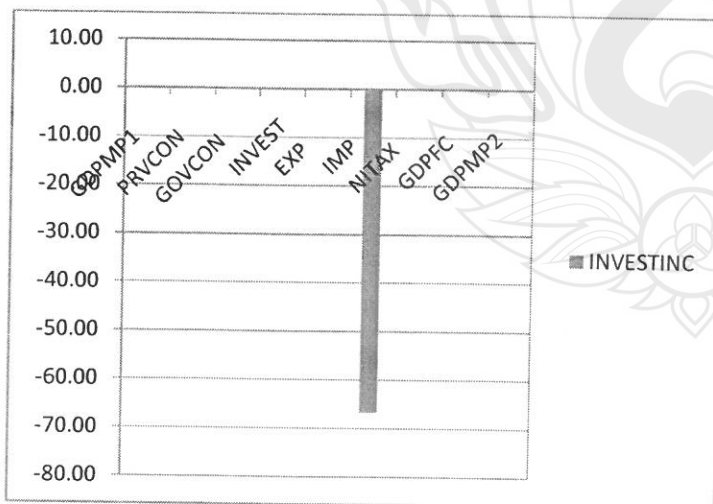


Figure 3.4 The Effect of INVESTINA on Household Income and Macroeconomic Fundamentals

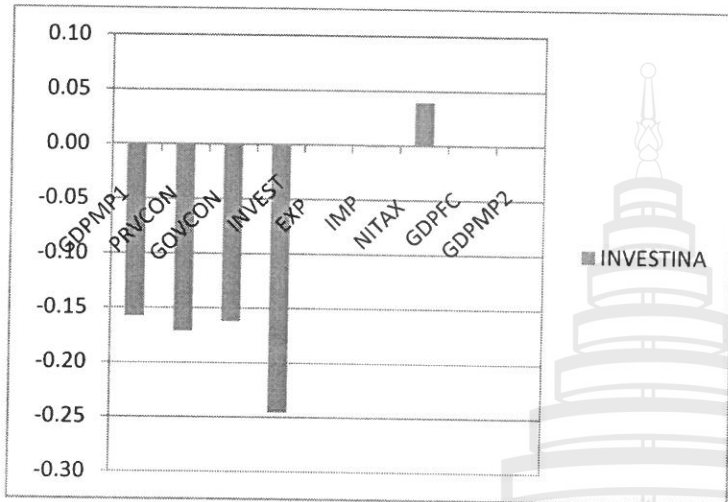


Figure 3.5 The Effect of PWEINCR on Household Income and Macroeconomic Fundamentals

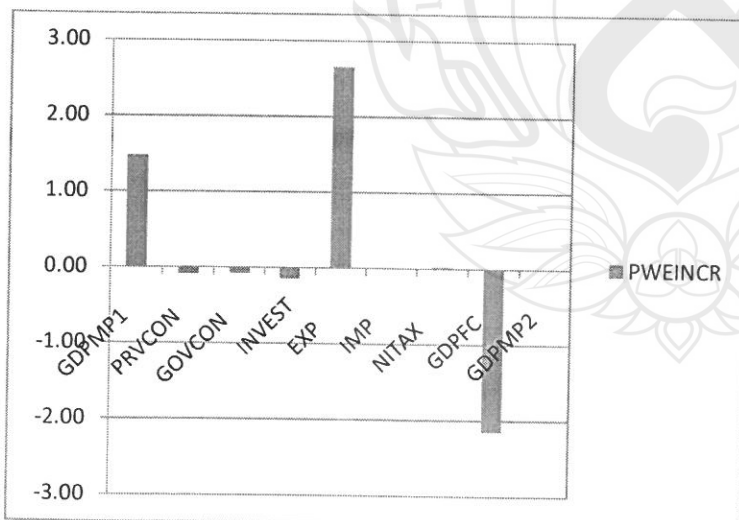


Figure 3.6 The Effect of PWMINCR on Household Income and Macroeconomic Fundamentals

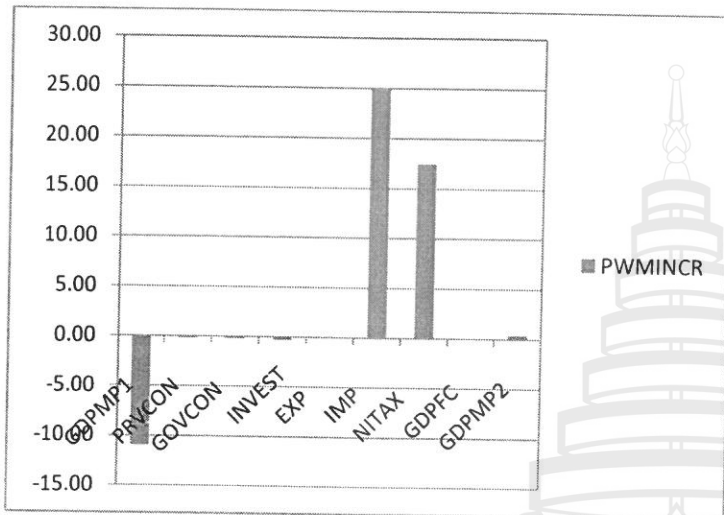
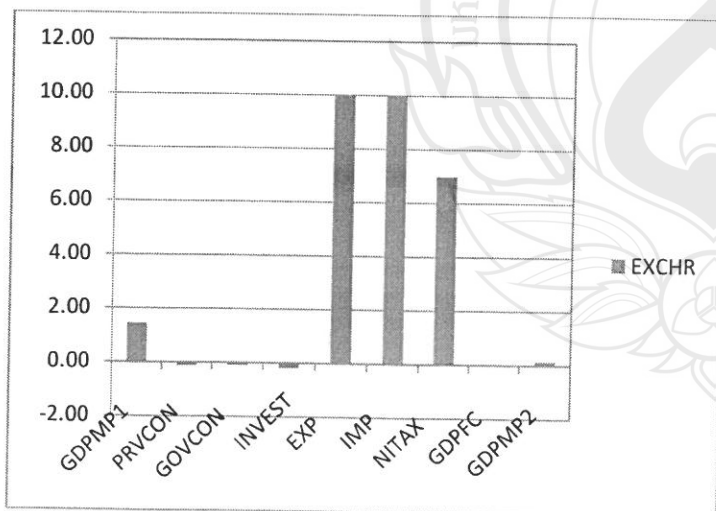


Figure 3.7 The Effect of EXCHR on Household Income and Macroeconomic Fundamentals



In the last simulation, a 10% depreciation (EXCHR), (Thai Baht exchange rate against the U.S dollar,) added an increase in the factor demand in trade and transportation services sector (CTTRA) sector only. This increase in incomes induces an increase in the demand for factors (labor and capital) in the production of CTTRA. The effect of a 10% depreciation in Thai Baht on household income is positive. It also increases both exports and imports by 10%. The increase in GDP indicated 1.5%.

In the six simulations (PWMINCR), an increase in import price, the direct effect of this policy is a negative effect on the incomes of households receiving formal wages. The terms of trade effect due to changes in export and prices contributes to a decrease in inequality. The fall in the rate of poverty is more significant in the rural than in the urban sector, which is also explained by the evolution of the terms of trade.

The impacts of six policy scenarios are presented in Figures 3.2 to 3.8. The first three are positive shocks and correspond to the two growth shocks of the formal value added and to the increase in the total factor productivity in the agriculture sector. The other three shocks are negative and symmetrical shocks.

In brief the findings under this study bear out the contribution of this approach to the analysis of the impact of economic liberalization on poverty and inequality in Northern Thailand. The results shows that the redistribution affects of the general equilibrium mechanisms are significant. The results also highlight the inter-linkages in the mechanisms connecting macroeconomic shocks and income distribution. The impact of a growth shock on each household is complex because it depends on current status of households, the structural characteristics of each household and the structural characteristics of the economy.

These income effects can be minimized using proactive policies that give access to education and credit to poor households. Thus redistribution among household groups is critically important. Analyzing the results through the filter of a classification into distinct socio-economic groups shows that the evolution of the poverty and inequality indicators can differ among income groups.

There are some limitations in the use of the model. First, the extreme aggregation of goods and sectors does not allow studying the impact of more specific policies on poverty and income distribution. Second, the economic impact of certain macroeconomic policies or liberalization generally depends on the tradability of the goods produced by the economy. One of the

contributions of this research report is the capacity to take into account these structural effects through disaggregation of activities and goods using micro-simulation model.

It is widely accepted that 'poverty targeting' can be performed in several ways: mostly by economic activity, by region, by state, by community, by employment status, and by gender. These income effects can be minimized using proactive policies that give access to education and credit to poor households. Thus redistribution among household groups is critically important. Analyzing the results through the filter of a classification into distinct socio-economic groups shows that the evolution of the poverty and inequality indicators can differ among income groups.



Chapter 4

Conclusion and Recommendations

4.1 Summary of Findings

This study investigates income inequality and poverty in Northern Thailand based on four main aspects as follows:

- (I) a profile of poverty, poverty status and change of poverty status,
- (ii) income inequality and household characteristics such as occupation, assets, skilled and unskilled labor, employment by type and village characteristics.
- (iii) income inequality and housing characteristics such as: age, household size, sex of household head, number of wage earners, disability, education attainment, healthcare and social welfare received;
- (iii) the association between determinants of household income and consumption based on wage and income functions; This section examines four key aspects of poverty: location, education status, welfare and occupation by household type and
- (iv) impact of economic liberalization on household income and poverty.

The findings suggest that Thailand experienced a decline of poverty during the period: 1999-2006. Average monthly income of households in Northern Thailand was 10,885 Baht, compared with a national average of 16355 Baht in 2004. In 2007, average monthly income of households in Northern Thailand indicated 13568 Baht, while a national average was 18660 Baht. It showed that nationwide household earned on average 1386 Baht per month in 2006. The average income per household increased 11.5 percent during the period under study. The Gini coefficient of household declined from 0.428 percent in 2002 to 0.418 percent in 2007. The highest 10 percent of households earned almost 49 percent of income, while the lowest 10 percent of households earned a constant share of 5.7 percent in 2007. The national level average income grew and poverty declined during the period under study. However the average income of Northern Thailand groups faced substantially lower growth.

The total number of people in poverty declined from 11 million in 1998 to 6.1 million in 2006. The poverty gap declined from 5.1 million to 1.8 million. Income distribution in Thailand improved in better shape since severity poverty declined nationally from 2 percent in 1998 to 2.5 percent in 2006 with a two folds declined. The headcount index fell 18.8 percent in 2002 to 9.6

percent in 2006. However, it needs to examine both the composition of growth share by the poor and the distribution of income so that poverty can be targeted in the processes. The share of population in poverty declined from 43 percent to 34 percent in Northern Thailand between 2002 and 2007 because of a 34 percent increase in mean per capita household expenditures. Mean per capita household expenditure grew by 41.6 percent and the average income of household increased by 46.6 percent during the periods: 1988 and 2006. People living at this level and below are classified as "poor."

In examining major source of income, wages and salaries form a main source of income; 4067 Baht followed by net profit from non-farm business 2645 Baht and net profit from farming 2332 Baht in the Northern region. Income from economically inactive was mainly from assistance from other persons outside the household or from government 1282 Baht, followed by income from property 222 Baht. The other source of earning was from assistance from government and organization in the form of welfare/goods and services 83 Baht.

The expenditure patterns exhibit that a majority of households in the study communities were net buyers of basic food staples. Portion of the poor in the Northern region is higher than in the Southern or Middle regions. Such communities mostly in rural areas are characteristically lack of schools, hospitals, welfare facilities and access roads. The existence of the regional, sectoral and location specific dimensions of poverty, the targeted interventions and policies oriented toward equity are critical for reaching specific groups of the poor.

About 63.3 percent of households in the whole country were indebted. The top two categories were for household consumption (33.3%) and for buying house/land (31.3%). Using credit for agricultural was 15.2 percent, followed by the debt on non-farm business (14.4%), where the loan for education was only 2.7 percent. It was found that households of high income also had a considerable amount of debt as well as high expenditure.

There were significant regional differences reflecting the differing economic structures and poverty. Northern region accounted for 46 percent of the lowest income group while country average of lowest income group show 31 percent in 2006. In addition the lowest income group in municipal area accounted for 20.3 percent while that of lowest income group in non-municipal area indicated 79.7 percent in the same year.

The survey result exhibited that nationwide household expenditure was average 14,500 Baht per month. About 33.0 percent was mainly spent on food and beverages (of which 1.3 percent was

paid for alcoholic drinking), followed by expense on housing and household appliances (20.1%), vehicles and transportation (18.2%), personal supplies/clothing/footwear (5.6%), communication (3.4%), recreation and entertainment (2.5%), education (2.1%), and activities related to religious (1.0%). In addition, household had non-consumption expenditure such as expenses on taxes, gifts, insurance lottery, and interest payment, which was about 12.2 percent.

. The share of food in total per capita expenditure was 66 percent in 2007 and the food share was remained stable, but the poorest households show a decrease in expenditure on food decreased during the period. Data from the SES indicate that the food share in total consumption decline from 62% to 59% from 2002 to 2007. Further analysis shows that, between 2002 to 2007, there were a decline in the share of food in total consumption at all levels of income.

The households' income inequality associated with characteristics is analyzed on the basic of household size, number of wage earners, disability, healthcare and social welfare received. Tables 2-15 and 2.17 summarize the age distribution and social services. It is striking that the female headed households which make up 10 percent of all households contribute only 5 percent to rural poverty and 8 percent to urban. In households headed by the young 16-25 years - only 20 percent were poor in 2004. Such households seem to be poor in 1992. But the incidence of poverty was lower in 2007 than in 2004 for most other households.

The results highlight the income inequality of households, of single male headed households in the Northern region areas, and the constraints on women's educational and employment opportunities as reflected in the type of household. In the Northern and middle zones, one-third of all households are female headed but only one-sixth male headed. Female headed households constituted 31.4 percent of total households of Northern region, while male headed households showed 68.6 percent as shown in Table 2.15.

While the poor spend proportionately more of their expenditures on food, the non-poor spend 3.6 to 4.5 times as much for food. The incidence of poverty is higher in larger households. How the different characteristics of heads of households and the regional location of the population affected the incidence of poverty in 2004 and 2007 is shown in Table 2.7. Rural populations are significantly poorer than urban. Households are headed by a man with no formal education, and only 6 percent have completed primary education.

In 2007 number of household which earned average income less than 5000 Baht indicated 1.27 million. Average income varied from Baht 630 in the Northern region to Baht 937 in the

Southern region. In the same year, income distribution between municipal and non-municipal area total population and there were considerable regional variations in urbanization and in average expenditure per capita in urban areas. There were also significant differences in average expenditures in these regions. The overall income inequality in the Northern region is due largely to income inequality between urban and rural, and much less to income inequality between households within rural area.

The classification of households in Northern region into poor and non-poor are performed in this study on using 8136 individuals under 'The 2004 SES survey: Northern Thailand' and the poverty line (Baht 1163). The results suggest that there were no urban poverty in this region, however, average wage of combined male and female in urban was lower than that of rural area. The average wage of female (Baht 793.5) was lower than that of male (Baht 857.8) in rural area.

The Lorenz curve dispersed tends toward the equal distribution line.

This rise in household expenditures was the result of a resumption of economic growth which was broad based but not evenly shared among income groups. But the incidence of poverty was lower in 2007 than in 2004 for most other households. Average monthly income of households in Northern Thailand was 10,885 Baht, compared with a national average of 16355 Baht, in 2004. In addition, average monthly wages of individuals was 9591 Baht, which reached far above the national poverty line of 1163 baht per month.

. The consumption patterns and income structures of 8235 individuals from sample of 18136 in Northern Thailand were investigated econometrically using behavioral equations in the model. In other words, the education effect of education i.e., the return from education is minimal. To enhance the education benefit for the poor, it is necessary to design particularly primary education curricula to provide knowledge of income earning skills for the poor.

The results show that the coefficients of education have the expected signs in the two equations and these coefficients are also significant. The impacts of urban dummy are positive in the two regressions but significant only in the second. In addition, the coefficients of education appear 2 times higher than that of age. The coefficient of the gender variable of the head of household is significant and positive, indicating that men have a significantly higher average wage rate than that of the women.

The major factors influencing wages of individuals are gender, age, education, urban or rural habitation and the size of firm.

The results also point out that impact of firm size on household income is also positive and significant. The consumption functions of household of Northern region are also modeled using the econometric estimations. From these estimations it is found that type of employment, location, household size and consumption on capital goods constitute major explanatory variables of the regression.

This suggests that consumption is significantly determined by income in this region. Income seems to impact consumption more in Northern region as it is evident from the elasticity of consumption functions. Consumption elasticity obtained for household size is 0.856 percent and that obtained for employment type is 1.346 percent. This implies that 85 percent of the consumers are sensitive to changes in household size while 134 percent of the consumers are sensitive to changes in employment type in the long run. Urban dummy is also highly significant in determining consumption as expected

The findings suggest that the major economic reforms of the 2000s, particularly the liberalization of international trade, investment and foreign exchange has led to increases not only in overall household incomes but benefited both the urban and rural poor.

The findings of the present research confirm that while women play an essential and dynamic role in performing socio-economic activities, they remain relatively disadvantaged in terms of equal access to health, education, financial and agricultural extension services. With a particular focus under this research, Basic Education is a major determinant of household income and constitute critical factor in overcoming poverty. Since poverty tends to be concentrated in poor communities, targeted efforts are needed, both to induce growth and to provide social services and infrastructure.

In the first simulation, a 20% reduction in import tariff is conducted. Trade sector growth corresponds to the creation of new importing activities and thus to an increase in the capital stock and employment. In the second simulation (INVESTINC), an increase in capital stock in agro-based industry was performed and it had no effect on GDP. The value added of formal capital increases as in the preceding simulation. This policy option is more favorable because the effect of impacts on household income is larger than the one under tariff reduction.

The third simulation a 25% increase in investment in primary agriculture (INVESTINA) leads to an increase in agricultural income and agricultural production. However, the effect on household income under this policy option is lower compared to simulation-3.

The fifth simulation (PWEAGR) considers a 25% increase in agriculture exports. This leads to an increase in agricultural income and agricultural production. In the next simulation, a 25% increase in import price: (PWMINCR) leads to a decline in GDP.

In the last simulation, 10% depreciation (EXCHR), added an increase in the factor demand in trade and transportation services sector. This increase in incomes induces an increase in the demand for factors (labor and capital) in the production of CTTRA. The effect of 10% depreciation in Thai Baht on household income is positive. It also increases both exports and imports by 10%. The increase in GDP indicated 1.5%.

In the six simulations (PWMINCR), an increase in import price, the direct effect of this policy is a negative effect on the incomes of households receiving formal wages. The impacts of six policy scenarios are presented. The first three are positive shocks and correspond to the two growth shocks of the formal value added and to the increase in the total factor productivity in the agriculture sector. The other three shocks are negative and symmetrical shocks.

In brief the findings under this study bear out the contribution of this approach to the analysis of the impact of economic liberalization on poverty and inequality in Northern Thailand. The results also highlight the inter-linkages in the mechanisms connecting macroeconomic shocks and income distribution.

It is widely accepted that 'poverty targeting' can be performed in several ways: mostly by economic activity, by region, by state, by community, by employment status, and by gender. These income effects can be minimized using proactive policies that give access to education and credit to poor households. Thus redistribution among household groups is critically important. Analyzing the results through the filter of a classification into distinct socio-economic groups shows that the evolution of the poverty and inequality indicators can differ among income groups.

There are some limitations in the use of the model. First, the extreme aggregation of goods and sectors does not allow studying the impact of more specific policies on poverty and income distribution. Second, the economic impact of certain macroeconomic policies or liberalization generally depends on the tradability of the goods produced by the economy. One of the contributions of this research report is the capacity to take into account these structural effects through disaggregation of activities and goods using micro-simulation model.

4.2 Policy Implications and Recommendations

Several main findings have direct operational implication on prioritizing poverty alleviation policies and practices. First, economic growth obtained during 2002 and 2007 attributed significantly to socio-economic conditions in both urban and rural areas of the Northern Region and other regions. The research investigates poverty in both aspects: income poverty and consumption poverty analyzing both income and expenditure patterns overtime.

The poverty profile and the evolution of poverty between 2002 and 2007 show clearly that growth is fundamental to the poverty reduction, but the composition of growth is also important. Important geographical and sectoral concentrations of poverty cannot be reduced unless the pattern of growth is changed to reflect consumption patterns of poor so that the poor in urban and rural areas can share benefits in the growth process in the context of inclusive growth. By definition, the inclusive growth demonstrates the growth in which poor can share benefits of growth for several decades.

The poor tend to reside in poor communities, where their economic options are limited; thus to access to social services, special efforts are needed to identify these poor communities and to design interventions. Government needs to make a firm commitment to place poverty alleviation in apparel with its growth strategy. Stimulating private sector economic activities through economic liberalization was successful in raising living standard in the Northern Region. Based on this experience, an integrated regional strategy, taking into account of the local socio-economic structure, may prove to be effective in achieving economic growth.

The more important results can be summarized as follows.

The most important changes in the degree of inequality took place mostly at the lower end of the income distribution. Another important point emerging from this research is the evidence that liberalization scenarios have had positive impacts on households' incomes with a varying degree. Finally it is observed that improvements in micro-economics aspects of household that linked substantially with the macro-economic fundamentals found under the simulation model results should be tailored for improving income distribution in the Northern Thailand.

Three inter-related development challenges that are key to both welfare improvement for the general population and to poverty reduction in particular. First, it has to establish a viable and stable macroeconomic framework and to streamline the incentive regime towards regional development. Second, it needs to pursue the poverty targeting and establish an enabling

environment with accountability, transparency and various forms of transfer of resource to poor. Third, it needs to adopt sectoral policies and re-arrange priorities in public expenditures to promote efficient economic growth, increase productivity and income of households focusing on rural areas.



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APPENDIX: CGE MODEL NOTATIONS¹

PMc = import price in LCU (local-currency units) including transaction costs,

$pwmc$ = c.i.f. import price in FCU (foreign-currency units),

tmc = import tariff rate,

EXR = exchange rate (LCU per FCU),

PWc = composite commodity price (including sales tax and transaction costs), and

$icmc.c$ = quantity of commodity c . as trade input per imported unit of c .

The import price in LCU (local-currency units) is the price paid by domestic

PEc = export price (LCU),

$pwec$ = f.o.b. export price (FCU),

tec = export tax rate,

$icec.c$ = quantity of commodity c . as trade input per exported unit of c .

$PDDc$ = demand price for commodity produced and sold domestically,

$PDSc$ = supply price for commodity produced and sold domestically, and

$icdc.c$ = quantity of commodity c . as trade input per unit of c produced and sold domestically.

QQc = quantity of goods supplied to domestic market (composite supply),

QDc = quantity sold domestically of domestic output,

QMc = quantity of imports of commodity, and

tqc = rate of sales tax (as share of composite price inclusive of sales tax)

PXc = aggregate producer price for commodity,

QXc = aggregate marketed quantity of domestic output of commodity,

QEc = quantity of exports.

PAa = activity price (gross revenue per activity unit),

$PXACa c$ = producer price of commodity c for activity a , and

θ_{ac} = yield of output c per unit of activity a .

$PINTAa$ = aggregate intermediate input price for activity a , and

$icac a$ = quantity of c per unit of aggregate intermediate input a .

The activity-specific aggregate intermediate input price shows the cost of disaggregated intermediate inputs per unit of aggregate intermediate input.

taa = tax rate for activity,

QAa = quantity (level) of activity,

$QVAa$ = quantity of (aggregate) value-added,

$QINTAa$ = quantity of aggregate intermediate input, and

¹ This section is prepared on the basis of Lofgren, Hans, R. Harris, S. Robinson, 2002. *A Standard Computable General Equilibrium (CGE) Model in GAMS*, Microcomputer in Policy Research 5, International Food Policy Research Institute, Washington.

$PVAa$ = price of (aggregate) value-added.
 $cwtsc$ = weight of commodity c in the consumer price index, and
 CPI = consumer price index (exogenous variable).
 $dwtsc$ = weight of commodity c in the producer price index, and
 DPI = producer price index for domestically marketed output.
 α_a^a = efficiency parameter in the CES activity function,
 δ_a^a = CES activity function share parameter, and
 ρ_a^a = CES activity function exponent
 $ivaa$ = quantity of value-added per activity unit, and
 $intaa$ = quantity of aggregate intermediate input per activity unit.
 $tvaa$ = rate of value-added tax for activity a ,
 α_a^{va} = efficiency parameter in the CES value-added function,
 δ_a^a = CES value-added function share parameter for factor f in activity a ,
 QF_{fa} = quantity demanded of factor f from activity a ,
 ρ_a^a = CES value-added function exponent,
 WFf = average price of factor, and
 $WFDIST_{fa}$ = wage distortion factor for factor f in activity a (exogenous variable).
 $QINT_{ca}$ = quantity of commodity c as intermediate input to activity a .
 $QXACa$ = marketed output quantity of commodity c from activity a , and
 $QHAA_{ch}$ = quantity of household home consumption of commodity c from activity a for household h .
 α_a^{ac} = shift parameter for domestic commodity aggregation function,
 δ_a^a = share parameter for domestic commodity aggregation function
 ρ_a^a = domestic commodity aggregation function exponent.
 α_c^t = a CET function shift parameter,
 δ_c^t = a CET function share parameter, and
 ρ_a^t = a CET function exponent.
 α_c^q = an Armington function shift parameter,
 δ_c^q = an Armington function share parameter, and
 ρ_c^q = an Armington function exponent.
 QTc = quantity of commodity demanded as transactions service input.
 YFf = income of factor f .
 $YIFi_f$ = income to domestic institution i from factor f ,
 $shif_i_f$ = share of domestic institution i in income of factor f ,
 tf_f = direct tax rate for factor f , and
 $trnsfr_{i_f}$ = transfer from factor f to institution i .
 $i \in \text{INSDNG} (= \text{INSDGN}' \subset \text{INSD})$ = a set of domestic nongovernment institutions,
 YI_i = income of institution i (in the set INSDNG), and

$TRII_{ii}$ = transfers from institution i . to i (both in the set INSDNG)

$shii_{ii}$ = share of net income of i . to i

MPS_i = marginal propensity to save for domestic nongovernment institution (exogenous variable), and

$TINS_i$ = direct tax rate for institution i

= a set of households, and

EH_h = household consumption expenditures.

QH_{ch} = quantity of consumption of marketed commodity c for household h ,

γ_{ch}^m = subsistence consumption of marketed commodity c for household h ,

γ_{ach}^h = subsistence consumption of home commodity c from activity a for household h , and

β_{ch}^m = marginal share of consumption spending on marketed commodity c for household h .

β_{ach}^h = marginal share of consumption spending on home commodity c from activity a for household h .

$QINV_c$ = quantity of fixed investment demand for commodity,

$IADJ$ = investment adjustment factor (exogenous variable), and

$qinv_c$ = base-year quantity of fixed investment demand

QG_c = government consumption demand for commodity,

$GADJ$ = government consumption adjustment factor (exogenous variable), and

qg_c = base-year quantity of government demand.

YG = government revenue.

EG = government expenditures.

QFS_f = quantity supplied of factor (exogenous variable).

$qdstc$ = quantity of stock change.

$FSAV$ = foreign savings (FCU) (exogenous variable).

$GSAV$ = government savings.

mps_i = base savings rate for domestic institution i ,

$MPSADJ$ = savings rate scaling factor (= 0 for base),

$MPS01i$ = 0-1 parameter with 1 for institutions with potentially flexed direct tax rates, and

$DMPS$ = change in domestic institution savings rates (= 0 for base; exogenous variable).